

CHAPTER I INTRODUCTION

1.1 Background

WTO creates a complete competition environment and pushes ahead the market open through the bilateral talk among members (BusinessWeek, 2001) [54]. In gaining for a greater market share, growing number of leading companies exerts themselves achieving a total resources integration e.g., the supply chain management, production floor management, product line refinement, marketing segmentation or capital reallocation through the means of merging or strategic allying vertically or horizontally (Mpoyi, 2003) [57].

By taking advantage of China's mass human resource with market expansion, Taiwan achieves to be one of the major players in the world market of 3C products (Computer, Communication and Consumer Electronics Product). The result of operation cost reduction caused by the built-up of complete supply chain channels and ample of experiences for the last 4 decades in electronics OEM manufacturing has made the paradigm of "Taiwan design China shipment" to be one of the most influential business models in the world. The information shared by MIC (Market Intelligence Center) pointed out that of more than 70% Notebook and 67% LCD monitor and 78 % M/B product will be made by Taiwan based manufacturer on the year of 2005 [45].

Table 1.1 Major Taiwanese ICT Product Shipment Volume, 2004 - 2005

Thousand Units			
	2004	2005	Share of Global Volume
Notebook PC	33,406	41,500	72.4%
Desktop PC	34,651	36,627	29.2%
Motherboard	107,987	112,350	78.3%
LCD Monitor	45,693	63,924	67.6%
CDT Monitor	35,329	26,005	53.6%
Optical Disk Drive	105,835	116,330	41.7%
Digital Still Camera	21,204	23,910	34.5%
Router	16,622	18,193	89.2%
Cable modem	11,968	14,559	66.3%
DSL CPE	32,771	40,107	70.9%
WLAN	61,318	104,096	83.0%

Source: MIC, March 2005

However, the promising picture didn't make future all brightening, one of problems hidden behind the market share is the trend of GP (Gross Profit) shrinking, take NB as an example, the average GP for Laptop (Note Book) manufacturing has greatly reduced from the peak of 16% to somewhere between 5 and 8 % as now (2004/E) in just 6 years, figures below sourced from the publication of Taiwan Stock Exchange Center exhibited that, in contrary to growing revenue in Laptop manufacturing of Taiwan top three ranked companies (Figure 1.1), the gross margin are actually adversely down trending from average 16 % in year 1998 to average 6.5% (Figure: 1.2), 2003.

A speech titled Economic Growth in a Shrinking World [3] by the First Deputy Managing Director of IMF, Anne O. Krueger, 2004, San Diego, could well prelude the discussion of shrinking margin, the arguments extracted from the nature of address argued that in benefiting from rapidly falling transport and communications costs, thanks to technological progress, combined with sharply rising trade flows thanks to trade liberalization, these forces have increasingly led world markets driving down prices to consumers and constituting a major engine of economic growth. Indeed, the ability to do business by phone, fax, and e-mail, regardless of location is arguably deemed as a driving force in the process of globalization.

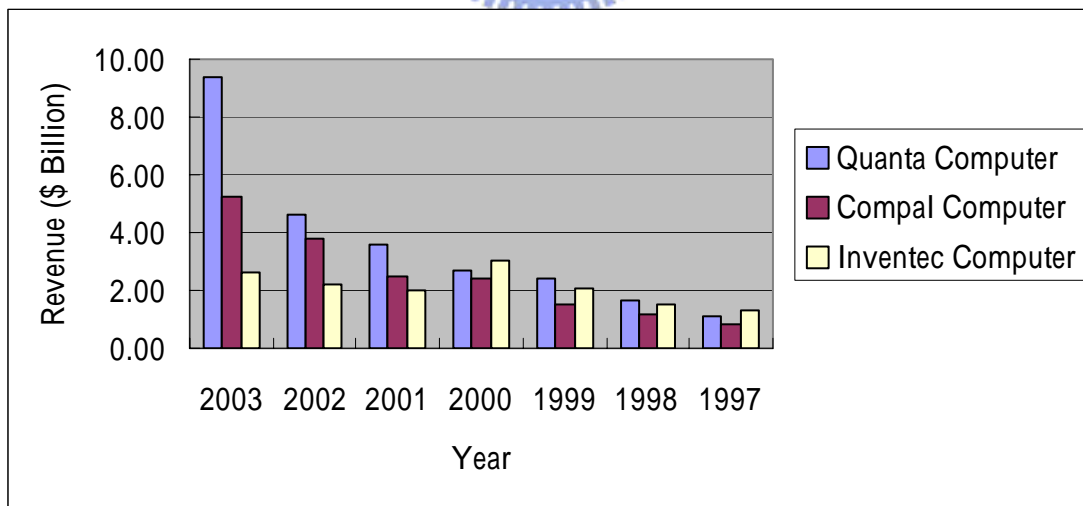


Figure 1.1 Taiwan top 3 notebook manufacturing revenue report
Source from Taiwan Stock Exchange Center

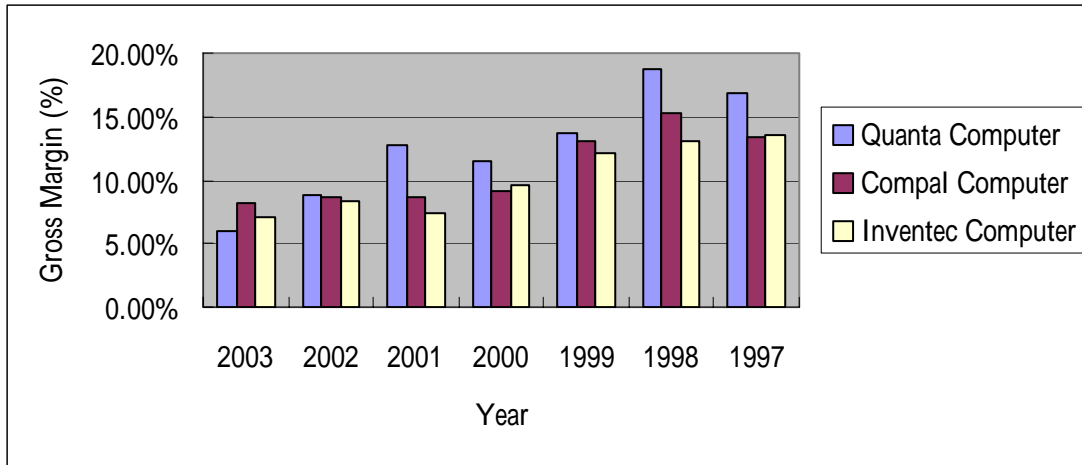


Figure 1.2 The gross margin record of Taiwan top 3 notebook manufacturer
Source from Taiwan Stock Exchange Center

In fact, the savoring of globalization is not always good as expected but a taste of bitter-sweet; while the world trade increased its worth to around \$8 trillion; 25% of global GDP in yr 2004, up from \$1.5 trillion; 13% of world GDP in yr 1970, the surging of world trade economy made the business competition keener than ever before and spurred companies putting forth themselves in technology development and processing re-engineering in their business model and management. As a result, the maturity of technology and deregulated barrier in world trade communication bring more rigorous competition and lead a margin cutting in face of product commoditization.

James Cooper [36], 1993, explained the situation from his Strategy Planning in Logistics and Transportation; as customers see little difference between products at a functional or technical level. Markets have been increasingly taking on the characteristics of commodity markets.

A live and vivid example of product commoditization resulting a great impact to the business sector goes to a case of Chinese PC manufacturer Lenovo merged PC business unit of IBM Corp. in December of 2004 [59]. The deal involved a payment of US\$650 million in cash and US\$600 million in securities to IBM, and the assumption of roughly US\$500 million in IBM debt shows a message that the coming of PC commoditization gives way for some prominent PC makers to surrender their business if they can't timely make the differentiation; the same case also valid in DRAM industry; a survey from Electronic News, 2001, indicates that gone from \$41 billion in 1995, the total profit for DRAM market has left only \$10 billion in 2001, while its bit shipments get doubling every year [33].

In fighting against the product commoditization, many companies exhaust their efforts on the marketing differentiation by creating more of value added activities, among which, a high resonance with the customer expectations makes customer service deemed as a good way to enhance the customer satisfaction. Senior VP of TSMC, Dr. Quincy Lin used to give a good statement in fitting practice of service business as; instead of the first order receiving, the real business is started after good service done. Customer service both in pre-sales and post-sales are very important, in that, quoted from Peter J. Patsula (1998) [55] in Successful Business Planning in terms of why customer service important, 5 highlighted statistic points were;

1. A typical business will hear from only four percent of its dissatisfied customers. The other 96 percent will just quietly go away, 91% percent never coming back.
2. A typical dissatisfied customer will tell 8 to 10 people about his or her problem. One in five will tell twenty. It typically takes twelve positive service incidents to make up for one negative incident.
3. Businesses having low quality service averagely gains 1 % returned on sales but loses 2% of market share per year. Business with high quality service averagely gains 12 percent returned on sales and 6% of market share per year, furthermore, charges significantly higher prices.
4. Seven out of ten complaining customers will do business with you again if you resolve the complaint in their favor. If the issue resolved on the spot, 95% will do business with you again.
5. The average business spends six times more to attract new customers than it does to keep old ones. Yet, customer loyalty is in most cases worth ten times the price of a single purchase.

Echoed by J.D. Power and Associates [34], in his study for the wireless, Internet, long distance/local telephone and cable/satellite TV industries addressed that the customer service is a key differentiator among products considered commodities in the increasingly competitive U.S. marketplace. While seeing the importance of customer service, a reminding needed for all of Taiwanese 3C manufacturers is to re-examine how good they are now performing in their customer service. MIC (Market Intelligence Center) provides a good reference of their performance on annual report, 2002, that among all the value activities of 3C product, customer service was listed one of the activities that had done very poorly and extremely need to be improved when comparing with that of the world leading companies.

In summary, the explosive growth of world markets resulting from rapid globalization makes good customer service vital to company's success given the business model is migrating from product oriented to customer oriented.



1.2 Objectives

Having realizing the rising position of customers, The motivation of initiating this area research is hopeful that, through the case study of Company XYZ with using 5 dimensions of PZB (Parasuraman, Zeithaml and Berry) survey [53], the methodology of improving service quality could be induced for Taiwanese Notebook manufacturers by a mean of realizing what customers care and what priority takes to improve the service quality in a basis of B to B (Business unit to Business unit) business.

1.3 The Research Process

The process of this research can be viewed as figure 1.3 below, in that, after initiating the possible area of research to directing professor, going through a complete discussion came the confirmation of research objectives and scope. In clarifying the research contents not overlapping with existing researches and in referencing to the constructs of questionnaires of existing papers, the literature review started when clarifying the objectives and scope with directing professor. The fitness of 5 dimensions of PZB (Parasuraman, Zeithaml and Berry) survey [53] required a pre-screening for some major factors from the basis of customer service operation and converting those screened factors into questions. Once done with questionnaire design, the distribution began at a time of finalizing the active customers mining.

The statistical analysis of collected data helped us find the gaps of customer's expectation to the real performance ranking and identify the items which significantly affecting customer's thinking. The inference of statistical analysis provided an good insight of research, in that, through understanding the properties of customers and their corresponding performance ranking, the suggestions came on a chart as figure 5.1 detailing the reference of question items in a position of importance and performance.

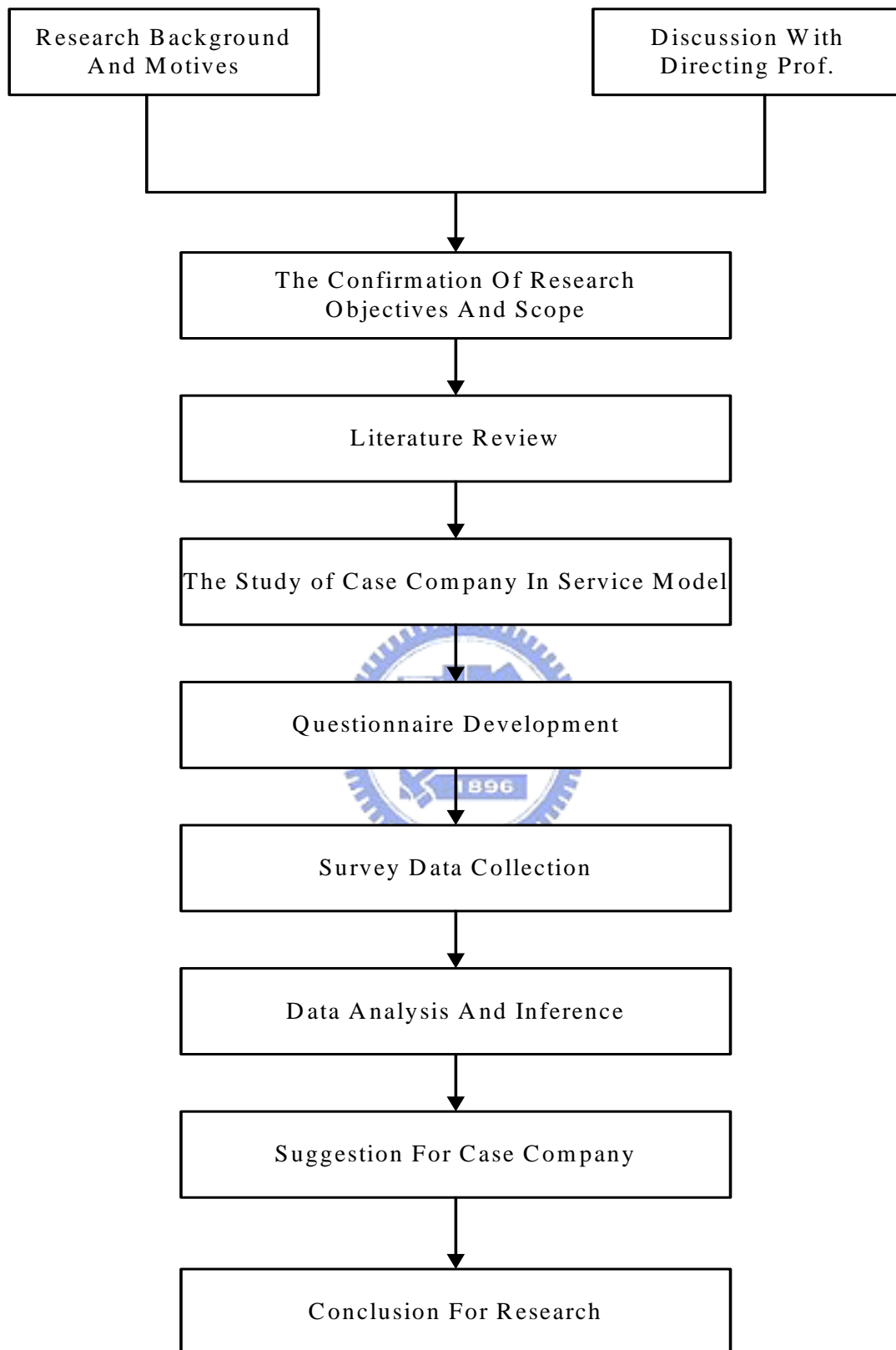


Figure 1.3 The research process

1.4 Research Contents

This research exhibited a complete methodology of service quality evaluation for Taiwan notebook manufacturers. A case study conducted was to look into the details of customer's thought say customer's expectations and perceptions in the basis of 5 dimensions survey known as PZB [54] and to expand that conception by statistical analysis for making suggestions.

The contents for this thesis of 5 chapters are:

1. Introduction

The argument in this chapter stated that the market globalization and improvement of communication technology led the world market to an explosive growing has brought business competition more rigorous than ever before. The inevitable price war that gave way for margin cutting and product commoditization makes the customer service important for companies to survive in the sea of competitors.

2. Literature Review

Of literature review, this chapter discussed the field of service quality, customer satisfaction and the connection between service quality and customer satisfaction.

3. Service Model of Case Company

The components discussed in this chapter, of service operations including the service contract, the management of call center, the management of RMA operation, the IT synchronization and Logistics management, were all in a purpose of giving readers a better picture of what the service operation is in B to B business.

4. Research Methodology and Data Analysis

This chapter detailed how the research was designed and implemented, e.g., the design of questionnaire, the collection of data, the grouping of customers, the methodology of statistical analysis and the inference base for making suggestions.

5. Suggestions

Based on the statistical analysis result of last chapter (the chapter 4), this chapter visited the core of research; to make suggestions for improving service quality.

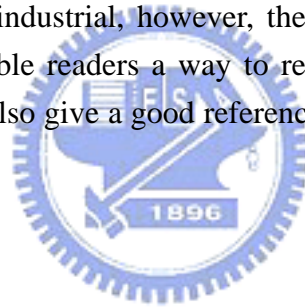
The inference base provided for making suggestions is on figure 5.2, in that, through understanding each significant item fallen on the dimensions corresponding to importance and performance rate, the priority was able to be made for root cause analysis and action to be taken.

6. Conclusions and Recommendations

This chapter concluded the finding of the research, and well explained the shortfalls as well as the recommendations to anyone who wants to expend this area research.

1.5 The Limitation of Research

Most of limitation of this research is a result of case study can't adequately explain the field of 3C industrial, however, the provided research process and test results not only enable readers a way to re-examine themselves in service quality performing, but also give a good referencing data in comparing with B to C business.



CHAPTER 2

THE LITERATURE REVIEW

The literature review in this chapter put the most of focus on service quality, in which, 3 sections were to discuss as below:

1. The definition of service; in this section, not only the definition of service will be addressed, but also the characteristics of service will be discussed.
- 2 The definition of quality
- 3 The concept of service quality

2.1 The Definition of Service

Philip Kotler (1991) [40] gave a good definition of service as any activity or benefit in which one party can offer to another that is essentially intangible and not necessary resulting in the ownership of anything ... it may or may not be tied to any physical product. A similar definition went to Berry (1988) [4] who made a good point in distinguishing the goods and service, addressed that the merchandise can be seen as a physical thing like consuming product or equipment or something intangible like service, which could be viewed as a behavior, performance or effort... mostly, the difference in service and good is mainly depending on whether the sold product is tangible as goods, or intangible as service. The service that was brought for better attention was on early 1970s, which in differentiating marketing strategies, companies began to make distinctions between product and service (kotler and Levy 1969) [38].

The definition given by AMA (American marketing Association) (1993) [16] for service is the activities, benefit provided by direct sale or by option combined to the sale. Furthermore, the association defines 3 channels for service delivery; respectively:

1. The service without resulting to any physical product attached, such as legal consultancy that is intangible and occurred through a direct sale.
2. The service like transportation, banking which need some forms of physical equipment or asset provided to fulfill the business activities.
3. The service attached to the product sale like warranty for which is adhered to the physical product, the examples could be taken as the repair service of cars, computer, handset, TV... etc.

Lovelock (1979) [44] defined service as a nature product, neither to be kept in a steady quality level nor to be stored like other physical product existing in a process of deliveries; but interactions between customers and suppliers with strong linkage to the effect of timing and personnel.

The Characteristics of Service

Parasuraman, Zeithaml and Berry (1988) [53] induced 4 characteristics of service as below in their series of study for service quality:

- 1) Intangibility; resembled to service definitions of last section, the first highlighted characteristic of service delivery is intangibility; customers usually can't see or touch what they would purchase or what they have purchased, nor can customers try or test the quality before cutting their order to service provider. Conducting business activities for service is perceived as a high risk for customers, thus, in creating more of service business, how to establish a good creditability is one of main topics among companies.
- 2) Inseparability: the meaning of inseparability is that service delivery is happened simultaneously with its consuming activity. Empirically, of physical products, the production activities are not usually happened on its consuming for lead time is still the basic element for business activities. However, having the characteristic of inseparability greatly leads the interaction with customers vital to succeed in business.
- 3) Heterogeneity: the volatility in performance resulted from different service providers, time, places or staffs, called heterogeneity. Having this characteristic makes service quality hard to be maintained in a steady level, and thus makes service remaining in a consistent level as one of critical topics.
- 4) Perishability; the last characteristics of service showed on PZB's study is that never could service product be stored for future delivery like physical product, called perishability. This characteristic make service unique from other consuming products that can be used to adjust the balance of marketing supply through a mean of exercising the product inventory.

Given by the characteristics of above, that contrasting with physical product, business of service is arguably having relatively more difficulties to keep their quality in a steady level.

In summary, to consolidate the definitions of service is that activities, performance or efforts taken to fulfill customer's need through three delivery channels; first, the intangible service without any assistance of equipment or facility, like lawyer, or consultancies delivering service by giving advice or assistances; second, the service with physical equipment or facility assistance, like bank or ticket sales delivering service through pre-built system or equipment; and third, the service packaged with physical product, like warranty offered to product shipping delivering service attached to shipped units.



2.2 The definition of Quality

Depending on occasion and purpose, quality can be defined in different dimensions. IAPT (International Association of Public Transport) [60] gave quality the definitions in public transport sphere as:

- 1 Quality is to say what need to be done, to do what has been said, and to constantly check what has been done is in keeping with what has been said.
- 2 Quality is a managerial step aiming at constantly improving services and processing delivery of these services.
- 3 Quality is to improve customer satisfaction with a view to retaining customer loyalty.

Quality not only enables companies to create the weapon of strategy, but also gives companies the advantage when facing the competition (Anderson and Zeithaml, 1984; Parasuraman et al, 1994) [1] [52]. Crosby (1979) [15] indicated that quality is a concept hardly been caught or understood or a concept of specification conformance to consumer's request. Feigenbaum (1983) [24] thinks that unnecessary does company have to reach its quality to the utmost level; the quality is the best status in customer's acceptance, another words; complying with quality requirement is the best solution for customers.

Kaoru Ishikawa (1986) [37] creates the notion of CWQC (Company Wide Quality Control) indicating that quality is characterized in satisfying customers, in short; letting customer feel glad to order. What companies need to achieve in quality should not be limited in quality control but in total quality management.

In summarizing the concept of quality defined by Edwards Deming, Joseph Juran, Philip Crosby and Garvin we came out the definitions of quality as:

1. Edward Deming (1992) [21]: Quality is the most usable products made from the most economical way, he then invent the Deming cycle, known as Shewart's Wheel or PDCA: A model that describes the cyclical interaction of research, sales, design, and production as a continuous work flow, so that all functions are involved constantly in the effort to provide products and services that satisfy customers and contribute to improved quality.

2. Joseph Juran (1980) [35]: Quality is the fitness for use; the meaning of fitness is a satisfaction for customer when product is in use.

3. Philip Crosby (1987) [14]: Quality is the result of letting customers believe they get more than they expected. He campaigned the system of Zero Defect, and DIRFT (Do It Right First Time), 4 raised components of quality are:
 - a. Quality is the task that complies with standard procedures.
 - b. The best way of improving quality is to prevent not to inspect.
 - c. The only criterion in processing the task is zero defection.
 - d. Rather than ratio or index, the measurement of quality is defined by the cost of not conforming to the standard process.

Garvin (1984) [26] defines the quality in 5 paths as:

1. **Transcendent** definition: The quality is an instant superior; to feel it one must come through a physical touch or experiences.
2. **Product based** definition: Good quality is not necessary expensive.
3. **User-Based** definition: The definition of good quality is based on customer's evaluation, or more precisely, customer satisfaction.
4. **Manufacturing-based** definition: Quality is the level of consistency.
5. **Value-based** definition: Quality is complying with customer's need in a shelter of reasonable price.

In compiling to the definitions above, a conclusion for quality is that the product made by a standard process with the consistency of conforming to specification that was sold with reasonable price in need for customers' acceptable level.

2.3 The concept of service quality

The conceptual framework of SERVQUAL was derived from the work of researchers who had examined the meaning of service quality (Sasser et al.,1978; Gronroos, 1982; Lehtinen and Lehtinen, 1982) [43] and comprehensive research studied by Parasuraman et al. (1985) [51]. In the SERVQUAL framework, customers are asked a series of questions concerning their expectations and perceptions for service quality from their suppliers. The expectations and perceptions are both measured by the SERVQUAL instrument (Parasuraman et al., 1988). The focus industries that Parasuraman Zeithaml and Berry had conceptualized regarding service quality in 1985 were retail banking, credit cards, securities brokerage and product repair and maintenance. All the focus firms were having the same attribute; they were all B to C business sectors (Han 1992; Dwyer 1993; Qualls and Rosa 1995)[31][22][56].

A re-define of service quality as a level of service gap occurred by the interaction between customer and service provider in a process of service delivery, Parasuraman, Zeithaml and Berry emphasized that Service Quality were defined by customers not by service providers. The factors determined the service quality were created as below:

1. Reliability: a consistency of service performance, perfect committed fulfillment with high one time fixed rate.
2. Responsiveness: the willingness and responsiveness in providing the service from service staff.
3. Competence: the ownership of technology and knowledge including the first line staff and the skill in technical support and development capability of organization.
4. Accessibility: the ease of accessibility including the telephone service, the availability and convenience of facility, the propriety of business hour.
5. Courtesy: treating customer with manner, expectation, consideration, and friendship.
6. Communication: Well listening to customer's complaint, using the most proper way in conversing with customer in problem description, cost estimation, service contents.
7. Security: letting customer free from the threat of confidentiality issue.
8. Credibility: gaining trust from customer, the factors including company's reputation, image, and the characters of service staff.
9. Understanding the customer: understanding what customer needs.
10. Tangibles: physical facilities, equipment and appearance of personnel.

Later, Zeithaml again based her work exclusively on private sector organizations and made a reference to medical diagnosis as a service that is highly difficult to be evaluated (Joan Buckley, 2003) [6]. The extent that the offered service meets or exceeds the customer's expectation will probably dictate whether the customer is likely to be satisfied (Oliver, 1980) [48]. In calculating the gap between expectations and perceptions, the average score of expectations is subtracted by average scores of perceptions score to discover the SERVQUAL gap. Through numerous qualitative studies to banking, credit cards publisher, Maintenance Company and Telephone Company, a set of five dimensions is a resulted of modification by Parasuraman, Zeithaml and Berry [53] in 1988 that changed from the 10 original dimensions. Consistently ranked by customers as the most important measurement for service quality, the five dimensions are defined as follows:

- a. **Tangibles:** Appearance of physical facilities, equipment, personnel and communication materials;
- b. **Reliability:** ability to perform the promised service dependably and accurately;
- c. **Responsiveness;** willingness to help customers and provide prompt service;
- d. **Assurance;** knowledge and courtesy of employees and their ability to convey trust and confidence.
- e. **Empathy;** the caring, individualized attention the firm provides its customers.

The SERVQUAL instrument helps service providers understand customer expectations and perceptions, as well as the process during the quality improvements. It also helps target specific service elements that are required for improvement, or for some training opportunities to staffs. Data drawn from application of the SERVQUAL instrument are rich in practical implications for service managers (Carmen. 1990) [8]. By reviewing the history of SERVQUAL from the early 1980s, Parasuraman start collaborating the service quality with Berry and Zeithaml in 1983 and 2 years later, Parasuraman [51] et al. published a conceptual paper identifying five service quality gaps (Viewed as figure 2.1 below) in 1985. This framework is recognized today as a major contribution to the marketing literature (Grapentine 2000) [27]. Quoting from that article, the definitions of each of the gaps are as follow:

Gap 1: Difference between consumer expectations and management perceptions of consumer expectations. The reason of having this gap is simply because the management level of service provider not well understand the expectation from customers. Three factors affecting this gap are:

1. Marketing research orientation of the organization, marketing research is the most direct medium that enables management to understand the customer's expectation.
2. Upward communication: though top managers may not have a firm grasp of consumer quality expectations, research suggests that customer contact personnel can accurately predict customer's expectations and perceptions of service.
3. Management layers: more the number of management layers, harder the customer expectation conveying to management level.

Gap 2: Difference between management perceptions of consumer expectations and service quality specifications. The reason of this gap occurred is by lack of resource or bad management or wrong policy that make service provide unable to fulfill customer expectations by setting the service specification. Thus the size of gap 2 can be affected by:

1. Management's commitment to service quality
2. Goal setting
3. Task standardization
4. Perception of feasibility



Gap 3: Difference between service quality specifications and the service actually delivered. The reason of gap 3 occurred is because the staffs unable to achieve the goals that management has set. Zeithaml et al. gives the following examples of issues affecting Gap 3 as follow; teamwork, employee-job fit, technology-job fit, perceived control, supervisory control systems, role conflict, role ambiguity.

Gap 4: Difference between service delivery and what is communicated about the service to customers. Service provider usually using commercial to communicate with customers would affect customer's expectation in service level, thus when there comes the over-commitment from service provider or miss-perception by customers would make the gap occurs. As an example, Zeithaml et al. cite an early Holiday Inn's "No Surprise" advertising campaign: Holiday Inn's agency used consumer research as the basis for a television campaign promising "no surprise" to customers. Top managers accepted the campaign in spite of opposition by operations executives who knew that surprises frequently occur in a complex service organization. When the campaign was aired, it raised consumer expectations, gave dissatisfied customers additional grounds on which to vent frustrations, and had to be discontinued."

Gap 5: Difference between customer expectations and perceptions. The causing of gap 5 is a summation from gap 1 to gap 4, in equation: $Gap\ 5 = f(Gap\ 1, Gap\ 2, Gap\ 3, Gap\ 4)$. This gap was the focus of the 1988 JR (Journal of Retailing) article, the article produced the famous equation, $Q = P - E$, where, Q = Service Quality, P= Customer Perception, and E= Customer Expectation.



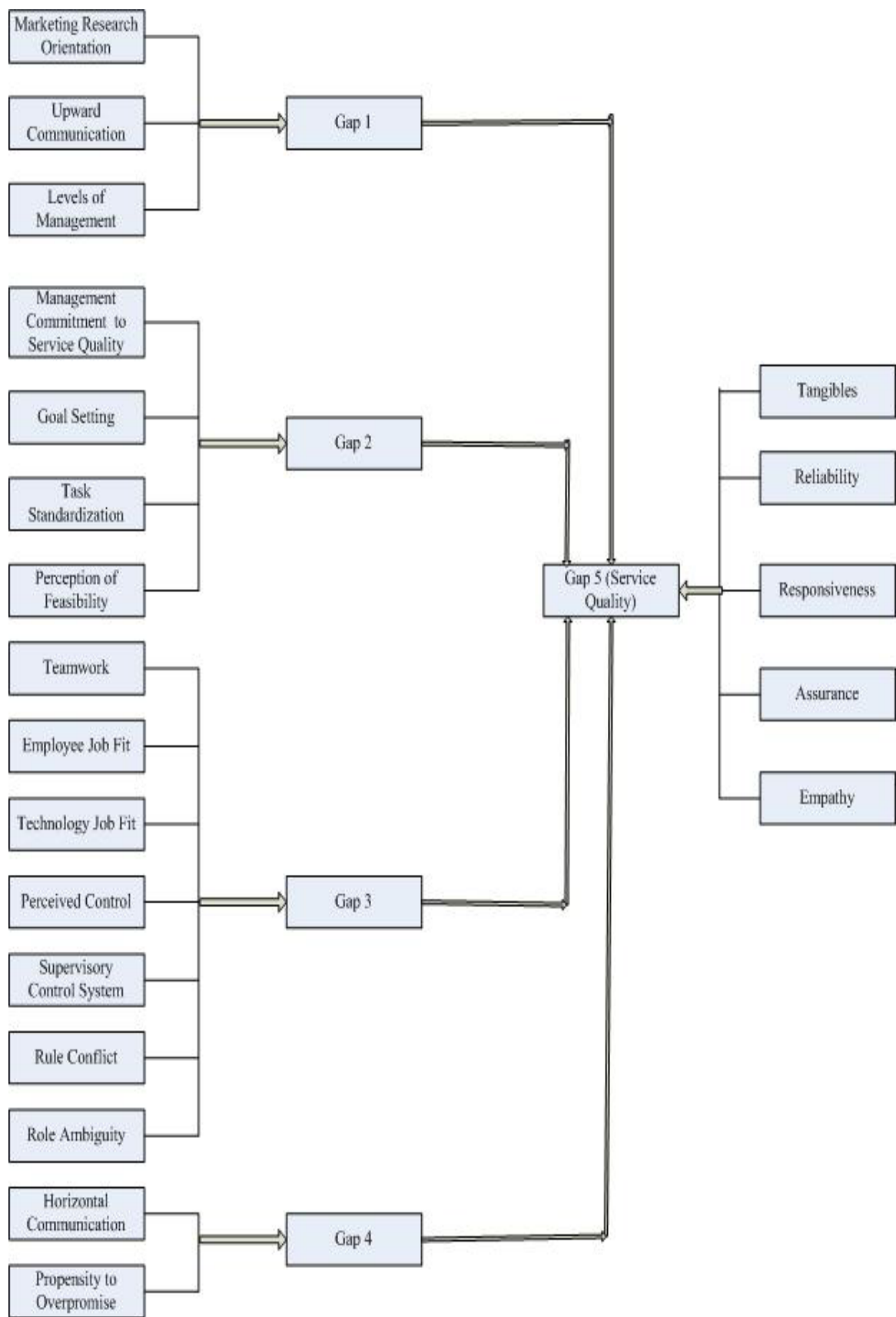


Figure 2.1 The 5 gaps of service quality

CHAPTER 3

THE SERVICE MODEL OF CASE COMPANY

The case company called XYZ is a Notebook manufacturing company, established in year 1992. In addition to producing N/Bs for OEM buyer, XYZ has been also striving to lever the business resource to its own brand market. Though far from the top world-class N/B manufacturer, XYZ's financial performance in year 2004 has greatly impressed the industrial field by handing over a score sheet of nearly \$1.5 brilliant business volume in 2004 out of \$70 million of capital, an almost 100 % growth rate in comparing to revenue a year before. With \$ 0.12 of profit per share, XYZ has ranked on the top three profitable companies among the N/B manufacturers in Taiwan during fiscal year of 2004. However, while savoring the great harvest year of 2004, the case company, XYZ is now dealing with challenges that made them no exception from other companies: to be in face of shrink margin. The result of dramatic increment in business that caused the jittering of logistics pipeline accelerated the chain reaction of piling up inventory and led case company deteriorating in terms of inventory level and logistics fulfillment rate.

This chapter comes the introduction of service operation for case company. Varying from other service operations, like medical caring, banking, accounting, transporting, ... etc that have occupied most of literature publications of B to C (Business unit to consumer) service, B to B service operation, as discussed over next sections, did exhibit a very different concept, such as customers would require providers more dedication and efforts to effectively solve problems, or to submit the analysis report accurately addressing the issue of customers' concern. The components of this chapter would be; the service contract, the operation model of call center, the process of RMA, the IT synchronization and Logistics management.

3.1 Service Contract

The biggest difference of service operation between B to B business and B to C business is that B to B business generally requires a contract to protect both parties before kicking-off the business, however, for B to C business, the service contract hasn't brought too much attention between sales and consumers unless there comes some business argument. The service contract not only protects the right for both parties, but also guideline a game rule for both parties to process the service operation. In addition, the contract effectively reduces the gray area existed among management perceptions, customer expectations and quality specifications.

Through contract negotiation in defining the R&R (Role and Responsibility) for both parties, the said 5 Gaps identified by Parasuraman et al. (1985) can be assumed as less priority from Gap 1 to Gap 4: the Gap 1 of difference between customer expectations and management perceptions of customer expectation, Gap 2 of difference between management perceptions of customer expectations and service quality specifications, Gap 3 of difference between service quality specifications and the service actually delivered, and Gap 4 of difference between service delivery and what is communicated about the service to customers.

Generally, service contract need to cover the components as below to well confine both parties in terms of business partnership.

1. **The definition of RMA/DOA:** This is to identify in what timeframe should the product defect called RMA (Return Material Authorization) or DOA (Dead on Arrival). The most reasons make the definition of RMA and DOA so important is because of cost impact; Generally, DOA is deemed as the extension of production fall out and should be therefore set the best favor for customers not only for cost but also for priority in handling. In preventing an event that customer claims every product defect as DOA regardless when and how that defect was found, the case company declared the term of DOA as product defect in one month from its shipment and RMA as the defect occurred other than DOA term. What concerns the most are the ownership of cost in unit repairing and freight: For DOA case, all the cost including the replacement units and back and forth of freight will be at supplier, for RMA, however, all the cost will base on what level of warranty had customer bought.

2. **The level of service and warranty:** linking the service level to warranty is because the cost of warranty is usually based on the given service level. In B to B business, the cost of warranty is one of major components that buyer can't ignore; the more customers want, the more customers are readied to pay for it. In general, the classification of service level could be seen as a warranty chain, in that, as figure 3.1 below, where customers buy the warranty of finished unit from manufacturer provided by multi-components suppliers, and so is to performing the RMA process: where customers return the defected finished unit to manufacturer, that will eventually be disassembled into components level and returned the faulty components back to suppliers. Thus, the longer the warranty can be provided by component suppliers, the more the warranty term can be offered to customers. But in a case that customer wants to buy warranty more than component suppliers can ever offer, service provider would need to change service level that was once committed.

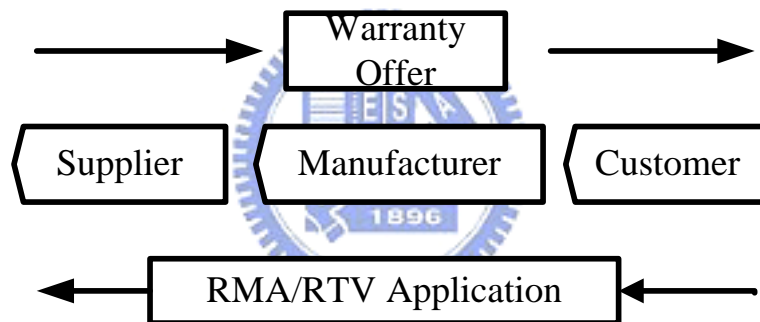


Figure 3.1 The Warranty Chain

Another case probably cause a change of service level is when customer request a no-fault quotation; the reason why customer request this is because manufacturer respond to product defection generally preconditioned only when unit is in normal use; meaning any physical abuse to product will not be covered by warranty. Therefore, the request of no-fault warranty means customer want to unstintingly raise the level of service to the highest for the end user (the customer's customer).

3. **The process of service operation:** Basically, contract should rule what process will service be processing in the situations as:
- a. Customer performs the level I service (the module swap) in the field, and then processes the RMA for replacing faulty components to manufacturer as

level II service (the component level). The considering of this business model is mostly happened when customers, like OEMs or distributors, who own a countrywide of service network.

- b. Customers stock some replacement units in anticipating the RMA returned from end users. In reducing the down time that customer would face, more units will be ordered on this purpose. The service model is mostly seen when customer is local resellers those can't afford to invest the service team or have to leverage their service operation to third party.



3.2 Call Center

The Call Center is the contact windows dealing with customer's approaching for repairing service. The case company has deployed 2 sites of worldwide Call center as below:

1. In Taiwan: for customers of pan America and EU.
2. In China: for the customers of Chinese speaker.

The process of Call center operation, as figure 3.2 below, that three communication channels as 1) by phone, 2) by internet connection and 3) by intranet are set-up to enable customer's accessing. In general, Call center agents receive user's contact and asks for further detail to clarify the failure symptom, from which, for record tracking, the agents will identify the unit serial number from customer to check out unit's warranty status.

The process of handling customer's problem is, viewed as figure 3.2 that firstly, try every effort to solve customer's problem on line, for that is believed the most cost saving in technical support. Secondly, in a event that faulty unit is likely not able to be fixed on line, then call center will send the RMA form to customer for more symptom detail and ask the contact window to arrange for customers to ship back faulty units for repair.

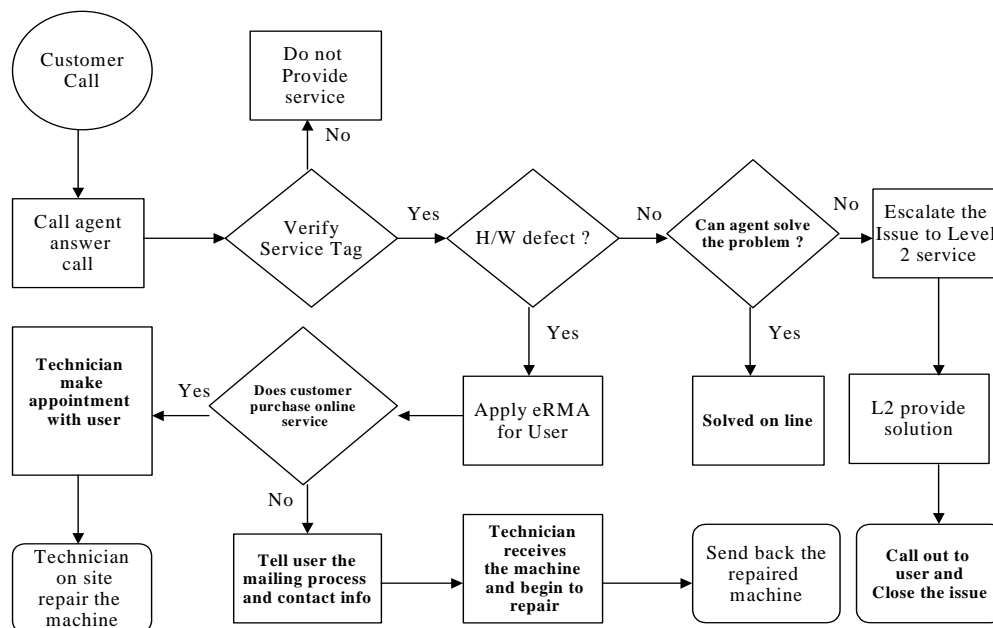


Figure 3.2 The process flow of service call

3.3 RMA / DOA Operation Model

A very essential issue for kicking off the service business is how to define the terms of RMA (Return Material Authorization) and DOA (Dead on Arrival) with partners.

RMA operation sometimes gets complicated when involves service charge with credit offer that generally given by supplier in differentiating customer's loyalty, its daily operation is basing on a common process viewed as figure 3.3 below: where upon customer's RMA request, contact windows of case company double check the service terms including the warranty status and the remaining of credit pool through the ERP system, then books the RMA number in system to instruct the applicants sending back unit for repair. Once received, warehouse checks the packing list through mining the booked information in ERP data base by RMA number, and scans the serial number and RMA number to the Shop Floor Control System (SFCS) if the shipment matched in part number and quantity. In completing the receiving process, ERP system initiates a notice to IQC for physical check on unit's cosmetic status and if any defection was found, IQC would then take the pictures to notify service team in getting customer's confirmation.

Contact windows run the transferring process in expediting the unit to repairing center. Service engineer analyzes the unit, checks the configurations to its shipping standards, then duplicates the problem, if necessary, informs Quality Department for their attention over the defect symptom, or returns the units back to customer in a case of No Trouble found (NTF). After identifying the problem, engineer then checks the inventory of needed spare parts and sends the quotation to customer for the cost uncovered by warranty. Upon customer's go-ahead signal, technician conducts the repair by module swap, retests the unit and produces the repairing report once it is done.

Depending on severity of defection, the processing for defected module could be divided by two ways in case company, 1) if the defection is expected as epidemic like, then let QA take over the issue for further analysis to come out the countermeasures in preventing the same problem occurred on future shipment, 2) if the defection is not severe or that failure module is out of warranty, then engineer will send the module to warehouse for expediting the RTV (Return To Vendor) process.

Note: The RTV (Return to Vendor) process is actually a RMA process from manufacturer (the case company, XYZ) to its supplier.

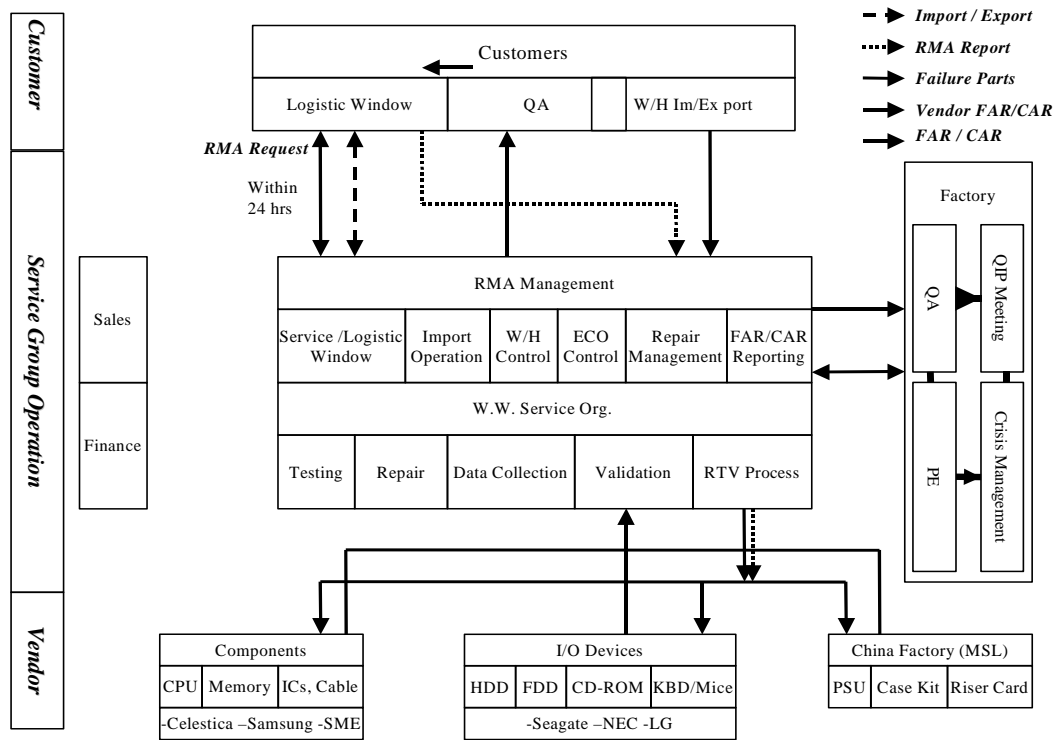


Figure 3.3 The process of RMA/DOA



3.4 IT Synchronization

The IT system is a core system to all the customer service operations. Never could case company optimize such a complicated pipeline of supply chain system as well as the mass volume of multi-sites transaction data without assistance of a complete and practical IT system. IT system in case company constituted by 4 major portions, namely, as figure 3.4, The Call Center/Contact Window interface system, RMA/SFCS system, ERP system and PDM/WIS system.

As outlined on the last section, the IT linkages for call center consisted of two databases as: ERP system and Shop Floor Control System (SFCS). The ERP system allowing the transparency of logistics management gives multi-users processing the warehousing, Manufacturing Order (MO), Docking, Financial, and Import/Export system, ... etc. SFCS engaging on manufacturing process control enables users timely accessing the status of RMA repair, the changed module and as well as some reports running for management.

The interlinking between ERP and SFCS system provides a seamless IT coverage in helping case company promptly fulfill customer's requirement for service support through processing RMA application, warehouse receiving, IQC inspection, repairing process, quotation, customer payment, all the way to unit shipping, and forwarder information tracking. The output of report included the production daily/monthly report, material consumption report, and quality report.

Another important function of SFCS is producing of Quality data. By systematically monitoring the repairing process, SFCS gives users a good way to understand the defective root-cause, repairing method, repairing yield rate, and creating statistical failure report, furthermore, the interlacing of networks allows the epidemic problem to be timely escalated to related departments, such as QA dept., or R/D dept so that the report of AFR (Annual Failure Rate), and AFER (Annual Failure Event Rate) can be promptly made. But most of all, the report generated by SFCS provides not only for customer as a good reference of how and why the units were defect, but also for management level of case company to accurately evaluate the cost of warranty and the performance of unit repair.

Technical Support is another module, which composed of PDM and WIS two systems. The data base of this module is to support the transparency of technical information, say the version table as system bios, keyboard bios, mother boards, and drivers, the

schematics, MPI (Manufacturing Process Instruction, TPI (Test Process Instruction), QII (Quality Inspection Instruction), as well as the specifications of every mechanical part, tool, the bug list during product development, the testing report of RAD (Reliability Assurance Department) and CAD (Compatibility Assurance Department), the history of ECR/ECO, service manual. Etc. Besides of giving all the repairing engineers a very important reference of technical knowledge, the PDM system provides the information selectively shared through WIS system allows customer to access the information with the channels as below:

- 1 The status of repairing unit and estimated shipping date.
- 2 The quotation report.
- 3 The parts replacement report.
- 4 Customer payment verification.
- 5 Drivers or technical support inquiring.
- 6 Shipping schedule as well as forwarder/tracking number.

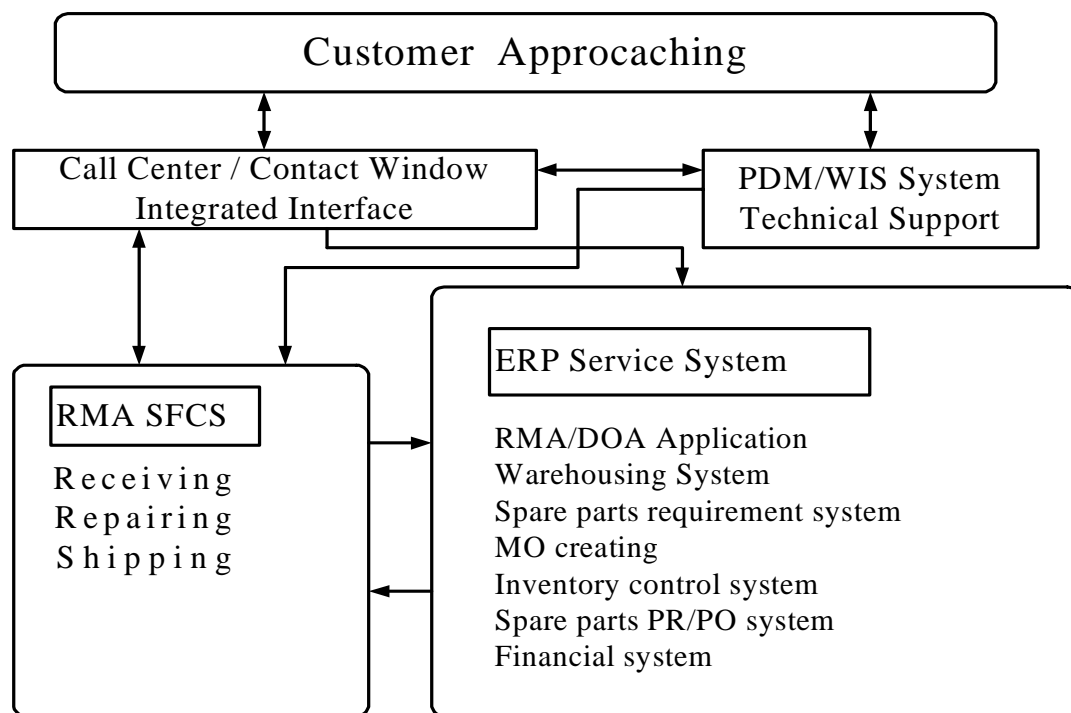


Figure 3.4 IT system connection of case company

3.5 Logistics Management

The Logistics is the core process in service management; it consists of four major components in service operation for case company:

1. **The warehousing management:** the process not only to secure accurate shipment but also to identify every inbound unit to be well controlled. The figure 3.5 below outlines the process of warehousing channels developed as a guild line for making sure every back and forth of material transferring is monitored. The reasons of setting such process is because first, customer returned unit is technically not the property of service provider, thus the process of handling returned unit is to prevent mixing them up with the existing stock, second, the storage areas like WFR (Wait for Repair), WFA (Wait For Analysis), WFS (Wait For Ship), ... etc, is to help service management on-line monitor the RMA unit and detect the bottle neck to effectively control the repairing schedule, third, having using the process allow customer on-line access the status of RMA units through WIS system.

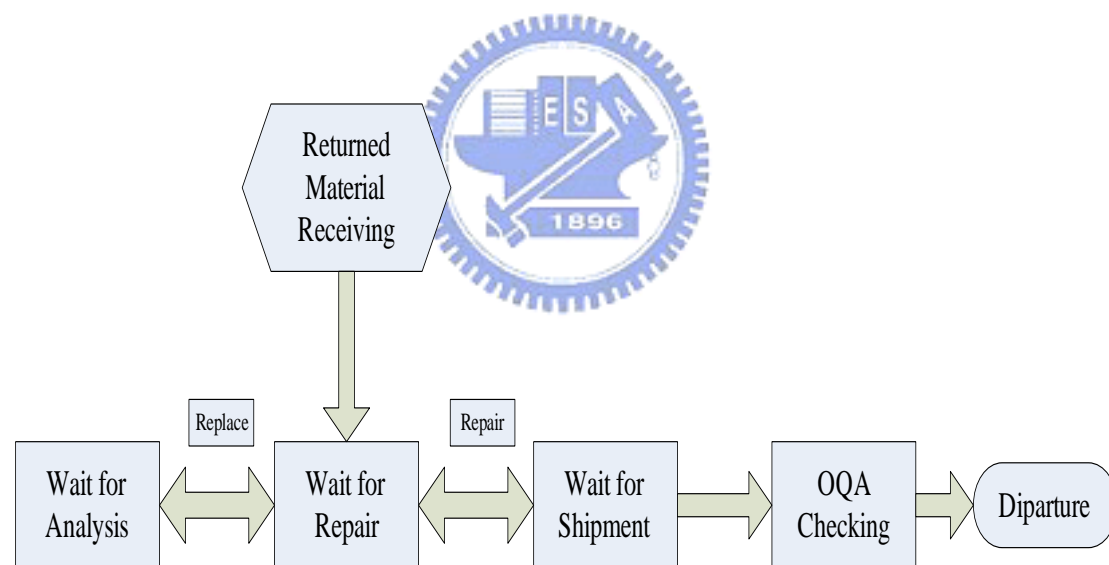


Figure 3.5 The warehousing process of RMA units

2. **Logistics planning management:** The forecast system is listed one of major topics in service spare part planning system. To predict the quantities of returned unit or spare parts, case company employs the measurement called AFER (Annual Failure Events Rate) as the base; However, in the event that during the product primary launching period, no field report is provided for AFER measurement, then, another important estimation method called MTBF (Mean Time Between Failure) will be adapted with the same purpose.

The difference in forecast system between production and service is that for production purpose, the spare parts preparation is based on the forecast of visible sales quantities, but, the forecast of spare parts demand for service repair is basing on how many spare parts are going to return back from fielding, i.e., to calculate the spare parts demand after product EOPL (End of production life) comes the equation as bellow:

$$P = \left[(S_{ij} * A_{ij} - I_{ij}) * L_{ij} + B_{ij} + z\sigma_w w_{ij} \sqrt{L_{ij}} \right] / A_{ij} \dots (1)$$

Where,

P= purchasing amount

S= shipping amount

A= AFER

L = lead time

I = Inventory

B= backlog

kz= Services safety level

σ_w = Standard deviation for weekly consuming quantities

A'ty= spare parts availability

i= models

j= the time duration



In interpretative, the minimum purchasing amount is the result of estimated needed amount considered factors includes sales shipment, AFER, inventory and lead time, to be divided by determined availability.

3. **Import/Export management:** The service site of case company in Taiwan is located in Science Park of Hsinchu, also is a bounded area where every return unit must be well monitored by Taiwan Custom, thus, in expediting the RMA shipping process, customers are required to make accurate statement in describing some necessary information as, the unit origin invoice #, the description of returned unit, the origin shipping part number, and serial number.
4. **RTV (Return To Vendor) process:** The RTV process is also called the level II (the module repairing) service. In referring to the process of warranty chain as last section (viewed as section 3.1, The Call Center) of above, where customer returns the defected unit and asks for the repair, then mostly what the action will be done is to do the module swap (the Level I service). After accumulating some defected

components, the case company will then conduct the RTV process to return the defected units back to vendor for warranty repair.

Timely conducting the RTV process not only gives service provider free from having too much stock to sustain the service business, but also allows vendors a source to understand the reliability performing in the field.



CHAPTER 4

DATA COLLECTION AND ANALYSIS

The nature brought by this chapter could simply be explained as:

1. Where was the collected data from?
2. What analysis methodology was conducted in this research?
3. What are the analysis results?

Through a case study, we used the questionnaire developed in a sense of 5 dimensions from SERVQUAL of PZB to collect the data from customers' expectations and perceptions, and to statistically analyze the data in coming out the suggestions.

The contains of this chapter are,

- 1 The Formation of Research
- 2 The Planning Data Collection And Analysis Process
- 3 The design of questionnaire
- 4 The Sequence of Questionnaire
- 5 The Proposed Method for Data Analysis
- 6 Questionnaire Data Collection
- 7 The summary of collected data
- 8 The Descriptive Statistics
- 9 The Reliability Test
- 10 The Question Items analysis
- 11 The Validity Test and Factor Analysis
- 12 Multivariate Analysis from Customers to Service Quality



4.1 The Formation of Research

The methodology of measurement in service quality for this research is called PZB (Parasuraman, Zeithaml and Berry, 1985) [51]; by measuring the gap of expectation and perception with questionnaire developed by 5 dimensions provided as; Tangibles, Reliability, Responsiveness, Assurance, Empathy, of SERVQUAL (Parasuraman, 1988) [53] to collect the survey data from all of the active customers with intent as to first, identify the items rated in low performance with high importance, second, give suggestions to improve those items accordingly.

Reviewing the service business model of case company brings an argument that the gaps of service quality known as the five gaps of PZB found by Parasuraman, 1985 [51] are actually not necessary to be all tested in B to B business by means of contract establishment. The reason that argument was raised is because contract acts a way to fill the gaps quoted as below which were stood between customers and suppliers on top of service perceptions such as the gaps quoted from PZB listed as below:

Gap 1: difference between consumer expectations and management perceptions of consumer expectations,

Gap 2: difference between management perceptions of consumer expectations and service quality specifications,

Gap 3: difference between service quality specifications and the service actually delivered and

Gap 4: difference between service delivery and what is communicated in service to customers.

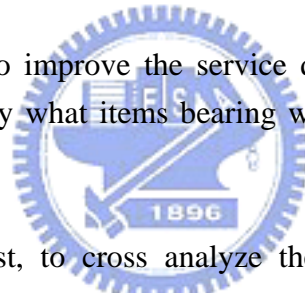
Hence, only the gap 5: the difference between customer expectations and perceptions was put on table for this research.



4.2. The Planning for Data Collection And Analysis Process

Viewed as Figure 4.1 below, the process that combining the data collection and statistical analysis came as below:

1. To select the active customers defined by having service contact with case company for last two years from the pool of customer list.
2. By reviewing to the literature regarding the service quality measurement, to design the questionnaire in the basis of 5 dimensions of PZB model.
3. After finalizing the questionnaire, to start distributing the questionnaires to all of active customers, given the number of customer in B to B business is not as many as B to C business.
4. Upon receiving customer's feedback, to start statistics analysis in reliability test.
5. In finding the direction to improve the service quality, to apply the method of Factor Analysis to identify what items bearing with high determinant of service quality.
6. By using multivariate test, to cross analyze the properties between customer groups and the scaled down question items in hoping to find what co-relationship is between the rating of every determinant item and grouped customers.
7. After getting result of multivariate test, to come up with conclusions and make suggestions for strategic mindset of service business.



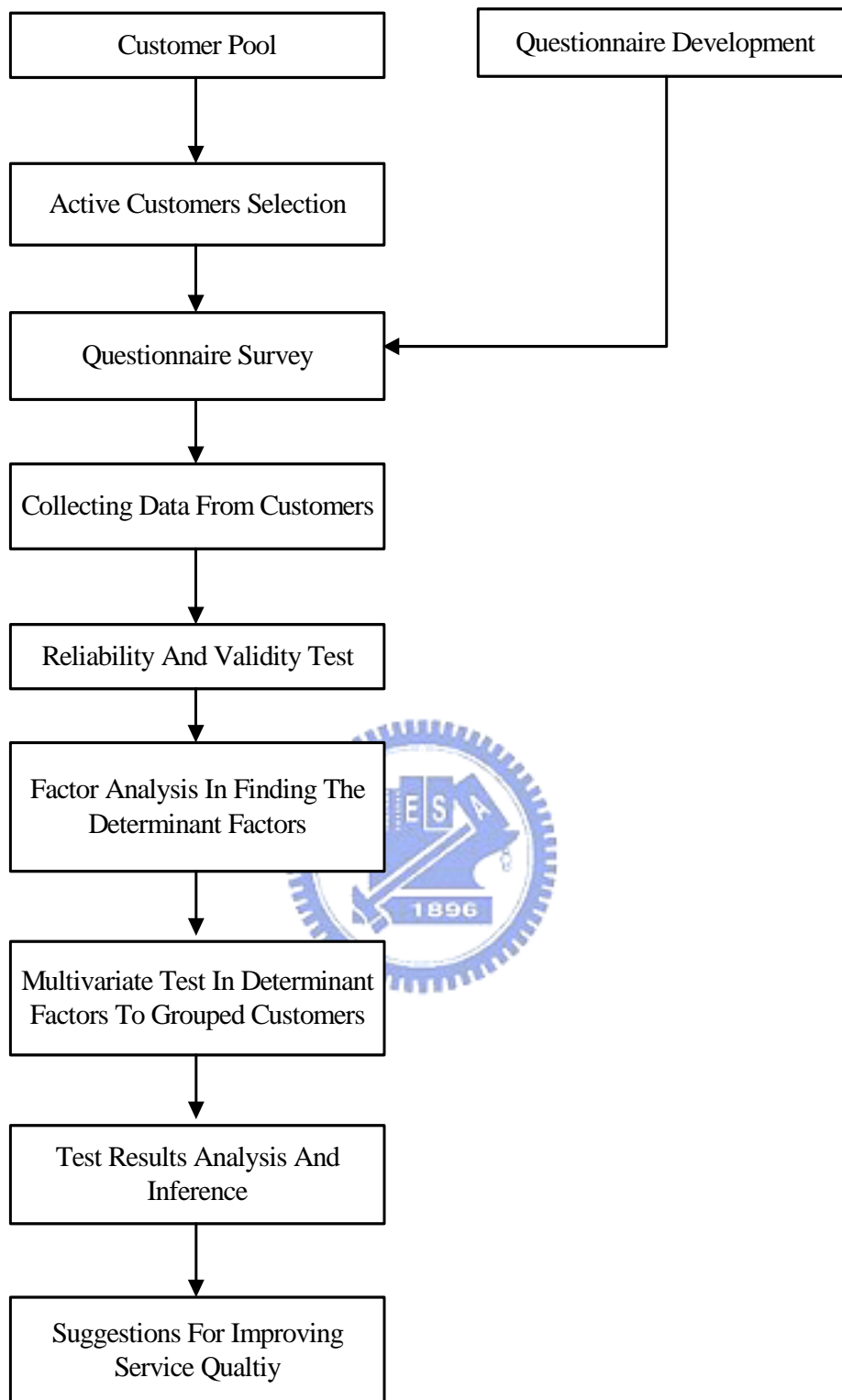


Figure 4.1 The data collection and analysis process

4.3 The Design of Questionnaire

In leveraging with real practice of working experience in service business, the questionnaire developed in this research is a result of collaboration with case company followed in the basis of SERVQUAL known as 5 dimensions as below. With using the Likert's 5 scales method, the questionnaire was to collect two corresponding information in a row; the expectation (importance) rating against of perception (performance) rating.

Dimension 1: Tangible:

Appearance of physical facilities, equipment, personnel courtesy and communication materials

A1: Do you receive adequate instruction of how to use, maintain the product through our user guide or technical support?

A2: Do you feel the ease in accessing to our service center?

A3: Do you feel the courtesy in our written or oral communication?

A9: Do our analysis report adequately address the issue of your concern?

Dimension 2: Responsiveness:

Willingness to help customers and provide prompt service

A5: Do you feel our actions to solve your problem are quick?

A6: Do you promptly obtain the quality analysis report on your query?

A12: Do you satisfy our Turn Around Time of RMA repairing?

A14: Do you timely obtain the repairing report on your query?

A15: Do you promptly obtain the shipping info on you query?

Dimension 3: Reliability:

Ability to perform the promised service dependably and accurately

A7: Do you feel our technical expertise capable of providing a better solution on your requirement?

A4: Do you think we are quickly catching the point of your stated problem through the communication?

A16: Do you satisfy to the quality of our repairing?

A17: Did we accurately provide you the list of service cost?

Dimension 4: Assurance:

Knowledge and ability to convey trust and confidence

A13: Do you promptly obtain the status of your unit in repairing through your query?

A20: Overall, do you satisfy in partnering with us in term of service business?

A18: Do we accurately deliver the spare parts or RMA units as we committed upon
(in right time, right place, right document and right marking)?

A21: In succeeding to the question above, would your satisfaction affect your
consideration of retaining the business with us?

Dimension 5: Empathy:

The care and individualized attention brought by service providers to their customers

A8: Do you feel our ownership in providing you our support?

A10: Do you think our service is highly adaptive in meeting your request?

A11: Do you feel convenient in our arrangement of RMA process?

A19: Do you feel our service is standing on the mutual benefit between customer and
us?

Customer's information survey:

In searching for the connections between groups of customers and surveyed questions so that the analysis data could be provided accurately to generate the action plan that could effectively improve the service quality. The required data from customers was as below:

B1. Years in partnership

B2. Model purchased

B3. The frequency of having contact for service per month

B4. Company scale of customers

B5. Check if case company is sole supplier to customers.

B6. The seniority of respondents

B7. Customer's originality

4.4 The Sequence of Questionnaire

The processing of the question sequence is followed in a way of service cycle, in that, the questions started from pre-using stage on production unit receiving: the first question was to investigate the service quality of technical support. Moving forward, questions for customers were to ask for the ease of accessing to service center, and the courtesy in communication. Then came when the defect occurred, customer was asked if communication from case company was quickly catching the point, and the feeling of responsiveness which including solving customer's problem, submitting quality analysis report.

Among the questions for responsiveness, the raised questions to customers regarding the reliability and assurance are, the questions for expertise of solving customer's problem, and ownership in providing support. And to summarize the question items in a period from pre-using to faulty occurred, a question dropped was to investigate how well the case company performing in adaptively meeting customer's request.

In the wake of defect events occurred, the questions started in terms of RMA process, i.g., the convenience in processing the RMA process, the obtaining of repairing status, the TAT (Turn Around Time), all the way until the shipping information submission, and the quality of repairing.

At last, for questions after touring over the RMA process, it went as, first, the service mindset of mutual benefit, second, the satisfaction of service partnership, and the last one, the effect of satisfaction for service partnership to customer's retention.

4.5 The Proposed Method for Data Analysis

In according to the stated objective in the first chapter, quoted as to induce a methodology of improving the service quality for Taiwanese Notebook manufacturer by mean of, first, realizing the determinant factors significantly affecting customer's decision on service quality rating and second, setting up the improvement priority with rated item of poor performance but high importance, the proposed methods for data analysis showed as below are the result of using SPSS, version 13 as below.

1. **Reliability and Validity Test:** The purpose of conducting Reliability and Validity test is to check the stability and consistency to the collected data.
2. **Factors Analysis:** By testing the commonality and eigenvalue to the collected data, Factors Analysis enables an effective scale down in question items for further analysis.
3. **Multivariate Test:** Multivariate test is for a purpose of finding the effectiveness to the items that could well explain the pattern of customer's rating in service quality so that improvement plans can be made accordingly.
4. **MANOVA Test:** The MANOVA test could be used on finding the effects on some individual items specifically in cross comparing with certain grouped customer. Thus, we employed some MANOVA tests to generate our suggestions for case company.

4.6 Questionnaire Data Collection

To reach the highest validity of the research, and consider the number of customer in B to B business is far less than that of the B to C (Business units to Consumer) business, a decision was made to conduct the research to all but not sampling of customers of case company, in that, the process of data collection and data analysis were as below:

1. To start mining customer's database with the number that having service contact with case company of total 120 customers in last 5 years.
2. To screen out active customers defined as having the service contact in last two years, and result was, of 120 customers, 103 customers were identified as active customer.
3. To test 10 questionnaires to the service team of case company and another 15 to some intimated customers to confirm the propriety of listed questions.
4. To delete 5 questions as below in responding to the result of pre-test.
 - a. Promptly obtaining the information of Bios Upgrade: the reason of its deletion was because information of Bios Upgrade should be combined to the question of technical support as the first question item.
 - b. The management of service spare parts in case company: the reason of deleting this question was because the same index could be referred from the performance of TAT (Turn Around Time).
 - c. The Providing accurate information of service inventory to customers: the reason of its deletion was same as above.
 - d. The feeling of reliable to service support of case company: the reason of deleting this question was because pre-testers complained of not easy to answer for too many considering points were involved.
 - e. Over-committed in service support for case company: the cause of its deletion was also in responding to the opinions from most of pre-testers complaining for the question has been also well addressed on other questions

5. After modifying some questions that are hard to answer or too much dependent with other questions, to started emailing the active customers, totally, 103 copies.
6. Upon receiving customer's feedback, to start basic description over collected data, in that, 89 copies were returned, of 86% return rate, 5 copies were found not completed. A further checking to customers indicated that 2 were found caused by faxing problem, while another three were simply because customers fail to mail back the questionnaires. But, most of importantly, all of those 5 copies have been re-fulfilled thereafter.
7. To analyze the service quality of case company, a concept of SERVQUAL based on PZB (Parasuraman, Zeithaml and Berry, 1988) [53] was employed for this research known as the gaps of service quality; the residual of customer perception out of customer expectation.

In equation:

$$Q = P - E,$$

Where,

Q = Service Quality,
P= Customer Perception, and
E= Customer Expectation.



4.7 The summary of collected data

In terms of customer's groups, the tables below indicated the frequency of each valid item.

Table 4.1 The summary of collected data in terms of years in partnership

Item	Description	Frequency	Percent	Valid Percent	Cumulative Percent
1	Below 1 year	10	11.24	11.24	11.24
2	1-2 years	49	55.06	55.06	66.29
3	2-3 years	27	30.34	30.34	96.63
4	3-5 years	2	2.25	2.25	98.88
5	Above 5 years	1	1.12	1.12	100.00
	Total	89	100.00	100.00	

Table 4.2 The summary of collected data in terms of main model purchased

Item	Description	Frequency	Percent	Valid Percent	Cumulative Percent
1	A Model	33	37.08	37.08	37.08
2	B Model	31	34.83	34.83	71.91
3	C Model	25	28.09	28.09	100.00
	Total	89	100.00	100.00	

Table 4.3 The summary of collected data in terms of frequency in having contacts for service support

Item	Description	Frequency	Percent	Valid Percent	Cumulative Percent
1	Below 1 time	23	25.84	25.84	25.84
2	1-5 times	26	29.21	29.21	55.06
3	5-10 times	8	8.99	8.99	64.04
4	10-20 times	14	15.73	15.73	79.78
5	Over 20 times	18	20.22	20.22	100.00
	Total	89	100.00	100.00	

Table 4.4 The summary of collected data in terms of customer's company scale

Item	Description	Frequency	Percent	Valid Percent	Cumulative Percent
1	Below 50 employees	7	7.87	7.87	7.87
2	50-150 employees	16	17.98	17.98	25.84
3	150-300 employees	25	28.09	28.09	53.93
4	300 - 500 employees	34	38.20	38.20	92.13
5	Above 500 employees	7	7.87	7.87	100.00
	Total	89	100.00	100.00	

Table 4.5 The summary of collected data in terms of customer taking case company as sole supplier

Item	Description	Frequency	Percent	Valid Percent	Cumulative Percent
1	Yes	36	40.45	40.45	40.45
2	No	53	59.55	59.55	100.00
	Total	89	100.00	100.00	

Table 4.6 The summary of collected data in terms of seniority of respondent

Item	Description	Frequency	Percent	Valid Percent	Cumulative Percent
1	Below 1 year	11	12.36	12.36	12.36
2	1-3 years	30	33.71	33.71	46.07
3	3-5 years	29	32.58	32.58	78.65
4	Above 5 years	19	21.35	21.35	100.00
	Total	89	100.00	100.00	

Table 4.7 The summary of collected data in terms of originality of customers

Item	Description	Frequency	Percent	Valid Percent	Cumulative Percent
1	US	41	46.07	46.07	46.07
2	EU	34	38.20	38.20	84.27
3	Asia	14	15.73	15.73	100.00
	Total	89	100.00	100.00	

4.8 Descriptive Statistics

The descriptive statistics gave a total picture to the items of how case company was performing, where in summarizing to the table 4.8, the descriptive statistics items in descending (to top down) performance rate: **the gaps of perception out of expectation** were as below:

1. Item 20: The satisfaction in partnership
2. Item 21: The effect of retention in partnership
3. Item 12: The satisfaction of TAT (Turn Around Time)
4. Item 9: Well addressing the issue in provided analysis report
5. Item 1: The instruction from User Guide or technical support.
6. Item 13: Obtaining status information of unit in repair.
7. Item 17: The accuracy in providing the service cost.
8. Item 88: The ownership in providing service support.
9. Item 5: Quickly solving customer's problem.
10. Item 7: Technical expertise in providing good solution to customer.
11. Item 14: Timely receiving the repairing report.
12. Item 10: Highly adaptive in meeting customer's request.
13. Item 16: The quality of repair.
14. Item 4: Quickly catching the point of customer's problem.
15. Item 15: Timely obtaining the shipping information.
16. Item 9: The respect of customer's benefit
17. Item 3: The courtesy in written or oral communications.
18. Item 6: Promptly obtaining the quality analysis report.
19. Item 2: The ease in accessing to service center.
20. Item 18: Accurately deliver the spare parts or RMA units as committed upon.
21. Item 11: The convenience in RMA process arrangement.

Table 4.8 The descriptive statistics table of service quality survey by items

Quest. Item	Exp.	Per.	Gap	Rank	Descriptive Question
1	4.35	4.06	-0.29	5	The instruction from User Guide or technical support.
2	4.51	4.01	-0.49	19	The ease in accessing to service center.
3	4.56	4.09	-0.47	17	The courtesy in written or oral communications.
4	4.62	4.18	-0.44	14	Quickly catching the point of customer's problem.
5	4.47	4.08	-0.39	9	Quickly solving customer's problem.
6	4.46	3.97	-0.49	18	Promptly obtaining the quality analysis report.
7	4.54	4.15	-0.39	10	Technical expertise in providing good solution to customer.
8	4.42	4.02	-0.39	8	The ownership in providing service support.
9	4.51	4.21	-0.29	4	Well addressing the issue in provided analysis report.
10	4.40	3.98	-0.43	12	Highly adaptive in meeting customer's request.
11	4.37	3.87	-0.51	21	The convenience in RMA process arrangement.
12	4.28	4.00	-0.28	3	The satisfaction of TAT (Turn Around Time)
13	4.33	4.00	-0.33	6	Obtaining status information of unit in repair.
14	4.34	3.91	-0.43	11	Timely receiving the repairing report.
15	4.45	4.01	-0.44	15	Timely obtaining the shipping information.
16	4.38	3.94	-0.44	13	The quality of repair.
17	4.30	3.94	-0.36	7	The accuracy in providing the service cost.
18	4.61	4.10	-0.51	20	Accurately deliver the spare parts or RMA units as committed upon.
19	4.65	4.20	-0.45	16	The respect of customer's benefit
20	4.40	4.16	-0.25	1	The satisfaction in partnership
21	4.71	4.46	-0.25	2	The effect of retention in partnership

EXP: Expectation. Per.: Perception.

Gap: Perception – Expectation = The Performance

4.9 Reliability Test

The purpose of Reliability Test is to test the stability and consistency in collected data; another words, it is a way to measure the property and the result of **observed scores** not of **test reliability**. The most popular method to test the reliability of observed scores is Alpha value created by L.J Cronbach (1951) [23]: Cronbach α .

$$\alpha = \frac{K}{K-1} \left(1 - \frac{\sum S_i^2}{S^2}\right)$$

Where:

K= the number of question items

S^2 = the variance of total observed scores

S_i^2 = the variance of each observed item scores

Cronbach α is a value somewhere sitting between 0 and 1, and only the extreme case will it show at 0 or 1. However, what value determines the research to move forward is still not consistent among statistics scholars. We employed the point raised by DeVellis (1991) [64] as: The value Cronbach α sitting between .60 and .65 should be inadequate for research: between .65 and .70 meets minimum acceptance criteria: a greater situation is it falling between .70 and .80: and the best situation is the value of Cronbach α sitting between .80 and .90.

Thus, The Cronbach α .8652 showed in the survey (viewed as table 4.9 below) is actually falling at the best situation.

Table 4.9: The Reliability Test

	Scale Mean If Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
A1R	-8.0225	83.9086	.5706	.5283	.8545
A2R	-7.8202	89.1491	.3772	.4462	.8618
A3R	-7.8427	87.2932	.4708	.3482	.8586
A4R	-7.8764	87.9277	.4328	.3957	.8600
A5R	-7.9213	87.1642	.5086	.4479	.8574
A6R	-7.8202	87.1037	.5268	.5171	.8568
A7R	-7.9213	88.1187	.3964	.3205	.8614
A8R	-7.9213	86.0960	.5685	.5097	.8552
A9R	-8.0225	87.4313	.4539	.4406	.8592
A10R	-7.8876	89.6463	.4331	.3287	.8602
A11R	-7.8090	88.2472	.4510	.4912	.8594
A12R	-8.0337	87.7375	.4599	.3720	.8590
A13R	-7.9888	81.4203	.6324	.5296	.8516
A14R	-7.8876	87.8736	.4366	.3537	.8598
A15R	-7.8764	88.5868	.3793	.3136	.8619
A16R	-7.8764	88.2005	.4160	.3835	.8606
A17R	-7.9551	86.6116	.4353	.3742	.8602
A18R	-7.8090	87.9972	.4767	.3745	.8585
A19R	-7.8652	91.0043	.2917	.3214	.8644
A20R	-8.0674	88.7227	.4447	.3569	.8596
A21R	-8.0674	92.2227	.2318	.3181	.8659

Reliability Coefficients 21 items

Cronbach Alpha = .8652

Standardized item alpha = .8636

4.10 Question Items analysis

To verify the feasibility and suitability of test, analyzing the effect of difficulty or distraction on respondent's answer is important before going any step further for the research. The purpose in doing so was to confirm that customer's rating is determinative and no confusion. In test of item analysis, the separation in scoring was on top 25% set as group of high scoring while setting the low 25% as group of low scoring, then calculated the ratio in number of respondents that belonging to both groups for coming out the index of discrimination.

The equation below [42] showed how the test of difficulty and discrimination was made.

$$\text{Difficulty P (DP)} = (\text{Ph} + \text{Pl}) / 2$$

$$\text{Discrimination D} = \text{Ph} - \text{Pl}$$

Where,

DP indicates the total difficulty in questionnaire;

Ph indicates the percentage of high scoring in all testers;

Pl indicates the percentage of low scoring in all testers.

D indicates the index of Discrimination.

The larger the DP (the total difficulty) value, the easier the questionnaire; good DP value should be standing between 0.2 and 0.8; same as the D value, the greater the D value, the better the questionnaire design; basically, above 0.3 is a must for questionnaire survey.

The research used CR (Critical Ratio) to select what item should be kept/deleted: a similar method taken on critical ratio evaluation was a way of calculating the independent T test on the difference of high and low scoring groups. Table 4.10 the result of T test to the group between high scoring and low scoring, as below, showed items # 2 and # 19 detailed as below bearing with P value that larger than 0.05 should be deleted;

Item 2: P (Sig. Value) = 0.103 => Do you receive adequate instruction of how to use, maintain the product through our user guide or technical support?

Item 19: P (Sig. Value) = 0.354 => Do you promptly obtain the shipping information on your query?

Table 4.10 The result of T test to the group between high scoring and low scoring

		Levene's Test for Equality of Variances		t-test for Equality of Means					5% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
A1R	Equal variances assumed	9.901	.002	5.007	65	.000	1.2251	.24467	.73650	1.71378
	Equal variances not assumed			4.418	34.408	.000	1.2251	.27731	.66183	1.78845
A2R	Equal variances assumed	7.192	.009	1.577	65	.120	.3030	.19214	-.08074	.68674
	Equal variances not assumed			1.656	61.309	.103	.3030	.18292	-.06274	.66874
A3R	Equal variances assumed	.223	.633	4.842	65	.000	.9522	.19805	.55342	1.34490
	Equal variances not assumed			4.744	49.775	.000	.9522	.20070	.54899	1.35533
A4R	Equal variances assumed	.078	.781	3.409	65	.001	.7148	.20971	.29600	1.13365
	Equal variances not assumed			3.214	43.426	.002	.7148	.22237	.26649	1.16316
A5R	Equal variances assumed	.061	.806	4.289	65	.000	.8546	.19927	.45662	1.25257
	Equal variances not assumed			4.131	46.868	.000	.8546	.20687	.43841	1.27079
A6R	Equal variances assumed	1.409	.240	4.389	65	.000	.7392	.16842	.40285	1.07558
	Equal variances not assumed			4.382	53.060	.000	.7392	.16870	.40085	1.07758
A7R	Equal variances assumed	3.442	.068	2.052	65	.044	.4672	.22766	.01249	.92184
	Equal variances not assumed			2.146	60.687	.036	.4672	.21772	.03177	.90256
A8R	Equal variances assumed	.859	.357	5.833	65	.000	.9353	.16035	.61504	1.25551
	Equal variances not assumed			5.622	46.954	.000	.9353	.16637	.60057	1.26998
A9R	Equal variances assumed	.057	.811	4.664	65	.000	.9212	.19752	.52672	1.31568
	Equal variances not assumed			4.741	56.221	.000	.9212	.19429	.53203	1.31037
A10R	Equal variances assumed	.706	.404	4.220	65	.000	.7111	.16849	.37458	1.04756
	Equal variances not assumed			3.830	37.871	.000	.7111	.18568	.33515	1.08699
A11R	Equal variances assumed	4.054	.048	2.712	65	.009	.4634	.17087	.12216	.80467
	Equal variances not assumed			2.696	52.277	.009	.4634	.17192	.11848	.80835
A12R	Equal variances assumed	.638	.427	3.630	65	.001	.6876	.18941	.30933	1.06590
	Equal variances not assumed			3.748	58.759	.000	.6876	.18347	.32046	1.05477
A13R	Equal variances assumed	2.729	.103	5.330	65	.000	1.3161	.24695	.82295	1.80932
	Equal variances not assumed			5.003	42.706	.000	1.3161	.26308	.78548	1.84679
A14R	Equal variances assumed	3.509	.066	2.336	65	.023	.4916	.21044	.07129	.91183
	Equal variances not assumed			2.491	63.137	.015	.4916	.19730	.09730	.88581
A15R	Equal variances assumed	.119	.731	2.320	65	.023	.5263	.22682	.07328	.97926
	Equal variances not assumed			2.231	46.594	.031	.5263	.23585	.05169	1.00084
A16R	Equal variances assumed	.000	.999	2.992	65	.004	.5891	.19689	.19590	.98233
	Equal variances not assumed			2.909	48.417	.005	.5891	.20253	.18199	.99624
A17R	Equal variances assumed	.786	.379	4.331	65	.000	.9315	.21507	.50200	1.36104
	Equal variances not assumed			4.542	61.082	.000	.9315	.20509	.52142	1.34162
A18R	Equal variances assumed	1.155	.286	3.464	65	.001	.6623	.19118	.28048	1.04409
	Equal variances not assumed			3.495	54.902	.001	.6623	.18949	.28253	1.04205
A19R	Equal variances assumed	.150	.700	.924	65	.359	.1876	.20297	-.21774	.59297
	Equal variances not assumed			.935	55.346	.354	.1876	.20066	-.21447	.58970
A20R	Equal variances assumed	.190	.664	4.597	65	.000	.8096	.17612	.45783	1.16131
	Equal variances not assumed			4.628	54.550	.000	.8096	.17492	.45895	1.16019
A21R	Equal variances assumed	5.747	.019	2.031	65	.046	.3799	.18704	.00637	.75348
	Equal variances not assumed			2.116	60.131	.039	.3799	.17956	.02077	.73908

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

4.11 Validity Test and Factor Analysis

Validity Test

The purpose of factor analysis is to test the construct validity (Comrey, 1988) [11]. For distinction, validity test is in a purpose of data measuring or summarizing what the investigators intend to measure and analyze, while the reliability test is, on the other hand, for a purpose of giving a way for different people interpreting the same data with the same way (Darlington, 1973) [18].

Churchill (1991) [9] suggested three types of validity: namely, Content Validity, Construct Validity and Pragmatic Validity. In that, construct validity has the most concerned with the questions in what instrument to measure the fact. High or low construct validity is due to real or illusive correlation between predictor variable and the criterion variable.

Andes De Paula (Mar. 2002) [2] defined the scientific research process on Research Methodology as, “ The scientific research process is that of generating reasonable questions and/or answers.” The term reasonable is referring to assessable and to of fairly high degree of validity and reliability. Questions are the results of a focused (driven by a purpose) explorative search: Answers are the results of a focused (driven by a purpose) search or the logic behind rejecting or accepting a hypothesis.

The research validity defined by Dr. H.Z Wong gives a good summarization [63], in which, he categorizes the validity by two parts:

1. Internal validity, means level of accuracy and reality to the context of research.
2. External validity means the accuracy in research inference.

Factor Analysis

Factor analysis includes both component analysis and common factor analysis (Darlington, Weinberg and Walberg, 1973) [18], said that “the central concept in component analysis is representation or summarization; suppose we want to replace a large set of variables by a smaller set which best summarizes the larger set.”

Each component’s eigenvalue is called the amount of variance the component explains. The major reason for this is the eigenvalue’s definition as a weighted sum of squared correlations. However, it also turns out that the actual variance of the component scores equals the eigenvalue. Thus, in components analysis the “factor variance” and “amount of variance the factor explains” are always equal. (Darlington, 1973) [18].

Henry Kaiser suggested a rule for selecting a number of factors m less than the number needed to perfect reconstruction: set m equal to the number of eigenvalues greater than 1. This rule is often used in common factor analysis as well as in component analysis.

Factor analysis in social science for most of applications are to transform the multi-correlated variances that were hard to explain into fewer conceptualized but more interpretable and independent factors. The most popular methodology in factor analysis is **PFA** (Principal Factor Analysis); the extraction of principal factor among factors. Two components for factor analysis are, first, Common Factor and second, Unique Factor. The model that often used in factor analysis sourced from Wu (2000) is:

$$Z_j = a_{j1}F_1 + a_{j2}F_2 + a_{j3}F_3 + \Lambda + a_{jm}F_m + U_j \dots\dots\dots(2)$$

Where :

Z_j = The standard score of question item j

F_i = The common factor

m = The total number of common factor

U_j = The unique factor of question item j

a_{j1} = The loading of factor

Factor Analysis (viewed to the table 4.11 below) is performed in the purpose of two paths: first, to test the validity, and second, to scale down the question items.

In popular, the methodologies provided for selecting the factor number are Kaiser's familiar eigenvalue rule and Cattell's scree test [61]. The research applied Kaiser's eigenvalue rule by using a formal significance test to identify the number of common factors, and to determine how many factors are needed.

By using SPSS with the extraction method of Principal Factor Analysis: PFA and the Varimax, the rotation method, table 4.11, as below, the KMO (Kaiser-Meyer-Olkin) and Bartlett's Test provides the value of Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.807, and basing on the criteria provided for factor analysis, the KMO measure value higher than 0.8 means the observed data is very appropriate for factor analysis. Furthermore, the Bartlett's test of Sphericity indicated the value of χ^2 is 464.939 with degree of freedom of 171, the significant value .000 means matrix of correlation for test body is truth; proper for factor analysis.

Table 4.11 the KMO and Bartlett's test for service quality

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.807
Bartlett's Test of Sphericity	Approx. Chi-Square	464.939
	df	171
	Sig.	.000

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

Table 4.12, as below, showed 5 commonality factors for eigenvalue were larger than 1.00 (viewed on the crossed circle), and the cumulative percentage for the variance of these 5 commonality factors was 56.581.

Table 4.12 Total variance explains for service quality

Componer	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.536	29.139	29.139	5.536	29.139	29.139	2.571	13.530	13.530
2	1.455	7.656	36.795	1.455	7.656	36.795	2.330	12.261	25.791
3	1.403	7.383	44.178	1.403	7.383	44.178	2.289	12.046	37.837
4	1.256	6.613	50.790	1.256	6.613	50.790	1.935	10.182	48.019
5	1.100	5.791	56.581	1.100	5.791	56.581	1.627	8.562	56.581
6	.971	5.109	61.690						
7	.912	4.800	66.490						
8	.857	4.511	71.001						
9	.772	4.066	75.067						
10	.735	3.866	78.933						
11	.686	3.611	82.543						
12	.561	2.951	85.494						
13	.513	2.701	88.196						
14	.467	2.456	90.651						
15	.417	2.196	92.847						
16	.406	2.138	94.985						
17	.371	1.952	96.937						
18	.346	1.823	98.759						
19	.236	1.241	100.000						

Extraction Method: Principal Component Analysis.

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

By using the Varimax with Kaiser Normalization as Rotation Method from the extraction of PCA (Principal Component Analysis) in SPSS, the table below, **4.13, the rotated components matrix for service quality**, showed the value of factor loading sorted in ascending sequence could be easily viewed the items contented in its extracted component. In that, the question item **12, 4 and 6** consisted of **components 4**, and question item **21, 18, 3** consisted of **component 5** are found too few items to accurately explain the attribute of component. Based on practical experience, a component that contains less than four items should be deleted to secure the properties of factors not to be distorted in its validity test (Wu, 2000) [62].

Tables 4.13 Rotated components matrix for service quality

Item	Component				
	1	2	3	4	5
A9R	.698	.102	.090	.182	.081
A17R	.689	.144	.103	.129	-.098
A15R	.676	.004	.109	-.007	.114
A13R	.521	.347	.290	.246	.126
A20R	.049	.726	.183	.145	-.088
A10R	.158	.672	.081	-.051	.216
A1R	.211	.541	-.011	.429	.417
A5R	.511	.535	.080	.028	-.002
A11R	.166	.013	.811	.043	.037
A14R	.175	.191	.644	-.035	.132
A8R	-.009	.434	.576	.251	.180
A7R	.065	.030	.526	.260	.206
A16R	.398	.180	.476	.167	-.417
A12R	.139	.063	.179	.794	-.009
A4R	.314	.010	-.008	.620	.373
A6R	.024	.457	.255	.605	.221
A21R	-.064	.078	.223	-.020	.735
A18R	.338	.113	.257	.147	.474
A3R	.299	.360	.077	.225	.364

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

In according to the table 4.13 of above, the detail items corresponding to the componenta were listed in summary as below:

Component 1 contained 5 question items as below:

Item 15: Service on mutual benefit between customer and provider?

Item 9: Well addressing the issue in provided analysis report

Item17: The accuracy in providing the service cost

Item13: Obtaining status information of unit in repair

Checking to the items contained as above, this component was given the name as **Responsiveness in RMA process.**

Component 2 contained 4 question items as below:

Item 20: The satisfaction in partnership

Item 10: Highly adaptive in meeting customer's request

Item 1: The instruction from user guide or technical support.

Item 5: Quickly solving customer's problem

Checking to the items contained as above, this component was given the name as **Empathy in meeting customer's need.**

Component 3 contained 4 question items as below:

Item 11: The convenience in RMA process arrangement

Item 14: Timely receiving the repairing report

Item 8: The ownership in providing service support

Item 7: Technical expertise in providing good solution to customer

Item 16: The quality of repair

Checking to the items contained as above, this component was given the name as **Customer's sense of reliability.**

Component 4 contained 3 question items as below:

Item 12: The satisfaction of TAT (Turn Around Time).

Item 4: Quickly catching the point of customer's problem.

Item 6: Promptly obtaining the quality analysis report.

Checking to the items contained as above, this component was given the name as **Assurance of Service Repairability**

Component 5 contained 3 question items as below:

Item 18: Accurately deliver the spare parts or RMA units as committed upon.

Item 3: The courtesy in written or oral communications

Item 21: The effect of customer retention in satisfaction of service quality.

Checking to the items contained of above, this components was given the name as the **Sensitivity of Accurate Service Delivery**

In reviewing the components above, a finding provided for case company regarding the factors loading extracted from customer's quality rating were summarized as below:

Component 1: Responsiveness in RMA processing.

Component 2: Empathy in meeting customer's need

Component 3: Customer's sense of reliability

Component 4: Assurance of service repairability

Component 5: Sensitivity of accurate service delivery.



4.12 Multivariate Analysis for Service Quality

The validity test and factor analysis provided a good information regarding the components factors loading as well as the referencing items in helping case company find the preliminary directions of what poor performance items which customers do care, however, in searching for the specific items or issues which getting most of customers' attention, the conducting of multivariate analysis is in need to identify the results of question items affecting with groups of customers.

1. The Multivariate Test on years of partnership

The test is intended to see if any question item significantly affecting customer's rating by years of partnership.

Hypothesis

$$H_0 = \mu_{P1} = \mu_{P2} = \mu_{P3} = \mu_{P4}$$

$$H_1 = \mu_{P1} \neq \mu_{P2} \neq \mu_{P3} \neq \mu_{P4}$$

Where

P1: below 1 year

P2: 1-2 years

P3: 2-3 years

P4: 3-5 years



By using Multi-Variance Analysis in SPSS, we came out the result as table 4.14, the multivariate test for years of partnership below. Visibly, 4 testing method provided for multivariate test showed most of value were not having significant effect.

Taken the variance analysis method of Wilks' Lambda [42], the most popular test method adapted by majority of researchers that is deemed as a good gating for whether or not the analysis should move forward. The value of 0.001 indicated the effect is significant enough on respondent's ranking," thus H_1 sustained.

Table 4.14 The multivariate test for years of partnership

Source of Effect	Test Measure	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.480	2.816	21.000	64.000	0.001
	Wilks' Lambda	0.520	2.816	21.000	64.000	0.001
	Hotelling's Trace	0.924	2.816	21.000	64.000	0.001
	Roy's Largest Root	0.924	2.816	21.000	64.000	0.001
B1	Pillai's Trace	1.363	1.649	84.000	268.000	0.001
	Wilks' Lambda	0.178	1.668	84.000	255.243	0.001
	Hotelling's Trace	2.259	1.681	84.000	250.000	0.001
	Roy's Largest Root	0.961	3.064	21.000	67.000	0.000

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

Further to verify the difference in quality rating between items and grouped customers as B1: The years of partnership, table 4.15 as below provided clear information of items having strong effect were:

Item 2: The ease in accessing to service center

Item 3: The courtesy in written or oral communications

Item 9: Well addressing the issue in provided analysis report

Item 11: The convenience in RMA process arrangement

Item 13: Obtaining status information of unit in repair

Item 14: Timely receiving the repairing report

Item 15: Timely obtaining the shipping information

Item 16: The quality of repair

Item 17: The accuracy in providing the service cost.

Table 4.15 Test of between-subjects effects in customer group B1: Years of partnership

Customer Group	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
B1	Item 1	5.097	4.000	1.274	1.147	0.340
	Item 2	8.209	4.000	2.052	2.970	0.024
	Item 3	10.709	4.000	2.677	3.658	0.009
	Item 4	4.377	4.000	1.094	1.361	0.254
	Item 5	1.706	4.000	0.426	0.564	0.690
	Item 6	4.627	4.000	1.157	1.686	0.161
	Item 7	1.706	4.000	0.426	0.462	0.763
	Item 8	4.984	4.000	1.246	1.681	0.162
	Item 9	8.652	4.000	2.163	2.763	0.033
	Item 10	0.942	4.000	0.235	0.441	0.779
	Item 11	10.078	4.000	2.520	4.057	0.005
	Item 12	6.026	4.000	1.506	2.043	0.096
	Item 13	21.318	4.000	5.329	4.557	0.002
	Item 14	13.813	4.000	3.453	5.005	0.001
	Item 15	9.307	4.000	2.327	2.934	0.025
	Item 16	7.377	4.000	1.844	2.401	0.056
	Item 17	12.387	4.000	3.097	3.168	0.018
	Item 18	3.045	4.000	0.761	1.118	0.354
	Item 19	5.594	4.000	1.398	2.329	0.063
	Item 20	3.597	4.000	0.899	1.426	0.232
	Item 21	3.836	4.000	0.959	1.801	0.136

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

2. Multivariate Test On Customers Of Different Models

The test on the effect of service quality rating in customers of different models divided as the customer of A series, W series, and CA series was to find whether or not that certain group of customers showed a significant effect in rating the service quality.

As usual, we set our hypothesis as below:

$$H_0 = \mu_A = \mu_W = \mu_{CA}$$

$$H_1 = \mu_A \neq \mu_W \neq \mu_{CA}$$

In that:

Three types of model are:

A series

W series

CA series.

Table 4.16, the multivariate test on customer grouped by main model purchaser as below showed the result of test: where, 4 taken measures indicated a significant effect on each model purchaser, thus, the H_1 was sustained.

Table 4.16 The multivariate test on customer grouped by different model purchaser

Customer Group	Test Measure	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.691	7.021	21	66	0.000
	Wilks' Lambda	0.309	7.021	21	66	0.000
	Hotelling's Trace	2.234	7.021	21	66	0.000
	Roy's Largest Root	2.234	7.021	21	66	0.000
B2	Pillai's Trace	0.766	1.982	42	134	0.002
	Wilks' Lambda	0.357	2.116	42	132	0.001
	Hotelling's Trace	1.453	2.249	42	130	0.000
	Roy's Largest Root	1.153	3.678	21	67	0.000

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

Further checking on the significant effect in question items to customer group of B2: the different model buyers, table 4.20 summarized the test results. In that, the items having strong effect (the number in bold) were listed as below:

Item 1: The instruction from user guide or technical support

Item 2: The ease in accessing to service center

Item 3: The courtesy in written or oral communications

Item 5: Quickly solving customer's problem

Item 6: Promptly obtaining the quality analysis report

Item 7: Technical expertise in providing good solution to customer

Item 8: The ownership in providing service support

Item 9: Well addressing the issue in provided analysis report

Item 10: Highly adaptive in meeting customer's request

Item 11: The convenience in RMA process arrangement

Item 13: Obtaining status information of unit in repair

Item 15: Service on mutual benefit between customer and provider?

Item 19: The respect of customer's benefit

Item 20: The satisfaction in partnership

Item 21: The effect of retention in partnership



Table 4.17 Test of between-subjects effects in customers divided by different models

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
B3	Item 1	17.557	2	8.779	9.338	0.000
	Item 2	13.344	2	6.672	10.846	0.000
	Item 3	16.877	2	8.439	13.123	0.000
	Item 4	9.026	2	4.513	6.172	0.003
	Item 5	12.294	2	6.147	9.986	0.000
	Item 6	8.661	2	4.330	6.950	0.002
	Item 7	12.960	2	6.480	8.409	0.000
	Item 8	11.680	2	5.840	9.040	0.000
	Item 9	7.969	2	3.984	5.158	0.008
	Item 10	3.684	2	1.842	3.764	0.027
	Item 11	4.600	2	2.300	3.431	0.037
	Item 12	4.163	2	2.082	2.805	0.066
	Item 13	9.641	2	4.821	3.772	0.027
	Item 14	4.149	2	2.074	2.638	0.077
	Item 15	6.093	2	3.047	3.753	0.027
	Item 16	2.893	2	1.447	1.802	0.171
	Item 17	4.972	2	2.486	2.388	0.098
	Item 18	2.907	2	1.453	2.180	0.119
	Item 19	3.725	2	1.863	3.063	0.052
	Item 20	9.011	2	4.505	8.149	0.001
	Item 21	4.255	2	2.128	4.130	0.019

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

3. Multivariate Test on The Frequency of Customer Having Contact For Service Support

The test on the effect of service quality rating in customer's frequency of having contact for service support was to find whether or not that certain group of customers showed a significant effect in ranking the service quality.

Hypothesis:

$$H_0 = \mu_{FQ1} = \mu_{FQ2} = \mu_{FQ3} = \mu_{FQ4} = \mu_{FQ5}$$

$$H_1 = \mu_{FQ1} \neq \mu_{FQ2} \neq \mu_{FQ3} \neq \mu_{FQ4} \neq \mu_{FQ5}$$

Where:

FQ1= below 1 time /per month

FQ2= around 1-5 times /per month

FQ3= around 5-10 times /per month

FQ4= around 10-20 times /per month

FQ5= over 20 times /per month

In reviewing to the test results as table 4.18 below, 4 testing methods were found not all showed significant, among them, the top two measures as Pillai's Trace, Wilk's Lambda were not significant enough, while the rest as Hotelling's Trace and Roy's largest Root were significant. Taking account to the measure mostly employed nowadays, the Wilks' Lambda [62], the value of .065 is lack in convincing as significant, however, still worth for a further analysis since the objective of research is to find the directions of improvement and therefore, to be more conservative is necessary for not losing the hiding message among items through customers survey. Thus, H_1 sustained.

Table 4.18 The multivariate test on the frequency of customer having contact for service support

Effect	Test Measure	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.662	5.97	21	64.00	0.000
	Wilks' Lambda	0.338	5.97	21	64.00	0.000
	Hotelling's Trace	1.959	5.97	21	64.00	0.000
	Roy's Largest Root	1.959	5.97	21	64.00	0.000
b3	Pillai's Trace	1.132	1.26	84	268.00	0.088
	Wilks' Lambda	0.246	1.30	84	255.24	0.065
	Hotelling's Trace	1.793	1.33	84	250.00	0.046
	Roy's Largest Root	0.922	2.94	21	67.00	0.000

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

A further checking on the effect on customer's rating within group, the items of significant effect (in bold) were showed as table 4.19 below:

Item 1: The instruction from user guide or technical support

Item 2: The ease in accessing to service center

Item 3: The courtesy in written or oral communication

Item 4: Quickly catching the point of customer's problem

Item 5: Quickly solving customer's problem

Item 6: Promptly obtaining the quality analysis report

Item 7: Technical expertise in providing good solution to customer

Item 13: Obtaining status information of unit in repair

Item 15: Service on mutual benefit between customer and provider?

Item 17: The accuracy in providing the service cost

Item 20: The satisfaction in partnership

Table 4.19, the test of between-subjects effects in customers' frequency of having service contact

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
B3	Item 1	12.106	4	3.027	2.946	0.025
	Item 2	11.206	4	2.801	4.275	0.003
	Item 3	8.918	4	2.230	2.961	0.024
	Item 4	10.535	4	2.634	3.604	0.009
	Item 5	10.386	4	2.597	3.977	0.005
	Item 6	9.793	4	2.448	3.921	0.006
	Item 7	13.144	4	3.286	4.176	0.004
	Item 8	3.314	4	0.829	1.089	0.367
	Item 9	7.724	4	1.931	2.433	0.054
	Item 10	2.310	4	0.577	1.116	0.354
	Item 11	2.913	4	0.728	1.031	0.396
	Item 12	6.811	4	1.703	2.338	0.062
	Item 13	21.331	4	5.333	4.561	0.002
	Item 14	4.648	4	1.162	1.454	0.224
	Item 15	10.627	4	2.657	3.418	0.012
	Item 16	6.881	4	1.720	2.222	0.073
	Item 17	10.390	4	2.598	2.594	0.042
	Item 18	4.971	4	1.243	1.889	0.120
	Item 19	5.519	4	1.380	2.295	0.066
	Item 20	6.700	4	1.675	2.822	0.030
	Item 21	2.344	4	0.586	1.065	0.379

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

4. Multivariate Test on The Company Scale of Customers

The test in this section was to find if customer's scale measured by the number of employees affected their rating in service quality.

We set the hypothesis as:

$$H_0 = \mu_{CS1} = \mu_{CS2} = \mu_{CS3} = \mu_{CS4} = \mu_{CS5}$$

$$H_1 = \mu_{CS1} \neq \mu_{CS2} \neq \mu_{CS3} \neq \mu_{CS4} \neq \mu_{CS5}$$

Where:

CS1 = Company Scale 1: below 50 employees

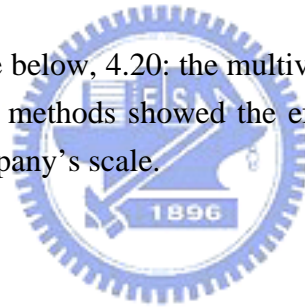
CS2 = Company Scale 2: 50-150 employees

CS3 = Company Scale 3: 150-300 employees

CS4 = Company Scale 4: 300-500 employees

CS5 = Company Scale 5: above 500 employees

Given the information as table below, 4.20: the multivariate test on the company scale of customers, most of testing methods showed the effect on customer's ranking has not been affected in their company's scale.



Thus, the H_0 was sustained.

Table 4.20, the multivariate test on the company scale of customers

Effect	Test Measure	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.468	2.680	21	64	0.001
	Wilks' Lambda	0.532	2.680	21	64	0.001
	Hotelling's Trace	0.879	2.680	21	64	0.001
	Roy's Largest Root	0.879	2.680	21	64	0.001
B4	Pillai's Trace	0.842	0.850	84	268	0.808
	Wilks' Lambda	0.376	0.855	84	255	0.799
	Hotelling's Trace	1.157	0.861	84	250	0.787
	Roy's Largest Root	0.596	1.903	21	67	0.025

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

5. Multivariate Test on Customers Having Case Company As a Sole Supplier

The test in this section was to find if customers taken case company as a sole supplier affected their rating in service quality.

Hypothesis:

$$H_0 = \mu_{SSyes} = \mu_{SSno}$$

$$H_1 = \mu_{SSyes} \neq \mu_{SSno}$$

Where:

SSyes means yes, the case company, XYZ is the sole supplier

SSno means no, the case company, XYZ is not the sole supplier

In checking to the Multivariate Test result as table 4.21 below, customers' rating grouped by taking case company as the sole supplier did exhibit a significant effect, thus, H_1 sustained.

Table 4.21 The multivariate test on customers having case company as a sole supplier

Effect	Test Measure	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.64	6	21.00	67.00	0.00
	Wilks' Lambda	0.36	6	21.00	67.00	0.00
	Hotelling's Trace	1.77	6	21.00	67.00	0.00
	Roy's Largest Root	1.77	6	21.00	67.00	0.00
B5	Pillai's Trace	0.67	6	21.00	67.00	0.00
	Wilks' Lambda	0.33	6	21.00	67.00	0.00
	Hotelling's Trace	2.03	6	21.00	67.00	0.00
	Roy's Largest Root	2.03	6	21.00	67.00	0.00

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

Further checking on table 4.22 below, the items bearing with significant effect within group could be found as below as number in bold:

Item 1: The instruction from user guide or technical support

Item 2: The ease in accessing to service center

Item 3: The courtesy in written or oral communications

Item 4: Quickly catching the point of customer's problem

Item 5: Quickly solving customer's problem

Item 6: Promptly obtaining the quality analysis report

Item 7: Technical expertise in providing good solution to customer

Item 8: The ownership in providing service support

Item 9: Well addressing the issue in provided analysis report

Item 10: Highly adaptive in meeting customer's request

Item 12: The satisfaction of TAT (Turn Around Time)

Item 13: Obtaining status information of unit in repair

Item 15: Service on mutual benefit between customer and provider?

Item 16: The quality of repair

Item 17: The accuracy in providing the service cost

Item 18: Accurately deliver the spare parts or RMA units as committed upon

Item 19: The respect of customer's benefit

Item 20: The satisfaction in partnership

Item 21: The effect of retention in partnership



Table 4.22 The tests of between-subjects effects on the company scale of customers

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
B5	Item 1	21.596	1	21.596	24.461	0.000
	Item 2	8.880	1	8.880	13.467	0.000
	Item 3	15.094	1	15.094	23.004	0.000
	Item 4	13.127	1	13.127	19.427	0.000
	Item 5	12.177	1	12.177	19.967	0.000
	Item 6	20.176	1	20.176	41.724	0.000
	Item 7	12.177	1	12.177	15.798	0.000
	Item 8	9.349	1	9.349	14.051	0.000
	Item 9	7.308	1	7.308	9.476	0.003
	Item 10	2.534	1	2.534	5.099	0.026
	Item 11	2.420	1	2.420	3.519	0.064
	Item 12	3.070	1	3.070	4.115	0.046
	Item 13	13.056	1	13.056	10.666	0.002
	Item 14	1.893	1	1.893	2.357	0.128
	Item 15	7.613	1	7.613	9.698	0.002
	Item 16	6.468	1	6.468	8.598	0.004
	Item 17	6.654	1	6.654	6.591	0.012
	Item 18	2.420	1	2.420	3.640	0.060
	Item 19	5.830	1	5.830	10.106	0.002
	Item 20	11.791	1	11.791	22.912	0.000
	Item 21	2.910	1	2.910	5.546	0.021

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

6. The Multivariate Test Of Service Quality For Seniority Of Respondents

The test in this section is to see if quality rating significantly affected by the seniority of respondents.

Hypothesis:

$$H_0 = \mu_{PN1} = \mu_{PN2} = \mu_{PN3} = \mu_{PN4} = \mu_{PN5}$$

$$H_1 = \mu_{PN1} \neq \mu_{PN2} \neq \mu_{PN3} \neq \mu_{PN4} \neq \mu_{PN5}$$

Where:

PN1= customer's seniority below 1 year

PN2= customer's seniority between 1-2 years

PN3= customer's seniority between 2-3 years

PN4= customer's seniority between 3-5 years

PN5= customer's seniority over 5 years

The result showed as table 4.23 below indicated that the seniority of respondents is not confirmed as having strong effect in service quality rating. Thus, H_0 sustained; the test is null.

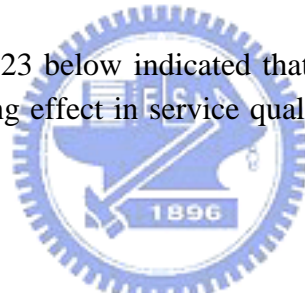


Table 4.23 The multivariate test of service quality test in seniority of respondents

Effect	Test Measure	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.515	3.290	21	65	0.000
	Wilks' Lambda	0.485	3.290	21	65	0.000
	Hotelling's Trace	1.063	3.290	21	65	0.000
	Roy's Largest Root	1.063	3.290	21	65	0.000
B6	Pillai's Trace	0.818	1.195	63	201	0.178
	Wilks' Lambda	0.372	1.214	63	195	0.160
	Hotelling's Trace	1.217	1.230	63	191	0.145
	Roy's Largest Root	0.650	2.075	21	67	0.013

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

7. Multivariate Test On Different Area Of Customers

This section tested customer's rating if significantly affected by their originality, say customers come from different areas such as US, EU or ASIA.

Hypothesis:

$$H_0 = \mu_{US} = \mu_{EU} = \mu_{ASIA}$$

$$H_1 = \mu_{US} \neq \mu_{EU} \neq \mu_{ASIA}$$

Where:

US= Customer based on US

EU= Customer based on EU

ASIA= Customer based on ASIA

The test result showed as table 4.24 below indicated customers of different originalities had no significant effect on their rating in service quality.

Thus, H_0 sustained.

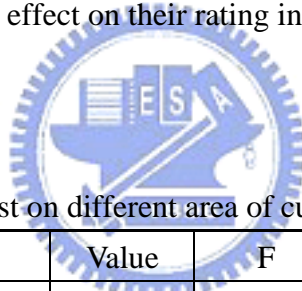


Table 4.24 The multivariate test on different area of customers

Effect	Test Measure	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.583	4.390	21	66	0.000
	Wilks' Lambda	0.417	4.390	21	66	0.000
	Hotelling's Trace	1.397	4.390	21	66	0.000
	Roy's Largest Root	1.397	4.390	21	66	0.000
B7	Pillai's Trace	0.562	1.248	42	134	0.173
	Wilks' Lambda	0.508	1.267	42	132	0.158
	Hotelling's Trace	0.831	1.286	42	130	0.144
	Roy's Largest Root	0.601	1.918	21	67	0.023

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

8. Summary of Multivariate Test in Customer's Attribute

Based on the results of multivariate test, by excluding three grouped customers as B4: The business scale of customers, B6: The seniority of partnership with case company, and B7: The originality of customer, for they were tested not having significant effect in rating of service quality, as well as the item 2 and item 19 for they were proved too difficult for customers to get their points clear, summary as below was made to conclude the question items having strong effect in customer rating:

Item 1: The instruction from user guide or technical support

Item 2: The ease in accessing to service center

Item 3: The courtesy in written or oral communications

Item 4: Quickly catching the point of customer's problem

Item 5: Quickly solving customer's problem

Item 6: Promptly obtaining the quality analysis report

Item 7: Technical expertise in providing good solution to customer

Item 8: The ownership in providing service support

Item 9: Well addressing the issue in provided analysis report

Item 10: Highly adaptive in meeting customer's request

Item 11: The convenience in RMA process arrangement

Item 12: The satisfaction of TAT (Turn Around Time)

Item 13: Obtaining status information of unit in repair

Item 14: Timely receiving the repairing report

Item 15: Service on mutual benefit between customer and provider

Item 16: The quality of repair

Item 17: The accuracy in providing the service cost

Item 18: Accurately deliver the spare parts or RMA units as committed upon

Item 19: The respect of customer's benefit

Item 20: The satisfaction in partnership

Item 21: The effect of retention in partnership

The question items corresponding with affected customers as figure 4.2 is in a purpose of summarizing the test result of chapter 4, where the last column showed the affected number against the question item could be deemed as integrated importance rating with the sense as more customers concern means more importance it is.

Item	Description	B1	B2	B3	B5	Affected Number
1	The instruction from User Guide or technical support.		Y	Y	Y	3
2	The ease in accessing to service center.	Y	Y	Y	Y	4
3	The courtesy in written or oral communications.	Y	Y	Y	Y	4
4	Quickly catching the point of customer's problem.			Y	Y	2
5	Quickly solving customer's problem.		Y	Y	Y	3
6	Promptly obtaining the quality analysis report.		Y	Y	Y	3
7	Technical expertise in providing good solution to customer.		Y	Y	Y	3
8	The ownership in providing service support.		Y		Y	2
9	Well addressing the issue in provided analysis report.	Y	Y		Y	3
10	Highly adaptive in meeting customer's request.		Y		Y	2
11	The convenience in RMA process arrangement.	Y	Y			2
12	The satisfaction of TAT (Turn Around Time)				Y	1
13	Obtaining status information of unit in repair.	Y	Y	Y	Y	4
14	Timely receiving the repairing report.	Y				1
15	Timely obtaining the shipping information.	Y	Y	Y	Y	4
16	The quality of repair.	Y			Y	2
17	The accuracy in providing the service cost.	Y		Y	Y	3
18	Accurately deliver the spare parts or RMA units as committed upon.				Y	1
19	The respect of customer's benefit		Y		Y	2
20	The satisfaction in partnership		Y	Y	Y	3
21	The effect of retention in partnership		Y		Y	2

Figure 4.2 The coverage of significant effect of question item in grouped customer

Note:

B1: Years of partnership.

B2: Customer grouped by main model purchased

B3: Customer grouped by level of frequency of having contact for service support

B5: Customer grouped by taken case company, XYZ as the sole supplier



CHAPTER 5

SUGGESTIONS FOR CASE COMPANY

Figure 4.2 provided good information of what factors determine the service quality of case company. However, considering the objective of research, the information provided by figure 4.2 only the coverage number of affected customers aligning to the question items was still not sufficient to make the proper suggestions. More information needed for the purpose of allowing case company checking out the test results through a single viewpoint is available on figure 5.1 as below, the importance and performance chart.

Figure 5.1 provided a two dimensions chart not only enables users easily find the position of each question item with its corresponding value of importance (the X value) and performance (the Y value), but also allows users identifying the priority ranking on that very item.

In detail, the items which sitting in the positions of figure 5.1 is listed as below:

Dimension 1, the High Importance and High Performance in descending sequence of performance rating included:

- Item 20: The satisfaction in partnership
- Item 9: Well addressing the issue in provided analysis report
- Item 1: The instruction from user guide or technical support
- Item 13: Obtaining status information of unit in repair.
- Item 17: The accuracy in providing the service cost.
- Item 5: Quickly solving customer's problem
- Item 7: Technical expertise in providing good solution to customer

Dimension 2, the High Importance but Low Performance in descending sequence of performance rating included:

- Item 15: Service on mutual benefit between customer and provider
- Item 3: The courtesy in written or oral communication
- Item 6: Promptly obtaining the quality analysis report

Dimension 3, the Low Importance but high performance in descending sequence of performance rating included:

- Item 21: The effect of retention in partnership
- Item 12: The satisfaction of TAT (Turn Around Time)
- Item 8: The ownership in providing service support

Dimension 4, the Low Importance and Low Performance in descending sequence of performance rating included:

Item 14: Timely receiving the repairing reports

Item 10: Highly adaptive in meeting customer’s request

Item 16: The quality of repair.

Item 4: Quickly catching the point of customer’s problem

Item 18: Accurately deliver the spare parts or RMA units as committed upon

Item 11: The convenience in RMA process arrangement

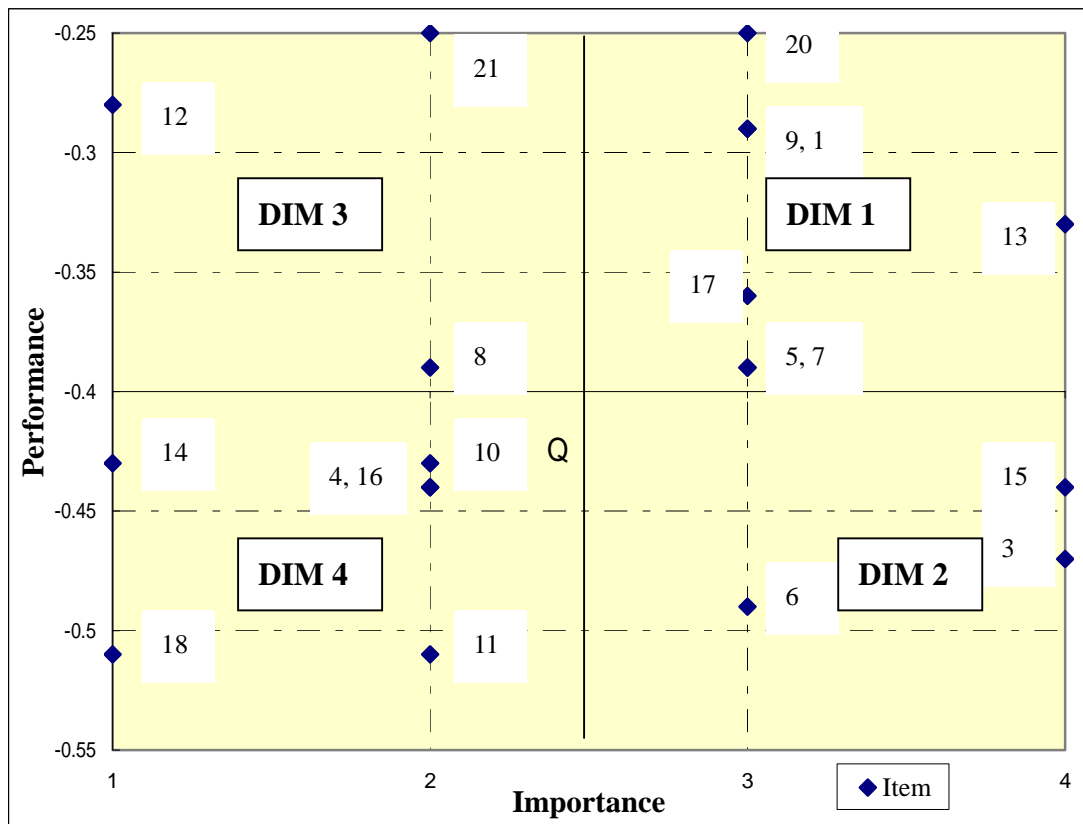


Figure 5.1 Importance / Performance chart

Note: To recap the meaning of importance and performance chart, we took item 20 as example: while checking the location of item 20, sitting in dimension one indicated this item was on a high importance and performance rating, i.e., three in X value meant three groups of customers, respectively, B2, B3, B5 (referred as figure 4.2) were significantly affected by this item, while aligning to Y value, visibly, item 20 located almost the highest value in performance rating (more detail could be referred in table 4.8) when comparing with that of the other items.

5.1 Suggestions by Item of Significant Effect

Figure 5.1 gave the priority for case company to improve service quality, however, a fact for the implementation plan to improve the service quality is that process could be associated with many dimensions, and very often the functionality of organization, working process as well as the IT system will get involved for the total solution. Thus, selectively giving the directions for case company to improve the service quality was the main topic of this section.

The suggestions listed as below are the results of collaboration with case company, in that, two paths will be presented as: horizontally, to present by items in priority ranking: the high importance but low performance as item 15, 3, 6, and 7 and vertically, to present by groups of customers in number sequence as B1, B2, B3, B5.

1. For item 15, customer's feeling about case company doing the service not too much considering the mutual benefit between two parties:

The only item located in dimension four meaning this issue is the first priority that needs to be settled; high importance rating (viewed as figure 4.2) that getting three out of four groups of customers' attentions means the problem significantly affecting most of customers' rating, but poor quality in its performance rating exhibits customers are not satisfying on case company has performed so far and thus, need some acute actions taken to solve the problem.

In seeing this problem, a thorough investigation with case company came out a conclusion that, of possible causes, it was very likely that tremendous stock holding cost which was reserved for 3 years of warranty repair and 7 years of spare parts provision added to price structure for service support make customers feel that case company cares only the profit they can earn but leaving customer's benefit behind.


Thus, a suggestion for case company is to share the cost structure to customers for their understanding the markup of service cost was actually gone to the stock holding.

2. For Item 3: The courtesy in written or oral communication

In B to B business, the relationship between customers and suppliers is very different with B to C business. Through back and forth of communication regarding the issues in business, quality, service, and delivery, ... etc, the partnership might get stronger and sturdy if it is taken very carefully by two parties, however, on another hand, it might damage the business relationship if one of parties can't fully recognize its importance.

Checking the item of courtesy in communication in figure 5.1 that high performance as it stands for 4 significant affected number in X value means most of customers seeing this issue important, however the low scoring in performance rating (the Y value) means case company would need a progressive action in turning back customer's perception.

A discussion with case company regarding this issue gave some directions that needed to be done as below:

- 
- a. To give a series of training courses for contact windows, and engineers in politely handling the case on customers' requests**
 - b. In enhancing the ownership of service staffs, to come out an incentive program to give reward for the one who have earned the most of customer's credit, and to discipline the one who received the most of customer's complaints.**

4. For item 6: Promptly obtaining the quality analysis report

To secure the reliability issue not turning into epidemic like and to make sure the quality analysis cycle is implemented seriously and traceably, customers would mostly want suppliers to submit the quality analysis report in a wake of units repaired. The analysis report is code name as Skynet in case company, from which, customer is able to see the whole analysis process all the way from symptom description, the analysis process, the root cause finding, the actions taken, as well as the effect confirmation.

Checking the location of item 6 in figure 5.1, the high importance with poor performance is it sitting at (3, -0.49) means that high priority for this item was badly in need for case company to make improvement. The directions of solving this problem as below was based on the conclusions after discussing with case company.

- a. To setup a dedicate quality analysis window to effectively bridge the quality issue between service team and quality team, by following the analysis process, the service team (the quality issue initiator) will document the analysis process with timely requesting a closed loop correction form to be filled and promptly returned by quality team.**
- b. To leverage the quality analysis system (call PDC, the Project Development Collaboration system) that could well manage the quality data to timely provide the analysis result to customers whenever the issue is in tracking or close status. The PDC system not only provides a same platform for each different department finding the solutions and getting done the issue with the same tempo, but also enables an online accessing for customers to freely download the data.**
- c. For management purpose, to setup an index of each different model in terms of timely providing the quality data for management purpose.**

3. For Item 7: Technical Expertise In Providing Good Solution to Customer

The reasons that customer would need solutions in B to B business model is mostly on a purpose of hitting some niche markets. From manufacturer's perspective, helping customers is a way to help themselves, thus, providing good solution for customer's better opportunity in gaining some market is one of task that manufacturers would need to put focus on.

In doing so, fully collaboration between two parties (the customers and suppliers) and seamless team work are required to go through a complete development process in a very limited available time, in that, the process is started from Product Management of finding the new specifications with which can meet customer's unique requirement, R&D dept. of modifying the existing platform and having the test done, all the way until a new prototype is made and gets approved by end customers, just like a game which needs focus on every player and great teamwork to win the game.

The item sat on the dimension 3 of high importance and high performance, shows that case company not doing so bad on this item, however, by closing to the border of dimension 4 in Y axis, it is suggested **that case company should do more effort in re-engineering their solution developing process and to be more unstintingly in cooperating with customers.**

5.2 Suggestions For Grouped Customers

Viewing to the suggestions which horizontally interpreting the question items covering the significant effects on each grouped customer's rating, another viewpoint listed as below vertically explaining the customer's behavior.

1. For years of partnership (B1)

Viewed as figure 4.2, the items of significant effect corresponding to this group of customers as having years of partnership with case company, or so called the aging customers are:

Item 2: The ease in accessing to service center..

Item 3: The courtesy in written or oral communications.

Item 9: Well addressing the issue in provided analysis report.

Item 11: The convenience in RMA process arrangement.

Item 13: Obtaining status information of unit in repair.

Item 14: Timely receiving the repairing report.

Item 15: Timely obtaining the shipping information

Item 16: The quality of repair

Item 17: The accuracy in providing the service cost.

This finding gives a good picture of what make customers want to stay with their provider. In considering the need of customers, we assumed that the reasons for items above bearing with strong effect of quality rating should because of aging customers equipped with basic knowledge of product data would so much in need of technical support and repair report submission to allow them (the aging customers) approaching the shortest down time when end users (customer's customers) facing problem in the field.

To further verify the assumption of above, we use the multivariate test by the means of expectations to check among those 9 mentioned items if any significant difference found. Thus, a set up of Hypothesis is as below:

$$H_0 = \mu_{EOY1} = \mu_{EOY2} = \mu_{EOY3} = \mu_{EOY4}$$

$$H_1 = \mu_{EOY1} \neq \mu_{EOY2} \neq \mu_{EOY3} \neq \mu_{EOY4}$$

Where:

EOY1= Expectation from Customer having less than 1 year of partnership with case company

EOY2= Expectation from Customer having 1 to 2 years of partnership with case company

EOY3= Expectation from Customer having 3 to 5 years of partnership with case company

EOY4= Expectation from Customer having over 5 years of partnership with case company

Checking on the table 5.1 below, the test of between-subjects effect to all of rating items, a finding is that the expectation means exhibit no significantly different except the item 14, thus, due to inconformity to the hypothesis as above, it is concluded that the test was null, and H_0 sustained.

Table 5.1, test of between-subjects effect in customer's expectation

		Sum of Squares	df	Mean Square	F	Sig.
a21	Between Groups	.144	3	.048	.145	.933
	Within Groups	28.103	85	.331		
	Total	28.247	88			
a31	Between Groups	.783	3	.261	.818	.487
	Within Groups	27.127	85	.319		
	Total	27.910	88			
a91	Between Groups	.755	3	.252	.779	.509
	Within Groups	27.492	85	.323		
	Total	28.247	88			
a111	Between Groups	1.393	3	.464	1.442	.236
	Within Groups	27.371	85	.322		
	Total	28.764	88			
a131	Between Groups	3.410	3	1.137	1.721	.169
	Within Groups	56.140	85	.660		
	Total	59.551	88			
a141	Between Groups	4.406	3	1.469	4.235	.008
	Within Groups	29.481	85	.347		
	Total	33.888	88			
a151	Between Groups	.818	3	.273	.608	.556
	Within Groups	33.205	85	.391		
	Total	34.022	88			
a161	Between Groups	.695	3	.232	.445	.722
	Within Groups	44.316	85	.521		
	Total	45.011	88			
a171	Between Groups	1.535	3	.512	.733	.535
	Within Groups	59.274	85	.697		
	Total	60.809	88			

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

Given the test result of above, it is suggested **that case company should focus more on giving aging customers the best of service support, especially on 9 items specified above for they have strongly affected customer's rating.**



2. For Different Model Purchaser (B2)

Due to characteristics of marketing for case company is almost 95% depending on the niche market, meaning that the sales channel is not as open as other commercial units but much depending on a differentiation base, one of attributes in this market is that product mostly runs independently. Seldom the case do customers buy 2 or more series of product in parallel to hit the same market.

Thus, as we check on the result from figure 5.2 below, strong evidence indicates that customers of A series have a much higher scoring than the customers of other models, like W or CA series. The reason to explain this phenomenon is that having a high reliability in quality for the model is the first series introduced to market, A series has won a good reputation of consistency in quality level. Over years of fine tuning in quality, though new generations has been launching to market every year, A series is still standing in peak of profit share when comparing to other product with its price margin, cost of product and warranty repair.

Good quality makes A series provides a good way to do service. In design, the consideration of repairability gives technicians an easy way to do module swap on returned unit, not only can it speedily turn around the RMA units back to customers, but also enable service provider to offer a more reasonable price to customers in terms of cost saving.

In face of the facts of above, the suggestions given for case company are:

- a. The product quality for other model as CA and W series must be improved immediately.**
- b. Since CA series bearing the lowest level of customer satisfaction, more focus on that series performing in service support should be extensively monitored by management level.**

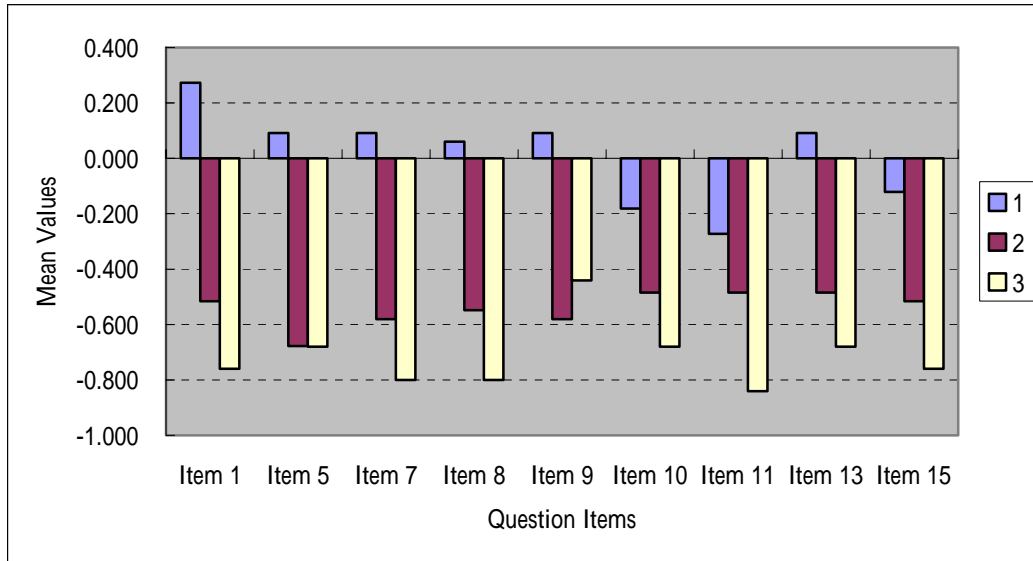


Figure 5.2 The mean value chart for customers grouped by main model purchased

The valid item:

- 1: the A series
- 2: the W series
- 3: the CA series




3. For Customers Having Frequent Contact For Service Support (B3)

Customers having frequent contact for service support could lead to two folds of results: one might degrade his rating for service quality because of recovering in service support can't turn around the down time problem that customer has been experiencing with, while the other might give credit to service provider for their help in quickly solving the problems despite the fact that customers are suffering the quality problem.

By reading the multivariate test result of chapter 4, a message is clear that customer's rating is significantly affected by the frequency of contact for service support. Figure 5.3 provides the primary result as the fewest frequency in contacting for service gets the highest score in quality rating.

However, while closely checking the question items to items by ANOVA test, a different story was found in test result; the P values 0.362 as table 5.2 below indicates no any significant effect is verified on customer's rating in each question item within customers of 5 sub-groups.

Table 5.2 The ANOVA analysis of service quality ranking in customer having years of partnership



Source	DF	SS	MS	F	sig
Mean	23	830.67	36.12	1.39	0.362
Error	6	156.00	26.00		
Total	29	986.67			

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

Though no strong effect is found on product quality related to service quality, still, the suggestion goes as **to improve the quality of product in reducing customer's request for service support so that the unloading of service task would indirectly help perfect the service task and get customer's positive feedback.**

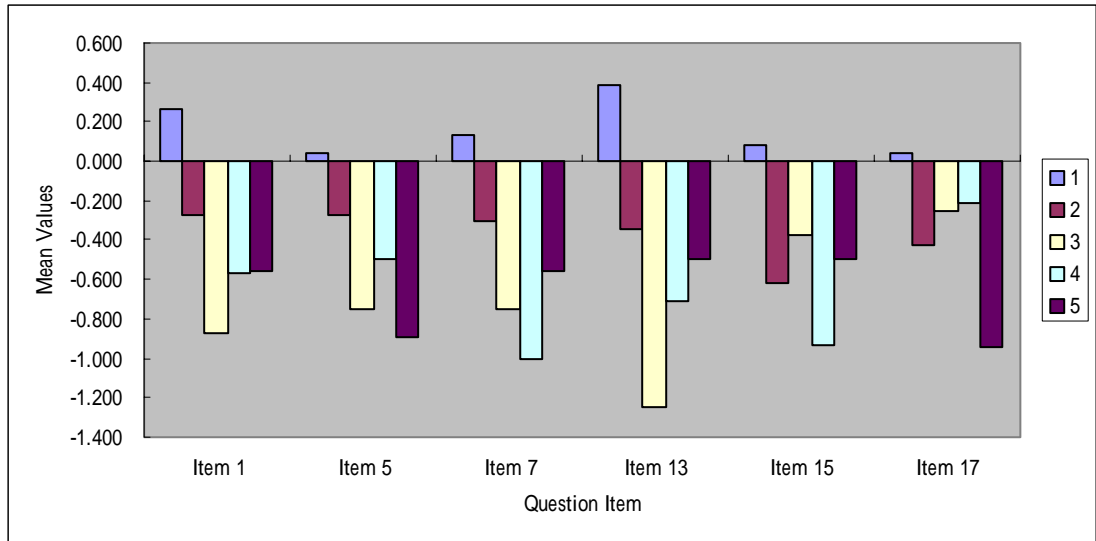


Figure 5.3 The service quality for B3: customers having frequent contact for service support

The valid items:

1. Below 1 time
2. 1-5 times
3. 5-10 times
4. 10-20 times
5. Over 20 times



4. Suggestion For Customers Who Take Case Company As Sole Supplier (B5)

A finding in chapter 4 provided the information that customers grouped by taking case company as sole supplier did show significant effect on service quality rating. Furthermore, given the main value as Figure 5.4 below, a definition is made as higher mean value (the performance) happened on customer employing case company as sole supplier. The finding above provides valuable information that due to certain reasons, customers, mostly the resellers in smaller scale, who take case company as sole supplier would more or less perceive themselves as a small customer with less bargain power, thus, while service provider offering a fair service level, would somehow make them feel more satisfied than customers not taking case company as sole supplier.

To further verify the assumption, the multivariate test of SPSS is provided for making sure that customer taking case company as sole supplier would have lower expectation than that of the company not taking case company as sole supplier. The hypothesis was set as below:

$$H_0 = \mu_{EOS} = \mu_{EOMS}$$

$$H_1 = \mu_{EOS} \neq \mu_{EOMS}$$



Where EOS = customer expectation on sole supplier

EOMS = customer expectation on multiple suppliers

Table 5.3 as below, the means pair-wise comparison, showed that customer's expectation on taking case company as sole supplier is significantly different with customers having multiple suppliers. Thus, H_1 is sustained. A further verification showing the mean values of two groups as figure 5.4 indicates that customers taking case company as sole supplier exhibiting much higher performance rating than that of customers not taking case company as sole supplier.

According to findings above, the suggestion comes as: **Don't leave the smaller customers too much behind from a fair level while putting more efforts to service customers having larger contribution scale with higher revenue scale.**

Table 5.3 The pairwise comparison table of customers' expectations grouped by taken case company as sole supplier

Dependent Variable (I) b5 (J) b5	Mean Difference (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^e		
				Lower Bound	Upper Bound	
a11	1.00 2.00	-.809*	.132	.000	-1.073	-.546
	2.00 1.00	.809*	.132	.000	.546	1.073
a51	1.00 2.00	-.419*	.119	.001	-.656	-.183
	2.00 1.00	.419*	.119	.001	.183	.656
a71	1.00 2.00	-.253*	.120	.038	-.491	-.015
	2.00 1.00	.253*	.120	.038	.015	.491
a81	1.00 2.00	-.418*	.118	.001	-.652	-.184
	2.00 1.00	.418*	.118	.001	.184	.652
a91	1.00 2.00	-.429*	.114	.000	-.656	-.202
	2.00 1.00	.429*	.114	.000	.202	.656
a101	1.00 2.00	-.353*	.120	.004	-.591	-.115
	2.00 1.00	.353*	.120	.004	.115	.591
a111	1.00 2.00	-.296*	.120	.016	-.535	-.057
	2.00 1.00	.296*	.120	.016	.057	.535
a131	1.00 2.00	-.734*	.160	.000	-1.053	-.415
	2.00 1.00	.734*	.160	.000	.415	1.053
a141	1.00 2.00	-.426*	.127	.001	-.678	-.174
	2.00 1.00	.426*	.127	.001	.174	.678
a151	1.00 2.00	-.568*	.121	.000	-.808	-.329
	2.00 1.00	.568*	.121	.000	.329	.808
a161	1.00 2.00	-.688*	.137	.000	-.960	-.416
	2.00 1.00	.688*	.137	.000	.416	.960
a171	1.00 2.00	-.603*	.169	.001	-.938	-.268
	2.00 1.00	.603*	.169	.001	.268	.938

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Confidence Level: $\alpha = 0.95$, sig. 0.05 *, sig. 0.01 **, sig. 0.001 ***.

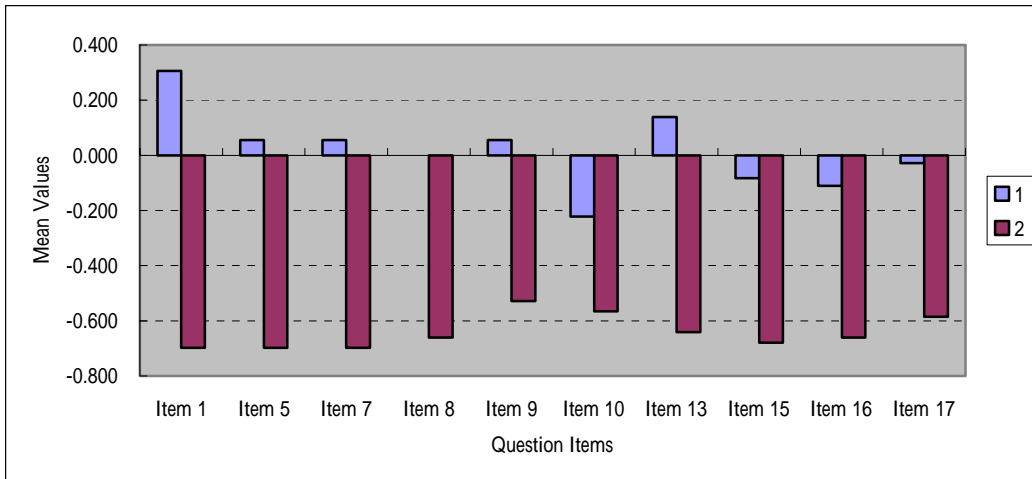


Figure 5.4 Service Quality for B5: customers taking case company as sole supplier



CHAPTER 6 CONCLUSION AND RECOMENDATION

6.1 Conclusion

To recap Garvin's 5 dimensions of quality, a given definition in user base was to say good quality should be based on customer's evaluation, or to be more precisely, the customer satisfaction.

Indeed, what hidden inside of customers is still like a mystery: Many assumptions based on practical experience were proved null or not conformed to the test result, some examples like:

1. An assumption for customers grouped by different originalities should exhibit a strong effect within groups while rating the service quality given the different culture; way of life, or way of management should cause a result of different thinking different rating. However, the test result showed a very different story, in that, against of our expectation is no significant effect found on multivariate test on groups of different originalities in customers (for more detail, viewed as Chapter 4.11.7).
2. Another case goes to question item 12, the TAT (Turn Around Time) requirement is arguably viewed as one of major factors in customer's ranking of service quality, and has been listed in many companies as one of KPI (Key Performance Index) management items. However, a big surprise is this item not even being put on the dimension of high importance, and a result of only 1 importance value (the X value) is something much beyond the expectation before initiating this research.

The uncertainty of customer's behavior has greatly impacted the values of service quality as well as customer satisfaction and made predicting customer's thinking or acting still the biggest obstacle. Limited by the resource of time and scale, incapable of extensively exploring more of customer's attributes is a major shortfall of this research.

6.2 Recommendation

Varying from the B to C business that has occupied most of released papers nowadays, B to B business focusing more on service operation for both parties (customer and supplier), e.g, the quality analysis, the ECR/ECO process, or spare part, RMA process, ... etc, is something that would need much further research.

Thus, it is recommended that readers could start the researches in the area as:

1. To extend the realization of co-relationship between grouped customers and question items without scaling down like the underlined research in gaining the full facet of customer's expectation and perception.
2. To further analyze the discrepancy in customer's expectations between B to B business and B to C business in finding what can be done in linking those two business models when it's mandated for companies to conduct both models in the same time.
3. To work on the field in IT re-engineering process, for which are deemed most concerned in Taiwan 3 C manufacturers.
4. The improvement program of service quality that having too much factors involved in root cause analysis and countermeasure taken to let the research details the improvement process as well as the achievement, thus it is suggested that if possible, reader could start the research of improvement process with tools like TQM or 6 sigma.

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