

Performance examination of the operations of a bank teller

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Abstract

To increase banking efficiency, this study presents a convenient and efficient index to evaluate a bank teller's the performance. This work presents a teller performance analysis chart by adopting the similar methodology of Vännman (1999) and Chen et al. (2001) to compare the operation performance of bank tellers. The proposed approach enables bankers to assess individual teller performance objectively from the chart to improve both teller performance and overall quality of service.

Keywords : Teller performance, performance index, multi-teller performance analysis chart.

1. Introduction

Many studies have demonstrated that the service sector accounts for an increasing proportion of gross domestic product (GDP) and employs a growing percentage of the workforce compared to the manufacturing sector in post-industrial regions, such as Europe, Japan and the United States. Newly industrialized nations like Korea and Taiwan also exhibit a similar phenomenon. The service sector has become the most important sector in many countries. Customer satisfaction in this sector is improved by providing fast, efficient, and high-quality service.

Dickson (1966) found that high quality and reliable delivery are essential for components' suppliers. Weber et al. (1991) obtained the same findings in a similar investigation 25 years later. Those two studies demonstrate that high quality and timely delivery are of priority concern to manufacturing customers. High quality and timely delivery can also attract customers in general service sectors.

Numerous scholars have examined quality characteristics in the service sector to develop efficient quality management methods in order to satisfy customer requirements and ensure satisfaction. Such studies include Takeuchi and Quelch (1983), Parasuraman et al. (1985), Parasuraman et al. (1991), Cronin et al. (1992), Cronin et al. (1994), and Chen and Yang (2000). All of these studies examine satisfaction with service quality, as well as discuss service structures and concepts.

Liang et al. (2000) and Chen et al. (2001) examine the performance of a bank and an administrative organization, respectively, by using service time as an indicator of quality. The two studies assume that service time X is a Smaller-the-Better quality characteristic. However,

considerable manpower is required to handle numerous operations in a typical commercial banking business. Furthermore, bank tellers are constantly influenced by all sorts of noise factors, including uncertainty of customer requests and customer inquiries. These factors may affect work quality by reducing service time, thus reducing customer satisfaction and perhaps resulting in the loss of some customers. On the other hand, lengthening service time to maintain high quality can increase customer waiting time to an unacceptable level, decrease customer satisfaction, and lead to the loss of customers and business. To ensure good service quality and service speed, banks should aim to improve their overall operation service procedures by pre-setting service time T as a reasonable standard.

The operation finishing time varies according to numerous influences on service operation time. Consequently, the reasonable operation time T should be defined for each operation, along with a suitable tolerance time d . Given a suitable tolerance time, the tolerance range is $[L, U]$, where $L = T - d$ represents the minimum tolerance of service operation time. According to the above argument, service operation time is clearly a Nominal-The-Best type quality characteristic. Assuming real service operation time ($X \sim N(\mu_x, \sigma_x)$) and square loss function $f(x) = (x - T)^2$, the expected loss is minimized when the average value of service operation time μ_x equals the expected delivery T . When $X > U$, the delay in the service operation time means that the service operation is being performed badly. When $X < L$, the quality of service operation will probably be loss-making. Nevertheless, the service operation efficiency will not be compromised.

According to the transaction service times of various kinds of tellers, a performance index for evaluating a service operation is developed, by adjusting the method used to evaluate the quality index. The following discusses the properties of the index and provides a convenient and efficient method for evaluating the performances of numerous tellers simultaneously. The method designed here provides an objective basis for assessing teller performance and improving service operation time, and thus is invaluable to managers.

2. Performance index for service operation

The transactions conducted at a unitary counter window at a commercial bank include new account openings, withdrawals, transfers, bill payments, term deposits, and so on. To preserve generality, this study assumes that k tellers are available to handle a total of h kinds of

transactions. If a random variable X_i denotes the operation time of the i th transaction, T_i represents the operation time for a standard service, and d_i is the tolerant inaccuracy, then the tolerance range for service operation time is $[L_i, U_i] = [T_i - d_i, T_i + d_i]$, $i = 1, \dots, h$. Since the tolerance range for service operation time ($[L_i, U_i]$) differs for each transaction, for convenient assessment of operation performance, a random variable $Y_i = (X_i - T_i)/d_i$ was set as a transformable value of operation time. Clearly, the tolerance range for service operation time can be transformed to $(L_i, U_i) = (-1, 1)$. Accordingly, the standard service operation time is transformed to $T_i = 0$, and the tolerance range for service time is transformed to $d_i = 1$. To assess the operation performance for each teller, a random variable W_j is set to represent the operation time that the j th teller spends on handling a transaction ($j = 1, \dots, k$). $W_{j1}, \dots, W_{jl}, \dots, W_{jn_j}$ are assumed to denote a set of random samples with size n_j , where W_{jl} represents the actual operation time that teller j spends on the l th transaction. Because the probability of each teller has a random probability of undertaking each type of transaction, the l th transaction could be anyone among the h types of transactions. For example, if teller j happens to perform a set of three different transactions, following the sequence the fourth, third and second type of transactions, then $W_{j1} = Y_4$, $W_{j2} = Y_3$, and $W_{j3} = Y_2$. The same method can be applied to the remainders.

The transaction operation time is appropriate when the value of W_j falls into the range $(-1, 1)$. An appropriate transaction operation time indicates that the operation performance of the teller improves with increasing percentage of properly performed transactions. Consequently, this study modifies the process capability index developed by Boyles (1994) to assess the operation performance of a bank teller.

The performance index of the operations of a bank teller is shown as follows:

$$I_j = \phi^{-1} \left\{ \frac{1}{2} \left(\Phi \left(\frac{1 - \mu_j}{\tau_j} \right) + \Phi \left(\frac{1 + \mu_j}{\tau_j} \right) \right) \right\}$$

where $\tau_j = [(\mu_j)^2 + (\sigma_j)^2]^{1/2}$, μ_j equals the mean of W_j , σ_j equals the standard differential value of W_j , and Φ denotes the distribution function of standard normal accumulation. The transaction operation time is appropriate when the value of W_j falls into the range $(-1, 1)$, and thus the percentage of properly performed transactions, (p_j) , for teller j can

be expressed as follows:

$$\begin{aligned}
 p_j &= P(-1 < W_j < 1) \\
 &= P\left(-\frac{1 - \mu_j}{\sigma_j} < Z < \frac{1 - \mu_j}{\sigma_j}\right) \\
 &= \Phi\left(\frac{1 - \mu_j}{\sigma_j}\right) - \Phi\left(-\frac{1 + \mu_j}{\sigma_j}\right) \\
 &= \Phi\left(\frac{1 + \mu_j}{\sigma_j}\right) + \Phi\left(\frac{1 - \mu_j}{\sigma_j}\right) - 1
 \end{aligned}$$

where $Z = (W_j - \mu_j)/\sigma_j$. Since $\tau_j = [(\mu_j)^2 + (\sigma_j)^2]^{1/2} \geq \sigma_j$, then

$$\Phi\left(\frac{1 + \mu_j}{\sigma_j}\right) + \Phi\left(\frac{1 - \mu_j}{\sigma_j}\right) \geq \Phi\left(\frac{1 + \mu_j}{\tau_j}\right) + \Phi\left(\frac{1 - \mu_j}{\tau_j}\right).$$

Thus, $p_j \geq 2\Phi(I_j) - 1$. Obviously, when the value of the performance index I_j is sufficiently large then the percentage of properly performed transactions is also high. For example, when the index $I_j = 1.0$, then the percentage properly performed transactions (p_j) for teller j is exceeds 68.27% ($p_j \geq 2\Phi(1.0) - 1 = 68.27\%$). Consequently, the index I_j provides a reasonable means of evaluating teller performance. In practical applications, this index provides a convenient and efficient reference tool for managers to use in assessing the performance of frontline bank staff. Table 1 lists the performance index I_j and the minimum percentage (p_{0j}) of the corresponding transactions, where $p_{0j} = 2\Phi(I_j) - 1$.

Table 1
The value of I_j correspond to p_{0j}

I_j	p_{0j}
1.0	68.27%
1.2	76.99%
1.4	83.85%
1.6	89.04%
1.8	92.81%
2.0	95.45%
2.2	97.22%
2.4	98.36%
2.6	99.07%
2.8	99.49%
3.0	99.73%

3. Evaluation and analysis chart of operation performance

To conveniently and accurately evaluate the operation performance of different tellers, this study uses the methodology of Vännman [12], and Chen et al. (2002) to develop a chart for analyzing teller performance, and thus compares operation performance among bank tellers. First, the relationship between the performance index I_j and the minimum percentage (p_{0j}) in Table 1 can be examined. The requirement value for the index of teller operation performance is set based on targets or strategies of the bank. Meanwhile, Table 2 is assumed to present the values required for constructing the index of operation performance based on the operation performance situation and suggestions for a bank. The values of v_1 and v_2 can be determined based on the background of the industry, the situations of competitors, the expectations of business owners, and so on ($v_1 < v_2$).

Table 2
Index value required versus the operation performance and the suggestion

Performance area	Performance condition	Performance index	Suggestion
A	Excellent	$I_j > v_2$	Encouragement
BL	Best	$v_1 \leq I_j \leq v_2,$ $u_y < 0$	Maintenance/ Encouragement
BR	Good	$v_1 \leq I_j \leq v_2,$ $u_y \geq 0$	Maintenance
CL	Question	$I_j < v_1,$ $u_y < 0$	Self-criticism (Improvement/ Encouragement)
CR	Poor	$I_j < v_1,$ $u_y \geq 0$	Improvement

Continuing, μ_j is used as the x -coordinate and σ_j as the y -coordinate. From Table 2, the contour map presents $I_j = v_1$ and $I_j = v_2$ (as illustrated in Figure 1). The contour map displayed three operation performance areas, and comprises the evaluation and analysis chart for teller performance. Consequently, the operation performance means for k different tellers and the performance coordinate points (μ_j, σ_j) obtained from the standard differential value can be displayed simultaneously on the same

analysis chart. The performance of each teller and some suggestions, as presented in Table 2, can easily be determined based on the area which the performance means fall into.

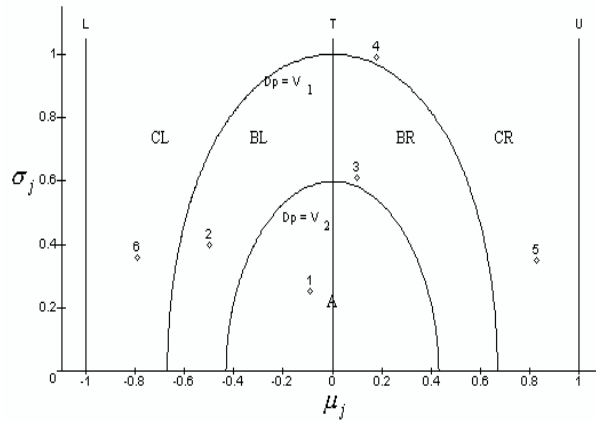


Figure 1
Multi-teller performance analysis chart

Figure 1 illustrates the performances of a total of five tellers. Meanwhile, the operation performance analyses of the five tellers are illustrated below.

1. The performance Teller 1 falls into performance area A. The mean of close to zero ($\mu_1 = -0.09$) indicates moderate operation efficiency, while the very small standard differential value ($\sigma_1 = 0.25$) shows stable operation efficiency. To sum up, the Teller has excellent and stable operation efficiency, and thus is worth rewarding.
2. The performance of Teller 2 falls into performance area BL. The small standard differential value ($\sigma_2 = 0.40$) shows stable operation efficiency, while mean $\mu_2 = -0.50$ indicates high operation efficiency, but the teller requires further review to determine if their operation efficiency influences operation quality. If not, the teller will be more worthy of reward.
3. The performance of Teller 3 falls into performance area BR. The mean of close to zero ($\mu_3 = +0.10$) reveals moderate operation efficiency, while the small standard differential value ($\sigma_3 = 0.61$), reveals stable operation efficiency. To summarize, this teller has good and stable operation efficiency, and so is worthy of rewarding.

4. The performance of Teller 4 falls into performance area CR. The mean of very closed to zero ($\mu_4 = 0.18$) indicates moderate operation efficiency moderate. Operation quality should not be influenced by operation efficiency, but the large standard differential value ($\sigma_4 = 0.99$) reveals unstable operation efficiency. The operation efficiency of this teller is variable, and thus they need to improve their performance.
5. The performance of Teller 5 falls into performance area CL. The mean $\mu_5 = 0.83$ represents low operation efficiency and thus improved performance is needed.
6. The performance of Teller 6 fans into performance area CL. The mean $\mu_6 = -0.81$ indicates excessively high operation speed, which may compromise operation quality. Hence, this teller should review to determine whether operation speed influences operation quality. If not, this teller should not only be encouraged to maintain their good performance but also be rewarded.

Table 3
Index of teller performance versus performance condition

Teller	μ_j	σ_j	Performance area	Performance condition	Suggestion
1	-0.09	0.25	A	Excellent	Encouragement
2	-0.50	0.40	BL	Best	Maintenance/ Encouragement
3	+0.10	0.61	BR	Good	Maintenance
4	+0.18	0.99	CR	Poor	Improvement
5	+0.83	0.35	CR	Poor	Improvement
6	-0.79	0.36	CL	Question	(Improvement/ Encouragement)

4. Assessment steps

To conveniently and accurately assess and analyze the operation performance of each teller, this study sorts a simple evaluation procedure according to the second section. This procedure is shown as follows:

- Step 1.* Setting the values of t_1 and t_2 and drawing a contour map for $I_j = t_1$ and $I_j = t_2$ in the analysis chart of teller performance.
- Step 2.* Gathering all the information on actual operation time, transferring the information according to $Y_i = (X_i - T_i)/d_i$, and calculating mean μ_j and standard differential value σ_j .

Step 3. Depicting the points (μ_j, σ_j) , obtained from the *Step 2*, in the analysis chart of teller performance and directly determining the performance of each teller.

Step 4. Table 3 is created based from the information on the evaluation and analysis chart of teller performance, we can make up. The table is useful in assessing teller performance and offers an objective basis for management to use in improving quality of service.

5. Conclusion

The index of teller operation performance presented in this study provides a convenient and efficient method for evaluating teller performance. The minimum percentage for properly performing the transaction, p_{0j} , can easily be calculated based on the discrepancy between performance index I_j and the corresponding percentage of properly performing the transaction, p_j . Based on the approach of Vännman [12], and Chen et al. (2002), a chart for analyzing teller performance is plotted using the coordinates of the actual average operation and standard difference. This chart provides a convenient method for bankers to objectively assess the performance of individual tellers. Consequently, banker can judge the actual performance of each teller, and can also use the chart as an objective reference basis for improving overall quality of service.

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