Service quality attributes determine improvement priority

Shun-Hsing Chen
Department of Industrial Engineering, Chung-Yuan University, Taiwan, and Department of Industrial Engineering and Management, Chin-Min Institute of Technology, Taiwan

Ching-Chow Yang
Department of Industrial Engineering, Chung-Yuan University, Taiwan

Wen-Tsann Lin
Department of Industrial Engineering, Chung-Yuan University, Taiwan and National Chin-Yi Institute of Technology, Taiwan, and

Tsu-Ming Yeh
Department of Industrial Engineering, Chung-Yuan University, Taiwan

Abstract

Purpose – Although there are many quality measurement theories and models, all are imperfect; that is, each has its own advantages and disadvantages. Particularly, some models cannot indicate accurate improvement priorities. The purpose of this study is to develop an integrated performance model that improves service quality and acquires accurate improvement priorities that promote customer satisfaction and eliminate resource wastage.

Design/methodology/approach – This study applied a performance matrix and quality loss function (QLF) theory to determine priority items needing improvement. A questionnaire was designed to determine the priority of improvement objectives derived from certain questionnaire items that do not fall into the appropriate performance zone (APZ) of the performance matrix. Finally, the QLF was adopted to rank the improvement objectives in terms of priority. A large QLF area indicates customer satisfaction needs improvement.

Findings – This study utilized an employee satisfaction survey to demonstrate this matrix, and found that it reflects the improvement priorities of different items and avoids the shortcomings of other models. In this case study, 11 items must be improved; furthermore, five items with the greatest QLF areas became the priority items for improvement.

Originality/value – This performance matrix also considers the items of surplus resource investment, which can be included in improvements, thereby avoiding resource wastage.

Keywords Quality improvement, Performance management, Customer services quality

Paper type Research paper

Introduction

Providing excellent service quality and high customer satisfaction is the important issue and challenge facing the contemporary service industry (Hung *et al.*, 2003). High customer satisfaction and loyalty have long been key concerns for operational management in service industries. Consequently, customer orientation, namely, understanding customer requirements and expectations, is the first step service providers must take to enhance service quality. Service quality plays a critical role in a firm's competitive advantage (Fitzsimmons and Fitzsimmons, 1994). Studies

The TQM Magazine
Vol. 19 No. 2, 2007
pp. 162-175

0954-478X
DOI 10.1108/09544780710730005

investigating service quality have extensively examined service quality measurement to assist practitioners in effectively managing quality service delivery (Parasuraman *et al.*, 1985).

Most businesses agree that customer service quality provided to their target customers affect global business performance and becomes a crucial business strategy (Hung *et al.*, 2003). Many businesses determine their improvement priorities based on surveys that identify items of low customer satisfaction. Although this approach improves some quality attributes, it does not necessarily address actual customer requirements. In the absence of objective measures, businesses must rely on consumers' perceptions of service quality to identify their strengths/weaknesses, and design appropriate improvement strategies. This makes development of psychometrically sound and managerially useful instruments for measuring service quality (Karatepe *et al.*, 2005). Therefore, customer satisfaction must be translated into a number of measurable models that evaluate customer satisfaction and organizational operating efficiency. Service quality measurement models are plentiful, but remain incomplete – each has its own advantages and disadvantages. In particular, certain methods are unable of obtaining improvement priorities (Lewis, 1993). This study presents a novel integrated matrix that improves service quality. The integrated models not only measure customer satisfaction and can be applied to employee satisfaction surveys. This study therefore employs an improvement priority methodology based on employee perceptions of importance and satisfaction. A questionnaire was designed to determine the priority of improvement objectives derived from certain questionnaire items that do not fall into the APZ of the performance matrix. Finally, the QLF of Taguchi *et al.* (1989) is adopted for prioritizing improvement objectives.

Performance model review

The SERVQUAL model is the best-known service quality measurement model (Parasuraman *et al.*, 1985). SERVQUAL model applies the gap model between customer perceptions and expectations of service quality to determine perceived service quality. Based on the service quality gaps in the PZB model, businesses can determine the service quality improvement plans to assess service quality and improve customer satisfaction. Methods such as SERVQUAL have been applied to do customers' satisfaction surveys that replace the expectation values with the importance values. Hung *et al.* (2003) proposed that customer pre-determined expectations on important service elements (importance) and customer perception after service transactions (satisfaction) help to determine the levels of customer service quality. Numerous studies in Taiwan have applied importance and satisfaction surveys rather than the SERVQUAL model in analyzing customer satisfaction (Yang, 2003b). Generally, low satisfaction attributes are those that require improvement. Selecting low satisfaction attributes is not, however, the best improvement approach. Businesses need to improve most are quality attributes that customer regard as important and have low satisfaction. Therefore, if one wishes to improve actual customer satisfaction, one must perform importance-level and satisfaction-level surveys simultaneously. Many scholars often applied many indices to build measurement models. Importance and satisfaction on service elements are two typical indicators applied to evaluate the corresponding service quality performance.

In order to solve the service quality problems and meet the customer requirements, many scholars have applied those two indicators to propose various kinds of models, as follows.

Importance-satisfaction model (I-S model)

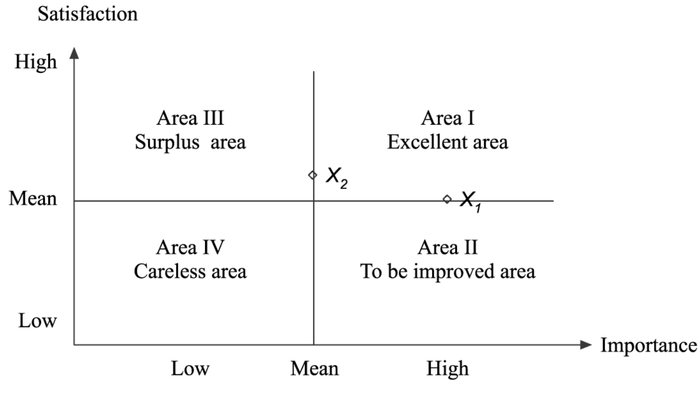
Low-quality attributes should not be the only consideration when designing improvement plans. Usually, the customer (employee) measures the quality of goods or services based on several important attributes or elements (Berry *et al.*, 1990; Deming, 1986). The customer (employee) evaluates product or service quality by considering several important quality attributes; therefore firms must take actions to improve the important attributes with lower satisfaction levels. Figure 1 shows the analytical results of an I-S model survey conducted by Yang (2003a). The results for each quality attribute are placed in the model and then improvement strategies are considered based on the areas of each item.

In the I-S model, all quality attributes were mapped into the performance control matrix, and improvement strategies are then determined according to the region of each attribute. Thus, the I-S model is the best application model for evaluation service quality. Although the I-S model helps business directors to detect improvement in service items, some shortcomings still exist, as listed below:

- For the items located in the "surplus area", meaning they are satisfaction far exceed importance; resources are over invested. However, these items were not listed in the items for improvement.
- Figure 1 shows a problematic situation in which the quality attributes X_1 and X_2 lie on the borderline between two different areas. Therefore, superior ratings become a very difficult decision as the attributes lie in the "excellent area" or the "to be improved area".

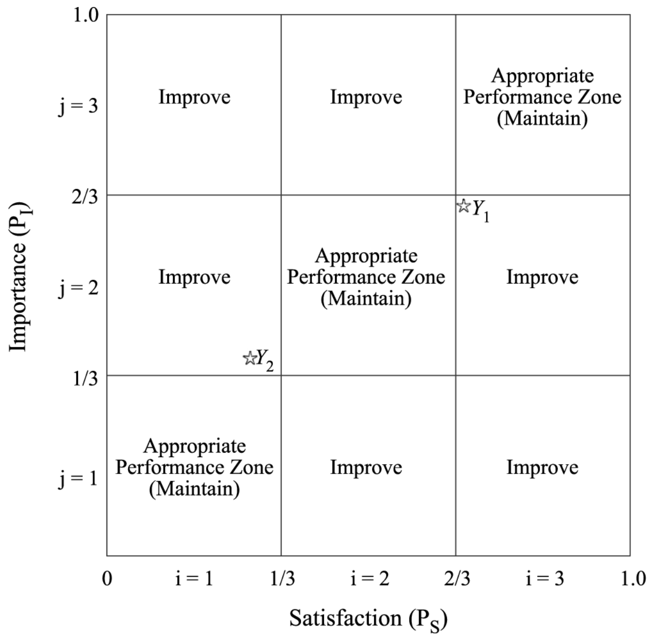
Service quality performance matrix

The performance matrix (Hung *et al.*, 2003) is divided into nine performance zones that represent the effectiveness of various system-improvement items (Figure 2). $B_{ij}(i, j = 1, 2, 3)$ is used to represent the performance zones. B_{13}, for example, is the item with the least satisfaction regarding improvement and the most importance; it is thus the zone



Source: Yang (2003a)

Figure 1. Importance-satisfaction model



Source: Hung *et al.* (2003)

Figure 2.
Service quality performance matrix

that requires most improvement. B_{31} is the item with the greatest satisfaction regarding improvement and the least importance corresponding to greatest effectiveness. With $i = 3$, the three performance zones B_{31}, B_{32}, and B_{33} represent the greatest satisfaction and are called the "greatest satisfaction zone". With $i = 2$, the three performance zones B_{21}, B_{22}, and B_{23} represent medium satisfaction and are called the "moderate satisfaction zone". With $i = 1$, the three performance zones B_{11}, B_{12}, and B_{13} are called the "least satisfaction zone". With $j = 3$, the three performance zones B_{13}, B_{23}, and B_{33} represent the greatest importance and are called the "most important zone". With $j = 2$, the three performance zones B_{12}, B_{22}, and B_{32} represent medium importance and are called the "moderately important zone". With $j = 1$, three performance zones B_{11}, B_{21}, and B_{31} represent the least importance and are called the "least important zone". With $i = j$, the importance of three performance zones B_{11}, B_{22}, and B_{33} equals satisfaction with improvement, and the zone is called the "appropriate performance zone (APZ)". B_{12}, B_{13}, and B_{23} demonstrate that importance is greater than satisfaction; resources to be invested must increase to improve satisfaction. B_{21}, B_{31}, and B_{32} indicate that importance is less than satisfaction; resources to be invested should be decreased to prevent waste. Although the performance matrix helps businesses distinguish superior and inferior service elements, imperfections still exist, as listed in the following:

- The items did not fall into the APZ, meaning they require improvement, but the items were not listed as improvement priorities.
- Figure 2 illustrates a problematic situation in which the quality attributes Y_1 and Y_2 lie on the borderline of APZ. Therefore, assigning superior ratings becomes

very difficult specifically in terms of deciding whether to list the attributes among the items for improvement.

Establishment of service quality performance model

To determine the best strategy for improving service quality and satisfaction of family members, the present study applied a performance-evaluation matrix (Lambert and Sharma, 1990) and a service-quality performance matrix (Hung *et al.*, 2003). In what follows, the random variable I denotes importance, whereas S denotes satisfaction. A five-point scale was adopted to evaluate the importance and satisfaction of each item. The indices of importance and satisfaction are defined as follows:

$$P_I = \frac{\mu_I - \min}{R} \text{(index of importance)} \tag{1}$$

$$P_S = \frac{\mu_S - \min}{R} \text{ (index of satisfaction)} \tag{2}$$

μ_I and μ_S are the means of importance (I) and satisfaction (S) respectively. Moreover, min = 1 represents the minimum of the k scale and $R = k - 1$ is the full range of the k scale. A lower value corresponds to an item that is of lesser importance or lesser satisfaction. Clearly, these two indices are within (0, 1). For example, on a five-point scale ($k = 5$) with $R = 5 - 1 = 4$, when the importance (or satisfaction) exceeds 3 (medium), the corresponding index will exceed 0.5 and the integral average importance (or satisfaction) will be positive. In contrast, when the average importance (or satisfaction) is below 3 (medium), indices will be below 0.5 and the integral average importance (or satisfaction) will be negative. Consequently, the values of the indices represent a convenient and efficient tool with which business management can evaluate the effectiveness of an improvement strategy.

The coordinates in the performance matrix proposed by Hung *et al.* (2003) cannot, on their own, objectively diagnose performance or judge the required improvements when they fall within (or come very close) to the APZ. Consequently, in the present study, the area of a performance matrix and the concepts of the quality-loss function (Taguchi *et al.*, 1989) were integrated to set up a control boundary model. Performance control upper and lower limits were established according to the coordinates and the area enabling objective diagnosis and judgment of required improvements to be performed. Taguchi *et al.* (1989) considered that product quality traits should be as close as possible to the target values because a more distant target value increases the loss. That is, a bigger loss area represents a higher cost loss, and vice versa.

Different coordinates $[P_I, P_S]$ of performance indices form different areas. First, the Shewhart control chart (Montgomery, 1991) was defined as the performance control line and the target value was set at 0. Based on heuristics, 99.73 percent of the indices fell within ± 3 standard deviations, which indicates a failure rate of about 0.27 percent, 95.44 percent of which fell within ± 2 standard deviations, indicating a failure rate of 4.56 percent, and 68.26 percent fell within ± 1 standard deviations, indicating a failure rate of about 31.74 percent. If ± 3 and ± 2 standard deviations were applied in this study, unqualified items could not be located. The failure rate was extremely low. Thus, the ± 1 standard deviation was used to establish the performance upper control limit (PUCL) and the performance lower control limit (PLCL) as follows:

$$\text{PUCL} = \text{T} + \sigma$$

$$\text{PCL} = \text{T} = 0$$

$$\text{PLCL} = \text{T} - \sigma$$

The square area in Figure 3 is $1 \times 1 = 1$. If the target value of the diagonal centerline is given by $\text{T} = 0$, the performance matrix can be divided into two triangles, each with an area of 0.5. When the coordinates $[P_I, P_S]$ fall on c, an isosceles triangle ($\triangle cde$) with an area of A is formed by extending it to the center line $\text{T} = 0$. According to Taguchi *et al.* (1989), a large area A with abnormal coordinates outside PLCL (zone E) demonstrates that importance is greater than satisfaction. When a performance index is moved towards the performance control line, resulting in a negative performance value, resources to be invested must increase to improve satisfaction. In contrast, a large area A of abnormal coordinates outside PUCL (zone F) indicates that importance is less than satisfaction. When a performance index is moved towards the performance control line, resulting in a positive performance value, resources to be invested should be decreased to prevent waste.

Area A can be calculated through Figure 3. Suppose the area of the isosceles triangle ($\triangle cde$) is A_1, then:

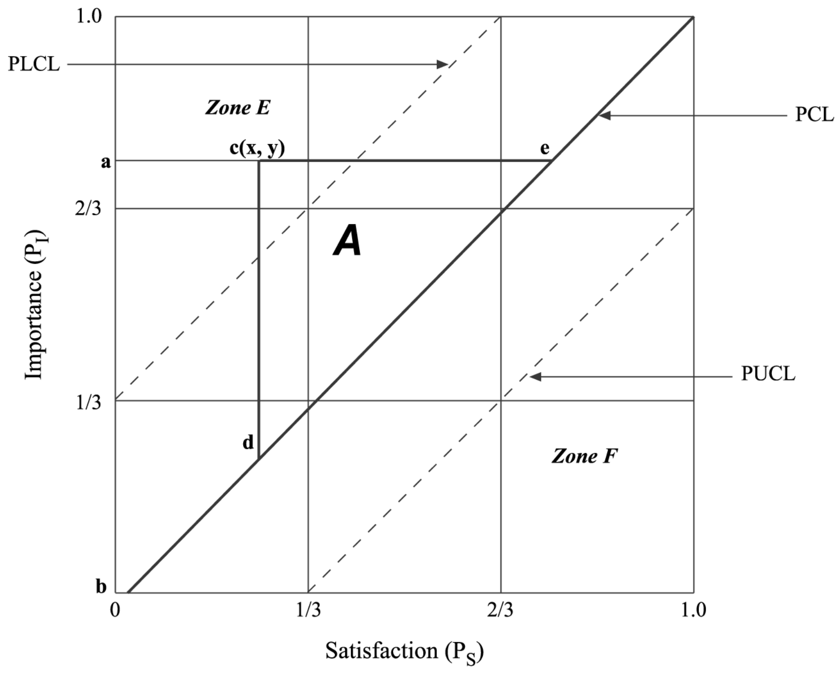


Figure 3.
Quality loss function of area A

$$\overline{ab} = \overline{ae} = y$$

$$\overline{ac} = x$$

$$\overline{cd} = \overline{ce} = \overline{ae} - \overline{ac} = y - x; x, y = 0\text{~}1$$

Suppose there are n coordinates of importance and satisfaction performance indices, which would result in area A of n isosceles triangles ($\triangle cde$). In addition, the original formula of (bottom × height)/2 was modified to (bottom × height), as before.

$$\text{Let } c(x, y)$$

$$\text{Then } e(x_1, y), d(x, y_1)$$

$$A_1 = \overline{cd} \times \overline{ce} = (y_1 - y) \times (x_1 - x)$$

$$A_i = (y_i - y) \times (x_i - x)$$

Because, $y_i - y = x_i - x$

$$A_i = (y_i - x_i)^2 \tag{3}$$

$$A_i = \tilde{0}1, i = \tilde{1}n$$

Accordingly, different coordinates [P_I, P_S] of performance indices form various areas. The PUCL and the PLCL cannot be calculated until the mean μ and the standard deviation σ of all areas A_i are known. Suppose each item for an organization introducing employees satisfaction survey is subject to normal distribution, μ and σ can be obtained as follows:

$$\mu = \frac{\sum_{i=1}^{n} (y\mathrm{i} - x_i)^2}{n} \tag{4}$$

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} (y_i - x_i)^4}{n} - \mu^2} \tag{5}$$

According to the upper and lower control lines defined above, equations (6) and (7) can be derived as follows:

$$PUCL = T + \sigma = \sqrt{\frac{\sum_{i=1}^{n}(y_i - x_i)^4}{n} - \mu^2} \quad (6)$$

$$PCL = 0$$

$$PLCL = T - \sigma = -\sqrt{\frac{\sum_{i=1}^{n}(y_i - x_i)^4}{n} - \mu^2} \quad (7)$$

The performance control line model is mapped onto the performance matrix. Management attends to only with the items located outside the control lines for improvement. This decreases time and cost, and serves as an extremely powerful tool.

Empirical analysis

Questionnaire design and structure

The employees are internal customers of the business, so this study uses a questionnaire of employee satisfaction survey to verify this matrix. The author of this study recently designed a questionnaire referring to employee satisfaction surveys in the high-tech industry. The following dimensions were used (Chen *et al.*, 2004):

- work environment (seven items);
- pay and benefits (nine items);
- management systems (14 items);
- motivation (four items); and
- organization vision (five items).

Table I shows the items used for measuring employee satisfaction with this industry (Table I). The satisfaction survey scale ranged from 1 to 5 (1 represents extremely dissatisfied, 5 represents extremely satisfied, intermediate points designate from 2 to 4). The importance survey is also the same.

Data collection and analysis

The questionnaire was distributed to the employees of production line in a high technology business in Taiwan. In all, 400 questionnaires were distributed and 312 were returned (a response rate of 78 percent). Reliability was assessed by Cronbach's alpha using SPSS software. Cronbach's alpha for employee importance was 0.9596, and for employee satisfaction it was 0.9648 indicating that the questionnaires were extremely reliable. Following return of the completed questionnaires, reliability and validity were analyzed for the five dimensions. According to Gay (1992), a reliability coefficient exceeding 0.8 for any test or scale is the minimum acceptable reliability coefficient. In terms of content validity, as noted above the questionnaire had been designed on the basis of related studies, consultation with human-resources directors, and discussion with employees. The questionnaire thus had high reliability and

No.	Items	u_I	u_S	P_I	P_S	A_i
1	Provision of convenient parking	4.727	2.194	0.9317	0.2985	0.400866
2	Provision of hygienic dining environments	3.002	4.249	0.5004	0.8124	0.097293
3	Provision of diversiform dining serving	3.010	4.013	0.5026	0.7532	0.062835
4	Space planning of the working environment	3.288	3.795	0.5721	0.6988	0.016073
5	Shipshape and clean of the working environment	2.579	4.046	0.3947	0.7614	0.134444
6	Safety and comfortable of the workplace	3.176	4.169	0.5439	0.7922	0.061631
7	Noise suppression of the working environment	3.017	3.657	0.5042	0.6642	0.025600
8	Provision of good salaries	4.561	2.985	0.8904	0.4963	0.155287
9	Provision of job security	4.558	2.352	0.8895	0.3381	0.304101
10	Provision of good retirement arrangements	4.250	2.977	0.8126	0.4942	0.101392
11	Provision of lodging, travel welfare allowances	3.535	3.912	0.6337	0.7281	0.008902
12	Provision of subsidies for further education	3.229	4.404	0.5574	0.8509	0.086156
13	Provision of subsidy for meal and traffic	3.360	4.265	0.5901	0.8163	0.051146
14	Handle the diversification of the tourist activity	2.758	4.306	0.4395	0.8265	0.149769
15	Planning of employee's education and training	3.762	3.071	0.6904	0.5176	0.029846
16	Subsidize the funds for employee's education and training	3.756	4.918	0.6890	0.9795	0.084436
17	The business pay attention to talent training	4.698	3.279	0.9245	0.5698	0.125827
18	Provision of fair promotion systems	4.347	2.686	0.8368	0.4215	0.172435
19	Provision of innovation management systems	3.741	3.684	0.6853	0.6709	0.000208
20	Clear system of rewards and penalties	3.814	2.621	0.7035	0.4053	0.088901
21	Directors with leadership and managerial capacity	3.523	3.360	0.6308	0.5901	0.001659
22	Open system of directors' assignation	4.058	3.374	0.7645	0.5935	0.029227
23	Provision of smooth communication channels	4.126	2.637	0.7816	0.4093	0.138590
24	Provision of high-quality service processes	3.351	3.097	0.5877	0.5241	0.004044
25	Provision of complete job pre-training for novice employees	3.343	3.785	0.5858	0.6962	0.012203
26	The superior encouragement and care to employees	3.320	3.725	0.5799	0.6813	0.010271
27	Provision of accredit arrangement for expatriated employees	3.298	3.684	0.5746	0.6711	0.009311
28	Provision of institutionalized job adjust systems	4.377	2.476	0.8443	0.3691	0.225828
29	Provision of complete performance assessment systems	3.934	2.647	0.7334	0.4118	0.103470
30	Provision of flexible working system	3.537	3.527	0.6342	0.6318	0.000006
31	Provision of plentiful an annual bonus	4.756	2.363	0.9390	0.3407	0.357910
32	Provision of Profit-Sharing Plan	4.900	2.006	0.9749	0.2515	0.523331
33	Provision of fair distribution operation results	4.216	3.877	0.8041	0.7193	0.007186
34	Provision of encouragement bonus in good time	4.541	3.854	0.8852	0.7135	0.029489
35	Let the employees understand businesses operation conditions	4.535	3.548	0.8837	0.6370	0.060877
36	Help the employees to develop self-visions	3.494	3.791	0.6235	0.6977	0.005495
37	Let the employees for business feel confident	3.441	3.646	0.6103	0.6615	0.002621
38	The CEO and high-level executive manage the idea	3.663	4.126	0.6657	0.7814	0.013393
39	Future development plan of the businesses	3.610	3.976	0.6526	0.7440	0.008348

Table I.
Relative performance value of case study

validity. Table II identifies all indices with their individual dimensions, and reliability coefficients (Table II).

Calculation of P_I and P_S

The importance mean and satisfaction mean of the 39 items in the performance matrix were initially calculated and transformed to P_I and P_S using equations (1) and (2), and were then entered in the proposed performance matrix (Table I). Areas A_i of 39 items were calculated by equation (3) and the mean $\mu = 0.094882$ and the standard deviation $\sigma = 0.11937$ were calculated using equations (4) and (5). Next, mean μ and standard deviation σ were brought into equations (6) and (7) for the PUCL $= 0.11937$ and the PLCL $= -0.11937$. The abnormal coordinates outside PUCL and PLCL were located after drawing the control lines (marked in a gray background).

Location of abnormal items

The areas A_i of the 39 items in the performance matrix were calculated by equation (3). These coordinates were mapped into the performance matrix (Figure 4). The abnormal coordinates outside PUCL and PLCL were located after drawing the control lines. Abnormal coordinates were found outside PUCL in items 5 and 14. This indicated that resources should be reduced in these items to avoid waste. Items found outside PLCL included items 1, 7, 8, 17, 18, 23, 28, 31, and 32. This indicated that resources should be increased in these items to promote employees satisfaction. A positive or negative value was then assigned to the performance matrix area of each set of abnormal coordinates.

Determination of improvement priority

If an organization possesses abundant resources, general improvement can be made; however, if resources are limited and only a few items can be improved, some items have to be selected as priorities (Yang, 2003a). Taguchi *et al.* (1989) proposed the evaluation of the quality level of products using the loss function approach according to three methods, nominal-the-best (NTB); smaller-the-better (STB); and larger-the-better (LTB). The present study adopted the "larger-the-better" method, in which a large loss function area indicates improvement priority. In this study, the five items with the greatest loss function area became the priority items for improvement (Table III):

(1) Provision of profit-sharing plan.

(2) Provision of convenient parking.

(3) Provision of plentiful an annual bonus.

Dimensions	Importance survey Cronbach's α	Satisfaction survey Cronbach's α
Work environment	0.878	0.856
Pay and benefits	0.869	0.876
Management systems	0.805	0.819
Motivation	0.952	0.962
Organisation vision	0.928	0.937

Table II.
Reliability and validity for the five dimensions of employee importance and satisfaction survey

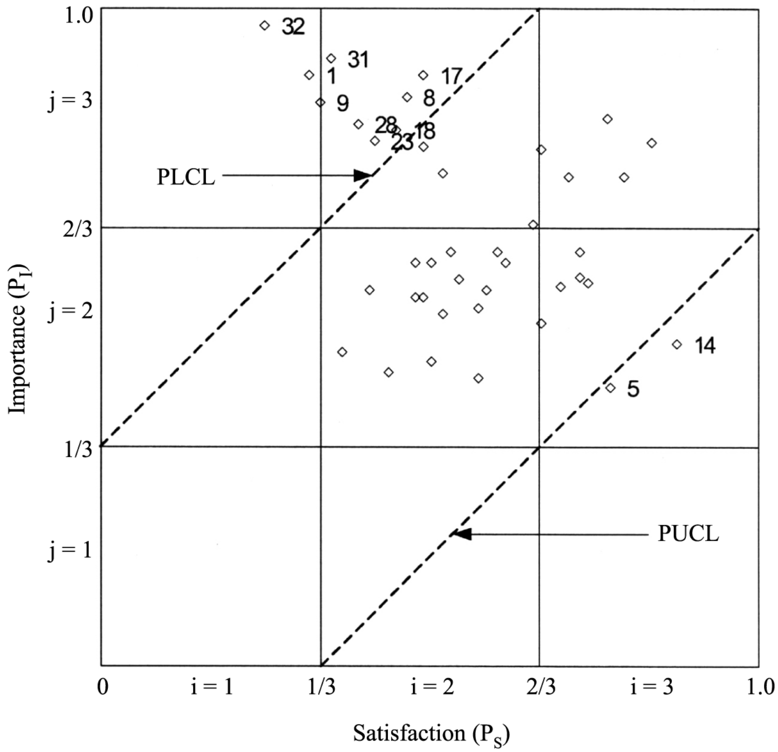


Figure 4.
Performance matrix of case study

Table III.
Improvement priority of case study

No.	Items	A_i	Priority
32	Provision of profit-sharing plan	0.523331	1
1	Provision of convenient parking	0.400866	2
31	Provision of plentiful an annual bonus	0.357910	3
9	Provision of job security	0.304101	4
28	Provision of institutionalized job adjust systems	0.172435	5
18	Provision of fair promotion systems	0.155287	6
8	Provision of good salaries	0.149769	7
14	Handle the diversification of the tourist activity	0.140785	8
23	Provision of smooth communication channels	0.138590	9
5	Shipshape and clean of the working environment	0.134444	10
17	The business pay attention to talent training	0.125827	11

(4) Provision of job security.

(5) Provision of institutionalized job adjust systems.

Discussion of case study

A total of 11 items must be improved. Because the resources of the business are limited, the 11 items cannot be simultaneously and completely improved; thus it is necessary to set a priority for improvement. Among them, items 5 and 14 involve monetary waste caused by overspending. The extra resources should be shared with other items that are lacking resources. There is no need to devote extra resources to items 5 and 14; so they can be improved more easily. The following lists details of the top five items that require improvement.

The high-tech industry requires highly educated and skilled employees. In Taiwan, high-tech businesses generally use profit-sharing plan to attract talent, and expect to keep the hard core of employees to boost employee morale. During good economic times, the stocks allotted to individual employees can be worth millions of Taiwan dollars per person. However, many employees still feel that the allotment is unfair and insufficiently generous. These employees hope to receive more stock allotments. Therefore, businesses should make it a priority to improve the fairness of stock allotment systems. The second problem that needs to be improved is the parking plan. Most high-tech businesses are located in the Hsinchu Science Park or Industrial Park in Taiwan. There are a lot of businesses in these areas. These areas contain numerous businesses and suffer problems like traffic jams and insufficient parking during peak periods. Therefore an urgent action plan for improvement is required, such as adopting mass transportation or car pool systems. Such methods can reduce employee complaints. The third problem that needs to be improved is an annual bonus system. An annual bonus is the performance of hard working during the entire year. When employees are satisfied with the appropriation of an annual bonus, they will be less likely to jump ship for other companies immediately after the appropriation. Since the bonus is very important to employees an appropriation system should be established immediately for determining and distributing fair bonus levels.

The fourth problem that needs to be improved is the job security system. Owing to the short lifecycle of high-tech products, and given the rapidly changing nature of market demand (Aydogan, 2002). The frequent use of employee lay-offs by businesses in response to problems, where the problems frequently result from a bad economic environment or poor investments, creates among employees a feeling of job insecurity. Therefore, businesses must establish a job-security system that allows employees to work peacefully and ensures sustainable development of the business. Finally, employees often face problems related to unwanted overtime or changes in their shifts. Due to the inflexible systems adopted by businesses and the shortage of shift workers, it is impossible to fulfill the wishes of all employees. Most production line employees are female, and they often have to sacrifice holidays to work. This overtime impacts the ability of these employees to care for their families, and thus affects their family life, producing negative emotions. The business thus must establish an urgent duty-shift system as soon as possible, while also striving to plan carefully and minimize changes to scheduled shifts. Meanwhile, when urgent situations arise businesses should inform employees immediately.

Service quality is usually used in customer satisfaction surveys, and is seldom used in employee satisfaction reviews. This study adopted the employee satisfaction survey as an example to demonstrate this matrix, and found that it reflexes the improvement priority of different items and avoids the shortcomings of other models. This study also considers the items of surplus resources investment, which can be included in the improvement and to avoid resources wastage (This is the problem that is usually being ignored during the improving process). The resources of organizations can then be boosted to maximize efficiency.

Conclusion

This study integrated scientific approaches, namely, a performance matrix and QLF theory, to improve shortcomings in previous research. The purposes of service quality attribute surveys are to understand actual customer satisfaction levels, and to determine necessary improvements via service quality survey results. Businesses generally determine enhancement priorities based on low satisfaction attributes, rather than by considering actual customer requirements. Although this approach improved some dissatisfied quality attributes, these attributes are not the primary concern of customers. Consequently, substantial amounts of money are spent on improving items without actually improving customer satisfaction. Therefore, businesses must perform importance-level and satisfaction-level surveys simultaneously. This study presented a complete assessment model that helps managers locate improvement items, and promotes efficiency and timeliness of service processes following considering cost and time. On the base of the academic support, the proposed model is combined with loss function theory for employee satisfaction survey in high-tech industry. Unlike other performance matrix that generates insufficient results, this study proved that the model generates positive results for satisfaction improvement priority. However, as calculating the loss function is very complex, we recommend simplifying the calculation process and integrated it with other theories in future research.

References

Aydogan, N. (2002), "Notes on the merger strategy of high versus low-tech industries: complementarities and moral hazard", *Economics Bulletin*, Vol. 12 No. 7, pp. 1-12.

Berry, L.L., Zeithaml, V.A. and Parasuraman, A. (1990), "Five imperatives for improving service quality", *Sloan Management Review*, Vol. 31, pp. 29-38.

Chen, S.H., Yang, C.C. and Pan, Z.L. (2004), "Establishment and application of hi-tech employees satisfaction model", paper presented at the 2004 Industry Management Innovation Conference, Taizhong.

Deming, J. (1986), *Out of Crisis*, MIT Press, Cambridge, MA.

Fitzsimmons, J.A. and Fitzsimmons, M.J. (1994), *Service Management for Competitive Advantage*, McGraw-Hill, New York, NY.

Gay, L.R. (1992), *Educational Research Competencies for Analysis and Application*, Macmillan, New York, NY.

Hung, Y.H., Huang, M.L. and Chen, K.S. (2003), "Service quality evaluation by service quality performance matrix", *Total Quality Management and Business Excellence*, Vol. 14 No. 1, pp. 79-89.

Karatepe, O.M., Yavas, U. and Babakus, E. (2005), "Measuring service quality of banks: scale development and validation", *Journal of Retailing and Consumer Services*, Vol. 12, pp. 373-83.

Lambert, D.M. and Sharma, A. (1990), "A customer-based competitive analysis for logistics decisions", *International Journal of Physical Distribution & Logistics Management*, Vol. 20 No. 1, pp. 20-3.

Lewis, B.R. (1993), "Service quality measurement", *Marketing Intelligence & Planning*, Vol. 11 No. 4, pp. 4-12.

Montgomery, D.C. (1991), *Statistical Quality Control*, John Wiley & Sons, New York, NY.

Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1985), "A conceptual model of service quality and its implication for future research", *Journal of Marketing*, Vol. 49 No. 9, pp. 41-50.

Taguchi, G., Elsayed, E.A. and Hsiang, T.C. (1989), *Quality Engineering in Production Systems*, McGraw-Hill, New York, NY.

Yang, C.C. (2003a), "Improvement actions based on the customers' satisfaction survey", *TQM and Business Excellence*, Vol. 14 No. 8, pp. 919-30.

Yang, C.C. (2003b), "Establishment and applications of the integrated model of the measurement of service quality", *Managing Service Quality*, Vol. 13 No. 4, pp. 310-24.

About the authors

Shun-Hsing Chen is a PhD candidate, Department of Industrial Engineering Chung-Yuan Christian University, and an Associate Professor, Department of Industrial Engineering, Chin-Min Institute of Technology. His research interests include quality management, service quality management, and higher education management. Chen once served as an educational administration executive, Chin-Min Institute of Technology for ten years. He honors remarkable contribution on quality management and performance evaluation of higher education, published education and management articles on relevant magazine. Shun-Hsing Chen can be contacted at: k872790@yahoo.com.tw

Ching-Chow Yang is a Professor at the Department of Industrial Engineering, Chung-Yuan Christian University in Taiwan. He teaches courses in project management, total quality management, quality management of service business, and policy and strategy management. He is presently on the board of assessors for the National Quality Award of the Republic of China (ROC). Yang has consulted for more than 100 companies in Taiwan and in Mainland China, on policy and strategy management, project management and total quality management studies. He leads several project teams in total quality management, six-sigma approaches in some manufacturing and service industries. He has published books on total quality management and service quality management.

Wen-Tsann Lin is a Professor at the Department of Industrial Engineering and Management, National Chin-Yi Institute of Technology, and a PhD candidate, Department of Industrial Engineering Chung-Yuan Christian University. His research interests include performance management, management information systems, and service quality management. He has also published numerous journal articles and conference papers. Lin once served as an educational administration executive, Chin-Yi Institute of Technology for 23 years. He honors remarkable contribution on quality management and performance evaluation of higher education.

Tsu-Ming Yeh is a PhD candidate at the Department of Industrial Engineering, Chung-Yuan Christian University. His research interests include quality management, service management, and operations management.