

A PATIENT-ORIENTED APPROACH TO FACILITIES  
MANAGEMENT IN SINGAPORE'S HOSPITALS

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## DECLARATION

I hereby declare that this thesis is my original work and it has been written by me in its entirety.

I have duly acknowledged all the sources of information which have been used in the thesis.

This thesis has also not been submitted for any degree in any university previously.

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## SUMMARY

As a relatively new discipline, facilities management (FM) has developed fast during the past 30 years. One topic that draws a lot of attention in the FM domain is customer satisfaction. Enhancing customer satisfaction becomes one of the major concerns of FM organisations. Customer satisfaction can be viewed as a result of the demand for high service quality. It can be enhanced only if the service quality level increases. Thus, service providers who seek to satisfy their customers should enhance their service quality level first, which is within their control. But before that can happen, it is essential to measure the service quality first, so that areas that need improvements can then be identified, to be followed by implementation of corrective actions, leading to the increased level of customer satisfaction.

Special attention is given to hospital FM because hospitals and healthcare facilities belong to the most complex, costly and challenging kind of buildings to manage. Although FM is identified as a key function in hospitals, the total amount of studies that were concentrated on hospital FM are limited. Furthermore, as stated above, customer satisfaction is of key importance to FM. Since patients are the key customers to hospitals, taking a patient-oriented approach to FM in hospitals is essential to improve the overall patients' satisfaction level.

Given this background, it is natural to raise the questions of how to evaluate the FM service quality in hospitals and how to improve them. This study aims to evaluate the FM service quality in Singapore's hospitals from the patient's perspective as well as providing effective ways to improve it to achieve patient satisfaction. In order to fulfill this aim, this study combines service quality and attractive quality theory, and integrates 3 instruments: SERVQUAL, Kano and QFD in the surveys.

The survey findings show that patients generally have a high perception of the FM services in Singapore's hospitals, but they also have a higher expectation, leading to 23 service gaps of FM services. Using the Kano model, all 24 service attributes are classified into different Kano categories to provide deeper understanding of their influences on patient satisfaction. The QFD



survey results in the ranking list of the 32 solutions for continuous improvement, which can serve as a reference list when priorities need to be given to them for corrective actions.

This study gives recommendations for facilities managers and future researchers. Limitations and contributions of this study are also discussed.

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## LIST OF ABBREVIATIONS

AH – Alexandra Hospital

BIFM – British Institute of Facilities Management

CGH – Changi General Hospital

CR – Customer Requirements

DR – Design Requirements

FM – Facilities Management

HOQ – House of Quality

IFMA – International Facility Management Association

IMH – Institute of Mental Health

KKH – Kangar Kerbau Women’s and Children’s Hospital

KTPH – Khoo Teck Puat Hospital

MRT – Mass Rapid Transit

NHC – National Heart Centre

NUH – National University Hospital

PEAT – Patient Environment Assessment Team

PUB – Public Utilities Board

QFD – Quality Function Deployment

SGH – Singapore General Hospital

STB – Singapore Tourism Board

TTSH – Tan Tock Seng Hospital

# Chapter 1 Introduction

## 1.1 Background

The field of facilities management<sup>1</sup> (FM) has experienced significant development over the past three decades (Lavy & Shohet, 2009). Companies' and organisations' perceptions of FM have changed from cleaning and maintenance to providing a service that makes a positive contribution to the core business (Barrett & Baldry, 2009); by coordinating all efforts related to the workplace, the FM department enhances an organisation's ability to survive and succeed in a competitive world (Kulatunga *et al.*, 2010). Moreover, contemporary researchers have suggested a strategic role for FM, emphasising that achieving best value and enhancing customer satisfaction are the two activities central to strategic FM (Atkin & Brooks, 2009). The British Institute of Facilities Management (BIFM) also regards customer satisfaction as a top issue in FM (BIFM, 2004). Customer satisfaction is the "post-choice cognitive judgment" linked to a particular purchase decision (Selnes, 1993); it has drawn constant attention from researchers and gained weight in academic research (Hui & Zheng, 2010) because of its influence on the long-term survival and success of a specific organisation (Robledo, 2001). The concept of customer satisfaction also applies to the FM domain. Enhancing customer satisfaction is therefore a major concern of FM organisations. Customer satisfaction results from an exchange that meets the needs and expectations of the customer (Dibb *et al.*, 2005). Thus, it can be viewed as a result of the demand for high service quality and can be enhanced only if the service quality increases. Service quality is distinct but closely related to customer satisfaction; researchers have provided evidence of high-level service quality's positive influence on customer satisfaction (Blanchard & Galloway, 1994; Chow-Chua & Komaran, 2002; LeBlanc & Nguyen, 1988; Spencer & Hinks, 2007). Studies have also shown that a low quality level results in negative word-of-mouth and negative evaluations (Seiler, 2004). Thus, service providers that seek to satisfy their customers should enhance their service quality level, an endeavour that is

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<sup>1</sup> The term "facility management" is used instead of "facilities management" in some literature. The author of this study considers this difference largely a matter of individual preference.

within their control (Padma *et al.*, 2010). However, before that can happen, it is essential to measure the existing service quality; as the old saying goes, “if you can’t measure it, you can’t improve it”. Thus, areas that need improvements can be identified and corrective actions can be implemented, which will lead to increased customer satisfaction.

In the FM domain, special attention is given to hospital FM because hospitals and healthcare facilities are among the most complex, costly and challenging buildings to manage (Loosemore & Hsin, 2001; Moy Jr., 1995). FM is a key function in hospitals (Gelnay, 2002). However, studies concentrating on hospital FM are limited and many of them have been focused on maintenance services (Lennerts *et al.*, 2005; Shohet, 2003). Another stream of research that touches on hospital FM is the study of hospital service quality and patient satisfaction. However, those studies have usually prioritised the evaluation of core services and medical care; they have covered only a relatively small portion of FM services, directly or indirectly (Elleuch, 2008; Lim & Tang, 2000b). Patient satisfaction depends on a patient’s overall evaluation of his or her real-life experience with hospital services (Johnson & Fornell, 1991), and delivering high-quality core services is necessary but not adequate for obtaining customer/patient satisfaction (Padma *et al.*, 2010). The most obvious non-core services hospitals provide are from the FM department. Thus, it is necessary to conduct more comprehensive research focused on hospital FM.

As stated above, customer satisfaction is of key importance to FM. In the context of hospitals, customers include patients, medical staff, non-medical staff and other stakeholders. Among them, patients are the key customers. Today’s patients are better educated and more aware than past patients because abundant information is available to them, reflecting the importance of patients’ perception of service quality (Andaleeb, 1998). Patients expect good medical care and a high level of personal catering. In addition, patients are likely to evaluate hospital service based on their real-life experience of catering, cleaning and similar services instead of medical care because they lack expertise in the technical side of healthcare service (Barrett & Baldry,

2009). Therefore, a patient-oriented approach to FM in hospitals is essential to improve overall patient satisfaction.

## **1.2 Research Problems**

Although the core business of hospitals is providing medical care for patients, patients assess hospitals' service quality subjectively due to their lack of expertise in medicine (Lim & Tang, 2000b). This assessment also applies to FM services in hospitals. Most patients cannot judge the technical competence of the FM department. Moreover, according to service quality theory, service quality is more difficult to evaluate than product quality because services are intangible, heterogeneous and inseparable (Zeithaml *et al.*, 1990). In addition, patients are sometimes direct customers of FM services while other times they are indirect customers (Lennerts *et al.*, 2005). However, to improve patients' satisfaction with hospital FM services, the current service quality level should be evaluated and areas that need improvement should be identified. In other words, it is necessary to measure service quality from the patients' point of view and identify service performance that patients find unsatisfactory. However, all the factors mentioned above make this task difficult. Furthermore, traditional performance measurement tools used in FM are focused on internal technical and financial issues; key performance indicators are used instead of customer-oriented service quality measurements. Looking at performance measurement in FM with the new service quality notion is, therefore, important in resolving this issue. Service quality theory can be applied in the FM context to provide a customer-oriented approach to service quality improvement and customer satisfaction. In the service sector, a widely used model to measure service quality is SERVQUAL. Devised by Parasuraman *et al.* (1985), SERVQUAL is based on the notion that service quality falls in the gap between customer expectations and customer perceptions. SERVQUAL contains five dimensions: tangibles, reliability, responsiveness, assurance and empathy; several attributes are provided under each dimension, for a total of 22 attributes. An overwhelming number of studies on service quality in the healthcare sector has used SERVQUAL as an accurate and valid tool (Suki *et al.*, 2011). However, one major concern with



SERVQUAL is that the content in the instrument tends to depend on context and service type (Paulin *et al.*, 1996). Bearing all this in mind, the first research problem this study tries to solve is:

(1) What are the service gaps in hospital FM in Singapore?

However, before that, we should give weight to each FM service attribute because we need to allocate the resources needed for corrective actions appropriately. In other words, we need to prioritise resources for the most critical service attributes (Spencer & Hinks, 2007). In addition, categorising these service attributes enables us to gain profound insight into the relationship between service performance and customer satisfaction. Developed by Kano *et al.* (1984), the attractive quality theory (Kano model) abandons the traditional linear view of the influence of service performance on customer satisfaction (Mikulic & Prebežac, 2011) and shows that the relationship between customer satisfaction and the performance of services depends on whether the service is gauged according to attractive, one-dimensional or must-be attributes (Xie *et al.*, 2003). Different conceptual approaches exist for classifying quality attributes in this model, including the Kano method, importance grid and direct classification method (Mikulic & Prebežac, 2011). In all, the second research problem this study tries to solve is:

(2) What are the categorisations of hospital FM service attributes?

With service gaps identified and service attributes categorised, the next step is to close the gaps. Studies in the field of FM have put forward several key factors and best practices that lead to successful FM (Chotipanich, 2004; Nutt, 1999); Zeithaml *et al.* (1990) proposed the extended gaps model with recommendations to close each gap. In addition, quality function deployment (QFD) is a tool widely used in quality management. In the service quality context, QFD can translate customer requirements (the gaps identified) into corresponding solutions (Xie *et al.*, 2003). Considering all the methods mentioned above, the third research problem of this study is:

(3) How can hospitals close the service gaps in their FM services?

### **1.3 Research Aims and Objectives**

This study aims to evaluate the FM service quality in Singapore's hospitals from the patient's perspective and to provide effective ways to improve FM to achieve patient satisfaction. The specific objectives of this study are to:

- (1) Identify service gaps and measure service quality of hospital FM in Singapore.
- (2) Categorise the FM service attributes.
- (3) Suggest effective ways to close the hospital FM service gaps.

### **1.4 Research Hypothesis**

In this study, the research hypothesis is as follows: Service gaps exist in hospital facilities management in Singapore. Through a survey of patients using the SERVQUAL instrument, the service attributes with a negative score (Perception — Expectation) are identified as service gap attributes.

### **1.5 Significance of Study**

This study tries to combine service quality theory and attractive quality theory to identify the service gaps in hospital FM and categorise each service attribute so as to effectively implement corrective actions. Tools used in this study include SERVQUAL, the Kano model and QFD. The technique of integrating SERVQUAL, Kano and QFD enables us to gain broader insights into customer satisfaction and service quality improvement.

In the practical world, this study will help the hospitals in Singapore identify the FM service attributes that need improvement and provide them with strategies and solutions to improve service quality, which will lead to higher level of patient satisfaction. In the academic world, although many researchers have studied the three tools' relationship and used them in complementary (Baki *et al.*, 2009; Sahney, 2011b; Tan & Pawitra, 2001), this study is the first to employ the technique in the field of hospital FM in the Singapore context. It is hoped that this study will stimulate more research into this field.

## **1.6 Structure of Thesis**

This thesis consists of eight chapters. Chapter 1 introduces the research background, research problems and objectives, research hypothesis and significance.

Chapter 2 reviews the literature on FM and hospital FM and identifies thirty-two key factors for successful hospital FM. An overview of the Singapore healthcare system is also provided.

Chapter 3 presents a review of the literature on service quality and SERVQUAL, attractive quality theory, the Kano model and the QFD model, as well as their relationships and integration for complementary purposes.

Chapter 4 develops a conceptual framework based on the findings from the literature review.

Chapter 5 presents the research design and data collection and analysis methods.

Chapter 6 provides the data analysis results for the three surveys: SERVQUAL, Kano and QFD.

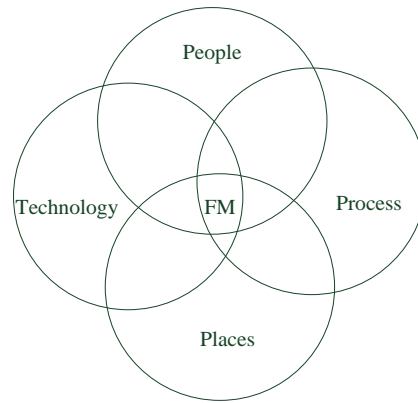
Chapter 7 discusses in detail the survey findings, as well as problems emerging in the survey process.

Chapter 8 concludes the thesis and provides recommendations for facilities managers in hospitals and future researchers. The limitations and contributions of this study are also discussed.

## **Chapter 2 Facilities Management and Singapore's Healthcare System**

### **2.1 Definition and Development of Facilities Management**

Many definitions of facilities management (FM) exist and it is difficult to generate a universally accepted definition because the discipline is still evolving (Hinks & McNay, 1999). Tay and Ooi (2001) provided a summary of different definitions of FM from various individuals and organisations; representative definitions are discussed below. The first and most frequently cited definition is from the International Facility Management Association (IFMA) ([www.ifma.org](http://www.ifma.org)), which defined FM as “a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, places, processes and technology”. This definition clearly shows the holistic nature of the FM discipline, indicating interdependence of various factors in successful FM (Atkin & Brooks, 2009). IFMA's definition is also deemed to be a basic framework for FM (see Figure 2.1). Another often-cited definition comes from Atkin and Brooks (2009). They looked at FM from the perspective of its functions and linked it to the organisation's core business; they defined it as “an integrated approach to operating, maintaining, improving and adapting the buildings and infrastructure of an organisation in order to create an environment that strongly supports the primary objectives of that organisation” (p.1). Similarly, Pitt and Tucker (2008) defined FM as “the integration and alignment of the non-core services, including those relating to premises, required to operate and maintain a business to fully support the core objectives of the organisation” (p.242). No matter what definition is adopted, the key aspect of FM is that it plays an integrating role whose purpose is to support the core business.



**Figure 2.1 The FM basic framework**

As to development of the FM discipline, Pathirage *et al.* (2008) identified four generations of FM development:

- (1) FM is considered an overhead expense to be managed for minimum cost rather than optimum value.
- (2) FM is considered an integrated continuous process in relation to the organisation's individual business.
- (3) FM is looked at as resource management concentrating on managing supply chain issues associated with FM functions.
- (4) FM is regarded as an aspect of strategic management to ensure alignment between organisational structure, work processes and the enabling physical environment consistent with the organisation's strategic intent.

This trend reflects the change in focus of FM from cost cutting to a gradually stronger strategic view (Jensen *et al.*, 2010).

In the practical world, about 40 years ago, we could find only fleeting mentions of FM; it functioned largely for maintenance and cleaning (Atkin & Brooks, 2009). Starting in innovation organisations such as fast-growing banking and telecommunications firms, FM development was driven by organisations' attempts to manage their buildings effectively under the pressure of becoming more competitive (Rondeau *et al.*, 1995). When services outsourcing came into people's sight, FM became the main cost-cutting

initiative (Noor & Pitt, 2009). This outsourcing trend assisted the development of FM as a profession “in its own right” (Loosemore & Hsin, 2001); the need for a united concept and common standards for FM gradually drew people’s attention. At the same time, professional associations began to appear; they organised different professionals with diverse backgrounds into one discipline, spreading the FM concept and providing a platform for “professionalisation and knowledge exchange” (Drion *et al.*, 2012). The Association of Facilities Engineering and the Association of Higher Education Facilities Officers were the pioneers in FM (Cotts *et al.*, 2010). Now FM has emerged as “a new professional discipline with its own codes, standards and technical vocabulary” (Atkin & Brooks, 2009, p. 2). However, FM is still a relatively new profession (Tay & Ooi, 2001) and in its early stage.

In the academic world, early FM researchers conducted empirical research in the field (Ventovuori *et al.*, 2007). Therefore, early developments in FM are deemed to be based on practical works (Alexander, 1994). To promote this discipline, practice and research should be linked (Nutt, 1999). Thus, theoretical and empirical research investigating both the physical and the non-physical areas of FM was called for (Cairns & Beech, 1999). Entering the 2000s, FM as a scientific discipline was maturing gradually with extended research areas including not only technical issues, the workplace, procurement and general trends, but also performance measurement and sustainability (Ventovuori *et al.*, 2007). In addition, research papers and conferences in this field are becoming more numerous (Jensen *et al.*, 2012; Meng & Minogue, 2011; Shaw & Haynes, 2004). However, no theory of FM has been clearly articulated and the lack of a comprehensive theoretical framework is considered a weakness of the field (Mudrak *et al.*, 2005). To establish the theoretical framework, some studies have emphasised facilities’ influence on the behaviour, health and well-being of people using them (Fleming, 2004; Leung & Fung, 2005; Smith *et al.*, 2011). Other studies have focused on FM’s effects on the success of the organisation to produce evidence that demonstrates FM’s contribution to the core business (Akhlaghi & Mahony, 1997; Duyar, 2010; Haynes, 2007; Price, 2004). However, a theoretical framework for FM should integrate both views. Moreover, this inadequate

knowledge base has led to a lack of “secure methods and techniques” for enhancing FM performance, thus indicating a good opportunity for research in the specific field of FM performance (Kulatunga *et al.*, 2010).

Furthermore, over the past 20 years, studies on the topic of “performance measurement and management” have become abundant (Amaratunga & Baldry, 2003; Walters, 1999; Wauters, 2005). Traditionally, FM performance measurement has used cost as the only indicator (Tranfield & Akhlaghi, 1995). This cost-only approach can lead to FM becoming a “commodity service” purchased at the lowest price from non-differentiated suppliers (Loch, 2000). Against this backdrop, researchers have applied various new models to measure FM performance using different indicators under the three main components: physical (e.g. building fabric, structural integrity, heating, lighting), functional (e.g. space, layout, ergonomics, health and safety) and financial (e.g. capital and life cycle expenditures, depreciation) (Loosemore & Hsin, 2001; Williams, 1996). Among these models, key performance indicators, the balanced scorecard and the business excellence model are the most widely used and most effective tools (Meng & Minogue, 2011). Although these models largely resolve the problem of cost-only indicators, they are more introspective and put more weight on technical aspects, more or less neglecting the needs of customers (Loosemore & Hsin, 2001; Massheder & Finch, 1998). Researchers have argued that FM services should be more customer-focused and provide higher quality (Hui *et al.*, 2013; Tucker & Pitt, 2009). However, as Tucker and Pitt (2009) pointed out, the level of FM performance measurement research that has focused on customer satisfaction is quite limited. Therefore, FM studies should develop models that are more sensitive to customers’ needs, that is, more customer-oriented (Shaw & Haynes, 2004). Caruana and Pitt (1997) pointed out that performance measurement in service quality should be based on asking customers about their perceptions and their expectations regarding the service they receive. Against this backdrop, this study emphasises the involvement of customers in FM performance measurement and takes the measurement approach from the customer’s point of view. Thus, a new method should be considered for this purpose instead of the conventional quantitative specification-compliance

methods. Evaluating performance from the customer's perspective requires a more "behavioral, holistic, systemic and subject approach" (Spencer & Hinks, 2007). Service quality theory has shed light on this problem and is reviewed and discussed in the next chapter.

## **2.2 FM Service Coverage**

As a relatively new discipline, FM has emerged out of practice, integrating three main streams of activities: property management, property operations and maintenance and office administration (Kincaid, 1994). FM was regarded as merely a support service in the past, but its position within organisations has changed considerably and now it is often viewed as part of the strategic business function (Kulatunga *et al.*, 2010). Therefore, FM now encompasses a myriad of services. There is no standard services coverage in FM; thus, the exact scope of FM should be determined empirically on a case-by-case basis to fulfill the requirements of its home organisation (Chotipanich, 2004).

Generally speaking, FM covers a variety of services, including real estate management, financial management, change management, human resources management, health and safety and contract management, in addition to building maintenance, domestic services and utilities supplies (Atkin & Brooks, 2009). Cotts *et al.* (2010) provided a detailed description of FM functions and sub-functions. The main functions include management of the organisation, facility planning and forecasting, lease administration, space/workplace planning, allocation and management, architectural/engineering planning and design, operations, maintenance and repair and general administrative services, among others. Barrett and Baldry (2009) also provided a range of services that are usually covered in FM (see Table 2.1).

Tucker and Pitt (2009) viewed the FM service coverage issue from a more customer-oriented perspective and provided 11 general FM services: maintenance of the building fabric, mechanical and electrical (M&E) engineering, waste management, maintenance of grounds and gardens/internal plantings, cleaning, catering, mailroom, security, health and safety, reception



(including switchboard) and helpdesk. Similarly, Hui et al. (2013) also took the customer's stand in identifying FM services. They included property management, security, cleaning, management of common areas, management and maintenance of communal facilities, washrooms and promotion (e.g. festive decorations, promotion of events) in FM service coverage for shopping malls. Thus, one can conclude that FM service coverage varies from organisation to organisation. FM service coverage is likely to differ in a small office building and a large complex manufacturing site. The provision of specific FM services depends on the nature of the organisation and the needs of the core business.

**Table 2.1 Typical FM services**

<p><b>Facility planning</b></p> <ul style="list-style-type: none"> <li>Strategic space planning</li> <li>Corporate planning standards and guidelines</li> <li>User needs</li> <li>Furniture layouts</li> <li>Monitoring of use of space</li> <li>Selection and control of use of furniture</li> <li>Definition of performance measures</li> <li>Computer-aided facilities management (CAFM)</li> </ul>	<p><b>Building operations and maintenance</b></p> <ul style="list-style-type: none"> <li>Operation and maintenance of the plant</li> <li>Maintenance of building fabric</li> <li>Management and adaptation</li> <li>Energy management</li> <li>Security</li> <li>Voice and data communication</li> <li>Control of operating budget</li> <li>Monitoring of performance</li> <li>Supervision of cleaning and decoration</li> <li>Waste management and recycling</li> </ul>
<p><b>Real estate and building construction</b></p> <ul style="list-style-type: none"> <li>New building design and construction management</li> <li>Acquisition and disposal of sites and buildings</li> <li>Negotiation and management of leases</li> <li>Advice on property investments</li> <li>Control of capital budgets</li> </ul>	<p><b>General/office services</b></p> <ul style="list-style-type: none"> <li>Provision of management support services</li> <li>Office purchasing (stationery and equipment)</li> <li>Non-building contract services (e.g. catering, travel)</li> <li>Reprographics services</li> <li>Housekeeping standards</li> <li>Relocation</li> <li>Health and safety</li> </ul>

*Source: Barrett and Baldry (2009).*

FM services can be divided into two categories: hard FM and soft FM (Kulatunga *et al.*, 2010). This hard-soft classification is also called premises

and business support services (Mudrak *et al.*, 2005). Table 2.2 illustrates these classifications and provides examples.

**Table 2.2 Classification of FM services**

	<b>Description</b>	<b>Examples</b>
<b>Hard FM</b>	Management and maintenance of property and other physical assets	Estate and property, indoor air, structure and fabric, water supply, electricity, telecommunication systems
<b>Soft FM</b>	Management of support services	Catering, cleaning, waste management, security, laundry

*Source: Adapted from Kulatunga et al. (2010).*

### **2.3 Singapore's Healthcare System**

The Republic of Singapore is a tropical island and city-state with an area of just over 700 square kilometers (Pwee, 2009) that is densely populated, with a total population of 5.31 million (Singapore Department of Statistics, 2012). Singapore is known as one of the world's cleanest and most efficiently run countries (Edlin, 2009). Its healthcare system is also internationally recognised and was ranked top in Asia and 6<sup>th</sup> among 191 countries in the World Health Report on health systems (World Health Organisation, 2000). Singapore's healthcare system comprises public and private sectors. The government's Ministry of Health manages the public sector and regulates the private sector.

In 2012, there were more than 10,000 hospital beds in the 25 hospitals and specialty centres in Singapore (Ministry of Health, 2012a). In the public sector, eight public hospitals comprise six general hospitals (AH, CGH, KTPH, SGH, NUH, TTSH), a women's and children's hospital (KKH) and a psychiatric hospital (IMH) (Ministry of Health, 2012b), as well as a specialty centre (NHC). Table 2.3 shows each hospital's name and size; information was gathered from each hospital's website and annual report.

The private sector has seven general hospitals, five rehabilitation/community hospitals and four special hospitals/medical centres (Ministry of Health, 2012b). Table 2.4 provides a general introduction to these facilities; information was gathered from each hospital's website.

**Table 2.3 Singapore's public hospitals**

<b>Name</b>	<b>Member of</b>	<b>Number of beds (as of August 2012)</b>
Alexandra Hospital (AH)	Jurong Health Services	400 beds
Changi General Hospital (CGH)	Eastern Health Alliance	788 beds
Kho Teck Puat Hospital (KTPH)	Alexandra Health	550 beds
National University Hospital (NUH)	National University Health System	1032 beds
Singapore General Hospital (SGH)	Singapore Health Services	1590 beds
Tan Tock Seng Hospital (TTSH)	National Healthcare Group	1481 beds
KK Women's and Children's Hospital (KKH)	Singapore Health Services	832 beds
National Heart Centre (NHC)	Singapore Health Services	185 beds
Institute of Mental Health (IMH)	National Healthcare Group	2000 beds

*Source: Retrieved from each hospital's website and annual report.*

**Table 2.4 Singapore's private hospitals**

<b>Name</b>	<b>Member of</b>	<b>Number of beds (as of August 2012)</b>
Gleneagles Hospital	Parkway Pantai Limited	272 beds
Mount Elizabeth Hospital	Parkway Pantai Limited	345 beds
Mount Elizabeth Novena Hospital	Parkway Pantai Limited	333 beds
Parkway East Hospital	Parkway Pantai Limited	113 beds
Raffles Hospital	Raffles Medical Group	380 beds
Mount Alvernia Hospital	NA*	303 beds
West Point Hospital	China Healthcare Group	NA*

*Source: Retrieved from each hospital's website.*

*NA\*: Not available.*

In Singapore, primary healthcare services are provided mainly by the private sector, taking up 80% of the services, while the public sector provides the remaining 20%. However, considering the more costly hospitalisation care, the

situation is opposite, where 80% is provided by the public sector and 20% by the private sector (Ministry of Health, 2012a). For this reason and reasons of data availability, this study mainly focused on the public general hospitals.

## 2.4 Hospital FM

As a critical element in the successful delivery of medical care (Gelnay, 2002), development of the FM profession will raise the effectiveness of healthcare service delivery (Lavy & Fernández-Solis, 2010). FM should achieve zero defects to ensure the 24-hour operation of the hospital. In addition, Baldwin and Shaw (2005) stated that when it comes to patients' choice of hospitals, technical health-related issues may affect the hospital's reputation, but patients tend to base their choice on subjective assessments of patient-encountered FM services, such as the hospital environment, ease of parking, facilities for visitors and perceived cleanliness.

Hospital FM always integrates various non-core services under its umbrella and thus it is difficult to demarcate its boundary. The National Healthcare Services Trust of the UK includes the following services under the domain of FM: domestic/linen/accommodation, portering/transport/receipt/dispatch, medical electronics and maintenance, operational estates, printing services, security, catering services, car parking, patient services (hairdressing, chaplaincy), reprographic services and receipt and distribution (Barrett & Baldry, 2009). Note that this service coverage is likely to vary across the world and organisations (Payne & Rees, 1999). Table 2.3 provides a comprehensive list of general services coverage (Okoroh *et al.*, 2001).

**Table 2.5 FM operations in healthcare sector**

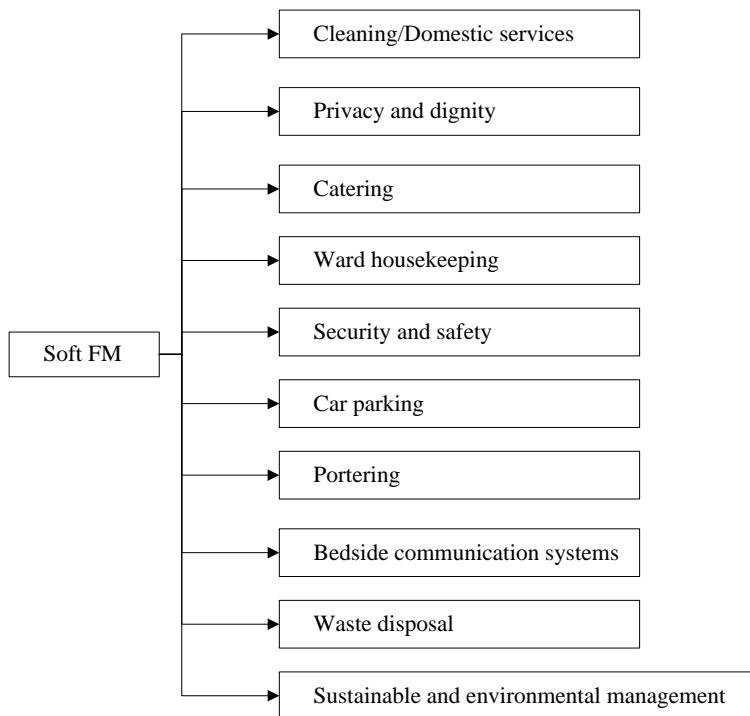
<b>Facilities Management</b>		
<b>Estate Management Support Services</b>	<b>Environmental Management Support Services</b>	<b>Hotel Support Services</b>
Grounds Gardening Energy Utilities	Health and safety Pollution control	Catering Reception Residences Housekeeping

Property management Property maintenance Design Building services	Fire precautions Incineration Waste management	
<b>Site Support Services</b>	<b>Business Support Services</b>	<b>Space Management Support Services</b>
Portering Security Car parking Telecom Accommodations Cleaning Hygiene	Leisure Recreation Strategic maintenance Transportation Occupational health Reprographic Procurement Information technology Purchasing Marketing Complaints management	Space utilisation Space allocation Space audit

*Source: Adapted from Okoroh et al. (2001).*

Following the FM services' classification mentioned above, soft FM services that are generally provided in hospitals are shown in Figure 2.2 (May & Pinder, 2008).

Although FM service coverage is complex and varies from hospital to hospital, four common and vital services can be identified from a customer-oriented perspective: catering, estates, domestic and portering (Sarshar, 2006). In Cole's (2004) study, of the 10 top priorities patients and the public identified for hospital services, 3 were FM related: cleanliness, hospital food and a safe and comfortable environment. Similarly, Miller and May (2006) suggested that the most important facilities factors to people were cleanliness, hospital food, comfortable environment and privacy and dignity.



**Figure 2.2 Hospital soft FM services coverage**

This study aims to identify the service gaps and evaluate the service quality of FM from the patients' perspective, so both the soft and the hard side of FM services are covered with a focus on patient-encountered service attributes. Thus, the soft side services take up a larger portion because they are accessible to patients.

To some extent, hospital FM differs from normal types of FM, such as FM for office buildings. Hospital facilities managers tend to view the systems and components of their facilities from a long-term life-cycle perspective because hospitals usually own their facilities. In addition, the unique nature of hospitals, that they are places where a mistake can cost the life of a human being, and the fact that FM is a critical component of hospital management contribute to the need for more research in this area.

Research on hospital FM has mainly focused on issues of performance measurement and benchmarking (Lavy & Shohet, 2009; Lennerts *et al.*, 2005; Shohet, 2006). As stated above, those considering the performance measurement of hospital FM have tended to take an internal view from the FM departmental and organisational perspective and have mainly concentrated on

one specific area, such as cleaning, catering, maintenance or waste management (Akter & Tränkler, 2003; Cesarotti & Di Silvio, 2006; Hwang *et al.*, 1999; Liyanage & Egbu, 2008; Suess, 1992). Indeed, these approaches have positive effects on FM performance, but they only provide information about the performance of one specific area and that performance is evaluated against indicators determined by the hospital, not the patients. Taking a patient-oriented approach to a set of more generalised FM services is more effective in identifying the service gaps and satisfying patients.

## 2.5 Key Aspects Contributing to Successful FM/Hospital FM

The success of FM depends on visionary commitment from multiple parties in multiple disciplines to meet customer demands (Kam-Shim, 1999). Various studies have proposed key factors that can contribute to the success of FM and, in the hospital context, hospital FM. Generally these factors fall into eight aspects. Table 2.6 contains the literature review findings regarding this topic.

**Table 2.6 Key aspects contributing to successful FM**

	<b>Factors</b>	<b>Sources</b>
1	Management of information and knowledge	Atkin and Brooks (2009); Pathirage <i>et al.</i> (2008); Nutt (1999)
2	Fitting FM function and role to the environment of practice	Atkin and Brooks (2009); Chotipanich (2004); Nutt (2002)
3	Sufficient budget and cost effectiveness	Rondeau <i>et al.</i> (1995); Shohet and Lavy (2004)
4	Selecting and dealing with the outsourcer	Hui (2005); Bull (1996)
5	Leadership and experience of facilities manager	Hui (2005); Rogers (2003); Rondeau <i>et al.</i> (1995); Bandy (2002)
6	Facilities managers' involvement in hospital level decision-making	Cotts <i>et al.</i> (2010); Barrett and Baldry (2009); Shohet and Lavy (2004)
7	Staff development and training: soft and hard skills	Srinivasan (2008); Bowers and Akhlaghi (1999); Rondeau <i>et al.</i> (1995); Bandy (2002)
8	Service tasks standardisation and benchmarking	Wauters (2005); Massheder and Finch (1998); Alexander (2003); Bandy (2002)

### (1) Management of information and knowledge

Based on the purpose of this study and the nature of hospital FM, “management of information” here mainly includes the information generated from FM work processes, such as operations information from inter- and intra-departments, instructions from management and feedback from patients and staff. Knowledge includes the FM staff’s intellectual skills and those valuable things learned from everyday operations. Managers must ensure and facilitate the flow of information. Since information flow is a two-way process, we emphasise the exchange or sharing of related information with different parties, such as managers and staff, patients and contact personnel. Information must be understood and used effectively. Good management of information and knowledge can make the most of past experiences and smooth the process of complex hospital FM, ensuring that all work is done effectively and correctly.

### (2) Fitting FM function and role to the environment of practice

Being fully aware of the environment in which one is working is important. From the big picture of the country’s economy and climate to the specific location and cultural context of the hospital, facilities managers should be sensitive to their surrounding environment. Singapore is a city-state with a tropical climate. It is also a diverse country with different races, cultures and religions. All of these characteristics can have implications for hospital FM, from influencing the hospital’s grounding to influencing staff’s behaviour or food provision. Facilities managers must learn to pay attention to the big picture. Even within the same sector, different hospitals share different goals and plans; understanding the hospital’s needs is crucial. Alignment of FM work should reflect the hospital’s long- and short-term objectives. Hospital FM is complex and it has no universal rules. The most appropriate approach is to fit the FM function and role to the environment in which the hospital operates.

### (3) Sufficient budget and cost effectiveness



FM service coverage varies among hospitals, but the services are all broad and require considerable monetary resources. For example, a lot of challenging issues exist in handling maintenance in healthcare facilities, so the FM department must have a budget adequate to pay for the work to be done. Therefore, by demonstrating its key role in ensuring the normal operation of the hospital and the value it adds to the hospital, the FM department should be proactive in the hospital's financial arrangements. On the other hand, the FM department should use its money wisely and its own budget plan should not hinder the hospital's financial performance. Thus, the facilities managers must justify their budgets and use the money wisely.

#### (4) Selecting and dealing with the outsourcer

Outsourcing in Singapore's hospitals is quite common. Some literature has recommended long-term partnerships with outsourcers so that both parties can take advantage of the good relationship. Other studies have argued that competitive tendering can better serve the organisation. Either way, outsourcing is an important factor that will affect FM performance. For the purpose of this study, we concentrate on the selection of outsourcing contractors and their management; their competence and service culture are two critical aspects to examine. In addition, effective control over contractors and subcontractors helps to ensure that they clearly understand the hospital's needs and meet a satisfactory service level. The hospital should obtain the best possible contractual and financial arrangements for outsourcing.

#### (5) Leadership and experience of facilities manager

Both leadership ability and experience are vital for facilities managers to achieve success. Hospital FM is a broad and complex concept. Thus, facilities managers must be able to lead and strategically plan FM services to ensure that everything is geared to achieving zero defects in hospital operations, meeting various goals and satisfying customers, whether internal or external, by providing clear guidelines instead of high

aspirations. On the other hand, FM is a labor-intensive business, whether outsourced or maintained in-house. Facilities managers need the people skills to manage people, foster a team spirit and inspire their staff, ensuring that employees feel appreciated for their contributions. In addition, health facilities always undergo rigorous inspections; facilities managers need to interact successfully with various regulatory agencies. All these responsibilities require that facilities managers have a balance of technical and managerial skills. By continuing professional development and the accumulation of experience, facilities managers can develop these skills.

(6) Facilities managers' involvement in hospital level decision-making

Facilities managers' involvement in hospital level decision-making can help smooth the arrangement of FM work and prepare them for future development of the hospitals. Facilities managers can demonstrate their commitment to quality service during the hospital level decision-making process. Facilities managers are familiar with their hospital's facilities and thus can give their own opinions and suggestions so as to achieve a better decision when any changes are anticipated. The FM department's requirements and operation information can also be reflected in the hospital's development strategy and external communications, which can contribute to the FM department's success.

(7) Staff development and training: soft and hard skills

Hospitals are filled with people. The professional behaviour of medical staff will impress patients, so will the behaviour of non-medical staff. Customer service skills are important for FM staff when they have direct contact with patients. A neat appearance, kind words and a sense of respect will make patients feel better and more satisfied with the services they receive. Some FM staff work behind the scenes and seldom have direct contact with patients; for them, the hard skills are of crucial importance. The staff's intellectual resources form the valuable knowledge base of the FM department and the hospital. Training is an effective way to equip the staff with the continuous-renewal skills they need to meet the demands of

their job responsibilities and handle general enquiries and complaints; such training will also influence their attitude towards work.

#### (8) Service tasks standardisation and benchmarking

Hospitals are places where an error can cost the life of a person. Thus, FM service tasks standardisation is essential to ensure that everything runs smoothly. Especially when it comes to healthcare equipment, the price of dysfunction is too huge to pay. Standardisation is also beneficial for outsourcing, clarifying the service level agreement. Without clear-cut standards, the quality of FM services performed cannot be assured. Benchmarking provides an opportunity to learn from best practice hospitals and to guide the direction for improvement, as well as stimulate competition and innovation. Good benchmarking requires formal processes for measuring performance and goal-setting. In addition, service goals in benchmarking should be based on customer standards rather than hospital standards.

The eight factors discussed above can help in achieving successful hospital FM performance. However, these factors alone do not necessarily contribute to improved service quality. They are described at a general level in the literature and not at the practical or operational level. More importantly, the understanding of how they can improve service quality is ambiguous. Thus, more detailed service quality-related sub-factors should be studied to justify their effectiveness in improving FM service quality. This is discussed in Chapter 4.

## **2.6 Summary of Chapter**

This chapter has reviewed the FM discipline's definition and development history and its service coverage, especially in the healthcare domain, as well as the healthcare system in Singapore. The literature review also identified eight aspects that are critical to successful hospital FM. However, those aspects are general in nature; combining them with other service quality tools will shed light on how to improve FM service quality.

## Chapter 3 SERVQUAL, the Kano model and QFD

### 3.1 Service Quality: Approaches and Measurements

As an antecedent to customer satisfaction, quality's economic benefits have long been established (Buzzell & Gale, 1987). Crosby (1979) defined quality as conformance to standards and specifications. It has also been defined as fitness for use (Juran, 1999). Quality is relatively more obvious and understandable in the manufacturing industry than in the service industry because production quality measurement is objective. Service can be viewed as an intangible activity provided by the service provider as a solution to a customer's problems; it does not result in the ownership of anything (Grönroos, 1990; Kotler *et al.*, 2001). Intangibility is the most obvious characteristic of service that creates difficulties for customers in assessing service quality before a sale (Khan, 2003). It also poses problems for the service provider in dictating how customers perceive its service (Ladhari, 2009). In addition to intangibility, service has three other characteristics: (a) inseparability, (b) heterogeneity and variability and (c) perishability (Regan, 1963). Inseparability of service means that production and consumption of the service are inseparable; they occur simultaneously (Zeithaml *et al.*, 1990). Therefore, service providers must get close to customers during service encounters (Redman & Mathews, 1998). Services are heterogeneous and variable because they differ from provider to provider, from place to place and from customer to customer, and a service provider cannot ensure absolute consistency in the service experience of each customer (Marković, 2006). Perishability of service means that the service cannot be stored and will disappear if not consumed (Ladhari, 2009). Those characteristics make service quality an elusive and abstract construct compared to goods quality (Parasuraman *et al.*, 1985) and place a barrier to understanding and measuring service quality. Against this backdrop, continued research has been carried out on the definition, modelling and measurement of service quality (Cronin & Taylor, 1992; Grönroos, 1984; Parasuraman *et al.*, 1985), which adds to the development of a sound knowledge base in this research area (Seth *et al.*, 2005). Now service quality is widely accepted as being subjective and

determined by customers (Sharabi & Davidow, 2010). Thus, it should be measured against the overall attitude customers hold towards the service (Shaw & Haynes, 2004).

Before service quality can be assessed, the construct of service should be established. There are two approaches to this issue. One is the antecedent approach, which suggests that factors relevant to service quality are better conceived as its antecedents than its components (Dabholkar *et al.*, 2000). Those antecedents refer to reliability, personal attention, comfort and features. Dabholkar *et al.* (2000) also examined the consequences and mediators of service quality, as well as the relationship between customer satisfaction and behavioural intention, providing insight into how customers view service quality as a whole (Sultan & Wong, 2010). However, as a contextual issue, service quality's antecedents might not apply across service types, service industries and cultures (Sultan & Wong, 2010). The antecedent approach also focuses on customer-specific (comparison shopping, word-of-mouth, personal relationship) and company-specific (market orientation) antecedents and looks at how they influence the perceived service quality (Gounaris *et al.*, 2003). However, this approach is criticised for not being conceptually sound. For example, word-of-mouth is considered a consequence of satisfaction or an instrument for measuring customer loyalty instead of an antecedent of service quality (Alves & Raposo, 2007; Cassel & Eklöf, 2001; Johnson *et al.*, 2001). In all, the antecedent approach has received little attention from researchers and needs to be generalised for different service settings (Seth *et al.*, 2005).

The other and more popular approach is the dimensional approach, which considers service quality as a multi-dimensional construct. Like the bulk of the literature (Juwaheer, 2004; Kilbourne *et al.*, 2004; Wicks & Chin, 2008), this study focused on the dimensional approach. Many models have evolved with various dimensions and scales to gauge service quality (Sultan & Wong, 2010), but extensive debate continues about the classification of dimensions (Pollack, 2009). Represented by Grönroos (1984), the European school of thought identified three components of service quality: technical quality, functional quality and image (Seth *et al.*, 2005). Technical quality refers to the quality of

what the customer actually receives after interaction with the service provider; functional quality refers to how the customer achieves the technical outcome; technical and functional quality, together with factors such as tradition and word-of-mouth build up a service provider's image (Grönroos, 1984). Represented by Parasuraman *et al.* (1988), the US school of thought maintains that service quality contains five dimensions (reduced from the original ten dimensions; see Parasuraman *et al.* (1985)): tangibles (the appearance of physical facilities, equipment, and personnel), reliability (the ability to perform the promised service dependably and accurately), responsiveness (the willingness to help customers and provide prompt service), assurance (the knowledge and courtesy of employees and their ability to inspire trust and confidence) and empathy (the provision of individual care and attention to customers). There are all together 22 service attributes belonging to the five dimensions. Each school of thought has been critiqued. Buttle (1996) pointed out two main deficiencies of the US school's five-dimensional approach: process orientation and problems in dimensionality. In addition, only the service process but not the service outcome is measured (Pollack, 2009). Furthermore, Buttle (1996) suggested context-specific dimensionality. At the same time, the European school's model has been criticised for not counting the physical service environment, which is a tangible dimension of the US school (Pollack, 2009). Bitner (1990) also emphasised the importance of tangibles. To overcome these problems, modifications and other kinds of models have been proposed, including the synthesised model of service quality developed by Brogowicz *et al.* (1990), the three-component (service product, service delivery, service environment) model introduced by Rust and Oliver (1994) and Philip and Hazlett's (1997) attribute service quality model. The European school's technical and functional quality model lacks an explanation of the quality measurement; since this study tries to measure service quality and is external customer-focused, we follow the US school of thought.

Within the same US school of thought, measures of the above mentioned service attributes differ. The two main measurement tools are SERVQUAL and SERVPERF. Parasuraman *et al.* (1988) proposed SERVQUAL in their

Gap model. This model considers service quality as the “gap” between customers’ expectations about the service and their perceptions of the service actually performed (Parasuraman *et al.*, 1988). Expectation has been defined as a person’s belief regarding anticipated performance and perception as a person’s formed opinion of the experienced service (Sahney, 2011a). Although SERVQUAL has been widely used and empirically examined, it has also been criticised for conceptual and operational flaws in the Perception-minus-Expectation measure (Brown *et al.*, 1993; Carman, 1990; Teas, 1994). Thus, Cronin and Taylor (1992) developed the performance-only measurement known as SERVPERF. Using the same dimensions and attributes as SERVQUAL, SERVPERF only measures SERVQUAL’s perception components, thereby reducing the number of attributes in the questionnaires from 44 to 22; thus, SERVPERF is claimed to be more efficient. Cronin and Taylor (1992) also provided empirical evidence of SERVPERF’s superiority to SERVQUAL in terms of reliability and convergent validity. Brady *et al.* (2002) and Jain and Gupta (2004) further confirmed this view. However, SERVQUAL’s criticism from researchers who support SERVPERF has been disputed. For example, Bolton and Drew (1991) concluded that the difference between expectations and perceptions was the key determinant of overall service quality. Ladhari (2009) argued that directions pointed out by the degree of difference between expectations and perceptions are critical for improving service quality; the perception alone cannot act as such an indicator. SERVQUAL measurement provides valuable information about the strengths and weaknesses of the service items (Parasuraman *et al.*, 1994). Dalrymple *et al.* (1995) also pointed out that customers’ expectations can constitute valuable feedback to service providers that can inform their policy formulation in improving the delivery system. Although Angur *et al.* (1999) found that the SERVPERF measurement explained a larger portion of variance in overall service quality than SERVQUAL measurement, they admitted that this difference was insignificant. They also claimed that SERVQUAL was more practical than SERVPERF for examining particular service shortcomings. Carrillat *et al.* (2007) reported that from 2002 through 2007 these two measurements received more than 46% of total citations in the literature of

service quality, stating that they were equally valid in predicating overall service quality. In summary, the effectiveness of SERVQUAL and SERVPERF depends on the nature and purpose of the study; simply claiming that one outperforms the other can be misleading (Robinson, 1999; Sultan & Wong, 2010). Although SERVPERF has shown some statistical superiority, SERVQUAL has better diagnostic capability (Kilbourne *et al.*, 2004). This study tries to identify service attributes that need improvement (service gaps) and provide corrective suggestions for improving service quality (to close the gaps). As Engelland *et al.* (2000) pointed out, this kind of gap analysis using SERVQUAL may help managers focus attention on possible causes for the gaps and on implementing corrective actions to close them. Therefore, the SERVQUAL measurement is preferred and applied in this study.

### **3.2 GAP Model and SERVQUAL**

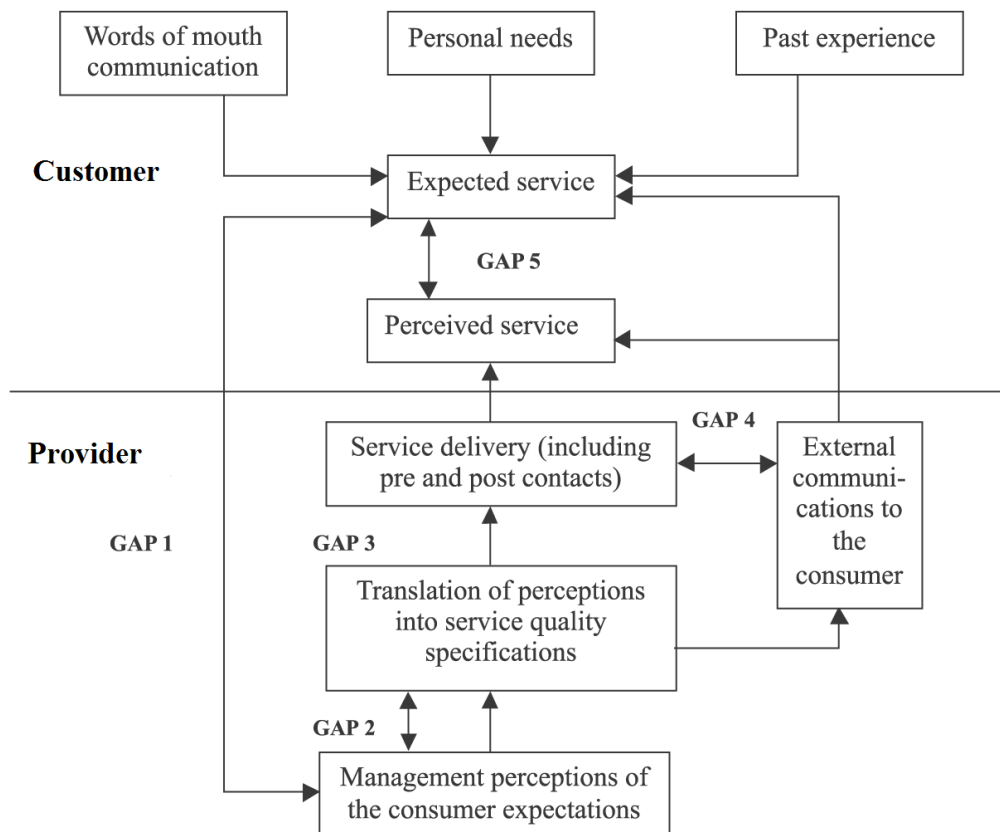
SERVQUAL is the instrument measuring service quality under the Gap model. The Gap model was developed by Parasuraman *et al.* (1985) based on gap analysis. According to this model, five gaps are the main sources of service quality problems, as follows (Zeithaml *et al.*, 1990):

- (1) Gap 1 is the difference between customer expectations and management's perceptions of those expectations.
- (2) Gap 2 is the difference between management's perceptions of customers' expectations and service quality specifications.
- (3) Gap 3 is the difference between service quality specifications and service delivery.
- (4) Gap 4 is the difference between service delivery and external communications to customers about service delivery.
- (5) Gap 5 is the difference between customers' expectations and perceived service.

Gap 5 is influenced by Gaps 1-4, which should be analysed to identify any corrective actions to diminish or eliminate Gap 5.



The Gap model is shown in Figure 3.1 (Zeithaml *et al.*, 1990).



**Figure 3.1 GAP model**

Based on Gap 5, Parasuraman *et al.* (1985) defined service quality as a function of the differences between customers' expectations for the service performance before the service encounter and customers' perceptions of the service they actually received, namely, Perception-minus-Expectation. The service quality is measured along the service dimensions and corresponding attributes. Originally (Parasuraman *et al.*, 1985) there were ten dimensions (tangibles, reliability, responsiveness, communication, credibility, security, competence, courtesy, understanding/knowing customers and access) and then these ten were collapsed into five generic dimensions, as mentioned above, assessed by a total of 22 attributes (Parasuraman *et al.*, 1988). The attributes used in their SERVQUAL instrument are shown in Table 3.1.

**Table 3.1 The SERVQUAL Instrument Presented by Zeithaml *et al.* (1990)**

<b>Dimensions</b>	<b>Attributes</b>
Tangibles	<ol style="list-style-type: none"> <li>1. Up-to-date equipment.</li> <li>2. Visually appealing physical facilities.</li> <li>3. Neat-appearing employees.</li> <li>4. Visually appealing materials associated with the service.</li> </ol>
Reliability	<ol style="list-style-type: none"> <li>5. The company keeps its promises to do something by a certain time.</li> <li>6. The company shows a sincere interest in solving the customer's problem.</li> <li>7. The company performs the service right the first time.</li> <li>8. The company provides its services at the time it promises to do so.</li> <li>9. The company insists on error-free records.</li> </ol>
Responsiveness	<ol style="list-style-type: none"> <li>10. Employees of the company tell customers exactly when services will be performed.</li> <li>11. Employees of the company give prompt service to customers.</li> <li>12. Employees of the company are always willing to help customers.</li> <li>13. Employees of the company are never too busy to respond to customer requests.</li> </ol>
Assurance	<ol style="list-style-type: none"> <li>14. The behaviour of employees of the company instills confidence in customers.</li> <li>15. Customers of the company feel safe in their transactions.</li> <li>16. Employees of the company are consistently courteous with customers.</li> <li>17. Employees of the company have the knowledge to answer customer's questions.</li> </ol>
Empathy	<ol style="list-style-type: none"> <li>18. The company gives customers individual attention.</li> <li>19. The company has operating hours convenient to all its customers.</li> <li>20. Employees of the company give customers personal attention.</li> <li>21. The company has the customer's best interests at heart.</li> <li>22. The employees of the company understand the specific needs of their customers.</li> </ol>

*Source: Adapted from Zeithaml et al. (1990).*

To provide insight into the causes of service gaps and possible ways to close them, Zeithaml *et al.* (1990) further extended the Gap model, adding possible causes and proposed solutions to each gap (see Figure 3.2).

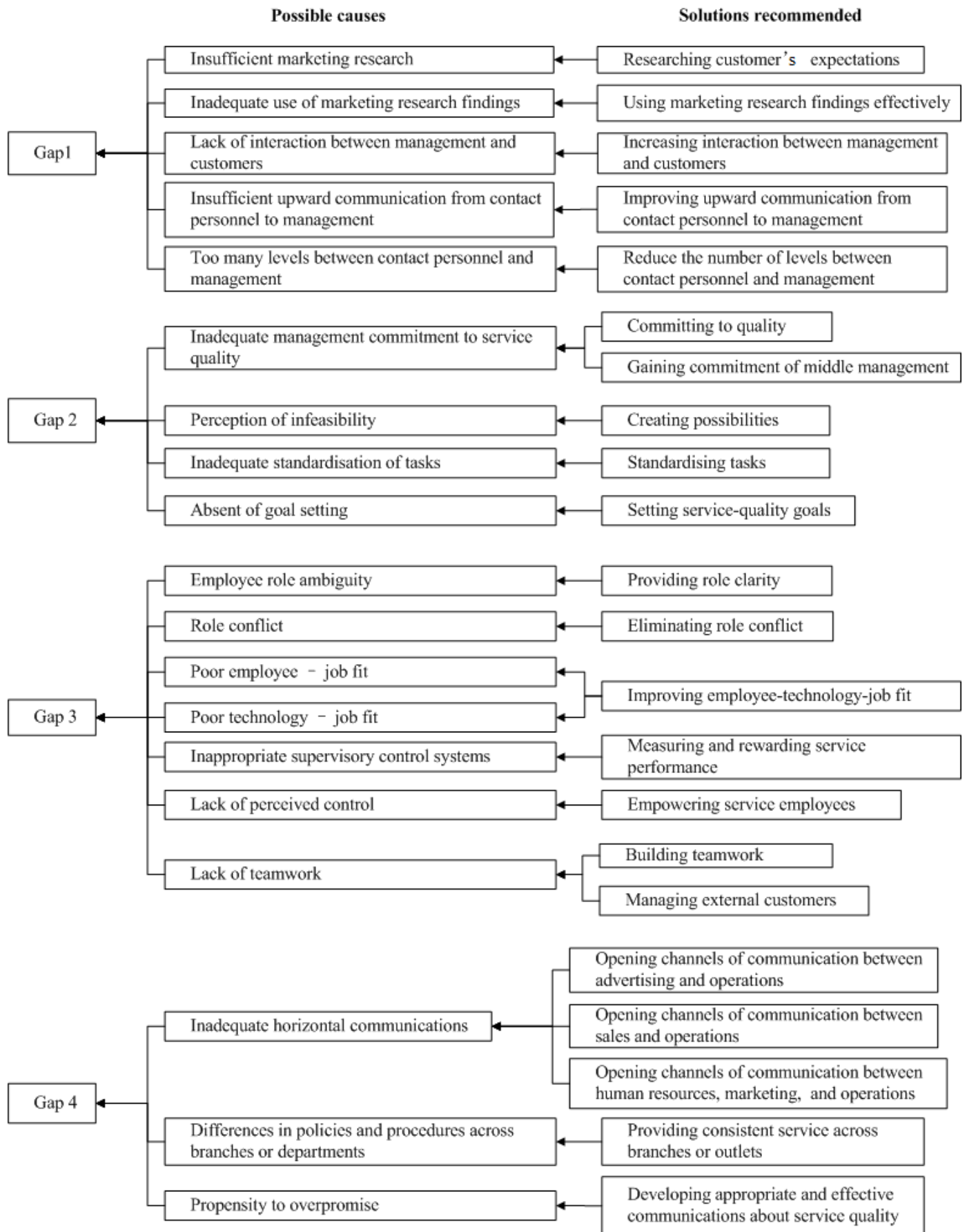


Figure 3.2 Extended Gap model

### 3.3 Applications of SERVQUAL in FM

As the best known tool for measuring service quality, SERVQUAL has been widely applied to a variety of service settings, including banking (Lam, 2002; Lassar *et al.*, 2000; Mels *et al.*, 1997), library services (Ahmed & Shoeb, 2009; Cook & Thompson, 2000; Sahu, 2007), education (Sahney, 2011a; Sahney *et al.*, 2004; Yeo, 2008), retailing (Finn & Lamb, 1991; Lee-Ross, 2008; Parasuraman *et al.*, 1994) and fast food (Asif *et al.*, 2011; Lee & Ulgado, 1997), among others. As mentioned earlier, despite its popularity among researchers and practitioners, SERVQUAL has received several criticisms regarding the conceptual foundation and empirical applicability of its scales (Badri *et al.*, 2005; Carman, 1990; Van Dyke *et al.*, 1997). In particular, its five generic dimensions and corresponding 22 attributes have been questioned for general application in all service contexts (Ladhari, 2009). Therefore, adaptations and modifications of the SERVQUAL scales are suggested when they are used in different industry-specific contexts (Ladhari, 2008).

Against this background, researchers have developed various alternative scales for measuring the service quality of specific service industries. For example, in management education, Sahney (2011a) developed a new scale that includes 26 attributes under five dimensions: competence, attitude, content, delivery and reliability. In retail banking, Aldaigan and Buttle (2002) proposed a new scale called “SYSTRA-SQ” that included 21 attributes grouped under four dimensions: service system quality, behavioural service quality, machine service quality and service transactional accuracy. In the library service setting, Shoeb (2011) developed a seven-dimension scale with 30 attributes; the dimensions were assurance, collection and access, empathy, library as place, reliability, responsiveness and tangibles. In summary, despite the concerns regarding its validity, SERVQUAL as a generic model has the potential for cross-industry service quality measurement and remains a useful tool (Ladhari, 2009). However, its original scale should not be applied to all circumstances without adaptations and modifications. Thus, Ladhari (2009) suggested that researchers either:

- (1) Develop their own instrument for use in a specific service setting based on the adapted SERVQUAL methodology or

(2) Validate the instrument through statistical methods (reliability and validity analysis) after data collection.

In the FM context, although the discipline is related to service quality, only a small amount of research has explored the relationship between them (Yusoff *et al.*, 2008). Related existing literature differs in focus and technique for adaptation and application of the service quality concept. Shaw and Haynes (2004) pointed out that identification of a set of service attributes that applies to the FM context is a crucial prerequisite for applying service quality theory to FM. In their study on FM for manufacturing sites, they identified 26 attributes specifically for project management services in FM by holding five focus group sessions. The subsequent factor analysis resulted in six dimensions: professionalism, provision of competent staff, communications, understanding the customer, reliability and demonstration value. They chose for analysis only the project management services from among all the FM services because of FM's highly diverse nature, and they questioned whether a common set of dimensions could be identified. Regarding this problem, instead of applying service quality theory to one specific FM service, Yusoff *et al.* (2008) applied the service quality concept to the four-factor FM framework proposed by the International Facility Management Association and developed an instrument called FM-SERVQUAL to measure service quality in local authorities in Malaysia. Thus, the 40 attributes in their instrument were originally generated under the four FM factors (people, places, processes and technology) and then grouped into seven service quality dimensions (responsiveness, professionalism, empathy, reliability, tangible 1, tangible 2 and assurance). By doing this, their instrument covered a variety of services under the umbrella of FM and those services were directly customer-encountered in nature. Spencer and Hinks (2007) used the SERVQUAL instrument to assess the soft FM service quality in a hospital, including catering, domestic, portering, estates, grounds, security, switchboard, residences, car parking, waste and linen services. They focused on internal customers (hospital staff) and administered the questionnaire survey to them. Although they claimed that the SERVQUAL instrument was empirically derived and the technique of use required developing an understanding of the

perceived service needs of target customers, their instrument used the original dimensions and attributes proposed by Parasuraman *et al.* (1988) without contextual modification, leading to the SERVQUAL instrument's weakened diagnostic ability. Jumat *et al.* (2012) examined stakeholders' expectations of service quality from a military FM organisation with a focus on maintenance work. They did not adopt the SERVQUAL instrument directly; instead, they developed their own instrument that contained 17 attributes based on experience without further grouping, but they claimed that those attributes matched the overall five dimensions categorised by Parasuraman *et al.* (1988). In summary, it seems more appropriate to apply the service quality concept to the FM framework rather than the SERVQUAL instrument when measuring a wide range of services under FM. Using the unchanged original 22 attributes may appear to amount to rote procedure. Thus the SERVQUAL instrument with specific modifications to cope with the study's objectives is applied in this study. In addition, service quality measurement in FM is customer-oriented. Hence a combination of hard and soft FM services that customers feel are significant should be included in the instrument, but customers' ability to assess those services' quality should also be considered; thus, an executable instrument can be developed.

### **3.4 Service Quality in Hospitals and Hospital FM**

For most people, healthcare is a service that is sometimes needed but not necessarily wanted (Berry & Bendapudi, 2007). Singapore's healthcare system is world renowned, at the heart of which is individual responsibility driven by Medisave – a compulsory national health savings account (Edlin, 2009). Thus, patients in Singapore are justified in calling for better service quality in all aspects of healthcare service encounters. In the healthcare sector, as the industry structure changes, “the role that patients play in defining what quality means” has become a vital competitive concern (Pai & Chary, 2013). Studies of hospital service quality measurement from the patients' perspective are abundant (Aagja & Garg, 2010; Camilleri & O'Callaghan, 1998; Jabnoun & Chaker, 2003; Vandamme & Leunis, 1993). Pai and Chary (2013) conducted a thorough review of this plethora of research. Their review comprised 47 studies, which were described and compared on factors such as questionnaire

administration, data analysis, scale (attributes in instrument) and final dimensions. They found that more than half of the studies (27 out of 47) employed the self-administered questionnaire and adopted exploratory factor analysis to determine the attributes' dimensional structure. They also found that almost half of the studies (23 out of 47) used SERVQUAL/modified SERVQUAL as the instrument for survey purposes and the studies were dominated by Perception-minus-Expectation scores (Pai & Chary, 2013). Final dimensions obtained in those studies varied from 2 to 14, suggesting the need to modify the SERVQUAL instrument according to context because, although in the same healthcare service sector, those studies were from different cultures and sectors (public/private) and varied in sample composition. Thus, they proposed that some of the more generic SERVQUAL dimensions be retained and new dimensions particular to a specific situation be added. In the questionnaire design process, reliance on past studies completed by others is legitimate (Spaeth, 1992). Actually, such reliance is highly recommended in social research based on validity and reliability considerations (Sudman & Bradburn, 1982). In Singapore's context, Lim and Tang (2000b) were the first to apply SERVQUAL to measure patients' perceptions and expectations of hospital service quality. Their instrument contained 25 attributes that were grouped under six dimensions: in addition to the original five dimensions, "accessibility and affordability" was added as the sixth. Their data were collected from clinics due to the "constraint of resources, time and reluctance of hospitals to participate in the survey". In addition, special attention should be given to the design of questionnaires that are administered to patients. One major concern is that patients are burdened with both a physical condition and psychological anxiety (Tomes & Ng, 1995); thus, the questionnaires should contain short and straightforward questions that are easy to answer to reduce the data collection demands on patients (Lin & Kelly, 1995; Manaf, 2012).

In Singapore, the Ministry of Health conducts an annual survey on patient satisfaction. The questionnaire survey asks patients to assess their perceptions of the following nine service attributes: (1) knowledge and skills of doctor, (2) care and concern shown by doctors, (3) clear explanation by staff of procedures and care, (4) knowledge and skills of nurses, (5) care and concern

shown by nurses, (6) knowledge and skills of allied health professionals, (7) care and concern shown by allied health professionals, (8) care coordination and (9) facilities. The 2012 survey showed that 77% of patients rated their overall satisfaction level as “excellent” or “good” (Ministry of Health, 2012c). It is not this study’s purpose to assess the service quality of hospitals in Singapore, but the FM-related factors identified in previous hospital service quality studies can shed light on the design of this study’s questionnaire for measuring FM service quality in hospitals. Therefore, those factors are extracted and listed in Table 3.2.

Since a patient-centered service atmosphere in hospitals is advocated, FM services should also be tailored to patients’ needs. The ward environment and services to patients are major influences on the quality of their stay (May & Smith, 2003). A majority of research on FM service quality in hospitals has focused on cleaning or catering services. For example, the SERVQUAL instrument has been applied to assess the quality of catering service in hospitals (Hwang *et al.*, 2003). Although the contributions of services like cleaning and food to the patients’ experience are clear to understand, services like water and power supply also need patients’ awareness (May & Clark, 2009) when evaluating FM service quality in hospitals. To assess the FM service quality from the patients’ perspective using the SERVQUAL instrument, the attributes that need to be included in the questionnaire must be identified first.

A review of hospital service quality literature provides some useful ideas. Although “facilities” is one of the nine service attributes measured in the Singapore Ministry of Health’s patient satisfaction survey, it is too general and specific items are not available. Another government assessment tool used in the hospital FM context is the UK’s Patient Environment Assessment Team (PEAT), which is often mentioned in FM service quality literature (Macdonald *et al.*, 2009; May & Pinder, 2008). PEAT assesses a wide range of detailed attributes that represent a hospital’s patient environment. For example, under the cleanliness section (excluding bathrooms and toilets), attributes to be assessed include patient equipment, electrical points and equipment, walls,



ceilings and doors, radiators, pipes and ventilation grilles, floors, curtains and blinds, internal glazing including mirrors, high and low surfaces, bedside area,

**Table 3.2 FM related factors in hospital service quality research**

FM related factors	Andaleeb, 1998	Bakar <i>et al.</i> , 2008	Elleuch, 2008	Jabnoun and Chaker, 2003	Kilbourne <i>et al.</i> , 2004	Lam, 1997	Lim and Tang, 2000	Manaf, 2012	Mostafa, 2005	Padma <i>et al.</i> , 2010	Sohail, 2003	Suki <i>et al.</i> , 2011	Tomes and Ng, 1995	Zmeidin <i>et al.</i> , 2009
Up-to-date and well-maintained facilities and equipment	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		
Clean and comfortable environment	✓		✓	✓			✓	✓		✓				✓
Good direction signs							✓							
Privacy during treatment (screen around the bed)							✓							
Physical facilities are visually appealing		✓	✓	✓	✓	✓			✓	✓	✓			
Availability of modern communication equipment in the hospital (including public telephone, TV and so on)	✓							✓						
Food are provided hygienic, nicely and timely without mistakes								✓		✓			✓	✓
The ward is clean and comfortable (including well-ventilated)			✓							✓			✓	✓
Adequate overall security prevalent in the hospital										✓				
Materials associated with the service are visually appealing						✓			✓		✓			
Employees are neat in appearance		✓	✓		✓	✓	✓					✓		✓
Adequate parking facilities							✓							✓
Sense of security from physical harm in hospital														✓

waste receptacles, bedside entertainment systems/public televisions and display screens and beverage bays/patient kitchens including equipment. The attributes measured in PEAT served as a basic database for the development of FM service attributes for the questionnaire used in this study. However, each hospital's PEAT score comes from multidisciplinary expert teams, not patients; in other words, the attributes used in PEAT may be trivial and hard to assess if the purpose is to obtain patients' evaluation of FM service quality. Thus, trade-offs and adaptations are necessary. In addition, as stated above, review findings from hospital service quality literature also provided useful insights for designing the questionnaire used in this study.

### **3.5 Kano Model**

There is an underlying assumption in SERVQUAL for prioritising service attributes: the larger the negative gap score, the higher the priority of the improvement ratio (Zeithaml & Berry, 1993; Zeithaml *et al.*, 1996). However, many problems result from this linear and symmetric relationship assumption (Li *et al.*, 2003). Mittal *et al.* (1998) pointed out three dilemmas for organisations that seek to maximise customer satisfaction by improving service quality:

- (1) The negative performance of a single attribute cannot be offset by the positive performance of a host of other attributes because worse-than-expected quality hurts more than better-than-expected quality helps.
- (2) Improving performance of those service attributes that customers identify as important elements does not yield corresponding changes in customer service.
- (3) Minor decreases in service level of some service attributes lead to a sharp decline in customers' overall satisfaction rating.

Against this backdrop, new thinking about the relationship between service quality and customer satisfaction is necessary. Some researchers have proposed a non-linear and asymmetric relationship between service quality and customer satisfaction. Dr. Noriaki Kano supported this view by stating that, when considering its relationship with customer satisfaction, service quality

attributes comprise two more components in addition to the traditional one-dimensional component: the attractive component and the must-be component. Based on this notion, Kano *et al.* (1984) developed the Kano model, which classifies service/product attributes into five categories according to how well they can satisfy customer needs:

(1) Attractive quality attributes

In this category, the presence of the service attributes excites the customers and results in satisfaction, but their absence does not cause customer dissatisfaction because customers do not usually have experience with them (Chen *et al.*, 2011).

(2) Must-be quality attributes

In this category, service attributes must be provided to customers. They are of “taken for granted quality”, their presence does not have a significant positive impact on customer satisfaction, but their absence causes dissatisfaction (Chen *et al.*, 2011).

(3) One-dimensional quality attributes

In this category, the presence of the service attributes results in customer satisfaction. These services’ quality is linearly related to customer satisfaction: the higher the quality level, the higher the degree of satisfaction and vice versa (Chen *et al.*, 2011).

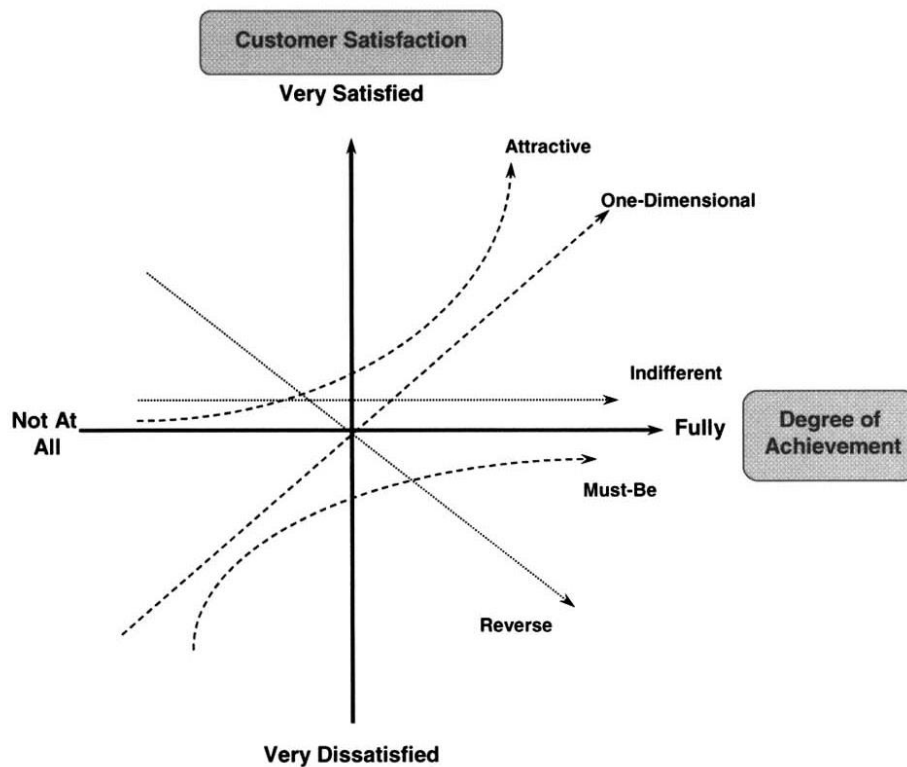
(4) Indifferent quality attributes

In this category, the service attributes’ state of fulfillment does not influence customers’ degree of satisfaction (Fundin & Nilsson, 2003). In other words, customers are indifferent towards them.

(5) Reverse quality attributes

In this category, the absence of these service attributes results in customer satisfaction and vice versa, just contrary to one-dimensional quality attributes (Fundin & Nilsson, 2003).

Figure 3.3 presents an overview of the Kano model (Fundin & Nilsson, 2003).



**Figure 3.3 Overview of the Kano model**

The corresponding classification process is based on the questionnaire survey. This questionnaire comprises several service attributes; it does not require the respondents to have had experience with these attributes (Mikulic & Prebežac, 2011). Two forms of questions are asked regarding each service item: functional (how do you feel if this figure is presented) and dysfunctional (how do you feel if this figure is not presented). For each question, the respondent selects one of five alternative answers (Baki *et al.*, 2009):

1. I like it that way.
2. It must be that way.
3. I am neutral.
4. I can live with it that way.
5. I dislike it that way.

The respondents' perceptions are then evaluated based on the Kano evaluation table shown in Table 3.3.

**Table 3.3 Kano evaluation table**

		Response to dysfunctional question				
		1. Like	2. Must be	3. Neutral	4. Live with	5. Dislike
Response to functional question	1. Like	Q	A	A	A	O
	2. Must be	R	I	I	I	M
	3. Neutral	R	I	I	I	M
	4. Live with	R	I	I	I	M
	5. Dislike	R	R	R	R	Q

**Notes:** A - Attractive; I - Indifferent; M - Must-be; O - One-dimensional; Q - Questionable; R – Reverse

*Source: Tan and Pawitra (2001).*

A “questionable” evaluation in Table 3.3 means that it is unclear whether the respondents have understood the question (Kano *et al.*, 1984). The other five evaluations represent the five essential categories of service quality attributes in the Kano model. Usually, statistical analysis such as the t-test is used to make an overall classification of the quality attributes for all respondents (Witell & Löfgren, 2007). In addition to the above mentioned five-level Kano questionnaire, there are also new approaches for classifying service quality attributes based on Kano’s theory, such as the three-level Kano questionnaire (Kano, 2001) and classification through direct questions (Emery & Tian, 2002). However, there is a lack of empirical evidence that these new approaches deliver correct results; thus, the original five-level Kano questionnaire has been the most valid, the most reliable and the most commonly used tool for service quality attribute classification purposes (Mikulic & Prebežac, 2011; Witell & Löfgren, 2007).

In addition, after administering the Kano questionnaire survey, one can calculate the customer satisfaction coefficients of each service attribute. The coefficients indicate whether providing one attribute (presence) can increase customer satisfaction or prevent customer dissatisfaction (Matzler & Hinterhuber, 1998). They also indicate whether the inadequate performance of one specific attribute (absence) leads to dissatisfaction (Sahney, 2011b). The

formulas for calculating the extent of the satisfaction and dissatisfaction coefficient are as follows:

Extent of satisfaction:  $\frac{A+O}{A+O+I+M}$ . This coefficient ranges from 0 to 1; the higher it is to 1, the higher the influence on customer satisfaction.

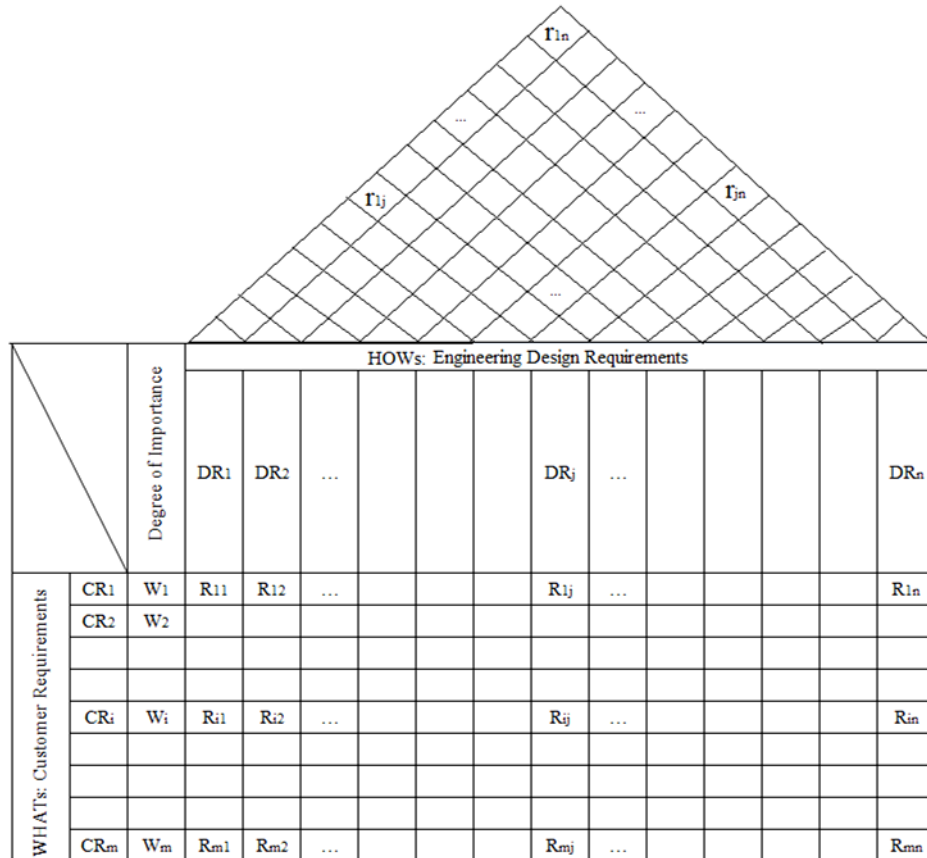
Extent of dissatisfaction:  $-\frac{O+M}{A+O+I+M}$ . The negative value of this coefficient indicates a negative influence on customer satisfaction. The closer it is to -1, the more the inadequate performance of the attribute negatively influences customer satisfaction.

According to Hinterhuber *et al.* (1997), the advantages of classifying customer needs using the Kano model include a better understanding of service needs. For example, if the quality of must-be service attributes already achieves a satisfactory level, it is not useful to invest in them rather than the one-dimensional and attractive attributes. Furthermore, when an organisation encounters a trade-off in the service improvement stage, the Kano model can offer help by setting the criteria for selecting the services that have the greatest influence on customer satisfaction (Shahin *et al.*, 2013).

### **3.6 Quality Function Deployment**

Quality function deployment (QFD) was originally developed in Japan in the 1970s as an attempt to encourage engineers to consider product quality early in the design process (Xie *et al.*, 2003). It was introduced to the Western world during the quality revolution of the 1980s (Emanuel & Kroll, 1998). In accordance with the translation of its Japanese phrases, QFD stands for deploying the customer-desired attributes of a product throughout all the appropriate functional components of an organisation (ReVelle *et al.*, 1998). Akao (2004) pointed out that QFD could translate customers' demands into design targets to satisfy them. QFD provides insight into understanding customer needs and systematic thinking about quality; thus, for quality maximisation, it helps increase customer satisfaction and adds value to the organisation (Mehrerjerdi, 2010).

The QFD methodology is broken down into four phases that are documented as matrices (ReVelle *et al.*, 1998). The House of Quality (HOQ) is the most important and frequently used matrix; the name comes from its house shape (Xie *et al.*, 2003). Figure 3.4 shows the structure of HOQ (Chin *et al.*, 2009):



**Figure 3.4 The structure of HOQ**

The components of HOQ are described as follows:

- (1) The exterior wall of the house is the WHATs: a list of customer requirements (CR) represented by  $CR_1, CR_2 \dots CR_m$  in Figure 3.4;  $m$  is the total number of CRs. Beside the WHATs is the degrees of importance of customer requirements represented by  $W_1, W_2 \dots W_m$ , respectively.
- (2) The ceiling of the house is the HOWs: a list of design requirements (DR) represented by  $DR_1, DR_2 \dots DR_n$  in Figure 3.4;  $n$  is the total number of DRs. Those DRs are provided as the responses to CRs.
- (3) The interior or living room of the house contains the relationships between CRs and DRs represented by  $R_{ij}$  in Figure 3.4, where  $i = 1, \dots, m; j =$

1, ..., n. CRs are translated to DRs through these relationships here (Xie *et al.*, 2003).

- (4) The roof of the house holds the interrelationship between the DRs and is represented by  $r_{jk}$  in Figure 3.4, where  $j = 1, \dots, n$ ;  $k = 1, \dots, n$ . Trade-offs between similar and/or conflicting DRs are included here (Xie *et al.*, 2003).

According to (Madu, 2006), the construction of HOQ contains five steps:

Step 1: List the customer requirements (WHATs).

As a process of listening to the voice of the customer, QFD's foundation is formed by customer requirements (Madu, 2006). One popular method of identifying CRs is called "quality dimension development" (Hayes, 1992). In this approach, an extensive literature review should be carried out to determine the generic industry attributes, then knowledgeable experts and focus customer groups should be employed to help the QFD team go beyond the generic industry attributes to identify specifically the attributes of the product that customers want. When going through the CR-gathering approach, it is possible for the QFD team to encounter a long list of CRs, some of which may not be important or value adding. Thus, as Madu (2006) proposed, it is important to devise methods to assign priorities to the CRs rather than wasting valuable resources on insignificant problems. When finishing this step, the exterior wall of HOQ (CRs and their degree of importance) will be established.

Step 2: List the engineering characteristics (HOWs).

Once the CRs are clarified, the QFD team must come up with the engineering characteristics (design requirements) that will affect the CRs. This step involves the translation from CRs to DRs. DRs are usually controlled by the manufacturer or producer and expressed in technical terms (Franceschini, 2002). When finishing this step, the ceiling of the HOQ will be established.

Step 3: Develop a relationship matrix between the WHATs and the HOWs.



This step involves comparing the CRs and DRs and determining their respective relationships by identifying the extent to which the DR can affect the CR. The degrees of relationships are usually presented by symbols, and in quantitative analysis the symbols are replaced by numbers, for example (Xie *et al.*, 2003):

A dark circle ● = strong relationship = 5 (or 9)

An empty circle ○ = medium relationship = 3

A triangle ▽ = weak relationship = 1

Those weights are then used in determining each DR's weight. Note that if there is an empty row (one CR is not addressed) or an empty column (one useless DR), then, after careful scrutiny, further adjustment should be made (Xie *et al.*, 2003). When finishing this step, the interior or living room of the HOQ will be established.

Step 4: Develop an interrelationship matrix between pairs of HOWs.

This step involves identifying any interrelationships between pairs of engineering characteristics (DRs). Symbols are used to describe the strength of the interrelationships (Xie *et al.*, 2003):

A dark circle ● = strong positive relationship

An empty circle ○ = positive relationship

A single X = negative relationship

A double XX = strong negative relationship

A simplified symbol system is also used in some places with “+” representing a positive relationship and “-” representing a negative relationship. This correlation matrix implies that conflicts exist in trying to achieve different CRs. Those conflicts need to be resolved through trade-off decisions based on the weighting of DRs (Madu, 2006). When finishing this step, the roof of the HOQ will be established.

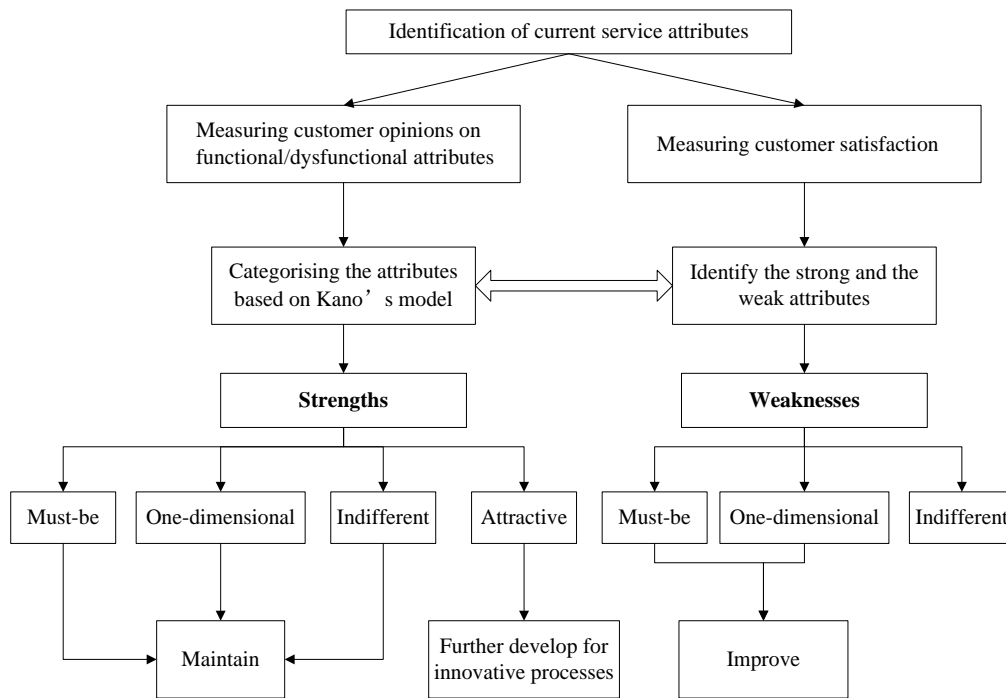
#### Step 5: Competitive assessments.

This step comprises two components, customer competitive evaluation and technical evaluation, which offer a benchmark for the manufacturer's product versus its competitor's product (Madu, 2006). Customer competitive evaluation corresponds to CR, comparing the manufacturer with its competitors on each of the CRs from the customers' perspective. Technical evaluation corresponds to DR, comparing the manufacturer with its competitors on each of the DRs to satisfy CRs. If the manufacturer wants to outperform its competitors, it must be the best in those competitive assessments.

Since its emergence, QFD has been applied successfully in many manufacturing industries across the world, including the automobile, computer, construction equipment and home appliances industries (Akao, 2004; Kim & Moskowitz, 1997). Although traditionally used for hard products, there is no boundary for QFD's potential fields of applications (Chan & Wu, 2002). For example, it has been introduced successfully in the service sector (Andronikidis *et al.*, 2009). Its applications in various service areas focus on quality management and customer service improvement and have demonstrated its wide acceptability in the service sector, including banking (Ko & Lee, 2000), library services (Chin *et al.*, 2001), hospitality (Jeong & Oh, 1998), higher education (Hwarng & Teo, 2001) and healthcare (Lim & Tang, 2000a). Similar to the manufacturing industry, in the service sector QFD can also enable listening to the voices of customers and coherently translating their expressed needs into actions that the service provider can take (Gremyr & Raharjo, 2013). Gremyr and Raharjo (2013) identified three antecedents of QFD application: understanding the customer (who is the customer), understanding the customers' needs (what do they need) and finding ways to prioritise and translate customers' needs. In addition, González *et al.* (2004) pointed out that conventional terminology must be modified to suit QFD to the service sector. For example, it is justifiable to change "engineering characteristics" to "processes and actions" representing the HOWs (Zisis *et al.*, 2009).

### **3.7 The integration of SERVQUAL, the Kano model and QFD**

As stated above, SERVQUAL is the most commonly used tool for measuring service quality. However, an underlying assumption in SERVQUAL is that the relationship between customer satisfaction and service quality is linear. The implication is that the larger the gap score of a service attribute, the more important it is to prioritise for improvement actions. In other words, if one service attribute has the largest gap score, then that service attribute should be the top priority for allocation of scarce resources for corrective actions. However, this is not necessarily true: paying more attention to improving the quality of a particular service attribute may not always lead to higher customer satisfaction if that attribute is taken for granted (Pawitra & Tan, 2003). Introducing Kano's service attribute categories into SERVQUAL and integrating them together can overcome this linearity limitation. As mentioned, the Kano model abandons the linear assumption about the relationship between customer satisfaction and service quality and adopts a non-linear and asymmetric assumption, stating that different types of service attributes have different degrees of influence on customer satisfaction and, thus, should be assigned different weights when prioritising attributes for improvement. Using the Kano method, service attributes can be grouped into three categories: must-be, one-dimensional and attractive. Attributes in the attractive category should receive the most weight in the improvement decisions, followed by attributes in the one-dimensional category, and then those in the must-be category (Pawitra & Tan, 2003). The weights for each service attribute assigned by the Kano model can then be added to the gap score obtained from SERVQUAL evaluation. Finally, the most significant item can be identified and prioritised for improvement. This integration also improves the Kano model's utility. As Tan and Pawitra (2001) pointed out, the Kano model does not evaluate service performance. By integrating it into SERVQUAL, a complete picture of service attributes' performance and their relationship to customer satisfaction can be obtained. Figure 3.5 shows the framework Tan and Pawitra (2001) proposed to integrate the Kano model into SERVQUAL.

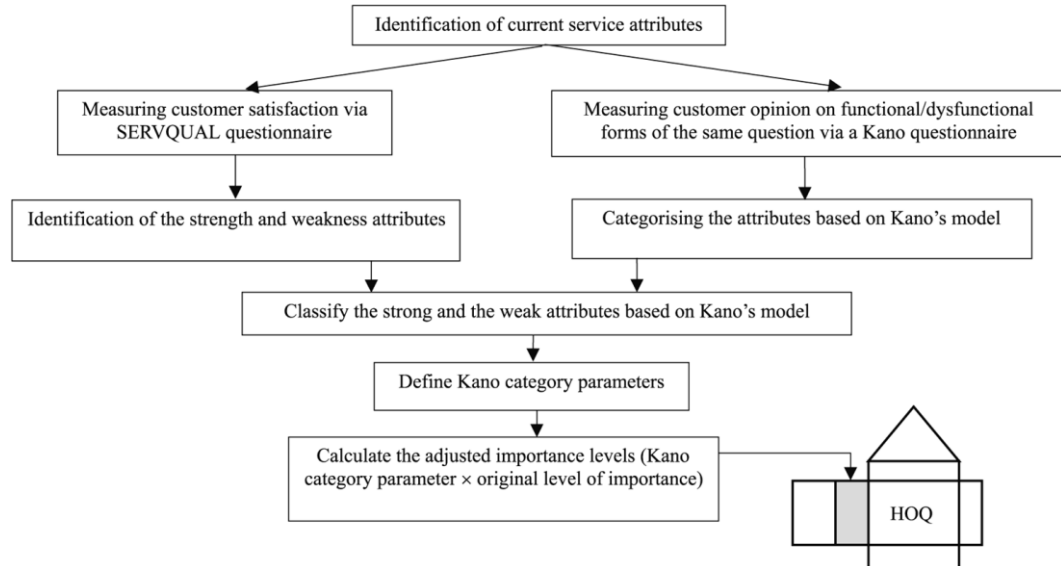


**Figure 3.5 Framework for integrating SERVQUAL and the Kano model**

Faced by all the service attributes that need improvement and their importance levels, the next step is to close the service gap and improve service quality. However, SERVQUAL and the Kano model alone cannot address this issue (Tan & Pawitra, 2001). Integrating SERVQUAL and the Kano model into QFD can provide insight in solving this problem. As introduced above, QFD serves as a tool for translating the customer requirements (voice of customer) into organisation requirements. Hence, it can provide guidance for improving the service quality of poorly performing attributes identified by using SERVQUAL and the Kano model. Various studies exist regarding the combination of SERVQUAL and QFD, or the Kano model and QFD. Lim *et al.* (1999) adopted the approach of integrating SERVQUAL and QFD in the healthcare sector in Singapore for measuring performance and designing services. Kuei and Lu (1997) also proposed this integrated approach for service quality improvement. However, problem exists in the area that has been stressed before: the linear relationship assumption between customer satisfaction and service quality in SERVQUAL. Studies which adopted the approach of integrating the Kano model and QFD have also been documented. Franceschini and Terzago (1998) used this approach in industrial training courses, converting needs of different people into design characteristics.

Similarly, Tan and Shen (2000) applied this approach in website design. This approach can assist in service design to meet customer needs, but it cannot measure the current service performance, namely, the positive or negative service gaps; thus, it lacks the diagnostic ability to identify poorly performing service attributes. Considering all the factors stated above, the integration of all the three techniques results in a more powerful and comprehensive approach for continuous service quality improvement, that is, the information on customer satisfaction and service performance is translated into specific working instructions and procedures (Tan & Pawitra, 2001). Figure 3.6 shows the framework for integrating SERVQUAL, the Kano model and QFD as proposed by Pawitra and Tan (2003). They also listed three benefits for this integrated approach:

- (1) It provides a basis for improvement planning.
- (2) There is a prioritisation of action plans as per the customers' voice.
- (3) There is enhanced documentation, communication and teamwork.



**Figure 3.6 Framework for integrating SERVQUAL, the Kano model and QFD**

Sahney (2011a) also supported the integrated approach by stating that this integration of the three methodologies enabled the gaining of insights into a customer satisfaction programme that could not be obtained through the use of either method alone.

The following section will focus on the application procedures of this integration of the three methodologies documented in the literature.

Tan and Pawitra (2001) were the first to propose the integrated use of SERVQUAL, the Kano model and QFD. They demonstrated this application by a case study focusing on the Singapore's tourism sector. The first phase of their study involved the employment of a SERVQUAL and a Kano questionnaire. The target respondents were tourists from Indonesia who had stayed in Singapore for at least three days. Because it was only an illustrative case study, their SERVQUAL questionnaire only contained seven service attributes with each attributes accompanying by three questions: expectation score, perceived score and importance score. Service gaps were measured by P-E; by multiplying this gap (absolute value) by the level of importance score, they obtained a new score for each service attributes and called it the "tourist satisfaction score". The Kano questionnaire adopted the common measures and contained the same seven service attributes in the SERVQUAL with each attribute accompanied by two types of questionnaires: functional and dysfunctional. As they pointed out, there would be unavoidable disagreement among subjects as to which attribute fell into which Kano category, so they used the arithmetic method to solve this problem. When each of the service attribute was grouped under the Kano categories, they were labeled by their group as "A", "M", "O", "I", "Q" and "R", representing "Attractive", "Must-be", "One-dimensional", "Indifferent", "Questionable" and "Reverse", respectively. The Kano multiplier they used is shown below:

Attractive = A = 4; One-dimensional = O = 2; Must-be = M = 1

At this stage, service gaps and service attributes' categories were identified, allowing attention to focus on the attributes with a negative gap score and at the same time classified under "A", "O" and "M". For example, in their analysis, they obtained three attributes with a negative gap score which belong to "I", "A" and "O", respectively. They left out the one labeled as "I" and picked the other two for incorporating in the next phase, QFD, because they thought that it was not a wise strategy to invest in improvement actions for this "I" attribute since tourists seemed to be indifferent to it. The next phase was to

use the output from the first phase and incorporate it into the HOQ. As stated above, two attributes were selected and put on the left side of the HOQ as the “WHATs”. Their original importance score was represented by the tourist satisfaction score. Since they were labeled as “A” and “O”, their original importance score was then multiplied by 4 and 2, respectively; this result was called the “adjusted importance score”. Thus, the customer requirements received an improved reprioritisation. The equation is shown below:

$$\text{Adjusted importance score} = |(P - E)| \times \text{Level of importance} \times \text{Kano multiplier}$$

Then they chose the Singapore Tourism Board’s (Singapore Tourism Board, 2000) strategic thrusts for the 21st century as the “HOWs”. The relationship matrix between the “WHATs” and “HOWs” was then established. The relationship multiplier they used is shown below:

$$\text{Strong relationship} = \bullet = 9$$

$$\text{Moderate relationship} = \circ = 3$$

$$\text{Weak relationship} = \nabla = 1$$

The importance score of each “HOW” equaled the adjusted importance score multiplied the relationship multiplier. The equation is shown below:

$$\text{Importance score of “HOW”} = \sum \text{Adjusted importance score} \times \text{Relationship multiplier}$$

Note that the HOQ used here is not complete– the ceiling was left – there was no interrelationship matrix between the “HOWs” and no competitive assessment was conducted because the case study was only in Singapore.

Finally, conclusions were drawn from the above data analysis and recommendations were made based on the results. At the end of their paper, Tan and Pawitra (2001) concluded that the integrated approach applied here created value out of the data that cannot be obtained through the use of either of the three methods alone: SERVQUAL’s service quality data were enriched

with Kano's categorisation information, further incorporating with QFD translated such information to organisation instructions and procedures, all leading to a relatively higher possibility of success in service quality improvement and customer satisfaction for the organisation.

Since the above mentioned case study conducted by Tan and Pawitra (2001) is just illustrative, there was no detailed information about the data collection process and statistical analysis method. In their following study, Pawitra and Tan (2003) further developed their case study on tourism in Singapore. They documented the adapted SERVQUAL questionnaire which contained 19 attributes obtained from the literature review (Echtner & Ritchie, 1991) without the traditional categorisation of five dimensions in SERVQUAL. A 5-point Likert scale was used and respondents were also Indonesian tourists. The method of survey was interview and potential interviewees were screened for appropriateness. Note that they conducted the SERVQUAL and Kano questionnaire survey at the same time, that is, the same interviewee would complete one SERVQUAL and one Kano questionnaire. The completion of two questionnaires constituted one return and they made 956 returns. Only one statistical method was used for data reliability testing: Cronbach's  $\alpha$ . Attributes with a negative gap score were selected in the HOQ, excluding those labeled as "I" from Kano questionnaire data analysis. The "HOWs" in the HOQ were the same as the Singapore Tourism Board's strategies for improving the new Asia-Singapore image, which were used in their former study's HOQ. This time the ceiling of HOQ was constructed but the data analysis and discussion part did not contain further explanation of the interrelationship matrix. It seems that although this interrelationship matrix is one component of HOQ, it is not an indispensable part whose importance is based on the nature and purpose of the specific study. Similar to their former study, there was no competitive assessment either. At the end of their paper, they suggested a number of further marketing implications for the Singapore Tourism Board based on their results.

Baki *et al.* (2009) adopted the technique of integrating SERVQUAL, the Kano model and QFD into the logistics sector. They chose a cargo company to carry



out the empirical analysis. In the first phase of their study, SERVQUAL and Kano questionnaires were combined together to form a long questionnaire. Service attributes were gathered from combination of the 22 original SERVQUAL attributes and 5 more from the literature review, resulting in 27 attributes together, without grouping under the 5 dimensions of SERVQUAL. Two managers of the cargo company were interviewed to ensure content validity of the attributes and 20 customers of the cargo company were pre-tested for understandability check. Using convenience sampling, a total of 178 completed questionnaires were collected. The second phase of their study involved the data analysis of the questionnaires. At the end of the stage, strong (positive gap score) and weak (negative gap score) service attributes were identified and categorised according to Kano model. Note that the gap scores of all the service attributes were negative. The Cronbach's  $\alpha$  test was used to examine the validity of the data from the SERVQUAL questionnaire and frequency analysis was used in grouping the attributes according to the Kano model. Different from Tan and Pawitra (2001)'s study, they followed Chen and Su (2006)'s advice and focused only on the attributes grouped under "Attractive". They picked up the 10 attributes labeled as "A" and conducted the second questionnaire survey asking customers to give an importance score to each of the "Attractive" attributes. The second questionnaire survey also contained questions for measuring customers' perceptions of other cargo company's service performance of the 10 attributes. Furthermore, these 10 attributes were taken as "WHATs" and incorporated in the HOQ; their levels of significance were represented by the mean score they received from the importance evaluation of the second questionnaire survey. The QFD team included three researchers and two cargo company managers. The team defined nine technical requirements which were taken as the "HOWs" in the HOQ. The relationship matrix between the "WHATs" and the "HOWs" was then constituted. They used the same relationship multiplier as the former study and the same equation to obtain the importance score of each of the technical requirements. For comparison purposes, the importance levels were also presented as percentages. What's more, there was no interrelationship matrix between the "HOWs", just like in Tan and Pawitra's (2001) study.

However, they conducted the customer competitive evaluation using the data gathered from the second questionnaire survey. At the end of their paper, they presented a number of further implications for academicians and practitioners in the cargo service sector based on their results.

Sahney (2011a, b) applied this integration method to the management education sector in India. This study was conducted across three phases. The first phase involved the identification of students' requirements for management education institutions and evaluating service quality through the use of SERVQUAL; 26 attributes were identified in the literature review. Students were asked to evaluate the importance level against a scale of 5 from "not important at all" to "absolutely important". The 26 attributes were grouped under five constructs/dimensions through validity and reliability tests. However, the Scree plots for the data set indicated that the 26 attributes were uni-dimensional. However, they concluded that these attributes had an impact on customer satisfaction regardless of their classification into constructs. Thus, using the same constructs, they surveyed students employing the SERVQUAL method. Students were asked to respond on a scale of 5 with their degree of expectation and perception, from "poor" to "excellent". Then the gap analysis was conducted and all the attributes obtained a negative gap score. The second phase involved the categorisation of service attributes according to the Kano model. In this phase, the Kano questionnaire was developed using the same constructs of SERVQUAL questionnaire. Note that in this study, the SERVQUAL and Kano questionnaires were separated and distributed to different respondents at different times. When analysing the data obtained from the Kano questionnaire, this study employed a more complex "customer satisfaction coefficient" for understanding the significance of each attribute compared to former studies which simply indicated the Kano classification result. The customer satisfaction coefficient reflects the extent to which the presence or absence of one attribute influences customer satisfaction or dissatisfaction (Matzler & Hinterhuber, 1998). The third phase of this study involved the application of QFD. The "HOWs" were identified from a literature review relating to models proposed for quality management in education institutions. Different from previous studies, the relationship matrix

was obtained from the result of a questionnaire survey. A total of 65 responses from students were found to be valid for analysis. Then the HOQ was constructed without competitive assessment. Finally, the ranking of the HOWs were presented and further recommendations were made.

Terzakis *et al.* (2012) also applied this integrated approach in the education sector. However, they first conducted a SWOT analysis of one academic department's environment. The outcomes of the SWOT matrix were used to construct the SERVQUAL and Kano questionnaire, as well as the "HOWs" in the HOQ. The SERVQUAL questionnaire contained 35 attributes grouped under six dimensions. Different from previous studies, the gap analysis in this study was conducted based on dimensions instead of specific attributes; in other words, the gap scores were calculated only for the six dimensions. Among them, four dimensions received the negative gap score. Thus, the "WHATs" in the HOQ were presented by the four dimensions and each of the adjusted importance score was calculated following Tan and Pawitra's (2001) method. Finally, the strategies which should be adopted by the academic department were highlighted by the authors based on the results.

Based on the review above, it seems that there are no standard steps for applying this integrated approach to specific service sectors. For example, although questionnaires generally comprise the SERVQUAL questionnaire and Kano questionnaire, the sampling and distribution method are not the same across the studies reviewed above. What's more, some components are not included in all studies, such as the competitive assessment and the interrelationship matrix. The members of the QFD team are also from different sources. Differences can also be seen from other aspects. Table 3.4 contains the summary drawn from the above review.

**Table 3.4 Summary on literature review of the integration method**

Source	Service sector	WHATs	Sampling	Reliability test	Adjusted importance of WHATs	HOWs	QFD team	Interrelationship matrix	Competitive assessment
Tan and Pawitra, 2001	Tourism	Literature review	Convenience sampling	Cronbach's $\alpha$	$(P - E) \times$ Level of importance $\times$ Kano multiplier	STB's strategies	Authors	Not contained	Not contained
Pawitra and Tan, 2003	Tourism	Literature review	Convenience sampling	Cronbach's $\alpha$	$(P - E) \times$ Level of importance $\times$ Kano multiplier	STB's strategies	Authors	Yes, but without further explanation	Not contained
Baki <i>et al.</i> , 2009	Cargo	Literature review and SERVQUAL's original attributes	Convenience sampling	Cronbach's $\alpha$	Level of importance	Decided by the QFD team	Authors and managers	Not contained	Yes
Sahney, 2011a, b	Education	Literature review	Stratified random sampling	Cronbach's $\alpha$ , Scree plot	Level of importance $\times$ Kano multiplier	Literature review	Students	Yes, but without further explanation	Not contained
Terzakis <i>et al.</i> , 2012	Education	SWOT analysis	Not specified	Not contained	$(P - E) \times$ Level of importance $\times$ Kano multiplier	SWOT strategies	Authors	Not contained	Not contained

It is worthwhile to note that the level of importance of each service attribute used in these studies was the result of a questionnaire survey which asked respondents to rate the level of importance for each attribute against a Likert scale. This questionnaire survey was separated from the SERVQUAL, Kano and QFD surveys. Although these studies incorporated this level of importance when calculating the adjusted importance score of WHAT, there were no clear explanations as to why they did that, while the reason for incorporating the gap score and Kano multiplier into the adjusted importance score was fully established. In addition, the potential respondents of this type of level of importance questionnaire are inpatients in this study's context. These patients are supposed to answer the SERVQUAL questionnaire as well. But patients are generally weak so much so that complicated and lengthy questionnaires would make them tired and unhappy. The gap score and Kano multiplier are therefore adequate for determining the adjusted importance score of WHAT. Taking all these facts into consideration, this study therefore decides against adopting the portion on the level of importance and only the SERVQUAL, Kano and QFD surveys are conducted.

### **3.8 Summary of Chapter**

This chapter reviewed the literature on service quality theory and SERVQUAL, the Kano model and QFD, as well as their integrated use in different service sectors. The researcher proposed the approach of integrating the three tools because it can yield valuable results that cannot be obtained by using either of them alone. It has been proven to be a useful tool for service quality management. The literature review also revealed that there are no standard steps or methods for applying this integrated approach. The detailed procedures and methods used by researchers depend on the nature and purpose of their studies.

## **Chapter 4 Conceptual Framework**

### **4.1 Applying Service Quality Theory in Hospital FM Context**

The literature review revealed the need to evaluate FM service quality from the customer's point of view. Service quality theory sheds light on this issue and provides a useful tool for customers to use in evaluating FM service quality: SERVQUAL. However, as many researchers have pointed out, the original dimensions and service attributes in SERVQUAL should be adapted to reflect the nature of the service sector (Ladhari, 2008). The International Facility Management Association defines FM as “a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, places, processes and technology”. The basic framework of FM encompasses four aspects: people, place, process and technology (Yusoff *et al.*, 2008). Hospital FM covers a wide range of services, hard and soft; some can be seen, felt and evaluated by patients and, because of their nature, others cannot. Thus, patient-oriented service quality evaluation here is not like traditional performance measurement, which includes a set of key performance indicators. This study aims to apply the service quality theory in the hospital FM context and, thus, only the service attributes that can be seen, felt and evaluated by patients have been selected and measured. The process orientation limitation of the original SERVQUAL attributes has also been avoided by including not only process but also outcome-oriented attributes. Those attributes differ from SERVQUAL's original scales because they are based on the nature of hospital FM and the purpose of this study. They have been sorted under the four aspects of FM and obtained from the literature review, primary patient interviews and consultations with experts and facilities managers in hospitals. A total of 25 service attributes have been identified, as shown in Table 4.1.

**Table 4.1 Service attributes identified**

	<b>Service Attributes</b>
Place	Clarity of signages (e.g. easy to spot)
Place	Attractiveness of public area landscape
Place	Cleanliness of overall environment in ward (including bathrooms)
Place	Provision for patient privacy (e.g. curtains)
Place	Cleanliness of public areas (e.g. floors, walls, seating)
Place	Cleanliness of bedding in ward
Technology	Condition of elevators and escalators
Technology	Performance of lighting systems in ward
Technology	Performance of ventilation systems in ward (e.g. odor)
Technology	Performance of bedside nurse call system in ward
Technology	Performance of drinking water supply systems
Technology	Performance of non-drinking water supply systems (e.g. at sink, toilet)
Technology	Performance of pest control in hospital
Technology	Choice and availability of food and drinks provided by hospital
Technology	Quality of food and drinks provided by hospital
Technology	Quantity of food and drinks provided by hospital
Technology	Adequacy of security prevalent in hospital
People	Tidiness of FM staff members' appearance
People	Courtesy of FM staff members
People	FM staff members' knowledge to answer patients' questions related to their services
People	FM staff members' willingness to help
People	FM staff members' professionalism in running their job
Process	Individual attention given to patients from FM staff members
Process	Convenience of FM service hours
Process	Adequacy of hygienic care during FM service encounter (e.g. materials FM staff members use are clean)

These attributes were then incorporated into the SERVQUAL questionnaire (the research design is discussed in Chapter 5).

In addition, service quality theory also suggests a non-linear and asymmetric relationship between service quality and customer satisfaction (Kano *et al.*, 1984). Thus, it is necessary to incorporate this issue into the service quality improvement scheme for prioritisation of the service attributes. The Kano model is widely accepted for categorising service attributes and it can provide deeper insight into the significance of each attribute (Chen *et al.*, 2011). By employing both SERVQUAL and the Kano model, researchers can obtain a

more valuable result regarding the understanding of each service attribute. For example, by analysing each attribute's gap score and category, the attribute's importance level can be determined, forming the base for resource allocation arrangements for corrective actions. The Kano categorisation is based on the Kano questionnaire, discussed in Chapter 3. The detailed design is provided in the next chapter.

Identifying service gaps and categorising service attributes comprises the diagnostic stage; the next stage for a quality improvement and customer satisfaction scheme is providing strategies and guidance for closing the gaps. The extended gap model provides solutions for each gap (Zeithaml *et al.*, 1990). Combining this extended gap model and the previously discovered eight key aspects for successful FM for the hospital FM context yields a detailed and effective decision pool for closing the service gaps. Table 4.2 shows solutions for closing service gaps within the hospital FM context.

#### **4.2 Integrating SERVQUAL, the Kano model and QFD for quality improvement and customer satisfaction**

When the service gaps have been identified and service attributes classified, and a pool of possible solutions for closing the service gaps established, a tool is needed to gather the information and create the relationship between the gaps and solutions. The HOQ of QFD is a useful tool for solving this kind of problem (Xie *et al.*, 2003). HOQ can help draw a clear relationship matrix of customer requirements and actions to fulfill those requirements. In this study, the results from the SERVQUAL and the Kano questionnaire survey serve as input for the WHATs in HOQ, and 32 solutions for closing gaps shown in Table 4.2 are the pool of HOWs. In addition, the importance level of each attribute in WHATs is determined by both its gap score and its Kano category; this is then reflected in the importance score of each of the HOWs. During the process of constructing the HOQ, the WHATs and HOWs will be linked; thus, the solutions for closing service gaps will be identified and their importance level will be determined for resource allocation assignment.



**Table 4.2 Solutions for closing service gaps**

<b>Key factors for successful FM</b>	<b>Close Gaps</b>
<b>I . Management of information and knowledge</b>	
Generate information about what patients want from FM services through formal and informal information gathering activities.	Gap 1
Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.	Gap 1
Managers understand and utilise patients' expectation information effectively.	Gap 1
Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.	Gap 3
Information flows smoothly between the FM department and other departments in the hospital.	Gap 4
Performance and management information are delivered as a consequence of service provision.	Gap 2
<b>II . Fitting FM function and role to the environment of practice</b>	
Levels of management within the FM department are adjusted to the needs of the hospital.	Gap 1
Facilities managers continuously process information and make decisions concerning all aspects of the work environment.	Gap 1, 2, 3
Facilities managers understand the hospital's needs.	Gap 4
<b>III. Sufficient budget and cost effectiveness</b>	
Adequate resources are committed to the FM department to improve service quality.	Gap 2
The FM department meets patients' expectations for FM services without hindering its financial performance.	Gap 2
<b>IV. Selecting and dealing with the outsourcer</b>	
Appropriate specifications for service levels are issued.	Gap 2
Make sure that the outsourced team has the capabilities and skills to deliver the service.	Gap 3
Diligent contract administration, and outsourced service provision is continually reviewed.	Gap 3
Openness is established in relationships between the hospital and service providers.	Gap 3
<b>V . Leadership and experience of facilities manager</b>	
Facilities managers are committed to continuing professional development for all the FM staff members and continual service quality improvement.	Gap 3
Facilities managers make FM staff members feel appreciated for their contributions.	Gap 3
Facilities managers foster teamwork among FM staff members.	Gap 3

Facilities managers make sure that front-line workers are empowered and held responsible.	Gap 3
Facilities managers ensure that change is managed successfully.	Gap 1, 2, 3
Facilities managers achieve an appropriate balance of general management and technical skills with an understanding of organisations, people and processes.	Gap 2, 3
<b>VI. Facilities manager's involvement in hospital level decision-making</b>	
Facilities managers emphasise serving patients, and this effort is reflected in the hospital's development strategy.	Gap 2
Facilities managers are involved early in the briefing stage when changes are around the corner.	Gap 1
The hospital's external communications accurately reflect the information that facilities managers provide about the FM service quality.	Gap 4
<b>VII. Staff development and training: soft and hard skills</b>	
Staff members are trained to interact effectively with patients.	Gap 3
Staff members understand hospital policy, FM department goals and what is expected of them.	Gap 3
Staff members are qualified for their job.	Gap 3
Staff members are given tools and equipment needed to perform their job well.	Gap 3
Patient-contact staff members commit to cooperation to provide quality service.	Gap 3
<b>VIII. Service tasks standardisation and benchmarking</b>	
Hard and soft technologies are used to standardise service tasks.	Gap 2
Service goals in benchmarking are based on customer standards rather than hospital standards.	Gap 2
Formal processes exist for measuring performance and goal-setting.	Gap 2

### 4.3 Conceptual Framework

Following the literature review and introduction of ideas in the previous two sections, this section will present the conceptual framework.

In the context of FM, on one hand, researchers have focused on several areas listed in the framework; in particular, FM performance measurement continues to draw research interest and new requirements are emerging for customer-focused evaluation. On the other hand, hospital FM is a key function in hospitals and covers a wide range of services, including hard and soft FM. A customer-oriented performance measurement for hospital FM is needed.

Service quality theory sheds light on this issue. A review of service quality theory resulted in the use of SERVQUAL in this study to satisfy the requirement just mentioned. Efforts taken to apply SERVQUAL in the hospital FM context result in the identification of several service attributes to be used in the SERVQUAL questionnaire. The SERVQUAL questionnaire survey will fulfill the first objective of this study: “identify service gaps and measure service quality of hospital FM in Singapore”. In addition, the limitation of SERVQUAL calls for an effective tool for identifying the relationships between service attributes and customer satisfaction. It is against this backdrop that the Kano model is introduced in this study. The Kano questionnaire survey will fulfill the second objective of this study: “categorise the FM service attributes”. At the same time, the literature review also revealed eight key aspects for successful hospital FM; these aspects can then be incorporated into the extended gap model to generate solutions to close service gaps. All this information can be taken as the input for employing QFD to identify effective means to achieve service quality and customer satisfaction improvement. The SERVQUAL and Kano results present customers’ requirements, so they are the WHATs in HOQ. The solution pool generated from the integration of hospital FM and the extended gap model serves as the HOWs in HOQ. Then the QFD team can establish the relationship matrix of WHATs and HOWs and identify effective solutions for closing service gaps. During this process, the importance level of each WHAT is influenced by its gap score and Kano category, while the importance level of each HOW depends on the extent to which it can affect the service attribute’s performance and the attributes’ importance level. Once the HOQ is constructed and the data have been analysed, the third objective of this study will be fulfilled: “suggest effective ways to close the hospital FM service gaps”. Figure 4.1 shows the conceptual framework for the above mentioned processes.

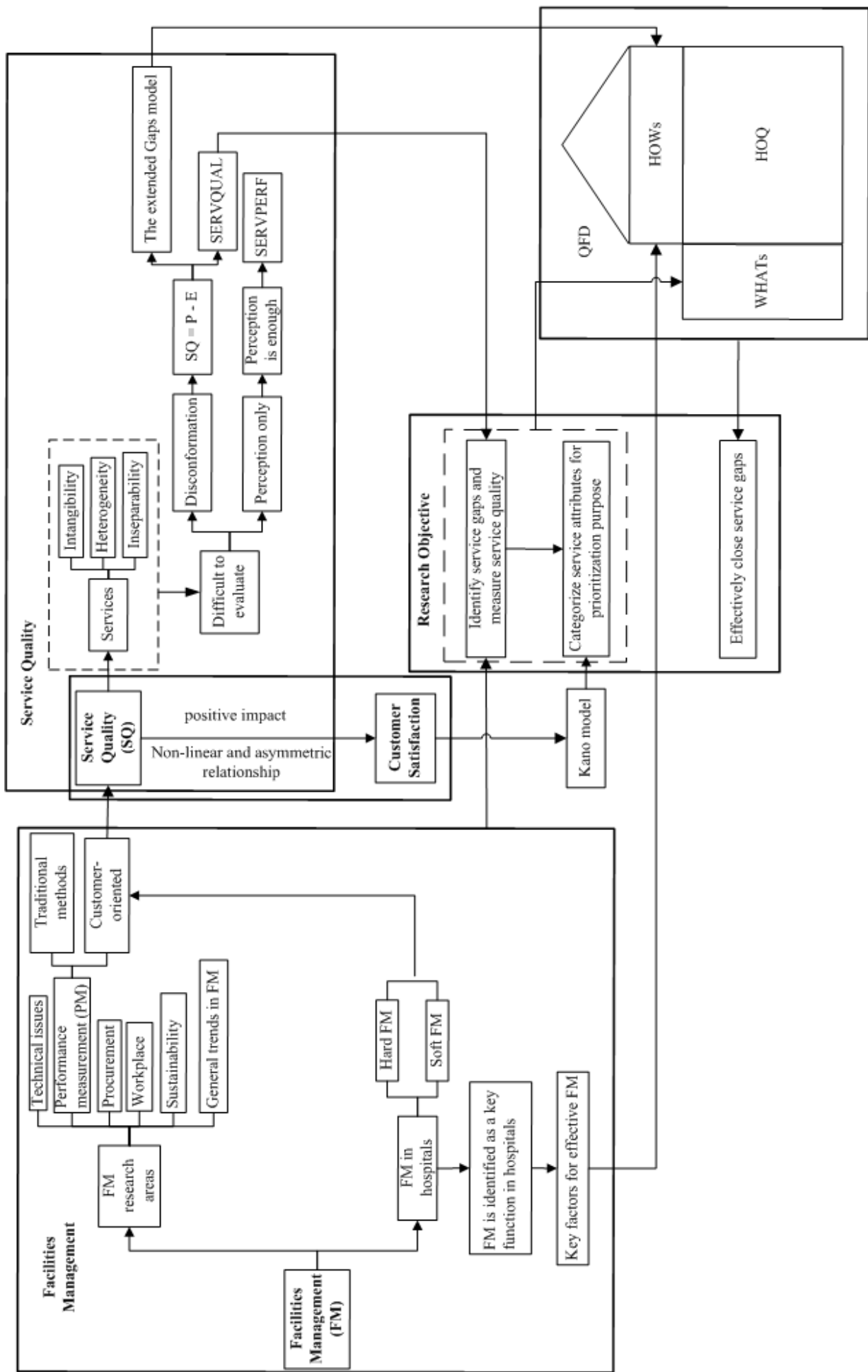


Figure 4.1 Conceptual framework

#### **4.4 Summary of Chapter**

This chapter discussed the selection of service attributes that can represent the service quality of hospital FM and can be evaluated by the patients. Based on the literature review, this chapter identified 25 service attributes to be used in the SERVQUAL survey. In addition, the chapter discussed the integration of SERVQUAL, the Kano model and QFD in this study and identified 32 key factors for successful FM, which can be incorporated in the QFD as the HOWs. Finally, this chapter summarized the findings from the previous chapters and presented the conceptual frame work of this study.

## **Chapter 5 Research Methodology**

### **5.1 Research Design**

The research design is the “blueprint” for testing the research hypothesis or interpreting events (Tan, 2012). A research design should fulfill two objectives; the first is to conceptualise an operational plan and undertake various procedures and tasks required to complete the study; the second is to ensure that these procedures are adequate to obtain answers to the research questions (Kumar, 2011).

Research designs include case study, survey, experiment and regression. Typically one design is dominant (Tan, 2012). According to Tan (2012), case studies are used to test theories, explore the ground, and offer new insights or interpretations by investigating a particular unit or entity or phenomenon; surveys are used to explore particular issues, describe phenomenon, determine preferences, and ascertain reasons by collecting data based on a sample; experiments are used if possibility exists for manipulating the variables to determine the cause and effect relationship; regressions are used to determine if the independent variables have an effect on the dependent variables.

As stated in Chapter 1, this study addresses three research problems:

- (1) What are the service gaps in hospital FM in Singapore?
- (2) What are the categorisations of hospital FM service attributes?
- (3) How can hospitals close the service gaps in their FM services?

Accordingly, there are three research objectives:

- (1) Identify service gaps and measure service quality of hospital FM in Singapore.
- (2) Categorise the FM service attributes.
- (3) Suggest effective ways to close the hospital FM service gaps.

Thus, patients’ opinions about the service quality of hospital FM should be sought; the general public’s ideas regarding the classification of FM service

attributes should be obtained; and facilities managers' views on closing the service gaps are also required. This study is not focused on a specific hospital, so the case study design is not applicable. Experiment and regression cannot solve the research problems here; thus they are also not applicable to this study. The survey design provides a quick and efficient way to obtain data to answer the research questions and, thus, fulfill the research objectives. Therefore, the survey design is used in this study.

Three surveys are conducted in this study. The first is intended to obtain patients' views on the service quality of FM in hospitals in Singapore based on the SERVQUAL instrument. This survey aims to identify the FM service gaps in hospitals. The population of this survey is hospitalised patients (who stay in hospital for at least two days) in Singapore's six public general hospitals during the data collection period, and the sampling frame is the hospitals' own patients' information documentation, which is not accessible to the author of this study. Thus, the sample is a non-probability sample. Considering that patients are generally physically weak, convenience sampling and snowball sampling are used in this survey. Hospitals in Singapore are usually reluctant to allow any survey to be conducted on their patients due to their strong intention to protect their patients from any form of disturbance. The researcher sent emails to the six public general hospitals to seek approval of this survey and three hospitals replied, with two approving this survey. Thus, the survey was administered on the two hospitals' (hospital A and hospital B) hospitalised patients.

The second survey is intended to obtain the general public's opinions about the classification of FM service attributes based on the Kano model. This survey aims to provide evidence to support grouping the service attributes under the Kano categories. The population of this survey is the general public (out-patients and visitors) in hospital A and hospital B. There is no sample frame, so convenience sampling is used for this survey.

The third survey is designed to obtain the facilities managers' views on closing the FM service gaps identified in the first survey based on QFD. The aim of this survey is to determine the relationships between service attributes'

performance and key factors for successful FM. The population of this survey is the facilities managers from hospital A and hospital B; the sample frame is the contact information for these facilities managers listed in the Singapore Government Directory. All the facilities managers on the list received emails seeking their approval and three from hospital B agreed to participate in the survey.

## **5.2 Data Collection Methods**

This study uses analysis of past documents and questionnaires as the data collection methods.

Past documents analysed include internal organisational sources and external sources. Internal organisational sources are mainly the hospitals' annual reports and brochures for patients and visitors; those documents contain information about the hospital type, size, facilities services and daily operation activities in the wards. Information gathered from them helps to provide the grounds for understanding the nature of FM in hospitals and insight into designing the questionnaires, as well as facilitating the data collection practices. For example, the visiting hours, drug administering time and cleaning and catering time in the wards are important information for the researcher since the patient survey cannot interrupt the normal operations in the ward or cause inconvenience to doctors, nurses or patients.

External sources consist of academic journals, newspapers and websites. Such information is available on the Internet. Literature from academic journals helps establish the theoretical foundation of this study and the questionnaire design; information gathered from newspaper reports concerning the healthcare system in Singapore, the Ministry of Health's website and hospitals' websites help in understanding the big picture of the roles patients, hospitals and the hospitals' FM department play in Singapore's healthcare system, as well as patients' requirements for both core and non-core hospital services.

There are three kinds of questionnaires corresponding to the three surveys in this study. The first questionnaire is the SERVQUAL questionnaire. As stated in Chapter 4, 25 FM service attributes were identified and contained in this



questionnaire. The target respondents were inpatients who had been in the hospital for at least two days. This questionnaire started by introducing the purpose of the survey and providing instructions for filling out the questionnaire. The first part of the questionnaire gathered general information about respondents, such as age, gender, race and educational background. The second part measured the service quality of FM from the respondents' point of view. Respondents were asked to score their expectation and perception regarding the performance of each service attribute using a 5-point Likert scale (1=very poor, 2=poor, 3=neutral, 4=good, 5=very good). A pilot study carried out on 12 inpatients from hospital A found two main problems. The first is the sequence of the 25 service attributes in the questionnaire. At first, the sequence was the same as that shown in Table 4.1, which grouped and displayed attributes under place, technology, people and process. However, respondents said this sequencing was a bit confusing; they felt like it jumped from one attribute to another and that it would be better if the order of attributes was aligned with real-life experience. Therefore, the sequence of some of the attributes in this questionnaire was changed according to the real-life experience of going to a hospital instead of their grouping under the four FM factors. For example, "provision of patient privacy" falls in the "place" group and was displayed as the fourth attribute. However, this attribute measured the privacy protection provision in the ward, so it was then put with other attributes from the "technology" group that also concerned the ward environment and was displayed ninth. The second problem was with the attribute "FM staff members' willingness to help". Respondents were confused because they thought that they seldom asked the FM staff for help so their willingness to help was hard to measure; they also thought that this attribute was included in another attribute "courtesy of FM staff members". Actually this "willingness to help" attribute was extracted from the original SERVQUAL list of 22 attributes under the "responsiveness" dimension and the "courtesy" attribute was under the "assurance" dimension. Some following studies did not include this "willingness to help" attribute in their SERVQUAL questionnaires because of the nature of their study (Pawitra & Tan, 2003; Yusoff *et al.*, 2008). This questionnaire was administered to

patients who were generally physically unwell and weak. Questions in the questionnaire should be easy to understand and the possibility of causing confusion should be kept to the minimum. Additionally, in the hospital context, inpatients usually ask the nurses for help when they encounter problems rather than the FM staff. Thus, considering the feedback from the respondents and the specific nature of this study, the attribute “FM staff members’ willingness to help” was eliminated from the questionnaire. The final 24 attributes used in the formal questionnaire survey are shown in Table 5.1.

**Table 5.1 Service attributes used in the SERVQUAL questionnaire**

	<b>Service Attributes</b>
P1	Clarity of signages (e.g. easy to spot)
P2	Attractiveness of public area landscape
P3	Condition of elevators and escalators
P4	Cleanliness of public areas (e.g. floors, walls, seating)
P5	Performance of pest control in hospital
P6	Adequacy of security prevalent in hospital
P7	Cleanliness of overall environment in ward (including bathrooms)
P8	Cleanliness of bedding in ward
P9	Provision for patient privacy (e.g. curtains and blinds)
P10	Performance of lighting systems in ward
P11	Performance of ventilation systems in ward (e.g. odor)
P12	Performance of bedside nurse call system in ward
P13	Performance of drinking water supply systems
P14	Performance of non-drinking water supply systems (e.g. at sink, toilet)
P15	Choice and availability of food and drinks provided by hospital
P16	Quality of food and drinks provided by hospital
P17	Quantity of food and drinks provided by hospital
P18	Tidiness of FM staff members’ appearance
P19	Courtesy of FM staff members
P20	FM staff members’ knowledge to answer patients' questions related to their services
P21	FM staff members’ professionalism in running their job
P22	Individual attention given to patients during FM service encounter
P23	Convenience of FM service hours
P24	Adequacy of hygienic care during FM service encounter (e.g. materials FM staff members use are clean)

For convenience purposes, these attributes will be presented as P1, P2, ..., and P24 in the following sections of this study. The finalised questionnaire containing 24 service attributes is shown in Appendix 1.

After the pilot study, this questionnaire survey was conducted in the two hospitals mentioned above. The dissemination of this questionnaire was combined with informal interviews. That is, the author distributed the questionnaire to respondents face to face and was present when they were completing the questionnaires for the purpose of explanation and clarification if necessary. In addition, respondents were asked to give other comments about the FM services, if any. Although time-consuming, this face-to-face practice enhanced the validity of the data since any confusion could be cleared up at the time. The SERVQUAL questionnaire is designed to measure both expectations and perceptions, and it differs from traditional customer surveys that ask about perceptions only. Thus, as the pilot study showed, the respondents were easily confused and could not understand the meaning of expectation and perception. Thus, because the researcher was present and could answer their questions immediately, the quality of the data gathered is better guaranteed. In addition, gathering the comments from patients provided a more comprehensive picture of the FM service quality they experienced as well as insights into how to improve the service quality. Thus, the method of face-to-face questionnaire distribution was adopted for this study.

The second questionnaire used in the second survey was the Kano questionnaire, which provided evidence for classification of the 24 attributes. The target respondents were the general public in the two hospitals mentioned above because the questionnaire concerns hospital FM services. If the questionnaire had been administered in other places, such as shopping malls, the respondents may not have understood what the questions addressed since they were not physically in the hospital compound. The questionnaire starts by introducing the purpose of this survey and providing instructions for filling out the questionnaire. The questionnaire had two parts. The first part gathered general information such as age, gender, race and educational background of the respondents. The second part measured the respondents' feeling about the

functional and dysfunctional conditions of each service attribute. The service attributes were the same 24 attributes as in the first questionnaire. For each service attribute, two questions were asked, one functional and one dysfunctional, so that the questionnaire contained 48 questions. According to respondents' answers to the questions, each service attribute was classified under a Kano service attribute category based on the matrix shown in Table 3.3. This questionnaire is shown in Appendix 2. The general public in hospitals mainly consists of outpatients and visitors, who are not familiar with the construct of the Kano questionnaire; thus, to ensure the quality of the responses, face-to-face questionnaire distribution was adopted for this survey too.

The third questionnaire used in the third survey was the QFD questionnaire. It aimed to derive insight into how to close the service gaps identified in the first questionnaire. Its target respondents were the facilities managers from hospital A and hospital B. As stated above, three facilities managers from hospital B agreed to participate in this questionnaire survey. This QFD questionnaire took the form of a HOQ and, as explained in Chapter 3, without the interrelationship matrix at the top (the ceiling). Considering the outputs from the SERQUAL and Kano survey, 22 out of 24 service attributes were selected as the WHATs. The HOWs were the 32 key factors for successful hospital FM identified in the literature review, as shown in Table 4.2. The respondents were asked to evaluate the extent to which each of the HOWs can influence the performance of each of the WHATs. The evaluation standard was as follows:

A strong relationship = 9

A medium relationship = 3

A weak relationship = 1

Since the QFD questionnaire was lengthy and completing it was a very time-consuming process, it was difficult to schedule a time slot sufficient for the three facilities managers and the researcher to sit down together and complete the questionnaire. Thus, the researcher held a preliminary meeting with the

three facilities managers. In this meeting, the researcher introduced the purpose of this study and carefully explained the QFD questionnaire survey. Then the three facilities managers read through the QFD questionnaire and the researcher answered any questions they had about the questionnaire immediately. After making sure that all the participating facilities managers were clear about the questionnaire survey and the method for filling it out, the researcher sent the questionnaire to each of them and asked them to consult each other when completing the questionnaire since they were working in the same office. Any glaring differences in their input could then be discussed and reconsidered to reach an agreement on the relationship matrix. The researcher also stressed that comments regarding solutions not included in the 32 HOWs that might be helpful in closing service gaps were welcome. After the three facilities managers completed the questionnaire, the researcher met their representative and worked together to finalise the answers. The outputs of this questionnaire survey provides insight into how to close the service gaps, as well as how to determine the importance of the HOWs and their priorities when allocating resources to implement them. This questionnaire is shown in Appendix 3.

### **5.3 Data Analysis Methods**

According to Trochim (2001), data analysis consists of descriptive statistics and inferential statistics. Descriptive statistics illustrate the basic characteristics of a specific single variable in a study, such as distribution, central tendency and dispersion. A single variable's distribution is often described with a frequency distribution. Central tendency is often estimated by the mean, median and mode. Dispersion is often measured by standard deviation, variance and range. Inferential statistics are used to draw conclusions that extend beyond the immediate data. Common analysis methods include the t-test, Mann-Whitney U test (the generalised t-test), analysis of variance, regression and analysis of covariance, among others.

Two software packages – Microsoft Excel and SPSS version 17.0 – were used for data analysis in this study. Following the profile of respondents, both the descriptive and inferential statistics were derived for the data gathered from

the first questionnaire survey. The respondents' age, gender, race, and education background distribution is first analysed. Then the Cronbach's  $\alpha$  test was carried out to test the internal consistency reliability of the questionnaire. Since this questionnaire used a 5-point Likert scale, the mode and distribution of responses to each specific attribute were presented, for both patients' expectations and their perceptions, to make the result easier to understand. Gap analysis was then conducted for each of the service attribute to identify the attributes with weak service quality. The gap score was calculated according to the Perception-minus-Expectation formula. The mean of each attribute's gap score was also calculated. Finally, the Mann-Whitney U test was carried out to see if the two hospitals' FM services have the same level of quality from patients' perspective.

For the second questionnaire survey data analysis, the first step was to convert the raw data gathered from the questionnaires to the categories in the matrix presented in Table 3.3. In other words, for each of the service attributes, two answers were obtained from the questionnaire regarding functional and dysfunctional questions, respectively. According to Table 3.3's matrix, each attribute's belonging category can be identified. Then all the category information was gathered and prepared for further analysis.

Similar to the SERVQUAL survey data analysis, the respondents' age, gender, race, and education background distribution were first presented. The frequency analysis was then carried out to determine which Kano category had the highest frequency belonging category of each attribute. This highest frequency category became the attribute's final belonging category. Thus, the Kano multiplier was assigned to each attribute based on its belonging category. The Kano multipliers are as follows:

Attractive = A = 4; One-dimensional = O = 2; Must-be = M = 1

In addition, the customer satisfaction coefficients of each service attribute were also calculated to obtain a deeper understanding of the relationship of the performance of each attribute and its influence on customer satisfaction. The formula used is shown below:

Extent of satisfaction:  $\frac{A+O}{A+O+I+M}$

Extent of dissatisfaction:  $-\frac{O+M}{A+O+I+M}$

For the third questionnaire survey, the data analysis mainly focused on the relationship matrix obtained and the integration of the outputs from the three questionnaire survey data analyses. The importance score of each WHAT was calculated first according to the formula below:

Importance score of WHAT =  $|(P - E)| \times$  Kano multiplier

Then the relationship score between each HOW and WHAT was integrated together with the importance score of each WHAT to obtain the importance score of each HOW. The formula is shown below:

Importance of HOW =  $\sum$  Importance of WHAT  $\times$  Relationship Score

The HOWs' importance score will serve as the basis for prioritisation. In other words, when allocating the resources to the HOWs to improve service quality, the one with the highest importance score should be placed top on the waiting list for efficiency concerns.

#### **5.4 Summary of Chapter**

This chapter introduced the research design of this study. Three surveys are to be conducted for realization of the research aims. This chapter also introduced the three types of questionnaires to be used in this study for the three surveys relating to SERVQUAL, the Kano model and QFD, respectively. Data collection methods were also discussed in this chapter. Convenience sampling and face-to-face questionnaire administration will be used in this study. The findings from the pilot study are incorporated in the questionnaire design with corresponding changes to the attributes and their sequence. This chapter also discussed the data analysis methods for the three questionnaire surveys, respectively.

## Chapter 6 Data Analysis

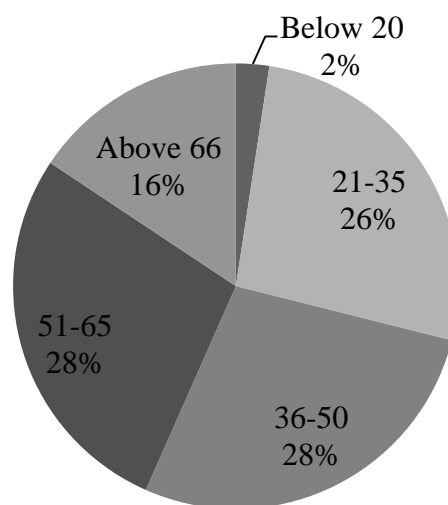
### 6.1 Data Analysis for SERVQUAL Questionnaire Survey

All together 83 complete and usable SERVQUAL questionnaires from the first survey were collected with 51 from hospital A and 32 from hospital B. Any incomplete and unusable questionnaire response was discarded during the data collection process since it was a face-to-face questionnaire survey.

The profiles of the respondents are as follows:

#### 1. Age Distribution

As shown in Figure 6.1, most of the respondents (46 persons) in the first survey came from the age groups 36-50 and 51-65, taking up 56% of the whole sample. The number of respondents who were from the age group 21-35 was 22 (26% of the whole sample), and there were 13 respondents (16% of the whole sample) who were older than 66 and 2 respondents (2% of the whole sample) who were younger than 20.

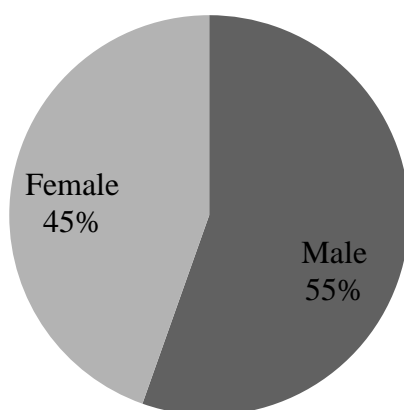


**Figure 6.1 Respondents' age distribution in the SERVQUAL survey**

#### 2. Gender Distribution

As shown in Figure 6.2, 55% of the respondents were male (46 persons) and 45% (37 persons) were female.

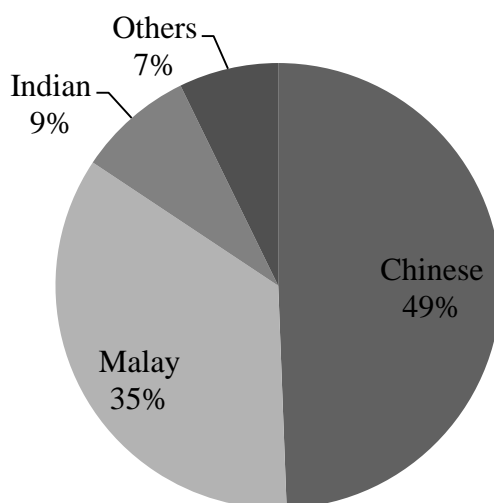




**Figure 6.2 Respondents' gender distribution in the SERVQUAL survey**

### 3. Race Distribution

As shown in Figure 6.3, 41 respondents were Chinese, accounting for nearly half of the sample; 35% (29 persons) were Malay and 9% (7 persons) were Indian. The other 7% were from other racial groups.

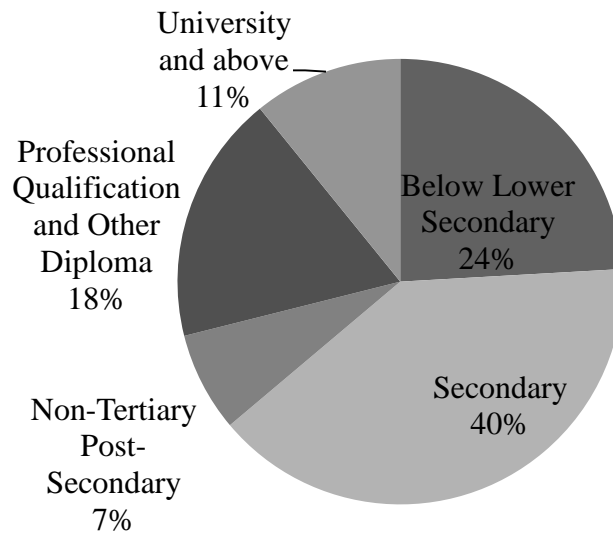


**Figure 6.3 Respondents' race distribution in the SERVQUAL survey**

### 4. Educational Background Distribution

As shown in Figure 6.4, 40% of the respondents (33 persons) were from the "Secondary" educational background group, followed by 24% (20 persons) from "Below Lower Secondary" group. 15 respondents held the

professional qualification or diploma, taking up 18% of the whole sample. The number of respondents who were from the group “University and above” and the group “Non-Tertiary Post-Secondary” was 9 and 6, respectively, accounting for 11% and 7% of the whole sample.



**Figure 6.4 Respondents’ educational background distribution in the SERVQUAL survey**

Following the introduction of respondents’ profiles, the Cronbach’s  $\alpha$  test was carried out to test the internal consistency and reliability of the questionnaire. First, the Cronbach’s  $\alpha$  for Expectation of the whole scale was calculated and the  $\alpha$  value was 0.957. The  $\alpha$  values for the Expectation sub-scales (categorised by the four FM factors) ranged from 0.815 to 0.909, as shown in Table 6.1. The Cronbach’s  $\alpha$  for Perception of the whole scale was 0.910. The  $\alpha$  values for the Perception sub-scales (categorised by the four FM factors) ranged from 0.706 to 0.843, as shown in Table 6.2. Those  $\alpha$  values were all greater than 0.7, indicating that the questionnaire was internally consistent (Cronbach, 1951).

**Table 6.1 Cronbach's  $\alpha$  test for Expectation**

<b>FM Factors</b>	<b>Place</b>	<b>Technology</b>	<b>People</b>	<b>Process</b>
<b>Attributes</b>	P1 P2 P4 P7 P8 P9	P3 P5 P6 P10 P11 P12 P13 P14 P15 P16 P17	P18 P19 P20 P21	P22 P23 P24
<b>Cronbach's <math>\alpha</math></b>	0.815	0.909	0.889	0.848

**Table 6.2 Cronbach's  $\alpha$  test for Perception**

<b>FM Factors</b>	<b>Place</b>	<b>Technology</b>	<b>People</b>	<b>Process</b>
<b>Attributes</b>	P1 P2 P4 P7 P8 P9	P3 P5 P6 P10 P11 P12 P13 P14 P15 P16 P17	P18 P19 P20 P21	P22 P23 P24
<b>Cronbach's <math>\alpha</math></b>	0.706	0.794	0.843	0.742

Since the Cronbach's  $\alpha$  tests proved the consistency and reliability of the SERVQUAL questionnaire, the patients' expectation scores for each service attribute were analysed, as shown below. As seen in Appendix 1, the evaluation standard for measuring expectations is as follows:

<b>Patients' Expectation</b>				
1	2	3	4	5
Should be very poor	Should be poor	Should be neutral	Should be good	Should be very good

For convenience purposes, the numbers 1, 2..., 5 were used instead of the literal descriptions, such as “should be very poor”, “should be poor”..., “should be very good”.

The frequency of each score (1, 2, 3, 4, or 5) given by respondents regarding their expectations for each service attribute is shown in Table 6.3.

**Table 6.3 Expectation score distribution-1**

Score Service Attributes	1	2	3	4	5
P1	0	1	11	38 <sup>a</sup>	33
P2	0	1	16	30	36 <sup>a</sup>
P3	0	0	6	33	44 <sup>a</sup>
P4	0	0	4	26	53 <sup>a</sup>
P5	0	0	6	26	51 <sup>a</sup>
P6	0	0	8	33	42 <sup>a</sup>
P7	0	0	5	22	56 <sup>a</sup>
P8	0	0	3	28	52 <sup>a</sup>
P9	0	0	5	33	45 <sup>a</sup>
P10	0	0	3	35	45 <sup>a</sup>
P11	0	0	7	29	47 <sup>a</sup>
P12	0	0	4	32	47 <sup>a</sup>
P13	0	1	10	24	48 <sup>a</sup>
P14	0	1	7	35	40 <sup>a</sup>
P15	1	0	13	34	35 <sup>a</sup>
P16	2	0	12	39 <sup>a</sup>	30
P17	1	0	12	39 <sup>a</sup>	31
P18	0	0	5	33	45 <sup>a</sup>
P19	0	0	6	38	39 <sup>a</sup>
P20	0	0	11	36 <sup>a</sup>	36 <sup>a</sup>
P21	1	0	3	39	40 <sup>a</sup>
P22	0	0	4	40 <sup>a</sup>	39
P23	0	0	6	38	39 <sup>a</sup>
P24	0	0	3	36	44 <sup>a</sup>

The number with a small “a” on its top right corner represents the most frequent score each attribute received. For example, for P1 – “Clarity of signages”, 1 respondent rated his or her expectation as 2, 11 respondents gave 3 as their expectation score, 38 respondents gave 4, 33 respondents gave 5 and no respondent gave 1. Thus, the most frequent score the attribute received is 4; that’s why the number 38 shoulders a small “a”. The percentage of replies and mode of each attribute’s expectation score is shown in Table 6.4.

**Table 6.4 Expectation score distribution-2**

	Percentage of replies					Mode
	1	2	3	4	5	
P1	0%	1%	13%	46%	40%	4
P2	0%	1%	19%	36%	43%	5
P3	0%	0%	7%	40%	53%	5
P4	0%	0%	5%	31%	64%	5
P5	0%	0%	7%	31%	61%	5
P6	0%	0%	10%	40%	51%	5
P7	0%	0%	6%	27%	67%	5
P8	0%	0%	4%	34%	63%	5
P9	0%	0%	6%	40%	54%	5
P10	0%	0%	4%	42%	54%	5
P11	0%	0%	8%	35%	57%	5
P12	0%	0%	5%	39%	57%	5
P13	0%	1%	12%	29%	58%	5
P14	0%	1%	8%	42%	48%	5
P15	1%	0%	16%	41%	42%	5
P16	2%	0%	14%	47%	36%	4
P17	1%	0%	14%	47%	37%	4
P18	0%	0%	6%	40%	54%	5
P19	0%	0%	7%	46%	47%	5
P20	0%	0%	13%	43%	43%	4,5
P21	1%	0%	4%	47%	48%	5
P22	0%	0%	5%	48%	47%	4
P23	0%	0%	7%	46%	47%	5
P24	0%	0%	4%	43%	53%	5

Table 6.3 and Table 6.4 show that patients generally have high expectations for hospital FM services. For attribute P20 – “FM staff members’ knowledge to answer patients’ questions related to their services”, the number of respondents who gave their expectation score as 4 or 5 was equal at 36 each.

Except for P20, four attributes' expectation score mode was 4, which represents "should be good"; they were P1 – "Clarity of signages", P16 – "Quality of food and drinks provided by hospital", P17 – "Quantity of food and drinks provided by hospital" and P22 – "Individual attention given to patients during FM service encounter". The other 19 attributes' expectation score mode was all 5, which represents "should be very good".

Following the analysis of patients' expectation scores, the perception scores were also analysed using the same methods. The evaluation standard used in the SERVQUAL questionnaire for measuring patients' perceptions is shown below (also presented in Appendix 1):

<b>Patients' Perception</b>				
1	2	3	4	5
Very poor	Poor	Neutral	Good	Very good

As with the expectation analysis, the numbers 1, 2..., 5 were used instead of literal descriptions, such as "very poor", "poor"..., "very good" for convenience purposes.

The frequency of each score (1, 2, 3, 4, or 5) given by respondents regarding their perceptions for each service attribute is shown in Table 6.5. The number with a small "a" on its top right corner represents the most frequent score each attribute received. The percentage of replies and mode of each attribute's perception score are shown in Table 6.6.

**Table 6.5 Perception score distribution-1**

Score Service Attributes	1	2	3	4	5
P1	0	2	21	37 <sup>a</sup>	23
P2	0	2	26	29 <sup>a</sup>	26
P3	0	2	9	45 <sup>a</sup>	27
P4	0	1	7	35	40 <sup>a</sup>
P5	0	0	8	36	39 <sup>a</sup>
P6	0	2	5	45 <sup>a</sup>	31
P7	0	3	8	37 <sup>a</sup>	35
P8	0	1	5	39 <sup>a</sup>	38
P9	0	0	12	39 <sup>a</sup>	32
P10	0	3	5	36	39 <sup>a</sup>
P11	1	0	12	41 <sup>a</sup>	29
P12	0	1	9	30	43 <sup>a</sup>
P13	0	0	17	27	39 <sup>a</sup>
P14	0	0	13	35 <sup>a</sup>	35 <sup>a</sup>
P15	2	4	24	29 <sup>a</sup>	24
P16	3	4	24	32 <sup>a</sup>	20
P17	1	1	23	34 <sup>a</sup>	24
P18	0	0	3	37	43 <sup>a</sup>
P19	0	0	6	42 <sup>a</sup>	35
P20	0	0	11	41 <sup>a</sup>	31
P21	0	0	4	47 <sup>a</sup>	32
P22	0	1	10	43 <sup>a</sup>	29
P23	0	1	15	37 <sup>a</sup>	30
P24	0	1	7	38 <sup>a</sup>	37

**Table 6.6 Perception score distribution-2**

	Percentage of replies					Mode
	1	2	3	4	5	
P1	0%	2%	25%	45%	28%	4
P2	0%	2%	31%	35%	31%	4
P3	0%	2%	11%	54%	33%	4
P4	0%	1%	8%	42%	48%	5
P5	0%	0%	10%	43%	47%	5
P6	0%	2%	6%	54%	37%	4
P7	0%	4%	10%	45%	42%	4
P8	0%	1%	6%	47%	46%	4
P9	0%	0%	14%	47%	39%	4
P10	0%	4%	6%	43%	47%	5
P11	1%	0%	14%	49%	35%	4
P12	0%	1%	11%	36%	52%	5
P13	0%	0%	20%	33%	47%	5
P14	0%	0%	16%	42%	42%	4,5
P15	2%	5%	29%	35%	29%	4
P16	4%	5%	29%	39%	24%	4
P17	1%	1%	28%	41%	29%	4
P18	0%	0%	4%	45%	52%	5
P19	0%	0%	7%	51%	42%	4
P20	0%	0%	13%	49%	37%	4
P21	0%	0%	5%	57%	39%	4
P22	0%	1%	12%	52%	35%	4
P23	0%	1%	18%	45%	36%	4
P24	0%	1%	8%	46%	45%	4

For the perception scores, only P14 – “Performance of non-drinking water supply systems” had two modes: 4 and 5, the rest of the 23 attributes had one mode, either 4 or 5. To be clear, 6 out of the 23 attributes’ mode were 5, and the other 17 attributes’ modes were 4. As stated above, a score of 5 means “very good” and 4 means “good”, so this result seems to suggest that patients generally have a good perception of the FM services in hospitals.

Then, the gap analysis was conducted after analyzing the Expectation and Perception score separately. Following the Perception-minus-Expectation formula, each service attribute’s gap score was calculated, as shown in Table 6.7.



**Table 6.7 Gap scores for the service attributes**

Service Attribute	Expectation Mean	Perception Mean	Gap Score	FM Factor
P15	4.23	3.83	-0.40	Technology
P16	4.14	3.75	-0.39	Technology
P7	4.61	4.25	-0.36	Place
P11	4.48	4.17	-0.31	Technology
P3	4.46	4.17	-0.29	Technology
P1	4.24	3.98	-0.26	Place
P2	4.22	3.95	-0.27	Place
P17	4.19	3.95	-0.24	Technology
P9	4.48	4.24	-0.24	Place
P23	4.40	4.16	-0.24	Process
P4	4.59	4.37	-0.22	Place
P8	4.59	4.37	-0.22	Place
P22	4.42	4.20	-0.22	Process
P10	4.51	4.34	-0.17	Technology
P13	4.43	4.27	-0.17	Technology
P5	4.54	4.37	-0.17	Technology
P24	4.49	4.34	-0.15	Process
P6	4.41	4.27	-0.14	Technology
P12	4.52	4.39	-0.13	Technology
P14	4.37	4.27	-0.10	Technology
P21	4.41	4.34	-0.07	People
P20	4.30	4.24	-0.06	People
P19	4.40	4.35	-0.05	People
P18	4.48	4.48	0.00	People

The sequence of the attributes in Table 6.7 is based on their gap scores, the largest at the top. The result shows that only one service attribute, P18 – “Tidiness of FM staff members’ appearance” received a non-negative gap score, which suggested a satisfactory service quality level; the other 23 attributes received negative gap scores ranging from -0.4 to -0.05. Among all the negative gap scores, the largest came from attribute P15 – “Choice and availability of food and drinks provided by hospital”, followed by P16 – “Quality of food and drinks provided by hospital”, while the smallest came from attribute P19 – “Courtesy of FM staff members”.

The Mann-Whitney U test was also conducted to determine whether the two hospitals' FM services have the same quality level in the eyes of patients. The service quality level was represented by the gap score. There were 24 service attributes, so the Mann-Whitney U test was conducted 24 times. Each time for each service attribute,  $\mu_1$  represented the mean gap score of one specific attribute of hospital A;  $\mu_2$  represented the mean gap score of the same attribute of hospital B. The hypothesis is as follows:

$$H_0: \mu_1 = \mu_2$$

$$H_1: \mu_1 \neq \mu_2$$

The results of the 24 two-tailed Mann-Whitney U tests are shown in Table 6.8.

**Table 6.8 Results from Mann-Whitney U tests**

Service Attributes	p Value	H <sub>0</sub>
P1	0.992	Do not reject
P2	0.065	Do not reject
P3	0.055	Do not reject
P4	0.008	Reject
P5	0.180	Do not reject
P6	0.328	Do not reject
P7	0.148	Do not reject
P8	0.112	Do not reject
P9	0.349	Do not reject
P10	0.066	Do not reject
P11	0.853	Do not reject
P12	0.800	Do not reject
P13	0.943	Do not reject
P14	0.395	Do not reject
P15	0.519	Do not reject
P16	0.355	Do not reject
P17	0.706	Do not reject
P18	0.029	Reject
P19	0.224	Do not reject
P20	0.495	Do not reject
P21	0.338	Do not reject
P22	0.513	Do not reject
P23	0.341	Do not reject
P24	0.342	Do not reject

The critical value was taken as 0.05. If the p value was smaller than 0.05, we rejected  $H_0$ ; if the p value was greater than 0.05, then we did not reject  $H_0$ . The results suggest that the two hospitals provide the same level of service quality regarding most of the service attributes except for P4 – “Cleanliness of public areas” and P18 – “Tidiness of FM staff members’ appearance”. Table 6.9 shows that hospital A provides better service quality with regards to these two attributes than hospital B.

**Table 6.9 Mann-Whitney U Test for P4 and P18**

Rank				
	Hospitals	N	Mean Rank	Sum of Ranks
P4	A	51	37.37	1906.00
	B	32	49.38	1580.00
	Total	83		
P18	A	51	39.02	1990.00
	B	32	46.75	1496.00
	Total	83		

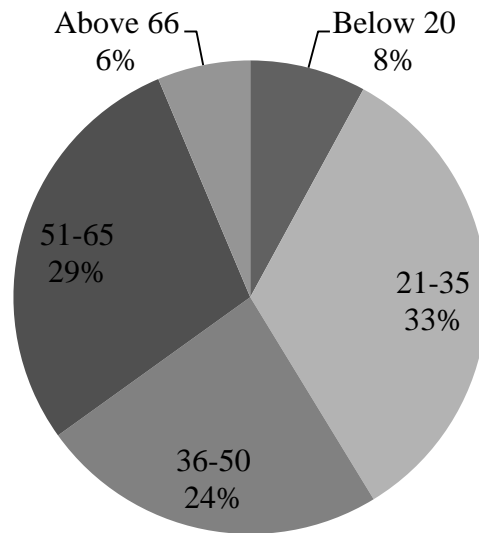
## 6.2 Data Analysis for Kano Questionnaire Survey

All together 63 complete and usable Kano questionnaires from the second survey were collected from hospital A and hospital B. Any incomplete or unusable questionnaire response was discarded during the data collection process since it was a face-to-face questionnaire survey.

The profiles of the respondents are as follows:

### 1. Age Distribution

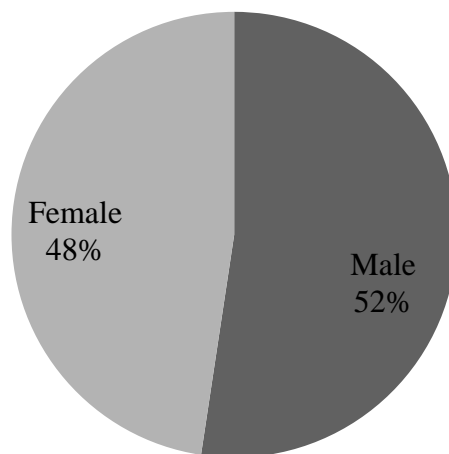
As shown in Figure 6.5, the majority of the respondents (21 persons) in the Kano survey came from the age group 21-35, taking up 33% of the whole sample. The numbers of respondents from the age group 51-65 and 36-50 are 18 (29% of the whole sample) and 15 (24% of the whole sample), respectively. The rest of the respondents were either younger than 20 (5 persons) or older than 66 (4 persons).



**Figure 6.5 Respondents' age distribution in the Kano survey**

## 2. Gender Distribution

As shown in Figure 6.6, 52% of the respondents were male (33 persons) and 48% (30 persons) were female.

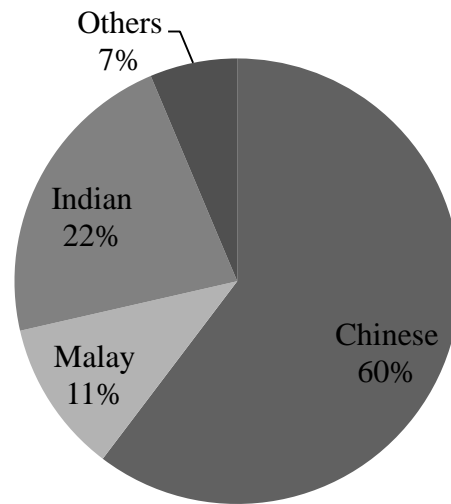


**Figure 6.6 Respondents' gender distribution in the Kano survey**

## 3. Race Distribution

As shown in Figure 6.7, most of the respondents (38 persons) were Chinese, accounting for 60% of the whole sample; 22% of the respondents

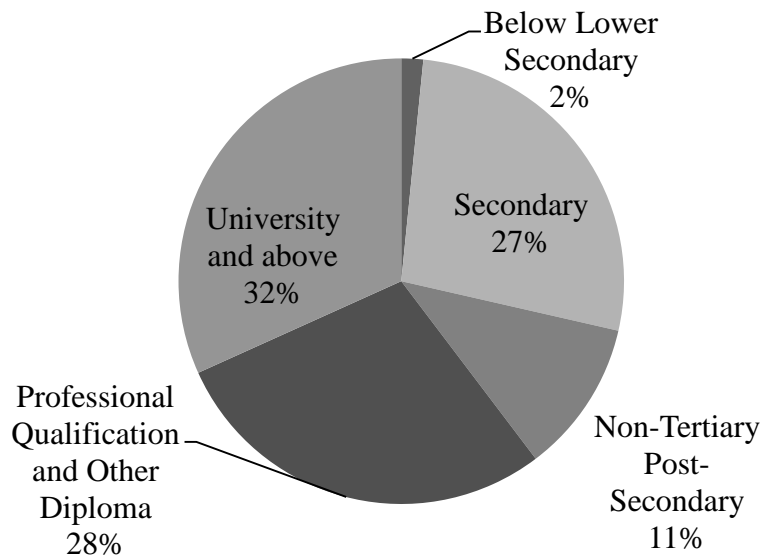
(14 persons) were Indian and 11% (7 persons) were Malay. The other 7% comprised respondents (4 persons) from other racial groups.



**Figure 6.7 Respondents' race distribution in the Kano survey**

#### 4. Educational Background Distribution

As shown in Figure 6.8, 32% of the respondents (20 persons) were from the "University and above" educational background group, followed by 28% (18 persons) from the "Professional Qualification and Other Diploma" group; 27% (17 persons) were from the educational background group "Secondary". The number of respondents who were from the group "Non-Tertiary Post-Secondary" and the group "Below Lower Secondary" was 7 and 1, respectively, accounting for 11% and 2% of the whole sample.



**Figure 6.8 Respondents' educational background distribution in the Kano survey**

Following the introduction of the profiles of respondents, the Kano categorisation was conducted and the result is shown in Table 6.10. As stated above, the raw data gathered from the Kano questionnaire were first converted to the categories: Attractive (A), One-dimensional (O), Must-be (M) and Indifferent (I). No Reverse and no Questionable replies were found. The percentage of replies of each category for each attribute was calculated and the most frequently appeared category was taken as the final category of the specific attribute. For example, the majority of the respondents (38%) indirectly categorised attribute P1 as a Must-be attribute by answering the questions in the Kano questionnaire. Thus, P1 was grouped in the Must-be category. In addition, the customer satisfaction coefficients of each service attribute were also calculated. The coefficients that reflect the attribute's extent of influence on customer satisfaction and dissatisfaction were calculated according to the formula stated in Chapter 5 and the results are also shown in Table 6.10.

Only one attribute, P17 – “Quantity of food and drinks provided by hospital” belonged to the Indifferent category. Also, only one attribute, P2 – “Attractiveness of public area landscape”, belonged to the Attractive category.

Five attributes, P1, P6, P8, P12 and P15, emerged under the category Must-be.

The other 17 attributes emerged under the category One-dimensional.

**Table 6.10 Results from Kano categorisation**

	Percentage of Replies				Category	Extent of Satisfaction	Extent of Dissatisfaction
	A	O	M	I		$\frac{A+O}{A+O+M+I}$	$\frac{-(O+M)}{A+O+M+I}$
P1	14%	25%	38%	22%	M	0.40	-0.63
P2	33%	22%	16%	29%	A	0.56	-0.38
P3	8%	38%	37%	17%	O	0.46	-0.75
P4	8%	49%	35%	8%	O	0.57	-0.84
P5	8%	40%	38%	14%	O	0.48	-0.78
P6	13%	24%	40%	24%	M	0.37	-0.63
P7	6%	44%	43%	6%	O	0.51	-0.87
P8	3%	44%	48%	5%	M	0.48	-0.92
P9	22%	30%	29%	19%	O	0.52	-0.59
P10	17%	37%	30%	16%	O	0.54	-0.67
P11	14%	43%	37%	6%	O	0.57	-0.79
P12	14%	35%	38%	13%	M	0.49	-0.73
P13	11%	43%	33%	13%	O	0.54	-0.76
P14	11%	38%	33%	17%	O	0.49	-0.71
P15	22%	24%	29%	25%	M	0.46	-0.52
P16	14%	41%	27%	17%	O	0.56	-0.68
P17	17%	22%	29%	32%	I	0.40	-0.51
P18	22%	32%	29%	17%	O	0.54	-0.60
P19	24%	43%	21%	13%	O	0.67	-0.63
P20	29%	35%	16%	21%	O	0.63	-0.51
P21	17%	40%	25%	17%	O	0.57	-0.65
P22	27%	46%	11%	16%	O	0.73	-0.57
P23	24%	32%	19%	25%	O	0.56	-0.51
P24	13%	41%	33%	13%	O	0.54	-0.75

### 6.3 Data Analysis for QFD

Taking the outputs from SERVQUAL and the Kano survey, the QFD survey used a questionnaire containing 32 key factors for successful hospital FM and 22 service attributes. The original number of attributes used in SERVQUAL and Kano survey was 24; the SERVQUAL survey result showed that P18 – “Tidiness of FM staff members’ appearance” received a gap score of 0, which

indicated a satisfactory service level; the Kano survey result showed that P17 – “Quantity of food and drinks provided by hospital” belonged to the Indifferent category, which indicated that this attribute was not an important factor for customer satisfaction. Thus, these two attributes were discarded and the QFD survey included the other 22 attributes. The importance score of each of the 22 attributes was calculated according to the formula introduced in Chapter 5 and the results are shown in Table 6.11.

**Table 6.11 The importance scores of WHATs**

		<b>Gap Score (absolute value)</b>	<b>Kano Multiplier</b>	<b>Importance Score of WHAT</b>
<b>WHATs</b>	P1	0.27	1	0.27
	P2	0.27	4	1.08
	P3	0.29	2	0.58
	P4	0.22	2	0.44
	P5	0.17	2	0.34
	P6	0.14	1	0.14
	P7	0.36	2	0.72
	P8	0.22	1	0.22
	P9	0.24	2	0.48
	P10	0.17	2	0.34
	P11	0.31	2	0.62
	P12	0.13	1	0.13
	P13	0.17	2	0.34
	P14	0.11	2	0.22
	P15	0.40	1	0.40
	P16	0.40	2	0.80
	P19	0.05	2	0.10
	P20	0.06	2	0.12
	P21	0.07	2	0.14
	P22	0.22	2	0.44
	P23	0.24	2	0.48
	P24	0.16	2	0.32

Consistent with the above analysis, the 22 attributes are represented by the codes P1, P2, and so on; the 32 key factors are also represented by the codes K1, K2, and so on, as shown in Table 6.12.



**Table 6.12 The HOWs and their codes in QFD**

<b>Key factors for successful FM</b>	
<b>I .</b>	<b>Management of information and knowledge</b>
K1	Generate information about what patients want from FM services through formal and informal information gathering activities.
K2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.
K3	Managers understand and utilise patients' expectation information effectively.
K4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.
K5	Information flows smoothly between the FM department and other departments in the hospital.
K6	Performance and management information are delivered as a consequence of service provision.
<b>II .</b>	<b>Fitting FM function and role to the environment of practice</b>
K7	Levels of management within the FM department are adjusted to the needs of the hospital.
K8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.
K9	Facilities managers understand the hospital's needs.
<b>III .</b>	<b>Sufficient budget and cost effectiveness</b>
K10	Adequate resources are committed to the FM department to improve service quality.
K11	The FM department meets patients' expectations for FM services without hindering its financial performance.
<b>IV .</b>	<b>Selecting and dealing with the outsourcer</b>
K12	Appropriate specifications for service levels are issued.
K13	Make sure that the outsourced team has the capabilities and skills to deliver the service.
K14	Diligent contract administration, and outsourced service provision is continually reviewed.
K15	Openness is established in relationships between the hospital and service providers.
<b>V .</b>	<b>Leadership and experience of facilities manager</b>
K16	Facilities managers are committed to continuing professional development for all the FM staff members and continual service quality improvement.
K17	Facilities managers make FM staff members feel appreciated for their contributions.
K18	Facilities managers foster teamwork among FM staff members.
K19	Facilities managers make sure that front-line workers are empowered and held responsible.
K20	Facilities managers ensure that change is managed successfully.

K21	Facilities managers achieve an appropriate balance of general management and technical skills with an understanding of organisations, people and processes.
<b>VI.</b>	<b>Facilities manager's involvement in hospital level decision-making</b>
K22	Facilities managers emphasise serving patients, and this effort is reflected in the hospital's development strategy.
K23	Facilities managers are involved early in the briefing stage when changes are around the corner.
K24	The hospital's external communications accurately reflect the information that facilities managers provide about the FM service quality.
<b>VII.</b>	<b>Staff development and training: soft and hard skills</b>
K25	Staff members are trained to interact effectively with patients.
K26	Staff members understand hospital policy, FM department goals and what is expected of them.
K27	Staff members are qualified for their job.
K28	Staff members are given tools and equipment needed to perform their job well.
K29	Patient-contact staff members commit to cooperation to provide quality service.
<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>
K30	Hard and soft technologies are used to standardise service tasks.
K31	Service goals in benchmarking are based on customer standards rather than hospital standards.
K32	Formal processes exist for measuring performance and goal-setting.

The QFD questionnaire's complete data and results (HOQ) are shown in Appendix 4. The final importance score of the HOWs and their relative ranking are presented in Table 6.13.

**Table 6.13 The importance scores of HOWs and their relative rankings**

Factors	Importance Score	Rank	Percentage	Factors	Importance Score	Rank	Percentage
K2	70	1	5.1%	K28	44	13	3.2%
K3	60	2	4.3%	K29	44	13	3.2%
K1	53	3	3.8%	K19	43	19	3.1%
K12	53	3	3.8%	K27	43	19	3.1%
K13	52	5	3.8%	K32	42	21	3.0%
K15	52	5	3.8%	K31	41	22	3.0%
K14	49	7	3.5%	K4	39	23	2.8%
K17	48	8	3.5%	K25	38	24	2.7%
K23	48	8	3.5%	K30	36	25	2.6%
K24	48	8	3.5%	K21	35	26	2.5%
K16	46	11	3.3%	K7	34	27	2.5%
K8	45	12	3.3%	K6	32	28	2.3%
K10	44	13	3.2%	K11	32	28	2.3%
K18	44	13	3.2%	K5	30	30	2.2%
K22	44	13	3.2%	K9	28	31	2.0%
K26	44	13	3.2%	K20	22	32	1.6%

#### 6.4 Summary of Chapter

This chapter presented the data analysis results from the three questionnaire surveys. The gap score and Kano category of each service attribute were determined and by multiplying them, the importance score of each attribute was calculated. Taking the inputs of the SERVQUAL and Kano results, the QFD computation identified the importance score of each HOW. The chapter discussed the results, with the numerical findings presented in this chapter laying the foundation for further discussion in the next two chapters.

## **Chapter 7 Discussion**

### **7.1 SERVQUAL Survey Findings Discussion**

The data analysis results for the SERVQUAL survey are shown in Chapter 6; this section continues the discussion of findings from the SERVQUAL survey.

Generally speaking, the findings of the SERVQUAL survey can be described as high expectation, high perception and room for improvement:

The data analysis results show that patients generally had a very high expectation of the FM service quality they received. The majority of the patients thought the performance of the 24 attributes should be good or very good. This result is understandable because patients are generally weak and physically burdened; a range of good FM services provided to them makes their stay in the hospital more comfortable and even helps with their recovery process. This result and the respondents' profile also reflect that today's patients are better educated and more aware than those in the past because of the abundant information made available to them by various channels. The Singapore government's efforts to promote competition and transparency in the healthcare system also provide the public with a good basis for expecting good medical care as well as a high level of catering provision. As pointed out in Chapter 1, it is likely that patients evaluate hospital service based on their real-life experience of catering, cleaning and other services instead of medical care because they lack expertise in the technical side of healthcare service. Thus, even though the core business in a hospital is to provide healthcare for patients, this high expectation of the non-core business, FM, should impress hospital managers and emphasise the need for continuous improvement in this area.

The data analysis also shows that patients' perceptions of the actual service level they received were high, but not as high as their expectations. The majority of the patients felt that all the 24 service attributes' performance was good or very good. However, the gap score calculated shows that only one attribute's service quality was satisfactory; the rest of the attributes had negative gap scores, which suggests an unsatisfactory

service quality. This result indicates that although patients generally had a good perception of the FM services, they expected more. In other words, they might feel that the performance of the services was good, but they wanted them to be better. For example, the attribute P9 – “Provision for patient privacy” received a gap score of -0.24, indicating an unsatisfactory service level; this attribute’s expectation mode was 5 and the perception mode was 4, suggesting that patients felt its performance was good but they want it to be very good. The patients’ opinions and complaints regarding this attribute during the face-to-face survey can explain this issue better. The hospitals provide patients with curtains hung around their bed and, when needed, the curtains can be drawn. Many patients were satisfied with this kind of privacy protection provision. However, when the researcher surveyed the patients whose beds were next to the window, some said that the curtains were not long enough to surround the entire bed and that reflections in the window rendered their privacy protection ineffective, making them feel a little uncomfortable. In addition, a few patients also reported that it would be better if the bedside cupboard had a lock. These comments can explain why the service gap exists and provide facilities managers with insight on how to improve their service quality.

Other salient patient comments gathered during the survey process regarding the remaining attributes are presented below, and these comments are useful inputs for the QFD process and for further quality improvement:

P1 – “Clarity of signages”: The signages in both hospitals are written in English. During the survey process, some patients, especially elderly patients, reported that they could not read English and it would be better if the signages in hospitals included other languages, such as Chinese, Malay and Tamil, just like the signages in the Mass Rapid Transit (MRT) stations.

P3 – “Condition of elevators and escalators”: A few patients said that the temperature inside the elevators was too high and they felt hot and stuffy, so they wanted a better ventilation system in the elevators. In addition, some patients complained that it took too much time to wait for the

elevators in the ward tower. They said it would be better if there were more elevators.

P5 – “Performance of pest control in hospital”: Although the majority of the patients didn’t give negative comments about the pest control, one patient reported insect remains in the bedside cupboard, so this patient gave low perception score to this attribute.

P10 – “Performance of lighting systems in ward”: Some patients reported that the brightness of lighting was not adjustable. Thus, their needs for different brightness in the lights could not be met. In addition, some patients also reported that when someone pressed one button, a row of lights would be turned on. In the night, for example, when one patient turned on the light to go to the bathroom, he pressed one button and the whole row of lights on his side turned on; other patients were disturbed and awakened from their sleep. That kind of experience made patients unhappy. This is largely a design problem which should be reflected in the future renovation or construction plans. Providing night light on the floor may be a corrective option.

P12 – “Performance of bedside nurse call system in ward”: Based on the face-to-face survey, most patients thought the performance of the bedside nurse call system was good. However, some reported that the equipment was old so that it was not good-looking. In addition, some patients said that it would be more convenient if the nurse call equipment had a remote control instead of the current wired control.

P13 – “Performance of drinking water supply system”: In Singapore, hospital water comes from the national water agency – Public Utilities Board (PUB). The infrastructures for water supply in hospitals are generally well established and the FM department has limited control of them. Water saving is reported to be the focus area of the FM department, but this is beyond the scope of this study. For P13, the FM department needs to ensure the quality and consistency of the water supply system. During the survey, the researcher found that some patients were

dissatisfied with the drinking water supply, mainly because sometimes there was a special flavour taste of disinfectant in the water. In addition, although the catering staff members in the ward fill the water jar of each patient at regular times, patients reported a lack of water dispensers in the public areas in the hospital.

P14 – “Performance of non-drinking water supply system”: During the survey, the most frequently mentioned problem of the non-drinking water supply system was that the flush in the toilet was not powerful enough. Some patients felt uncomfortable about this situation.

P15 – “Choice and availability of food and drinks provided by hospital”: This attribute received the largest gap score of -0.4 among all the 24 attributes, which means this attribute was the one with which patients were most dissatisfied. During the survey, the researcher found that a choice of hospital food was presented on the menu provided to each patient. The food was categorised according to nutrition information, such as normal menu, diabetic, low fat, low cholesterol and low salt, or according to type of food, such as Chinese, Indian, Muslim, Western and vegetarian. Patients with specific food needs were also provided with special menus, such as menus for chronic renal failure, peritoneal dialysis and haemodialysis. Although the menus were printed beautifully and seemed to contain various choices, the patients still reported that they thought the choices were limited because certain food appearing in the menu were only served on specified dates and there were not enough kinds of food to choose from. This was true especially for the patients who have stayed in hospital for more than one week, since the menu was repeated weekly.

P16 – “Quality of food and drinks provided by hospital”: This attribute received the second largest gap score of -0.39. This indicates that provision of hospital food and drinks is the service with which the patients are most dissatisfied. Patients complained about the food quite often. Actually, this kind of situation is understandable. Hospital managers may argue that food provided by the hospital is prepared and cooked by the hospital kitchen according to strict internal standards in a manner that is

nutritious for the patients. Normally, these meals contain minimal salt, hence the plain taste. As a result, some patients find the food unpalatable and will eat at the outside food court. To provide healthier food to patients, the taste of the food may be compromised. However, since the patients are concerned about the food and dissatisfied, and hospitals always claim that they put their patients first, this food problem provides hospitals with room for continuous improvement and even a chance to stand out among their competitors. Healthy food and tasty food are not an either-or option. Patients want a perfect combination of the two and that is where hospitals and FM departments should focus their efforts. Besides, the hospital can communicate with the patients and explain to them that healthy food may not taste good because of the limit amount of salt and oil used. Thus, the unsatisfactory patients may understand the situation and their attitudes towards hospital food may also change.

P21 – “FM staff members’ professionalism in running their job”: During the survey, patients were generally satisfied with the performance of this attribute. The gap score of this attribute was only -0.07. Although the FM staff members showed their professionalism in running their job on the whole, patients reported some problems in detail. The first was the arrangement of the bedside cupboards. The cupboards should all be placed on the right side or all on the left side of the beds of all patients in a ward, but some patients said that the cleaning and catering staff members did not pay enough attention to cupboard placement and this resulted in some patients’ cupboard being on the right side of their bed and others’ on the left side. Although this seems trivial, the problem created inconvenience for patients who did not get on well with their neighbours in the cubicle. The second problem was reported by only one patient; when she found that the water sprayer in the bathroom was broken, she told the cleaner but the problem was not solved for several days. This reflected a failure in timely reaction to patient requirements. Similar comments from another patient also mentioned the long waiting time for a porter when he had completed the medical examination and was to go back to the ward. However, this delay might be caused by many reasons and might not be the FM



department's fault. For example, one patient reported a breakdown to the cleaner, but the cleaner was not an in-house staff of the FM department since the cleaning services are outsourced. Thus, from the patient to the cleaner was just one sentence, but from the cleaner to the right person in the FM department and to the right person to solve the problem was far more than one sentence. Therefore, this problem really challenged the FM staff on how to manage information and facilitate information flow between different departments effectively and efficiently. The third problem concerned the consistency of service quality. Some patients reported that normally their bedside disposable bags were cleaned and changed to new ones every day, but sometimes the disposable bags just hung there and no one came to clean or change them. The same situation occurred in the change and refill of drinking water jars. This reflected an inconsistency in the service quality and easily resulted in unsatisfied patients. The last problem reported by patients was that sometimes when the cleaners did their job, they made too much noise. The noise of equipment such as the mechanical sweeper is unavoidable and patients understood that, but they pointed out that when the cleaner cleaned manually, their brooms or mops always knocked against the furniture in the ward, such as the bed's footpost, and made disturbing noises. This problem reflected a lack of care for patients and ignorance of details in the cleaners and raised the question to facilities managers on how to improve the cleaners' awareness of such problems.

P22 – “Individual attention given to patients during FM service encounter”:  
The gap score of this attribute was -0.22, belonging to the medium level among all the 24 attributes. One of the problems patients reported regarding this attribute was actually similar to the last problem of P21, the cleaning noise. Some patients said that they had been awakened several times by the noise of the brooms or mops hitting the footpost when the cleaner was cleaning. To solve this problem, the cleaners must give individual attention to patients when they do their job. If the patients are sleeping, they should minimise the noise they may make. The other problem was reported by one tall and overweight patient who complained

that when he was admitted there was no right-size hospital pyjamas for him. This problem reflected a lack of contingency plan and also a lack of detail-focused effort of the FM department.

P23 – “Convenience of FM service hours”: Problems with this attribute mainly came from the catering service. Some patients reported that the time of meal delivery was fixed. Sometimes they needed to go out of the ward for a medical examination and missed the mealtime, so when they went back they had nothing to eat and had to wait hungrily for the next meal. Thus, they thought it would be better if the timing of meal delivery became more flexible.

P24 – “Adequacy of hygienic care given by FM staff members during service encounter”: This attribute’s gap score was -0.15 and its perception score was above 4, again indicating that patients thought the performance of this attribute was good but they expected it to be better. During the face-to-face survey process, the most frequently mentioned problem by the patients was the process of laundry collection. Some patients pointed out that when the staff collected their clothes for laundry, they put those clothes together in a big bag or basket just in front of the patients and this process made the patients feel a little uncomfortable and more concerned about the hygiene problem. In fact, the clothes were put together and washed together by the eligible outsourcer. The clothes of patients who had infectious diseases are collected separately and given special hygienic care during the laundry process. Most importantly, there are standards and requirements regarding the level of hygienic care given to laundry and patients can rest assured about the cleanliness of the laundry. However, some patients didn’t want to see their clothes mixed together with other patients’ and didn’t understand the laundry process. Thus, they proposed that it would be better if their clothes were collected separately; for example, the staff could use different bags or containers for different patients’ laundry. To the facilities managers, this separately-collecting process may make little sense because even if the staff members collect every patient’s cloth separately, those clothes will still be washed together

in the washing machine. Even so, for patients, this separately-collecting process will make them feel more comfortable and assured. It is patients' feelings that matter in a hospital that claims to always put patients first.

## **7.2 Kano Survey Findings Discussion**

The Kano survey conducted for this study showed that most of the 24 service attributes influenced patient satisfaction. Only one attribute P17 – “Quantity of food and drinks provided by hospital” was categorised into the Indifferent group, indicating that it was not worthwhile to direct improvement efforts to this attribute since patients were indifferent about the performance of this attribute. Therefore, this attribute was discarded and not included in the following QFD survey. The Kano categorisation result is shown in Table 6.10. There was also only one attribute, P2 – “Attractiveness of public area landscape” that belonged to the Attractive category. According to the attractive quality theory, those attractive service attributes excite the customers and results in satisfaction, but absence of them does not cause customer dissatisfaction. So it is wise to invest on the attributes under the Attractive category since every dollar spent yield higher customer satisfaction compared to other categories. In a hospital, attractive landscape impresses the patients and visitors. So for the hospital, given the suitable space and adequate resource, this is a good investment for return of patient satisfaction.

The customer satisfaction coefficients of each attribute were calculated and are presented in Table 6.10. A positive satisfaction coefficient, which is above 0.6, is considered a high score; similarly, a negative dissatisfaction coefficient, which is under -0.6, is considered a high score (Sahney, 2011b).

As seen in Table 6.10, only three attributes' positive satisfaction coefficient is larger than 0.6; they are P19 – “Courtesy of FM staff members”, P20 – “FM staff members' knowledge to answer patients' questions related to their services” and P22 – “Individual attention given to patients during FM service encounter”. They all belong to the One-dimensional category. The higher these attributes' performance, the higher would be the patients' satisfaction. Note that P19's and P20's gap scores were -0.05 and -0.06, respectively, indicating that those attributes' performance nearly met the patients'

expectations. In addition, during the SERVQUAL survey, negative comments about the two attributes were seldom heard. Thus, one can conclude that hospitals actually did a good job in these two service attributes, which had a high satisfaction coefficient and this was good for the hospitals. P22's gap score was -0.22, and it ranked in the middle among all the attributes. However, it had the largest satisfaction coefficient, which means the good performance of this attribute can more heavily influence the level of patient satisfaction. Unfortunately, the performance of P22 did not meet the patients' expectations, and comments regarding its problems from patients during the SERVQUAL survey indicated room for improvement. As discussed above, those comments were detailed and patients cared about them. As far as FM service quality is concerned, whether or not a hospital can pay attention to details and how well it deals with patients' requirements regarding those details largely affect its ability to satisfy its patients.

For the negative dissatisfaction scores, 17 attributes received a high score which was under -0.6. Those attributes belong to either the Must-be or the One-dimensional category. The fact that the number of attributes whose negative dissatisfaction scores were high was far greater than the number of attributes that had high positive satisfaction scores indicates that patients are more easily dissatisfied than satisfied. Thus, hospitals must pay attention to those attributes with high dissatisfaction coefficient scores. The attribute that received the highest dissatisfaction score, -0.92, was P8 – “Cleanliness of bedding in ward”; it is under the category of Must-be. However, the gap score of P8 was -0.22, which indicates that the performance of this attribute did not meet the patients' expectations. In other words, patients' expectations were not fulfilled and since this attribute had a high dissatisfaction coefficient, this unfulfilment had a strong negative influence on patient satisfaction. This situation reveals the need for hospitals to give special attention and improvement actions to this attribute. Generally speaking, hospitals should also pay attention to attributes with high absolute gap scores and high dissatisfaction coefficients, for example, P16 – “Quality of food and drinks provided by hospital kitchen” and P7 – “Cleanliness of overall environment in ward”. Based on the results of this study, the number of this kind of attribute is

noticeable. These attributes naturally have stronger influence on patient dissatisfaction if they do not meet patients' expectations, and the survey findings showed that, in fact, they really did not meet patients' expectations. That was not a good sign for hospitals that try to achieve patient satisfaction with all the services they provide to gain a competitive edge.

The above discussion is about the attributes' characteristics reflected by their Kano categories and customer satisfaction coefficients. The following discussion focuses on the performance of service attributes and their Kano categories: the important level of attributes to hospitals. As shown in Table 6.11, the importance score of each attribute equals its absolute gap score multiply by its Kano multiplier. The rankings are shown in Table 7.1.

**Table 7.1 The importance scores of attributes and their relative rankings**

<b>Attribute</b>	<b>Importance score</b>	<b>Rank</b>
P2	1.08	1
P16	0.8	2
P7	0.72	3
P11	0.62	4
P3	0.58	5
P9	0.48	6
P23	0.48	6
P4	0.44	8
P22	0.44	8
P15	0.4	10
P5	0.34	11
P10	0.34	11
P13	0.34	11
P24	0.32	14
P1	0.27	15
P8	0.22	16
P14	0.22	16
P6	0.14	18
P21	0.14	18
P12	0.13	20
P20	0.12	21
P19	0.1	22

The rankings provide the facilities managers with a reference for service attribute prioritisation. Since the importance score of each attribute reflect its current performance and its influence on patient satisfaction, an attribute that ranks high in the list should draw managers' attention either because of its high influence on patient satisfaction or large gap score or both. For example, attribute P2 – “Attractiveness of public area landscape” is the most important attribute in the list, its absolute gap score is 0.27, smaller than the absolute gap score of the second most important attribute P16 – “Quality of food and drinks provided by hospital”, which received a gap score of -0.39. However, P2 belongs to the Attractive category while P6 belongs to the One-dimensional category, their Kano multipliers are 4 and 2, respectively. Thus, P2's importance score is larger than P6. According to the attractive quality theory, organisations should put attractive attributes first because they are the salient points for creating a competitive edge which means more customers, more profit and even entry barrier to their competitors. In this study, even though the surveys were conducted at public hospitals instead of private hospitals, patients found the public area landscape an attractive attribute, and they thought the performance of this attribute did not meet their expectations. This results in P2's first place in the importance list, reminding the facilities managers of the potential improvement direction. What's more, the usage of the importance list depends on the specific circumstances the FM departments face. There are no fixed rules for FM. Public area landscape development is a complex process and limited by the area of the hospital. Similar situation is true for the rest of the attributes; hospitals have various goals and even conflicting goals. The list only looks at the FM side. To make most of the usage of the list, it should be fitting into the specific environment of the hospital. In order to achieve different goals, the facilities managers and other hospital managers should make decisions based on all kinds of information available to them and this list is an important part of it.

### **7.3 QFD Survey Findings Discussion**

So far, the problems of the FM service attributes have been discussed. Hence, the question: How can FM departments use the information gathered and deal with the problems to improve service quality and, ultimately, patient

satisfaction? In addition, FM departments should also determine the most effective and important means for quality improvement so that they can allocate their resources efficiently and maximise the benefits. The QFD survey analysis results give answers to these questions.

As stated above, when the QFD questionnaire was completed and returned to the researcher, the researcher called a meeting with the representative of the respondents to discuss the survey process and finalise the results. The representative was a QFD team member and facilitated the completion of the questionnaire and gathering of feedback from his colleagues – the other respondents. There were no empty rows or columns in the completed QFD questionnaire, indicating that all the requirements (WHATs) were addressed by the HOWs and the HOWs all influenced the WHATs. The HOWs – 32 key factors for successful FM identified in the literature review – were claimed to be thorough as quality improvement efforts for the FM services by the representative and, hence, he and other QFD team members did not put forward any other suggestions for quality improvement. As explained above, the WHATs included 22 attributes and excluded P17 and P18 because they either received a gap score of 0 or were categorised under the Indifferent group. The importance score of each HOW was calculated and the results were shown earlier in Table 6.13. The importance score ranged from 70 to 22 and, judging from the percentage each score took up, the scores distributed evenly. In other words, the difference in the importance of the 32 factors was not very big. Thus, it would be wise to pay less attention to the relatively less crucial factors but not ignore them. The following discussion focuses on the top 10 factors.

The ranks of importance of the 32 factors are shown in Table 6.13. The top three factors, K2, K3 and K1, all come from the category of “Management of information and knowledge”. From the relationship matrix of the QFD questionnaire, K2 – “Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service”, K3 – “Managers understand and utilise patients expectation information” and K1 – “Generate information about what patients want from

FM services through formal and informal information gathering activities” all have a strong or medium relationship with most of the 22 service attributes. The three factors concern information gathering, processing and utilising and are deemed to be the most important means for FM service quality improvement.

By focusing on the three factors, patients’ requirements can be gathered thoroughly and analyzed, and then the requirement information can be transferred to detailed actions to satisfy the patients. For example, the problems in P1 – “Clarity of signages” reflect the patients’ requirement of this attribute. Those requirements cannot be gathered only by a simple feedback form which contains several general questions about the services of the hospital and the evaluation standards are just cartoon faces with different looks. If a hospital wants to provide FM services that are better than those provided by others, it must pay attention to every detail, including the languages used in the signages. Formal means of expectation gathering may include feedback forms, patient focus groups, and telephone calls and informal means can vary from hospital to hospital and manger to manager. Some facilities managers may visit the ward themselves and ask the patients about the quality of services provided and their expectations. Some managers may ask the front-line staff members such as the cleaner or caterer to report the patients’ complaints or requirements. If the manager is concerned about quality and serving patients, he/she can also get hidden information from daily operations, for example, the food wastage may serve as an indication of food quality and patient satisfaction. The department that handles the patients complains is also a source of information gathering, but at the same time, a passive and unexpected source. During the survey process, it was found out that nurses were the people patients most frequently contacted. Patients did not bother to report different problems to different people. Usually they just told the nurses what they wanted regardless it was clinical issue or non-clinical issue. Thus, managers should not complain that patients report to the wrong person, but seek, stimulate and facilitate the information-gathering process among the front-line workers. For example, patients and visitors most frequently ask the porters or the cleaners about directions. Thus, they may



know how patients and visitors feel about the signages in the hospital, such as the language used. If they feel responsible for reporting the single-language problem to a higher level of management, then it is a good practice of informal information gathering and helps point out the direction for improvement. Furthermore, these staff members know which locations are most frequently asked about; if they pay attention to this and let the managers know, the information may provide evidence for modification of the current signage system, such as highlighting the locations frequently asked about in a different color or font in the direction signs or guide book. Good modification methods are a result of sufficient information gathering and effective utilisation of such information.

Facilities managers face a great deal of information every day and they must know how to manage this information. Urgent information should be tackled first, less than urgent and trivial information should also be understood and not ignored. Again, take the signage as an example, the facilities manager may hear about the single language problem from his or her staff members, but not think it is an urgent problem and put it aside, finally forgetting about it. In this case, the facilities manager's action renders the whole information gathering process meaningless and the staff may be demoralised. Most importantly, the service quality is not improved even though the patients' requirement is heard.

In all, K1, K2 and K3 as a whole form the base for any quality improvement effort and help foster the culture of continuous improvement in the FM department from the front-line staff members to the top managers. Therefore, they are the most important factors and also the most important for FM departments in hospitals that strive for better patient service.

In the rankings in Table 6.13, the four factors following the first three are K12, K13, K15 and K14. They are all from the category "Selecting and dealing with the outsourcer", reflecting the importance of the outsourcer to the FM departments in hospitals. Although varied from hospital to hospital, typical outsourced services include pest control, general cleaning, laundry, grounding and maintenance, among others. As one of the facilities managers pointed out, public hospitals do not need to worry much about money compared to private

hospitals, so public hospitals keep some of the portering, cleaning and catering services in house, which is also partly because of the government's policy to create jobs for elderly people and other people in need of help. It is quite understandable that the four factors have strong relationships with the performance of outsourced services, such as pest control, ventilation and lighting. The service level agreement is the most important document for the contractual relationship between the FM department and the outsourcers. The FM department must know what patients expect from them and, incorporating internal requirements and regulations, the FM department provides appropriate specifications of the service levels in the agreement with the outsourcer. Before awarding the contract, the FM department must ensure that the outsourcers have the capabilities, experience and skills to deliver the target services. After the specific outsourcer starts to carry out the job, diligent contract administration must be conducted and the service level must be continually reviewed to make sure that the outsourcer complies with the service level agreement and does a good job. Since monitoring patients' expectations and information gathering are ongoing processes and sometimes small changes may be needed to satisfy patients, it is important that the FM department keep a good and open relationship with the outsourcer so that any change required can be implemented in a timely manner and without much red tape. Furthermore, considering the fact that many of the front-line workers or the patient contact FM staff members are from the outsourcers, and FM is a relatively labor-intense professional, good relationships with the outsourcers also mean that, ideally, the FM department can get valuable patient expectation information from these external workers. However, this is the ideal situation and will not occur if the outsourcer's interests will be hurt. For example, if one cleaner makes too much noise during the cleaning time, as mentioned above, and patients complain about that to the cleaner, it is not likely that the cleaner will report this to his or her boss so that the boss can tell the FM department about the problem. However, in a win-win situation, this learning from the outsourcer may occur. For example, in one of the hospitals surveyed, the food and drinks are cooked and provided by the hospital kitchen, while the delivery services are outsourced. The patients have reported their

expectation of a more flexible food delivery time, as mentioned above; if the caterers know the patients' expectations and let their boss know, then the boss may be willing to talk with the FM department about this issue. This is because if the problem is really substantial, the FM department may want to add flexibility to the food delivery service, which means more workers and more costs as well as more satisfied patients; to the outsourcer, this means a potential profit-creating opportunity. Therefore, in a win-win situation like this, openness in the relationship with outsourcers may help the FM department learn of the requirements of patients. In all, outsourcer selection and contract administration are very important to the FM department. Only the competent service provider with a good service culture can be considered as potential outsourcer. Besides, as pointed out above, the FM department must have effective formal and informal ways to let the patients' voices be heard, and one way to ensure that is to keep the openness in relationships with the outsourcers.

K17 – “Make FM staff members feel appreciated for their contributions” is the only factor from the group “Leadership and experience of facilities manager” that is in the top 10 in the ranking list. The representative from the QFD team explained to the researcher that his department held events such as birthday parties and family days for their staff members to boost morale. He also noted that if the staff members felt appreciated for their job, they would perform additional work that was not required but was good for serving the patients. For example, if patients or visitors ask one cleaner for directions, the cleaner has two options. One is to show them the way in words and the other is to lead them to the place. Which manner the cleaner chooses will make a difference in the patients' or visitors' impression of the hospital's services. The latter choice is more likely to satisfy the patients and make them feel they are at the heart of the hospital. If the contributions of the FM staff members are appreciated, he or she will be willing to make more contributions. This is especially true for the front-line staff members. Those people naturally have direct information of what patients want. If the incentive mechanism is well established, then those people will be willing to share what they know. Then it is the facilities

manager's job to identify the important issues and reward the one who provide such information. Thus, a virtuous cycle is formed within the FM department.

To answer the question of how to make the FM staff members feel appreciated for their job, different hospitals have different answers and traditions. Monetary rewards and welfare such as birthday parties may be the most frequently mentioned actions. However, the facilities managers should also understand that staff members may have bad times because of their personal life, so good leaders in the FM department provide flexibility to the staff members, too. Such consolation helps build the staff's confidence in the department and boosts morale. Therefore, with energetic staff members, the FM departments can achieve continuous improvement in service quality. This situation will not occur without the good leadership and experience of the facilities managers. Just as the representative pointed out, incompetent managers would be eliminated.

The last two factors in the top 10 list are K23 – “Early involvement in briefing stage when changes are around the corner” and K24 – “Hospital's external communications accurately reflect the information that facilities managers provide about the FM service quality”. They are all from the group “Facilities manager's involvement in hospital level decision-making”. The facilities manager's early involvement in the briefing stage when changes are going to occur allows the facilities manager to understand the background and his or her department can prepare for the changes as soon as possible. In addition, the facilities manager can provide professional advice on the changes and his or her valuable input may influence the hospital's decision regarding the change. This is especially true when the hospital wants to build new buildings or renovate old ones. The facilities manager has rich experience in the hospital's daily operations and knows what may be best for the hospital. In addition, if the FM department has good information management, then the facilities manager can give advice on the building system, such as lighting, ventilation or number of elevators, which may reflect patients' expectations that are not feasible in the current situation but meaningful for future hospital development. For example, as reported by the patients during the SERVQUAL

survey, the brightness of the lights in the wards was not adjustable; the FM department and the hospital may not be able to solve this problem in the short term. However, in the future, if the hospital is going to have renovation or new construction work, then the facilities manager can bring up this problem in the briefing stage and it may be resolved in the new buildings after the trade-off of cost and benefit to the hospital.

K24 talks about the external communications of the hospital FM service quality. Facilities managers deemed this factor important when dealing with patient complaints. Usually, the FM department attaches great importance to patient complaints, especially those which may appear in the newspapers and other social media. Thus, they care about the clarification the hospital gives to bad feedback. It is crucial to provide appropriate information to unhappy patients. This is not a job that can be done solely by the FM department. The departments that deal with such complaint hotlines and media should display good manners and communicate with the FM department quickly and efficiently. The facilities manager should act in a timely manner to provide accurate information, explain the situation and comfort the patient. The patient may understand and change his or her perceptions of the service provided after obtaining a satisfactory result from the hospital. This external communication also influences the patient expectation side as well as the above mentioned perception side. For example, the brochure hospitals provide to patients and visitors should accurately reflect the facilities and FM services in the hospital and in the wards so that the target reader will not have unrealistic expectations of the services. In all, it is wise to involve the facilities manager in hospital level decision-making and give appropriate weight on the FM department's suggestions regarding to external communications.

#### **7.4 Summary of Chapter**

This chapter primarily discussed the findings from the SERVQUAL, Kano and QFD surveys. Attributes with negative gap scores and not under the Indifferent category were given attention in the discussions and recommendations of corrective actions. Problems reported by the patients about the FM services during the survey process were also presented and

discussed for the purpose of providing insights into the real word practice. The influences of the attributes on the patient satisfaction were also discussed and the rankings of attributes and key factors for continuous improvement according to their importance were also presented to provide evidence for the conclusion in the next chapter.

## **Chapter 8 Conclusions**

### **8.1 Validation of Hypothesis and Summary of Findings**

As stated in Chapter 1, the research hypothesis is as follows: there are service gaps in hospital FM domain in Singapore. The results from the first SERVQUAL survey indicate that 23 out of 24 service attributes have negative gap scores. Thus, it is fair to say that service gaps exist in FM services in Singapore's hospitals.

This study tries to answer the following three questions, as stated in Chapter 1:

(1) What are the service gaps of hospital FM in Singapore?

Through the hospital FM SERVQUAL survey, the researcher found out that 23 of the 24 service attributes received a negative gap score, indicating the need for performance improvement to meet patients' expectations. The only attribute received a non-negative gap score was P18 – “Tidiness of FM staff members' appearance”, indicating this attribute's satisfactory quality level. Thus, the first research objective which is to “identify service gaps and measure service quality of hospital FM in Singapore” is achieved. Note that although most of the attributes received a negative gap score, their perception and expectation scores were both generally high, indicating that the patients thought the performance of the attributes was good, but they wanted it to be better. In addition, the face-to-face survey also generated patient complaints about the problems with FM services. As discussed in Chapter 7, those problems reflect that the FM department of a hospital should pay sufficient attention to details and make sure that every detail is perfect if they aim to achieve higher levels of patient satisfaction.

(2) What are the categorisations of hospital FM service attributes?

Through the Kano questionnaire survey, the 24 service attributes were grouped under the four Kano categories: Attractive, One-dimensional, Must-be, and Indifferent. Only attribute P17 – “Quantity of food and drinks provided by hospital” fell into the Indifferent category, indicating

that the other 23 attributes' performances influence patient satisfaction levels. Thus, the second research objective which is to "categorise the FM service attributes" is achieved. In addition, the customer satisfaction coefficients were calculated to provide deeper insight into the attributes' influences on patient satisfaction.

(3) How can hospitals close the service gaps in hospital FM?

With input from the first two questionnaire surveys, the QFD survey was conducted and the importance score of each of the 32 factors was calculated. The results reveal that the 32 factors all influence the 22 service attributes, indicating that they are useful ways to improve FM service quality. Thus, the third research objective which is to "suggest effective ways to close the hospital FM service gaps" is achieved. In addition, among the 32 factors, the 10 most important ones were identified and discussed in detail in Chapter 7. These 10 factors come from four groups: Management of information and knowledge, selecting and dealing with the outsourcer, leadership and experience of the facilities manager and facilities managers' involvement in hospital level decision-making, suggesting that the FM department should pay more attention to these issues.

In all, it is fair to say that patients generally think the performance of FM services in Singapore's hospitals is good, but they want it to be better. Thus, service gaps exist and it is evident that room for improvement rests in the details. The 32 key factors for successful FM identified from the FM literature and service gap theory literature proved to be useful tools to close the FM service gaps. To enable the FM department in a hospital to relocate resources effectively and efficiently for corrective actions, the most important 10 factors were selected and discussed in Chapter 7. At this point, by answering the three questions, this research's corresponding objectives and research aims have been realised.



## 8.2 Recommendations

The 10 most important factors and also the effective means for continuous quality improvement are discussed in Chapter 7; the FM department should pay more attention and prioritise those 10 factors, as listed in Table 8.1.

**Table 8.1 Top 10 factors for continuous improvement in FM**

No.	Top 10 Factors	Groups
1	Top management seeks, stimulates, and facilitates the flow of information from patients contact personnel concerning quality of service.	Management of information and knowledge
2	Managers understand and utilise patients' expectation information effectively.	
3	Generate information about what patients want from FM services through formal and informal information gathering activities.	
4	Appropriate specification of service levels.	Selecting and dealing with the outsourcer
5	Make sure that the outsourced team has the capabilities and skills to deliver the service.	
6	Openness in relationships between the hospital and service providers.	
7	Diligent contract administration, and outsourced service provision is continually reviewed.	Leadership and experience of facilities manager
8	Make FM staff feel appreciated for their contributions.	
9	Early involvement in briefing stage when changes are around the corner.	
10	Hospital's external communications accurately reflect the information that facilities managers provide about the FM service quality.	Facilities manager's involvement in hospital level decision-making

Furthermore, based on the information gathered from face-to-face survey processes and results, this study also provides the following recommendations to FM departments in Singapore's hospitals that want to achieve higher levels of patient satisfaction:

- (1) Effective information gathering and management to ensure patient expectations and perceptions are clear to the FM department

The three most important factors K1, K2 and K3 are all about information management and flow. Since service quality is mainly about the

customer's perception and expectation, the feedback and expectation information are important for continuous improvement. Therefore, this section mainly focuses on the expectation and perception information gathered from the patients. In the hospital context, the feedback form is often used to gather patients' perceptions about the hospital service. Some hospitals may also conduct telephone interviews with discharged patients. However, those activities seek the patients' perceptions of the hospital services as a whole; only a few FM services are included in those surveys. In fact, the patients experience far more services provided by the FM department and they have their own views about the service quality. Besides the formal ways of perception and expectation gathering, patients may also speak of their views on informal occasions and the voices cannot be heard if the front-line staff members ignore them or if the information flow is not smooth. Thus, the FM department needs to establish effective information gathering and management practices to achieve excellence, such as a more comprehensive feedback form and a guideline to the front-line staff members to be more sensitive to voices of patients.

It is also important to facilitate the information flow between the FM department and other departments. For example, patients usually talk to nurses if something is wrong, including FM services, so nurses can be a good source of patient requirement information. If such information flows smoothly from the nurses to the FM staff members, then it will be effective and efficient to tackle the problems. In all, from information gathering, flow, analysis and utilisation to transferring to action plans, the FM department must make sure that patients' voices are heard and reacted to. Effective information gathering and management is the first step for the FM department that strives to excel in providing satisfactory services.

(2) Select the right outsourcers and keep an open relationship with them

Services that are outsourced differ from hospital to hospital in Singapore; outsourcing is a common practice. The competence of the outsourcer directly affects the service quality of the outsourced service and, thus, the

patient satisfaction level. For the purpose of this study, we emphasised the selection of competent outsourcers and openness in relationships with them. The competent outsourcer must have the capabilities and skills to deliver the service at the agreed quality level, as clearly specified in the service level agreement. The service culture of the outsourcer should also be a concern for the FM department when choosing the right service provider so as to keep the relationship open. Since FM is a relatively labor intense profession, the FM department should also pay attention to the experience of the outsourcer before awarding the contract. In addition, diligent contract administration is necessary; effective control over contractors and subcontractors helps ensure that they clearly understand the hospital's needs and meet a satisfactory service level. The outsourced service provision should be continually reviewed so that the best contractual and financial arrangements for outsourcing can be obtained. Furthermore, openness in relationship with the outsourcer is essential for patient expectation and perception information gathering. The external front-line workers are naturally more exposed to the direct feedback information from the patients. If such information can be forwarded to the FM department, the department will be more aware of what exactly patients feel and expect.

### (3) Pay enough attention to details

During the face-to-face survey process, most of the problems reported by the patients were rooted in details. The FM services in hospitals are everywhere and patients are easily dissatisfied by seemingly "little details". Thus, for the FM department, it is necessary to pay attention to the details. This notion should be carried by all FM staff members in their work. Only if the front-line workers act with care and a proper attitude can the patients be satisfied with the details. How can an FM department determine the problematic details? The various ways are many and the most important is an effective information gathering system, formal and informal, as discussed above. When every detail is addressed, the FM department can excel and impress the patients.

### **8.3 Validation of Findings and Recommendations**

The validation process of this study was conducted in August 2013. Two experts from public hospital C and public hospital D participated in the validation interviews. They have been working in the hospital FM sector for more than 20 years and have rich experience in this field.

To facilitate the validation process, before the formal interviews, the author of this study wrote a brief report to introduce the research; the research findings and recommendations were included in the report. Then the author sent the report to the two experts and explained the validation process to them to make sure they understand the research as well as the validation purpose. A few days later, when the two experts finished reading the report, two separate interviews were held to ask them to give comments on the reliability of the research findings and practicability and significance of the recommendations.

The two experts said that this was a good study. They both agreed that the findings were comprehensive and reliable and the recommendations were practical. One of the experts said that the recommendations can contribute to the continuous improvement in the service quality of FM department in hospital.

The salient points gathered in the validation interviews are presented below:

Problems with outsourcing: One recommendation of this study is to select the right outsourcers and keep an open relationship with them. The two experts both said that this was very important. But one expert also mentioned that outsourcing had its own disadvantages as well as advantages. The FM department should make the outsourcing decisions depending on its own situation; if the sector was very critical, it should be better maintained in-house instead of outsourced. He gave the following explanations:

The outsourcing contract normally lasts for three or five years. For example, company A is your current service provider. When company A started working in your organisation, their staff would start to learn your organisation's policy, performance criteria, and other things they had to comply with. When the contract expires, company B submits the lowest

tender and takes over company A's position; company B will start the learning process all over again. Your organisation will not benefit from that. Because you will have a batch of new people, they need to learn. There will be a lot of problems within human resource, competency, and also sometimes knowledge. For example, company B's staff may not be familiar with your building system, so they may make mistakes while working. Besides, when your organisation changes the service provider from company A to B, company A will somehow misplace some documents. This is because of competition. No company will maintain something very good for the next company – their competitor to succeed. This is not good for your organisation. The main thing is your organisation has to balance the gain and loss.

Training of cleaners: This study has brought up several problems with the cleaners, such as the inconsistency of work quality and noise. One expert admitted that this kind of problems also occurred in his hospital and the effective ways to solve this problem was staff training as mentioned in this study in Chapter 2. One expert pointed out that Singapore was short of manpower. A lot of cleaners were from other countries such as China, Malaysia, Indonesia and India. This kind of situation caused problems in cleaning. He explained as follows:

Sometimes the quality of work is different. Because in different countries, they have different expectations, so when the foreign cleaners come here, they may have to learn and adapt to the standards in Singapore. They have to be trained to do their work right and keep consistent the work quality.

Information flow: The two experts both agreed that facilitating the information flow as proposed and explained in this study was very important. One expert emphasised the information flow between the FM department and the nursing department. He explained as follows:

We hold monthly meetings with the representatives from the nursing department. They provide us with the feedback they obtained formally or informally from patients. You know, the patients always tell the nurses what

they feel uncomfortable or unsatisfactory. So the monthly meeting is a good feedback opportunity for us to learn from the nurses. Thus, we know what our patients want.

Lastly, since this study suggests that current problems be reflected in the future renovation or construction process, one expert's hospital is undergoing a new construction process and he pointed out that in the design stage it was hard to balance interests from different parties. For example, as the study has revealed that patients found the landscape of the hospital an attractive attribute, the expert said that beautiful and appealing landscape was good but that might add to the burden of the housekeeping group. So the balance between different parties in the hospital was important but difficult. He concluded that for the FM department early involvement when changes were around the corner and fitting FM function and role into the hospital environment were critical aspects when dealing with trade-offs.

In all, the validation process has supported the reliability of the research findings and the relevance and practicability of the research recommendations. The two experts gave valuable opinions and practical suggestions. The 32 key factors in this study are comprehensive and can contribute to continuous improvement in the FM department. More importantly, the practical world is different from the academic world; any suggestion should be utilised according to the real circumstances which the FM department is in.

#### **8.4 Contributions**

This study's contributions to practice are as follows:

This study identified 23 service gaps in hospital FM in Singapore and pointed out the service attributes that need improvement. The face-to-face SERVQUAL survey also gathered practical and detailed information about problems reported by the patients that exist in the current FM services. In addition, the SERVQUAL survey provided insight into the FM department on designing more comprehensive feedback forms that have their own purpose. The Kano survey helped to classify all the 24 service attributes into different categories and customer coefficients were also calculated to provide a deeper

understanding of the service attributes' influence on patient satisfaction. Finally, this study conducted the QFD survey and identified 32 key factors for closing service gaps and continuous improvement. Among them, the top 10 factors were discussed in detail, and together with other survey findings, this study provided three simplified recommendations for FM departments to achieve higher levels of patient satisfaction.

This study's academic contributions are as follows:

Tools used in this study include SERVQUAL, Kano and QFD. The technique of integrating SERVQUAL, Kano and QFD enabled this study to gain broader insights into service quality and continuous improvement in hospital FM. Although many researchers have studied the three tools' relationships and used them in a complementary manner, this study is the first to use the technique in the field of hospital FM in the Singapore context. It is hoped that this study will stimulate more research into this field.

### **8.5 Limitations and Suggestions for Future Research**

One limitation of this study is that only the public hospitals in Singapore were included in the research. Although the public hospitals provide 80% of the in-hospital service in Singapore, the private hospitals should also be considered if one wants to obtain a more comprehensive picture of the FM service quality in Singapore.

The other limitation of this study is that the sample size is relatively small. There are six public hospitals in Singapore, but this study's surveys were only conducted in two of them, leading to a relatively small sample size for each survey. If more public hospitals can participate in the survey and more samples can be obtained, then there will be fewer constraints in generalising the findings.

Considering the limitations of this research, one suggestion for future research is to include the private hospitals as well as the public hospitals in the surveys to obtain a whole picture of the FM service quality in Singapore. In addition, the competitive assessment in QFD may also be conducted between public and private hospitals; comparisons between them may provide deeper

understanding on FM services and give insights on continuous improvement if the two types of hospital have the opportunity to learn from each other.

Another suggestion for future research addresses obtaining more samples. It would be better to involve more hospitals and more patients in the surveys. This would help in obtaining a broader view of people and sets of data that are closer to the true situation. Thus, the findings would be more meaningful and suitable for generalisation.



## References

- Aagja, J. P., & Garg, R. (2010). Measuring perceived service quality for public hospitals (PubHosQual) in the Indian context. *International Journal of Pharmaceutical and Healthcare Marketing*, 4(1), 60-83.
- Ahmed, S. Z., & Shoeb, M. Z. H. (2009). Measuring service quality of a public university library in Bangladesh using SERVQUAL. *Performance Measurement and Metrics*, 10(1), 17-32.
- Akao, Y. (2004). *Quality function deployment: integrating customer requirements into product design*: Productivity Pr.
- Akhlaghi, F., & Mahony, L. (1997). Service integration and multiskilling in facilities management within the UK National Health Service. *Facilities*, 15(3/4), 66-71.
- Akter, N., & Tränkler, J. (2003). An analysis of possible scenarios of medical waste management in Bangladesh. *Management of Environmental Quality: An International Journal*, 14(2), 242-255.
- Aldlaigan, A. H., & Buttle, F. A. (2002). SYSTRA-SQ: a new measure of bank service quality. *International Journal of Service Industry Management*, 13(4), 362-381.
- Alexander, K. (1994). A strategy for facilities management. *Facilities*, 12(11), 6-10.
- Alexander, K. (2003). A strategy for facilities management. *Facilities*, 21(11/12), 269-274.
- Alves, H., & Raposo, M. (2007). Conceptual model of student satisfaction in higher education. *Total Quality Management*, 18(5), 571-588.
- Amaratunga, D., & Baldry, D. (2003). A conceptual framework to measure facilities management performance. *Property management*, 21(2), 171-189.
- Andaleeb, S. S. (1998). Determinants of customer satisfaction with hospitals: a managerial model. *International Journal of Health Care Quality Assurance*, 11(6), 181-187.
- Andronikidis, A., Georgiou, A. C., Gotzamani, K., & Kamvysi, K. (2009). The application of quality function deployment in service quality management. *The TQM Journal*, 21(4), 319-333.
- Angur, M. G., Nataraajan, R., & Jahera Jr, J. S. (1999). Service quality in the banking industry: an assessment in a developing economy. *International Journal of Bank Marketing*, 17(3), 116-125.
- Asif, U., Javed, K., & Saleem, W. (2011). Measuring Customer Satisfaction in Fast Food Industry A Case From Pakistan Fast Food Industry. *Interdisciplinary Journal of Contemporary Research In Business*, 3(4), 306-318.
- Atkin, B., & Brooks, A. (2009). *Total facilities management*: Wiley-Blackwell.

- Badri, M. A., Abdulla, M., & Al-Madani, A. (2005). Information technology center service quality: Assessment and application of SERVQUAL. *International Journal of Quality & Reliability Management*, 22(8), 819-848.
- Bakar, C., Akgün, H. S., & Al Assaf, A. (2008). The role of expectations in patients' hospital assessments: A Turkish university hospital example. *International Journal of Health Care Quality Assurance*, 21(5), 503-516.
- Baki, B., Basfirinci, C. S., AR, I. M., & Cilingir, Z. (2009). An application of integrating SERVQUAL and Kano's model into QFD for logistics services: a case study from Turkey. *Asia Pacific Journal of Marketing and Logistics*, 21(1), 106-126.
- Baldwin, E., & Shaw, C. (2005). Buildings. Patient choice. Pick and mix. *The Health service journal*, 115(5940), 38.
- Bandy, N. M. (2002). Setting service standards: a structured approach to delivering outstanding customer service for the facility manager. *Journal of Facilities Management*, 1(4), 322-336.
- Barrett, P., & Baldry, D. (2009). *Facilities management: Towards best practice*: Wiley-Blackwell.
- Berry, L. L., & Bendapudi, N. (2007). Health care a fertile field for service research. *Journal of Service Research*, 10(2), 111-122.
- BIFM. (2004). Rethinking facilities management: accelerating change through best practice. Retrieved 15 May, 2013, from [www.bifm.org.uk](http://www.bifm.org.uk)
- Bitner, M. J. (1990). Evaluating service encounters: the effects of physical surroundings and employee responses. *The Journal of Marketing*, 69-82.
- Blanchard, R., & Galloway, R. (1994). Quality in retail banking. *International Journal of Service Industry Management*, 5(4), 5-23.
- Bolton, R. N., & Drew, J. H. (1991). A multistage model of customers' assessments of service quality and value. *Journal of consumer research*, 375-384.
- Brady, M. K., Cronin Jr, J. J., & Brand, R. R. (2002). Performance-only measurement of service quality: a replication and extension. *Journal of Business Research*, 55(1), 17-31.
- Brogowicz, A. A., Delene, L. M., & Lyth, D. M. (1990). A synthesised service quality model with managerial implications. *International Journal of Service Industry Management*, 1(1), 27-45.
- Brown, T. J., Churchill Jr, G. A., & Peter, J. P. (1993). Improving the measurement of service quality. *Journal of retailing*, 69(1), 127-139.
- Bull, P. (1996). The secret of a successful FM marriage. *Facilities*, 14(12/13), 38-41.
- Buttle, F. (1996). SERVQUAL: review, critique, research agenda. *European Journal of marketing*, 30(1), 8-32.

- Buzzell, R. D., & Gale, B. T. (1987). *The PIMS principles: Linking strategy to performance*: Simon and Schuster.
- Cairns, G., & Beech, N. (1999). Flexible working: organisational liberation or individual strait-jacket? *Facilities*, 17(1/2), 18-23.
- Camilleri, D., & O'Callaghan, M. (1998). Comparing public and private hospital care service quality. *International Journal of Health Care Quality Assurance*, 11(4), 127-133.
- Carman, J. M. (1990). Consumer perceptions of service quality: An assessment of the SERVQUAL dimensions. *Journal of retailing*.
- Carrillat, F. A., Jaramillo, F., & Mulki, J. P. (2007). The validity of the SERVQUAL and SERVPERF scales: a meta-analytic view of 17 years of research across five continents. *International Journal of Service Industry Management*, 18(5), 472-490.
- Caruana, A., & Pitt, L. (1997). INTQUAL-an internal measure of service quality and the link between service quality and business performance. *European Journal of marketing*, 31(8), 604-616.
- Cassel, C., & Eklöf, J. A. (2001). Modelling customer satisfaction and loyalty on aggregate levels: Experience from the ECSI pilot study. *Total Quality Management*, 12(7-8), 834-841.
- Cesarotti, V., & Di Silvio, B. (2006). Quality management standards for facility services in the Italian health care sector. *International Journal of Health Care Quality Assurance*, 19(6), 451-462.
- Chan, L.-K., & Wu, M.-L. (2002). Quality function deployment: a literature review. *European Journal of Operational Research*, 143(3), 463-497.
- Chen, M.-C., Chang, K.-C., Hsu, C.-L., & Yang, I.-C. (2011). Understanding the relationship between service convenience and customer satisfaction in home delivery by Kano model. *Asia Pacific Journal of Marketing and Logistics*, 23(3), 386-410.
- Chen, Y.-H., & Su, C.-T. (2006). A Kano-CKM model for customer knowledge discovery. *Total Quality Management & Business Excellence*, 17(5), 589-608.
- Chin, K.-S., Pun, K.-F., Leung, W., & Lau, H. (2001). A quality function deployment approach for improving technical library and information services: a case study. *Library Management*, 22(4/5), 195-204.
- Chin, K.-S., Wang, Y.-M., Yang, J.-B., & Gary Poon, K. K. (2009). An evidential reasoning based approach for quality function deployment under uncertainty. *Expert Systems with Applications*, 36(3), 5684-5694.
- Chotipanich, S. (2004). Positioning facility management. *Facilities*, 22(13/14), 364-372.
- Chow-Chua, C., & Komaran, R. (2002). Managing service quality by combining voice of the service provider and voice of their customers. *Managing Service Quality*, 12(2), 77-86.

- Cole, A. (2004). Better late than never. *FM world*, 18-19.
- Cook, C., & Thompson, B. (2000). Reliability and validity of SERVQUAL scores used to evaluate perceptions of library service quality. *The Journal of Academic Librarianship*, 26(4), 248-258.
- Cotts, D. G., Roper, K. O., & Payant, R. P. (2010). *The facility management handbook*: Amacom Books.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.
- Cronin, J. J., & Taylor, S. A. (1992). Measuring service quality: a reexamination and extension. *The Journal of Marketing*, 55-68.
- Crosby, P. B. (1979). *Quality is free: The art of making quality certain* (Vol. 94): McGraw-Hill New York.
- Dabholkar, P. A., Shepherd, C. D., & Thorpe, D. I. (2000). A comprehensive framework for service quality: an investigation of critical conceptual and measurement issues through a longitudinal study. *Journal of retailing*, 76(2), 139-173.
- Dalrymple, J., Donnelly, M., Wisniewski, M., & Curry, A. (1995). Measuring service quality in local government *Total Quality Management* (pp. 263-266): Springer.
- Dibb, S., Simkin, L., Pride, W. M., & Ferrell, O. (2005). *Marketing: Concepts and strategies*: Houghton Mifflin.
- Drion, B., Melissen, F., & Wood, R. (2012). Facilities management: lost, or regained? *Facilities*, 30(5/6), 254-261.
- Duyar, I. (2010). Relationship between school facility conditions and the delivery of instruction: Evidence from a national survey of school principals. *Journal of Facilities Management*, 8(1), 8-25.
- Echtner, C. M., & Ritchie, J. B. (1991). The meaning and measurement of destination image. *Journal of tourism studies*, 2(2), 2-12.
- Edlin, M. (2009). In Singapore's health system, there's no free lunch. *Managed Healthcare Executive*, 19(7), 8-8.
- Elleuch, A. (2008). Patient satisfaction in Japan. *International Journal of Health Care Quality Assurance*, 21(7), 692-705.
- Emanuel, J. T., & Kroll, D. E. (1998). Concurrent engineering *Handbook of Total Quality Management* (pp. 425-445): Springer.
- Emery, C. R., & Tian, R. G. (2002). Schoolwork as products, professors as customers: a practical teaching approach in business education. *The Journal of Education for Business*, 78(2), 97-102.

- Engelland, B. T., Workman, L., & Singh, M. (2000). Ensuring service quality for campus career services centers: a modified SERVQUAL scale. *Journal of marketing Education*, 22(3), 236-245.
- Finn, D. W., & Lamb, C. W. (1991). An evaluation of the SERVQUAL scales in a retailing setting. *Advances in consumer research*, 18(1), 483-490.
- Fleming, D. (2004). Facilities management: a behavioural approach. *Facilities*, 22(1/2), 35-43.
- Franceschini, F. (2002). *Advanced quality function deployment*: CRC Press LLC.
- Franceschini, F., & Terzago, M. (1998). An application of quality function deployment to industrial training courses. *International Journal of Quality & Reliability Management*, 15(7), 753-768.
- Fundin, A., & Nilsson, L. (2003). Using Kano's theory of attractive quality to better understand customer experiences with e-services. *Asian Journal on Quality*, 4(2), 32-49.
- Gelnay, B. (2002). *Facility management and the design of Victoria Public Hospitals*. Paper presented at the Proceedings of the CIB Working Commission.
- González, M. E., Quesada, G., Picado, F., & Eckelman, C. A. (2004). Customer satisfaction using QFD: an e-banking case. *Managing Service Quality*, 14(4), 317-330.
- Gounaris, S. P., Stathakopoulos, V., & Athanassopoulos, A. D. (2003). Antecedents to perceived service quality: an exploratory study in the banking industry. *International Journal of Bank Marketing*, 21(4), 168-190.
- Grönroos, C. (1984). A service quality model and its marketing implications. *European Journal of marketing*, 18(4), 36-44.
- Grönroos, C. (1990). *Service management and marketing: managing the moments of truth in service competition*: Lexington Books Lexington, MA.
- Gremyr, I., & Raharjo, H. (2013). Quality function deployment in healthcare: a literature review and case study. *International Journal of Health Care Quality Assurance*, 26(2), 135-146.
- Hayes, B. E. (1992). *Measuring customer satisfaction: development and use of questionnaires*: Irwin Professional Pub.
- Haynes, B. P. (2007). Office productivity: a shift from cost reduction to human contribution. *Facilities*, 25(11/12), 452-462.
- Hinks, J., & McNay, P. (1999). The creation of a management-by-variance tool for facilities management performance assessment. *Facilities*, 17(1/2), 31-53.
- Hinterhuber, H. H., Matzler, K., Bailom, F., & Sauerwein, E. (1997). Un modello semiquantitativo per la valutazione della soddisfazione del cliente. *Micro & Macro Marketing*, 6(1), 127-144.

- Hui, E. C.-m., Zhang, P., & Zheng, X. (2013). Facilities Management Service and Customer Satisfaction in Shopping Mall Sector. *Facilities*, 31(5/6), 1-1.
- Hui, E. C., & Zheng, X. (2010). Measuring customer satisfaction of FM service in housing sector: a structural equation model approach. *Facilities*, 28(5/6), 306-320.
- Hwang, J. L.-J., Desombre, T., Eves, A., & Kipps, M. (1999). An analysis of catering options within NHS acute hospitals. *International Journal of Health Care Quality Assurance*, 12(7), 293-308.
- Hwang, L.-J. J., Eves, A., & Desombre, T. (2003). Gap analysis of patient meal service perceptions. *International Journal of Health Care Quality Assurance*, 16(3), 143-153.
- Hwarng, H. B., & Teo, C. (2001). Translating customers' voices into operations requirements-A QFD application in higher education. *International Journal of Quality & Reliability Management*, 18(2), 195-226.
- Jabnoun, N., & Chaker, M. (2003). Comparing the quality of private and public hospitals. *Managing Service Quality*, 13(4), 290-299.
- Jain, S. K., & Gupta, G. (2004). Measuring service quality: SERVQUAL vs. SERVPERF scales. *Vikalpa*, 29(2), 25-37.
- Jensen, P. A., van der Voordt, T., Choenen, C., von Felten, D., Lindholm, A.-L., Nielsen, S. B., . . . Schmid, M. (2010). The added value of FM: Different research perspectives.
- Jensen, P. A., van der Voordt, T., Coenen, C., von Felten, D., Lindholm, A.-L., Nielsen, S. B., . . . Pfenninger, M. (2012). In search for the added value of FM: what we know and what we need to learn. *Facilities*, 30(5/6), 199-217.
- Jeong, M., & Oh, H. (1998). Quality function deployment:: An extended framework for service quality and customer satisfaction in the hospitality industry. *International Journal of Hospitality Management*, 17(4), 375-390.
- Johnson, M. D., & Fornell, C. (1991). A framework for comparing customer satisfaction across individuals and product categories. *Journal of Economic Psychology*, 12(2), 267-286.
- Johnson, M. D., Gustafsson, A., Andreassen, T. W., Lervik, L., & Cha, J. (2001). The evolution and future of national customer satisfaction index models. *Journal of Economic Psychology*, 22(2), 217-245.
- Jumat, A. R., Coffey, V., & Skitmore, M. (2012). Stakeholder service delivery expectations of military facilities management. *Built Environment Project and Asset Management*, 2(2), 146-166.
- Juran, J. M. (1999). How to think about Quality. *Juran's quality handbook*, 5, 1-18.
- Juwaheer, T. D. (2004). Exploring international tourists' perceptions of hotel operations by using a modified SERVQUAL approach—a case study of Mauritius. *Managing Service Quality*, 14(5), 350-364.

- Kam-Shim, M. W. Y. (1999). Managing change: facilities management at the Pamela Youde Nethersole Eastern Hospital. *Facilities*, 17(3/4), 86-90.
- Kano, N. (2001). *Life cycle and creation of attractive quality*. Paper presented at the 4th QMOD Conference, Linköping, Sweden.
- Kano, N., Seraku, N., Takahashi, F., & Tsuji, S. (1984). Attractive quality and must-be quality. *The Journal of the Japanese Society for Quality Control*, 14(2), 39-48.
- Khan, M. (2003). ECOSERV: Ecotourists' quality expectations. *Annals of Tourism Research*, 30(1), 109-124.
- Kilbourne, W. E., Duffy, J. A., Duffy, M., & Giarchi, G. (2004). The applicability of SERVQUAL in cross-national measurements of health-care quality. *Journal of Services Marketing*, 18(7), 524-533.
- Kim, K. J., & Moskowitz, H. (1997). Quality function deployment: optimizing product designs *Integrated Product, Process and Enterprise Design* (pp. 64-89): Springer.
- Kincaid, D. G. (1994). Measuring performance in facility management. *Facilities*, 12(6), 17-20.
- Ko, A. S. O., & Lee, S. (2000). Implementing the strategic formulation framework for the banking industry of Hong Kong. *Managerial Auditing Journal*, 15(9), 469-477.
- Kotler, P., Armstrong, G., Wong, V. W., & Saunders, J. A. (2001). Principles of marketing: European edition.
- Kuei, C.-H., & Lu, M. H. (1997). An integrated approach to service quality improvement. *International journal of quality science*, 2(1), 24-36.
- Kulatunga, U., Liyanage, C., & Amaratunga, D. (2010). Performance measurement and management in facilities management. *Facilities*, 28(5/6).
- Kumar, R. (2011). *Research methodology*: APH publishing.
- Ladhari, R. (2008). Alternative measures of service quality: a review. *Managing Service Quality*, 18(1), 65-86.
- Ladhari, R. (2009). A review of twenty years of SERVQUAL research. *International Journal of Quality and Service Sciences*, 1(2), 172-198.
- Lam, S. S. (1997). SERVQUAL: a tool for measuring patients' opinions of hospital service quality in Hong Kong. *Total Quality Management*, 8(4), 145-152.
- Lam, T. K. (2002). Making sense of SERVQUAL's dimensions to the Chinese customers in Macau. *Journal of Market-Focused Management*, 5(1), 43-58.
- Lassar, W. M., Manolis, C., & Winsor, R. D. (2000). Service quality perspectives and satisfaction in private banking. *Journal of Services Marketing*, 14(3), 244-271.

- Lavy, S., & Fernández-Solis, J. (2010). Complex Healthcare Facility Management and Lean Construction. *Health Environments Research & Design Journal*, 3(2), 3-6.
- Lavy, S., & Shohet, I. M. (2009). Integrated healthcare facilities maintenance management model: case studies. *Facilities*, 27(3/4), 107-119.
- LeBlanc, G., & Nguyen, N. (1988). Customers' perceptions of service quality in financial institutions. *International Journal of Bank Marketing*, 6(4), 7-18.
- Lee-Ross, D. (2008). An exploratory study of the contextual stability of SERVQUAL amongst three retail clusters in far North Queensland. *Journal of Place Management and Development*, 1(1), 46-61.
- Lee, M., & Ulgado, F. M. (1997). Consumer evaluations of fast-food services: a cross-national comparison. *Journal of Services Marketing*, 11(1), 39-52.
- Lennerts, K., Abel, J., Pfründer, U., & Sharma, V. (2005). Step-by-step process analysis for hospital facility management: An insight into the OPIK research project. *Facilities*, 23(3/4), 164-175.
- Leung, M.-y., & Fung, I. (2005). Enhancement of classroom facilities of primary schools and its impact on learning behaviors of students. *Facilities*, 23(13/14), 585-594.
- Li, Y., Tan, K., & Xie, M. (2003). Managing service quality: applying utility theory in the prioritization of service attributes. *International Journal of Quality & Reliability Management*, 20(4), 417-435.
- Lim, P. C., & Tang, N. K. (2000a). The development of a model for total quality healthcare. *Managing Service Quality*, 10(2), 103-111.
- Lim, P. C., & Tang, N. K. (2000b). A study of patients' expectations and satisfaction in Singapore hospitals. *International Journal of Health Care Quality Assurance*, 13(7), 290-299.
- Lim, P. C., Tang, N. K., & Jackson, P. M. (1999). An innovative framework for health care performance measurement. *Managing Service Quality*, 9(6), 423-433.
- Lin, B., & Kelly, E. (1995). Methodological issues in patient satisfaction surveys. *International Journal of Health Care Quality Assurance*, 8(6), 32-37.
- Liyanage, C., & Egbu, C. (2008). A performance management framework for healthcare facilities management. *Journal of Facilities Management*, 6(1), 23-36.
- Loch, B. (2000). Avoiding the usual suspects. *Facilities*, 18(10/11/12), 368-370.
- Loosemore, M., & Hsin, Y. (2001). Customer-focused benchmarking for facilities management. *Facilities*, 19(13/14), 464-476.
- Macdonald, R., Price, I., & Askham, P. (2009). Excellent patient environments within acute NHS trusts: external influences and trust characteristics. *Journal of Facilities Management*, 7(1), 7-23.



- Madu, C. N. (2006). *House of quality (QFD) in a minute: Quality function deployment*: Chi Publishers Inc.
- Manaf, N. H. A. (2012). Inpatient satisfaction: an analysis of Malaysian public hospitals. *International Journal of Public Sector Management*, 25(1), 6-16.
- Marković, S. (2006). Expected service quality measurement in tourism higher education. *Our Economy*, 1(2), 86-95.
- Massheder, K., & Finch, E. (1998). Benchmarking methodologies applied to UK facilities management. *Facilities*, 16(3/4), 99-106.
- Matzler, K., & Hinterhuber, H. H. (1998). How to make product development projects more successful by integrating Kano's model of customer satisfaction into quality function deployment. *Technovation*, 18(1), 25-38.
- May, D., & Clark, L. (2009). Achieving patient-focused maintenance services/systems. *Journal of Facilities Management*, 7(2), 128-141.
- May, D., & Pinder, J. (2008). The impact of facilities management on patient outcomes. *Facilities*, 26(5/6), 213-228.
- May, D., & Smith, L. (2003). Evaluation of the new ward housekeeper role in UK NHS Trusts. *Facilities*, 21(7/8), 168-174.
- Mehrjerdi, Y. Z. (2010). Quality function deployment and its extensions. *International Journal of Quality & Reliability Management*, 27(6), 616-640.
- Mels, G., Boshoff, C., & Nel, D. (1997). The dimensions of service quality: The original European perspective revisited. *The Service Industries Journal*, 17(1), 173-189.
- Meng, X., & Minogue, M. (2011). Performance measurement models in facility management: a comparative study. *Facilities*, 29(11/12), 472-484.
- Mikulic, J., & Prebežac, D. (2011). A critical review of techniques for classifying quality attributes in the Kano model. *Managing Service Quality*, 21(1), 46-66.
- Miller, L., & May, D. (2006). Patient choice in the NHS: how critical are facilities services in influencing patient choice? *Facilities*, 24(9/10), 354-364.
- Ministry of Health. (2012a). Healthcare Institution Statistics. Retrieved 14 May, 2013, from [http://www.moh.gov.sg/content/moh\\_web/home/statistics/healthcare\\_institutionstatistics.html](http://www.moh.gov.sg/content/moh_web/home/statistics/healthcare_institutionstatistics.html)
- Ministry of Health. (2012b). Medical Directory. Retrieved Augst 8, 2012, from [http://www.moh.gov.sg/content/moh\\_web/home/medical-directory.html](http://www.moh.gov.sg/content/moh_web/home/medical-directory.html)
- Ministry of Health. (2012c). Patient Satisfaction Survey. Retrieved 18 May, 2013, from [https://www.moh.gov.sg/content/moh\\_web/home/pressRoom/pressRoomItemRelease/2012/patient\\_satisfactionsurvey2012.html](https://www.moh.gov.sg/content/moh_web/home/pressRoom/pressRoomItemRelease/2012/patient_satisfactionsurvey2012.html)

- Mittal, V., Ross Jr, W. T., & Baldasare, P. M. (1998). The asymmetric impact of negative and positive attribute-level performance on overall satisfaction and repurchase intentions. *The Journal of Marketing*, 33-47.
- Mostafa, M. M. (2005). An empirical study of patients' expectations and satisfactions in Egyptian hospitals. *International Journal of Health Care Quality Assurance*, 18(7), 516-532.
- Moy Jr., F. (1995). Facility “wellness”: health facilities management. *Facilities*, 13(9/10), 45-48.
- Mudrak, T., van Wagenberg, A., & Wubben, E. (2005). FM as a scientific field of inquiry: theory, research and practice. *Facilities*, 23(3/4).
- Noor, M. N. M., & Pitt, M. (2009). A critical review on innovation in facilities management service delivery. *Facilities*, 27(5/6), 211-228.
- Nutt, B. (1999). Linking FM practice and research. *Facilities*, 17(1/2), 11-17.
- Nutt, B. (2002). The essence and value of facility management.
- Okoroh, M., Gombera, P., John, E., & Wagstaff, M. (2001). Adding value to the healthcare sector—a facilities management partnering arrangement case study. *Facilities*, 19(3/4), 157-164.
- Padma, P., Rajendran, C., & Lokachari, P. S. (2010). Service quality and its impact on customer satisfaction in Indian hospitals: Perspectives of patients and their attendants. *Benchmarking: An International Journal*, 17(6), 807-841.
- Pai, Y. P., & Chary, S. T. (2013). Dimensions of hospital service quality: a critical review Perspective of patients from global studies. *International Journal of Health Care Quality Assurance*, 26(4), 2-2.
- Parasuraman, A., Zeithaml, V., & Berry, L. (1988). SERVQUAL: A multiple item scale for measuring consumer perceptions of service quality. *Journal of retailing*, 64, 12-40.
- Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1985). A conceptual model of service quality and its implications for future research. *The Journal of Marketing*, 41-50.
- Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1994). Alternative scales for measuring service quality: a comparative assessment based on psychometric and diagnostic criteria. *Journal of retailing*, 70(3), 201-230.
- Pathirage, C., Haigh, R., Amaratunga, D., & Baldry, D. (2008). Knowledge management practices in facilities organisations: a case study. *Journal of Facilities Management*, 6(1), 5-22.
- Paulin, M., Perrien, J., Kunst, P., & Lemmink, J. (1996). Measurement of service quality: the effect of contextuality. *Managing Service Quality*, 2, 76-96.
- Pawitra, T. A., & Tan, K. C. (2003). Tourist satisfaction in Singapore—a perspective from Indonesian tourists. *Managing Service Quality*, 13(5), 399-411.

- Payne, T., & Rees, D. (1999). NHS facilities management: a prescription for change. *Facilities*, 17(7/8), 217-221.
- Philip, G., & Hazlett, S.-A. (1997). The measurement of service quality: a new PCP attributes model. *International Journal of Quality & Reliability Management*, 14(3), 260-286.
- Pitt, M., & Tucker, M. (2008). Performance measurement in facilities management: driving innovation? *Property management*, 26(4), 241-254.
- Pollack, B. L. (2009). Linking the hierarchical service quality model to customer satisfaction and loyalty. *Journal of Services Marketing*, 23(1), 42-50.
- Price, I. (2004). Business critical FM. *Facilities*, 22(13/14), 353-358.
- Pwee, K. H. (2009). Health technology assessment in Singapore. *International journal of technology assessment in health care*, 25(S1), 234-240.
- Redman, T., & Mathews, B. P. (1998). Service quality and human resource management: a review and research agenda. *Personnel Review*, 27(1), 57-77.
- Regan, W. J. (1963). The service revolution. *The Journal of Marketing*, 57-62.
- ReVelle, J., Mora, J., & Cox, C. (1998). *The QFD handbook*. New York: Wiley.
- Robinson, S. (1999). Measuring service quality: current thinking and future requirements. *Marketing Intelligence & Planning*, 17(1), 21-32.
- Robledo, M. A. (2001). Measuring and managing service quality: integrating customer expectations. *Managing Service Quality*, 11(1), 22-31.
- Rogers, P. A. (2003). Performance matters: How the high performance business unit leverages facilities management effectiveness. *Journal of Facilities Management*, 2(4), 371-381.
- Rondeau, E. P., Brown, R. K., & Lapides, P. D. (1995). *Facility management*: Wiley (New York).
- Rust, R. T., & Oliver, R. L. (1994). *Service quality: New directions in theory and practice*: Sage Publications California.
- Sahney, S. (2011a). Delighting customers of management education in India: a student perspective, part I. *The TQM Journal*, 23(6), 644-658.
- Sahney, S. (2011b). Delighting customers of management education in India: a student perspective, part II. *The TQM Journal*, 23(5), 531-548.
- Sahney, S., Banwet, D., & Karunes, S. (2004). A SERVQUAL and QFD approach to total quality education: A student perspective. *International Journal of Productivity and Performance Management*, 53(2), 143-166.
- Sahu, A. K. (2007). Measuring service quality in an academic library: an Indian case study. *Library Review*, 56(3), 234-243.

- Sarshar, M. (2006). Improving service delivery in FM: case study of a UK hospital facilities directorate. *Journal of Facilities Management*, 4(4), 271-285.
- Seiler, V. L. (2004). *Examining service quality for homebuyers in the residential real estate brokerage industry*: University of Western Sydney.
- Selnes, F. (1993). An examination of the effect of product performance on brand reputation, satisfaction and loyalty. *European Journal of marketing*, 27(9), 19-35.
- Seth, N., Deshmukh, S., & Vrat, P. (2005). Service quality models: a review. *International Journal of Quality & Reliability Management*, 22(9), 913-949.
- Shahin, A., Pourhamidi, M., Antony, J., & Park, S. H. (2013). Typology of Kano models: a critical review of literature and proposition of a revised model. *International Journal of Quality & Reliability Management*, 30(3), 341-358.
- Sharabi, M., & Davidow, M. (2010). Service quality implementation: problems and solutions. *International Journal of Quality and Service Sciences*, 2(2), 189-205.
- Shaw, D., & Haynes, B. (2004). An evaluation of customer perception of FM service delivery. *Facilities*, 22(7/8), 170-177.
- Shoeb, Z. H. (2011). Identifying service superiority, zone of tolerance and underlying dimensions: service quality attributes in a private university library in Bangladesh. *Library Review*, 60(4), 293-311.
- Shohet, I. M. (2003). Key performance indicators for maintenance of health-care facilities. *Facilities*, 21(1/2), 5-12.
- Shohet, I. M. (2006). Key performance indicators for strategic healthcare facilities maintenance. *Journal of Construction Engineering and Management*, 132(4), 345-352.
- Shohet, I. M., & Lavy, S. (2004). Healthcare facilities management: state of the art review. *Facilities*, 22(7/8), 210-220.
- Singapore Department of Statistics. (2012). Population. Retrieved 14 May, 2013, from <http://www.singstat.gov.sg/index.html>
- Singapore Tourism Board. (2000). *Tourism 21: Visions of a Tourism Capital*.
- Smith, A., Tucker, M., & Pitt, M. (2011). Healthy, productive workplaces: towards a case for interior landscaping. *Facilities*, 29(5/6), 209-223.
- Sohail, M. S. (2003). Service quality in hospitals: more favourable than you might think. *Managing Service Quality*, 13(3), 197-206.
- Spaeth, J. (1992). Perils and pitfalls of survey research. *Applying research to practice: How to use data collection and research to improve library management decision making*, 27-29.

- Spencer, R., & Hinks, J. (2007). The significance of cognitive dissonance for the “hard and soft FM” paradigm and quality assessment practices: A whole new can of worms? *Journal of Facilities Management*, 5(4), 243-262.
- Srinivasan, A. V. (2008). *Managing a modern hospital*: Response Books.
- Sudman, S., & Bradburn, N. M. (1982). *Asking questions*: Jossey-Bass Inc Pub.
- Suess, M. J. (1992). Hospital Waste Management: An International Viewpoint. *Environmental Management and Health*, 3(3), 6-8.
- Suki, N. M., Lian, J. C. C., & Suki, N. M. (2011). Do patients' perceptions exceed their expectations in private healthcare settings? *International Journal of Health Care Quality Assurance*, 24(1), 42-56.
- Sultan, P., & Wong, H. Y. (2010). Service quality in higher education—a review and research agenda. *International Journal of Quality and Service Sciences*, 2(2), 259-272.
- Tan, K. C., & Pawitra, T. A. (2001). Integrating SERVQUAL and Kano's model into QFD for service excellence development. *Managing Service Quality*, 11(6), 418-430.
- Tan, K. C., & Shen, X.-X. (2000). Integrating Kano's model in the planning matrix of quality function deployment. *Total Quality Management*, 11(8), 1141-1151.
- Tan, W. C. K. (2012). *Practical research methods*. Singapore: Pearson Prentice Hall.
- Tay, L., & Ooi, J. T. (2001). Facilities management: a “Jack of all trades”? *Facilities*, 19(10), 357-363.
- Teas, R. K. (1994). Expectations as a comparison standard in measuring service quality: an assessment of a reassessment. *The Journal of Marketing*, 132-139.
- Terzakis, D., Zisis, P., Garefalakis, A., & Arvanitis, S. (2012). Translating the Service Quality Gaps into Strategy Formulation. An Experimental Case Study of a Greek Academic Department. *European Research Studies Journal*, 15(1), 99-126.
- Tomes, A. E., & Ng, S. C. P. (1995). Service quality in hospital care: the development of an in-patient questionnaire. *International Journal of Health Care Quality Assurance*, 8(3), 25-33.
- Tranfield, D., & Akhlaghi, F. (1995). Performance measures: relating facilities to business indicators. *Facilities*, 13(3), 6-14.
- Trochim, W. M. (2001). *Research methods knowledge base*.
- Tucker, M., & Pitt, M. (2009). National standards of customer satisfaction in facilities management. *Facilities*, 27(13/14), 497-514.
- Van Dyke, T. P., Kappelman, L. A., & Prybutok, V. R. (1997). Measuring information systems service quality: concerns on the use of the SERVQUAL questionnaire. *MIS quarterly*, 195-208.

- Vandamme, R., & Leunis, J. (1993). Development of a multiple-item scale for measuring hospital service quality. *International Journal of Service Industry Management*, 4(3), 30-49.
- Ventovuori, T., Lehtonen, T., Salonen, A., & Nenonen, S. (2007). A review and classification of academic research in facilities management. *Facilities*, 25(5/6), 227-237.
- Walters, M. (1999). Performance measurement systems-a case study of customer satisfaction. *Facilities*, 17(3/4), 97-104.
- Wauters, B. (2005). The added value of facilities management: benchmarking work processes. *Facilities*, 23(3/4), 142-151.
- Wicks, A. M., & Chin, W. W. (2008). Measuring the three process segments of a customer's service experience for an out-patient surgery center. *International Journal of Health Care Quality Assurance*, 21(1), 24-38.
- Williams, B. (1996). Cost-effective facilities management: a practical approach. *Facilities*, 14(5/6), 26-38.
- Witell, L., & Löfgren, M. (2007). Classification of quality attributes. *Managing Service Quality*, 17(1), 54-73.
- World Health Organisation. (2000). The world health report 2000 - Health systems: improving performance. Retrieved 14 May, 2013, from <http://www.who.int/whr/2000/en/index.html>
- Xie, M., Tan, K.-C., & Goh, T. N. (2003). *Advanced QFD applications*: ASQ Quality Press Milwaukee, WI.
- Yeo, R. K. (2008). Brewing service quality in higher education: Characteristics of ingredients that make up the recipe. *Quality Assurance in Education*, 16(3), 266-286.
- Yusoff, W. Z. W., Ismail, M., & Newell, G. (2008). FM-SERVQUAL: a new approach of service quality measurement framework in local authorities. *Journal of Corporate Real Estate*, 10(2), 130-144.
- Zeithaml, V., Parasuraman, A., & Berry, L. (1990). Delivering quality service: balancing customer perceptions and expectations.
- Zeithaml, V. A., & Berry, L. L. (1993). The nature and determinants of customer expectations of service. *Journal of the academy of Marketing Science*, 21(1), 1-12.
- Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (1996). The behavioral consequences of service quality. *The Journal of Marketing*, 31-46.
- Zisis, P., Garefalakis, A., & Sariannidis, N. (2009). The Application of Performance Measurement in the Service Quality Concept: The Case of a Greek Service Organization. Available at SSRN 1359926.

## Appendix

### Appendix 1 Survey on Service Quality of Facilities

#### Management in Singapore's Hospitals

##### Instructions:

This survey aims to identify the service gaps (if any) of Facilities Management (FM) in hospitals with a focus on patient-facing services such as catering, housekeeping, security, portering and so on. Your responses will contribute to future improvement in facilities management service level in hospitals.

In this survey, please score each attribute according to your expectation and real life experience (i.e. perception).

Please adopt the following evaluation standards:

**Patients' Expectation** represents what you think the specific attribute's service level should be:

<b>Patients' Expectation</b>				
1	2	3	4	5
Should be very poor	Should be poor	Should be neutral	Should be good	Should be very good

**Patients' Perception** represents the actual service level you received for each attribute:

<b>Patients' Perception</b>				
1	2	3	4	5
Very poor	Poor	Neutral	Good	Very good

##### Part I: General Information (Please tick the relevant boxes):

Age:	Below 20 <input type="checkbox"/>	21-35 <input type="checkbox"/>	36-50 <input type="checkbox"/>	51-65 <input type="checkbox"/>	Above 66 <input type="checkbox"/>
Gender:	Male <input type="checkbox"/>	Female <input type="checkbox"/>			
Race:	Chinese <input type="checkbox"/>	Malay <input type="checkbox"/>	Indian <input type="checkbox"/>	Others <input type="checkbox"/>	

**Part II: Facilities Management Service Quality (1: Very Poor ... 5: Very Good)**

	Service Attributes	Patients' Expectations	Patients' Perceptions
1	Clarity of signages (e.g. easy to spot)	1 2 3 4 5	1 2 3 4 5
2	Attractiveness of public area landscape	1 2 3 4 5	1 2 3 4 5
3	Condition of elevators and escalators	1 2 3 4 5	1 2 3 4 5
4	Cleanliness of public areas (e.g. floors, walls, seating)	1 2 3 4 5	1 2 3 4 5
5	Performance of pest control in hospital	1 2 3 4 5	1 2 3 4 5
6	Adequacy of security prevalent in hospital	1 2 3 4 5	1 2 3 4 5
7	Cleanliness of overall environment in ward (including bathrooms)	1 2 3 4 5	1 2 3 4 5
8	Cleanliness of bedding in ward	1 2 3 4 5	1 2 3 4 5
9	Provision for patient privacy (e.g. curtains and blinds)	1 2 3 4 5	1 2 3 4 5
10	Performance of lighting systems in ward	1 2 3 4 5	1 2 3 4 5
11	Performance of ventilation systems in ward (e.g. odor)	1 2 3 4 5	1 2 3 4 5
12	Performance of bedside nurse call system in ward	1 2 3 4 5	1 2 3 4 5
13	Performance of drinking water supply systems	1 2 3 4 5	1 2 3 4 5
14	Performance of non-drinking water supply systems (e.g. at sink, toilet)	1 2 3 4 5	1 2 3 4 5
15	Choice and availability of food and drinks provided by hospital	1 2 3 4 5	1 2 3 4 5
16	Quality of food and drinks provided by hospital	1 2 3 4 5	1 2 3 4 5
17	Quantity of food and drinks provided by hospital	1 2 3 4 5	1 2 3 4 5
18	Tidiness of FM staff members' appearance	1 2 3 4 5	1 2 3 4 5
19	Courtesy of FM staff members	1 2 3 4 5	1 2 3 4 5
20	FM staff members' knowledge to answer patients' questions related to their s	1 2 3 4 5	1 2 3 4 5
21	FM staff members' professionalism in running their job	1 2 3 4 5	1 2 3 4 5
22	Individual attention given to patients during FM service encounter	1 2 3 4 5	1 2 3 4 5
23	Convenience of FM service hours	1 2 3 4 5	1 2 3 4 5
24	Adequacy of hygienic care during FM service encounter (e.g. materials FM staff members use are clean)	1 2 3 4 5	1 2 3 4 5

Educational Background: Below Lower Secondary  Secondary  Non-Tertiary Post-Secondary   
Professional Qualification and Diplomas  University and Above



## Appendix 2 Survey on Facilities Management Services in Singapore's Hospitals

### Instructions:

This survey aims to prioritize the services provided by the Facilities Management Department of hospitals with a focus on patient-facing ones such as catering, housekeeping, security, portering and so on. Your responses will contribute to future improvement in facilities management service level in hospitals.

In this survey, please answer two types of questions relating to one specific service attribute: Functional and Dysfunctional, by marking each attribute from a scale of 1 to 5 according to the evaluation standard below:

Evaluation Standard				
1	2	3	4	5
I like it that way	It must be that way	I am neutral	I can live with it that way	I dislike it that way

### Part I: General Information (Please tick the relevant boxes):

Age:	Below 20 <input type="checkbox"/>	21-35 <input type="checkbox"/>	36-50 <input type="checkbox"/>	51-65 <input type="checkbox"/>	Above 66 <input type="checkbox"/>
Gender:	Male <input type="checkbox"/>	Female <input type="checkbox"/>			
Race:	Chinese <input type="checkbox"/>	Malay <input type="checkbox"/>	Indian <input type="checkbox"/>	Others <input type="checkbox"/>	
Educational Background:	Below Lower Secondary <input type="checkbox"/>	Secondary <input type="checkbox"/>	Non-Tertiary Post-Secondary <input type="checkbox"/>	Professional Qualification and Other Diploma <input type="checkbox"/>	University and Above <input type="checkbox"/>

## Part II: Facilities Management Services

**1: I like it that way**

**2: It must be that way**

**3. I am neutral**

**4: I can live with it that way**

**5: I dislike it that way**

	Attributes					
1	If the signages in hospital are clear, how do you feel?	1	2	3	4	5
	If the signages in hospital are not clear, how do you feel?	1	2	3	4	5
2	If the public area landscape in hospital is attractive, how do you feel?	1	2	3	4	5
	If the public area landscape in hospital is not attractive, how do you feel?	1	2	3	4	5
3	If elevators and escalators in hospital are in good condition, how do you feel?	1	2	3	4	5
	If elevators and escalators in hospital are not in good condition, how do you feel?	1	2	3	4	5
4	If public areas (floors, walls, seating) in hospital are clean, how do you feel?	1	2	3	4	5
	If public areas (floors, walls, seating) in hospital are not clean, how do you feel?	1	2	3	4	5
5	If the performance of pest control in hospital is good, how do you feel?	1	2	3	4	5
	If the performance of pest control in hospital is not good, how do you feel?	1	2	3	4	5
6	If the level of security prevalent in hospital is adequate, how do you feel?	1	2	3	4	5
	If the level of security prevalent in hospital is not adequate, how do you feel?	1	2	3	4	5
7	If the ward is clean, how do you feel?	1	2	3	4	5
	If the ward is not clean, how do you feel?	1	2	3	4	5
8	If the bedding in ward is clean, how do you feel?	1	2	3	4	5
	If the bedding in ward is not clean, how do you feel?	1	2	3	4	5
9	If the hospital provides good patient privacy protection in ward (curtains, blinds), how do you feel?	1	2	3	4	5
	If the hospital does not provide good patient privacy protection in ward (curtains, blinds), how do you feel?	1	2	3	4	5
10	If the performance of lighting system in ward is good, how do you feel?	1	2	3	4	5
	If the performance of lighting system in ward is not good, how do you feel?	1	2	3	4	5
11	If the performance of ventilation system in ward is good, how do you feel?	1	2	3	4	5
	If the performance of ventilation system in ward is not good, how do you feel?	1	2	3	4	5
12	If the performance of bedside nurse call system in ward is good, how do you feel?	1	2	3	4	5
	If the performance of bedside nurse call system in ward is not good, how do you feel?	1	2	3	4	5
13	If the performance of drinking water supply system in ward is good, how do you feel?	1	2	3	4	5
	If the performance of drinking water supply system in ward is not good, how do you feel?	1	2	3	4	5

**Continued:**

**1: I like it that way**

**2: It must be that way**

**3. I am neutral**

**4: I can live with it that way**

**5: I dislike it that way**

14	If the performance of non-drinking water supply system (at sink, toilet) in ward is good, how do you feel?	1	2	3	4	5
	If the performance of non-drinking water supply system (at sink, toilet) in ward is not good, how do you feel?	1	2	3	4	5
15	If the choice and availability of food and drinks provided by hospital are satisfactory, how do you feel?	1	2	3	4	5
	If the choice and availability of food and drinks provided by hospital are not satisfactory, how do you feel?	1	2	3	4	5
16	If the quality of food and drinks provided by hospital are good, how do you feel?	1	2	3	4	5
	If the quality of food and drinks provided by hospital are not good, how do you feel?	1	2	3	4	5
17	If the quantity of food and drinks provided by hospital are satisfactory, how do you feel?	1	2	3	4	5
	If the quantity of food and drinks provided by hospital are not satisfactory, how do you feel?	1	2	3	4	5
18	If the appearances of FM staff members are tidy, how do you feel?	1	2	3	4	5
	If the appearances of FM staff members are not tidy, how do you feel?	1	2	3	4	5
19	If the FM staff members are courteous to you, how do you feel?	1	2	3	4	5
	If the FM staff members are not courteous to you, how do you feel?	1	2	3	4	5
20	If the FM staff members have the knowledge to answer your questions related to their services, how do you feel?	1	2	3	4	5
	If the FM staff members do not have the knowledge to answer your questions related to their services, how do you feel?	1	2	3	4	5
21	If the FM staff members are professionalized in running their job, how do you feel?	1	2	3	4	5
	If the FM staff members are not professionalized in running their job, how do you feel?	1	2	3	4	5
22	If the FM staff members give individual attention to you during service encounter, how do you feel?	1	2	3	4	5
	If the FM staff members do not give individual attention to you during service encounter, how do you feel?	1	2	3	4	5
23	If the FM service hours are convenient, how do you feel?	1	2	3	4	5
	If the FM service hours are not convenient, how do you feel?	1	2	3	4	5
24	If the FM staff members give adequate hygienic care during service encounter, how do you feel?	1	2	3	4	5
	If the FM staff members do not give adequate hygienic care during service encounter, how do you feel?	1	2	3	4	5

## **Appendix 3 Quality Function Deployment Survey on Facilities Management Services in Singapore's Hospitals**

### **Instructions:**

The left side of the questionnaire contains 32 key factors for successful hospital FM which were identified from literature review. The right side of the questionnaire contains 22 FM service attributes.

Please complete the questionnaire by indicating to what extent each key factor would influence each service attribute following the evaluation standard below:

A strong relationship is represented by 9;

A medium relationship is represented by 3;

A weak relationship is represented by 1.

If there are no relationship between one specific key factor and one service attribute, please just leave it blank.

Because the 32 factors were just a pool of actions and strategies identified from academic studies for your references, there might be some omissions, you are welcomed to provide any other factors that you think would influence the performance of the service attributes.

Thank you very much!

Key factors for successful FM		Service attributes	
		Clarity of signages (e.g. easy to spot)	Attractiveness of public area landscape
<b>I. Management of information and knowledge</b>			
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II. Fitting FM function and role to the environment of practice</b>			
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III. Sufficient budget and cost effectiveness</b>			
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV. Selecting and dealing with the outsourcer</b>			
12	Appropriate specifications for service levels are issued.		
13	Make sure that the outsourced team has the capabilities and skills to deliver the service.		
14	Diligent contract administration, and outsourced service provision is continually reviewed.		
15	Openness is established in relationships between the hospital and service providers.		
<b>V. Leadership and experience of facilities manager</b>			
16	Facilities managers are committed to continuing professional development for all the FM staff members and continual service quality improvement.		
17	Facilities managers make FM staff members feel appreciated for their contributions.		
18	Facilities managers foster teamwork among FM staff members.		
19	Facilities managers make sure that front-line workers are empowered and held responsible.		
20	Facilities managers ensure that change is managed successfully.		
21	Facilities managers achieve an appropriate balance of general management and technical skills with an understanding of organisations, people and processes.		
<b>VI. Facilities manager's involvement in hospital level decision-making</b>			
22	Facilities managers emphasise serving patients, and this effort is reflected in the hospital's development strategy.		
23	Facilities managers are involved early in the briefing stage when changes are around the corner.		
24	The hospital's external communications accurately reflect the information that facilities managers provide about the FM service quality.		
<b>VII. Staff development and training: soft and hard skills</b>			
25	Staff members are trained to interact effectively with patients.		
26	Staff members understand hospital policy, FM department goals and what is expected of them.		
27	Staff members are qualified for their job.		
28	Staff members are given tools and equipment needed to perform their job well.		
29	Patient-contact staff members commit to cooperation to provide quality service.		
<b>VIII. Service tasks standardisation and benchmarking</b>			
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
32	Formal processes exist for measuring performance and goal-setting.		

Key factors for successful FM		Service attributes	
		Condition of elevators and escalators	Cleanliness of public areas (e.g. floors, walls, seating)
<b>I. Management of information and knowledge</b>			
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II. Fitting FM function and role to the environment of practice</b>			
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III. Sufficient budget and cost effectiveness</b>			
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV. Selecting and dealing with the outsourcer</b>			
12	Appropriate specifications for service levels are issued.		
13	Make sure that the outsourced team has the capabilities and skills to deliver the service.		
14	Diligent contract administration, and outsourced service provision is continually reviewed.		
15	Openness is established in relationships between the hospital and service providers.		
<b>V. Leadership and experience of facilities manager</b>			
16	Facilities managers are committed to continuing professional development for all the FM staff members and continual service quality improvement.		
17	Facilities managers make FM staff members feel appreciated for their contributions.		
18	Facilities managers foster teamwork among FM staff members.		
19	Facilities managers make sure that front-line workers are empowered and held responsible.		
20	Facilities managers ensure that change is managed successfully.		
21	Facilities managers achieve an appropriate balance of general management and technical skills with an understanding of organisations, people and processes.		
<b>VI. Facilities manager's involvement in hospital level decision-making</b>			
22	Facilities managers emphasise serving patients, and this effort is reflected in the hospital's development strategy.		
23	Facilities managers are involved early in the briefing stage when changes are around the corner.		
24	The hospital's external communications accurately reflect the information that facilities managers provide about the FM service quality.		
<b>VII. Staff development and training: soft and hard skills</b>			
25	Staff members are trained to interact effectively with patients.		
26	Staff members understand hospital policy, FM department goals and what is expected of them.		
27	Staff members are qualified for their job.		
28	Staff members are given tools and equipment needed to perform their job well.		
29	Patient-contact staff members commit to cooperation to provide quality service.		
<b>VIII. Service tasks standardisation and benchmarking</b>			
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
32	Formal processes exist for measuring performance and goal-setting.		

Key factors for successful FM		Service attributes	
		Performance of pest control in hospital	Adequacy of security prevalent in hospital
<b>I.</b>	<b>Management of information and knowledge</b>		
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II.</b>	<b>Fitting FM function and role to the environment of practice</b>		
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III.</b>	<b>Sufficient budget and cost effectiveness</b>		
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV.</b>	<b>Selecting and dealing with the outsourcer</b>		
12	Appropriate specifications for service levels are issued.		
13	Make sure that the outsourced team has the capabilities and skills to deliver the service.		
14	Diligent contract administration, and outsourced service provision is continually reviewed.		
15	Openness is established in relationships between the hospital and service providers.		
<b>V.</b>	<b>Leadership and experience of facilities manager</b>		
16	Facilities managers are committed to continuing professional development for all the FM staff members and continual service quality improvement.		
17	Facilities managers make FM staff members feel appreciated for their contributions.		
18	Facilities managers foster teamwork among FM staff members.		
19	Facilities managers make sure that front-line workers are empowered and held responsible.		
20	Facilities managers ensure that change is managed successfully.		
21	Facilities managers achieve an appropriate balance of general management and technical skills with an understanding of organisations, people and processes.		
<b>VI.</b>	<b>Facilities manager's involvement in hospital level decision-making</b>		
22	Facilities managers emphasise serving patients, and this effort is reflected in the hospital's development strategy.		
23	Facilities managers are involved early in the briefing stage when changes are around the corner.		
24	The hospital's external communications accurately reflect the information that facilities managers provide about the FM service quality.		
<b>VII.</b>	<b>Staff development and training: soft and hard skills</b>		
25	Staff members are trained to interact effectively with patients.		
26	Staff members understand hospital policy, FM department goals and what is expected of them.		
27	Staff members are qualified for their job.		
28	Staff members are given tools and equipment needed to perform their job well.		
29	Patient-contact staff members commit to cooperation to provide quality service.		
<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>		
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
32	Formal processes exist for measuring performance and goal-setting.		

Key factors for successful FM		Service attributes	
		Cleanliness of overall environment in ward (including bathrooms)	Cleanliness of bedding in ward
<b>I.</b>	<b>Management of information and knowledge</b>		
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II.</b>	<b>Fitting FM function and role to the environment of practice</b>		
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III.</b>	<b>Sufficient budget and cost effectiveness</b>		
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV.</b>	<b>Selecting and dealing with the outsourcer</b>		
12	Appropriate specifications for service levels are issued.		
13	Make sure that the outsourced team has the capabilities and skills to deliver the service.		
14	Diligent contract administration, and outsourced service provision is continually reviewed.		
15	Openness is established in relationships between the hospital and service providers.		
<b>V.</b>	<b>Leadership and experience of facilities manager</b>		
16	Facilities managers are committed to continuing professional development for all the FM staff members and continual service quality improvement.		
17	Facilities managers make FM staff members feel appreciated for their contributions.		
18	Facilities managers foster teamwork among FM staff members.		
19	Facilities managers make sure that front-line workers are empowered and held responsible.		
20	Facilities managers ensure that change is managed successfully.		
21	Facilities managers achieve an appropriate balance of general management and technical skills with an understanding of organisations, people and processes.		
<b>VI.</b>	<b>Facilities manager's involvement in hospital level decision-making</b>		
22	Facilities managers emphasise serving patients, and this effort is reflected in the hospital's development strategy.		
23	Facilities managers are involved early in the briefing stage when changes are around the corner.		
24	The hospital's external communications accurately reflect the information that facilities managers provide about the FM service quality.		
<b>VII.</b>	<b>Staff development and training: soft and hard skills</b>		
25	Staff members are trained to interact effectively with patients.		
26	Staff members understand hospital policy, FM department goals and what is expected of them.		
27	Staff members are qualified for their job.		
28	Staff members are given tools and equipment needed to perform their job well.		
29	Patient-contact staff members commit to cooperation to provide quality service.		
<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>		
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
32	Formal processes exist for measuring performance and goal-setting.		



Key factors for successful FM		Service attributes	
		Provision for patient privacy (e.g. curtains and blinds)	Performance of lighting systems in ward
<b>I.</b>	<b>Management of information and knowledge</b>		
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II.</b>	<b>Fitting FM function and role to the environment of practice</b>		
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III.</b>	<b>Sufficient budget and cost effectiveness</b>		
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV.</b>	<b>Selecting and dealing with the outsourcer</b>		
12	Appropriate specifications for service levels are issued.		
13	Make sure that the outsourced team has the capabilities and skills to deliver the service.		
14	Diligent contract administration, and outsourced service provision is continually reviewed.		
15	Openness is established in relationships between the hospital and service providers.		
<b>V.</b>	<b>Leadership and experience of facilities manager</b>		
16	Facilities managers are committed to continuing professional development for all the FM staff members and continual service quality improvement.		
17	Facilities managers make FM staff members feel appreciated for their contributions.		
18	Facilities managers foster teamwork among FM staff members.		
19	Facilities managers make sure that front-line workers are empowered and held responsible.		
20	Facilities managers ensure that change is managed successfully.		
21	Facilities managers achieve an appropriate balance of general management and technical skills with an understanding of organisations, people and processes.		
<b>VI.</b>	<b>Facilities manager's involvement in hospital level decision-making</b>		
22	Facilities managers emphasise serving patients, and this effort is reflected in the hospital's development strategy.		
23	Facilities managers are involved early in the briefing stage when changes are around the corner.		
24	The hospital's external communications accurately reflect the information that facilities managers provide about the FM service quality.		
<b>VII.</b>	<b>Staff development and training: soft and hard skills</b>		
25	Staff members are trained to interact effectively with patients.		
26	Staff members understand hospital policy, FM department goals and what is expected of them.		
27	Staff members are qualified for their job.		
28	Staff members are given tools and equipment needed to perform their job well.		
29	Patient-contact staff members commit to cooperation to provide quality service.		
<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>		
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
32	Formal processes exist for measuring performance and goal-setting.		

Key factors for successful FM		Service attributes	
		Performance of ventilation systems in ward (e.g. odor)	Performance of bedside nurse call system in ward
<b>I.</b>	<b>Management of information and knowledge</b>		
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II.</b>	<b>Fitting FM function and role to the environment of practice</b>		
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III.</b>	<b>Sufficient budget and cost effectiveness</b>		
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV.</b>	<b>Selecting and dealing with the outsourcer</b>		
12	Appropriate specifications for service levels are issued.		
13	Make sure that the outsourced team has the capabilities and skills to deliver the service.		
14	Diligent contract administration, and outsourced service provision is continually reviewed.		
15	Openness is established in relationships between the hospital and service providers.		
<b>V.</b>	<b>Leadership and experience of facilities manager</b>		
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<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>		
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
32	Formal processes exist for measuring performance and goal-setting.		

Key factors for successful FM		Service attributes	
		Performance of drinking water supply systems	Performance of non-drinking water supply systems (e.g. at sink, toilet)
<b>I.</b>	<b>Management of information and knowledge</b>		
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II.</b>	<b>Fitting FM function and role to the environment of practice</b>		
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III.</b>	<b>Sufficient budget and cost effectiveness</b>		
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV.</b>	<b>Selecting and dealing with the outsourcer</b>		
12	Appropriate specifications for service levels are issued.		
13	Make sure that the outsourced team has the capabilities and skills to deliver the service.		
14	Diligent contract administration, and outsourced service provision is continually reviewed.		
15	Openness is established in relationships between the hospital and service providers.		
<b>V.</b>	<b>Leadership and experience of facilities manager</b>		
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<b>VI.</b>	<b>Facilities manager's involvement in hospital level decision-making</b>		
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29	Patient-contact staff members commit to cooperation to provide quality service.		
<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>		
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
32	Formal processes exist for measuring performance and goal-setting.		

Key factors for successful FM		Service attributes	
		Choice and availability of food and drinks provided by hospital	Quality of food and drinks provided by hospital
<b>I.</b>	<b>Management of information and knowledge</b>		
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II.</b>	<b>Fitting FM function and role to the environment of practice</b>		
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III.</b>	<b>Sufficient budget and cost effectiveness</b>		
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV.</b>	<b>Selecting and dealing with the outsourcer</b>		
12	Appropriate specifications for service levels are issued.		
13	Make sure that the outsourced team has the capabilities and skills to deliver the service.		
14	Diligent contract administration, and outsourced service provision is continually reviewed.		
15	Openness is established in relationships between the hospital and service providers.		
<b>V.</b>	<b>Leadership and experience of facilities manager</b>		
16	Facilities managers are committed to continuing professional development for all the FM staff members and continual service quality improvement.		
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28	Staff members are given tools and equipment needed to perform their job well.		
29	Patient-contact staff members commit to cooperation to provide quality service.		
<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>		
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
32	Formal processes exist for measuring performance and goal-setting.		

Key factors for successful FM		Service attributes	
		Courtesy of FM staff members	FM staff members' knowledge to answer patients' questions related to their services
<b>I.</b>	<b>Management of information and knowledge</b>		
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II.</b>	<b>Fitting FM function and role to the environment of practice</b>		
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III.</b>	<b>Sufficient budget and cost effectiveness</b>		
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV.</b>	<b>Selecting and dealing with the outsourcer</b>		
12	Appropriate specifications for service levels are issued.		
13	Make sure that the outsourced team has the capabilities and skills to deliver the service.		
14	Diligent contract administration, and outsourced service provision is continually reviewed.		
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<b>VI.</b>	<b>Facilities manager's involvement in hospital level decision-making</b>		
22	Facilities managers emphasise serving patients, and this effort is reflected in the hospital's development strategy.		
23	Facilities managers are involved early in the briefing stage when changes are around the corner.		
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<b>VII.</b>	<b>Staff development and training: soft and hard skills</b>		
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28	Staff members are given tools and equipment needed to perform their job well.		
29	Patient-contact staff members commit to cooperation to provide quality service.		
<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>		
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
32	Formal processes exist for measuring performance and goal-setting.		

Key factors for successful FM		Service attributes	
		FM staff members' professionalism in running their job	Individual attention given to patients during FM service encounter
<b>I.</b>	<b>Management of information and knowledge</b>		
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II.</b>	<b>Fitting FM function and role to the environment of practice</b>		
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8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
9	Facilities managers understand the hospital's needs.		
<b>III.</b>	<b>Sufficient budget and cost effectiveness</b>		
10	Adequate resources are committed to the FM department to improve service quality.		
11	The FM department meets patients' expectations for FM services without hindering its financial performance.		
<b>IV.</b>	<b>Selecting and dealing with the outsourcer</b>		
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<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>		
30	Hard and soft technologies are used to standardise service tasks.		
31	Service goals in benchmarking are based on customer standards rather than hospital standards.		
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Key factors for successful FM		Service attributes	
		Convenience of FM service hours	Adequacy of hygienic care during FM service encounter (e.g. materials FM staff members use are clean)
<b>I.</b>	<b>Management of information and knowledge</b>		
1	Generate information about what patients want from FM services through formal and informal information gathering activities.		
2	Top management seeks, stimulates and facilitates the flow of information from patient contact personnel concerning quality of service.		
3	Managers understand and utilise patients' expectation information effectively.		
4	Accurate information is provided to FM staff members concerning job instructions, hospital policy and performance assessment.		
5	Information flows smoothly between the FM department and other departments in the hospital.		
6	Performance and management information are delivered as a consequence of service provision.		
<b>II.</b>	<b>Fitting FM function and role to the environment of practice</b>		
7	Levels of management within the FM department are adjusted to the needs of the hospital.		
8	Facilities managers continuously process information and make decisions concerning all aspects of the work environment.		
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<b>III.</b>	<b>Sufficient budget and cost effectiveness</b>		
10	Adequate resources are committed to the FM department to improve service quality.		
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<b>VIII.</b>	<b>Service tasks standardisation and benchmarking</b>		
30	Hard and soft technologies are used to standardise service tasks.		
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32	Formal processes exist for measuring performance and goal-setting.		

Appendix 4 The QFD survey data and results (HOQ)

	Importance Score of WHAT	HOWs																																					
		K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	K23	K24	K25	K26	K27	K28	K29	K30	K31	K32						
P1	0.27	3	9	9	1	3	1	9	9	9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1				
P2	1.06	3	9	9	3	1		3	9	1	3	9	9	9	9	9	9	9	9	3	3	3	9	3	3	9	3	3	3	3	3	3	3	3	1				
P3	0.58	3	9	9	3	3	1	9	9	9	9	9	9	9	9	9	9	9	3	1	1	9	9	9	9	9	9	9	9	9	9	9	9	9	9				
P4	0.43	3	9	3	9	3	3	9	3	9	9	1	9	9	9	9	9	9	9	9	9	3	3	3	3	3	3	3	3	3	3	3	3	3	9	9			
P5	0.34	3	9	9	9	9	9	9	9	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9			
P6	0.14	3	9	9	3	9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1			
P7	0.72	9	9	3	9	3	9	9	9	3	9	9	9	9	9	9	9	9	9	9	9	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9			
P8	0.22	9	9	9	3	9	3	9	1	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	3		
P9	0.48	9	9	3		3	3	3	1	3		9	9	9	9				1	1		1	3	9	3	3	3	3	3	3	3	3	3	3	3	3			
P10	0.34	3	9	9	3	3	9	9	3	9	9	9	9	9	9	9	9	9	9	9	9	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9	1		
P11	0.63	9	9	9	3	3	3	3	9	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	3		
P12	0.13	9	9	9	1	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	3		
P13	0.34																																				3		
P14	0.22																																					1	
P15	0.40	9	9	9	3	3	1		1	3	1																										1	9	
P16	0.80	9	9	9	3	9	9	1	1	3	3																										3	9	
P19	0.10	9	9	9	9																																9	9	
P20	0.12	9	9	3	9	9	3		3	9	3	1	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9		
P21	0.14	1	3	3		1	9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1		
P22	0.43	9	9	9	9	9			1	3	3	1	9	9	1	3	3	3	9	3	3	3	1														9	3	3
P23	0.48	9	9	9	9	9	3		9		3																										9	3	3
P24	0.31	9	9	3	9	3	1	3	3	3	1	3	3	3	3	3	3	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	3	3
Importance Score of HOW		53	70	60	39	30	32	34	45	28	44	32	53	52	49	52	46	48	44	43	22	35	44	48	48	38	44	43	13	25	36	41	42	42	42				
Rank		3	1	2	23	30	28	27	12	31	13	28	3	5	7	5	11	8	13	19	32	26	13	8	8	24	13	19	13	13	25	22	22	21	21				