PERFORMANCE EVALUATION FOR THE BANKING INDUSTRY IN TAIWAN BASED ON TOTAL QUALITY MANAGEMENT

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ABSTRACT

This study explores critical factors for quality improvement in the Taiwanese banking industry. The study examines eight measurement dimensions. In addition, a hierarchical framework for the Taiwanese banking industry is constructed based on the eight dimensions and various sub-factors. Fuzzy Analytic Network Process (FANP) is utilized to analyze the opinions collected from a sample of experts in Taiwanese banks. The results of this study are that the top five crucial quality factors for the banking industry in Taiwan are Operation and Improvement of Strategy, Customer Relationship Management, Evaluation of Innovation Results, Cross-Organization Management, and Social Responsibility. The article closes with a discussion of key research findings and practical implications for the Taiwanese banking industry.

JEL: C51; C52; M10; G21

INTRODUCTION

Various kinds of organizations have implemented total quality management (TQM) to generate competitive advantage (Nilsson et al., 2001; Chan & Quazi, 2002). In Taiwan companies in different industries face significant competition from both domestic and international companies. Related studies focusing on Taiwanese industries are increasing; however, studies that examine the banking industry is still rare. In addition, mergers have now become an emergent issue for Taiwanese banks. Due to the rising importance of total quality management, some banks' top managers are trying to adopt this philosophy to improve their competitive advantage. Nevertheless, there are still some banks being merged or closing down. The aim of this study is to explore the most critical and effective factors for banks to efficiently conduct quality improvement.

We utilize literature-summarizing methods to identify related measurement factors proposed by recent research. Next, we use in-depth interviews to establish priority measurement factors. A fuzzy analytic network process (FANP) was used to overcome problems of dependence and feedback among dimensions or factors. FANP is a general form of the Fuzzy Analytic Hierarchy Process (FAHP) that releases hierarchical structural restrictions (Liou et al., 2007). In this study, literature-summarizing methods based on National Quality Award (NQA) are utilized in combination with FANP to extract the most critical quality improvement factors for the Taiwanese banking industry. The remainder of the paper is organized as follows. In the next section we discuss the relevant literature. Next, we discuss the Fuzzy Analytic Network process. A discussion of the Data and Methodology, along with a presentation of the results follow. The paper closes with some concluding comments and a discussion of the implications of this research.

LITERATURE REVIEW

Recent studies have observed that quality has a variety of meanings (Sitalakshmi, 2007) causing confusion since each individual's perception of quality differs (Shield, 1999). Since increased quality has been shown to contribute to greater market share, better returns on investments (Philips et al., 1983;

Cole, 1992), lower manufacturing costs, improved productivity (Garvin, 1983) and improved strategic performance (Zhang, 2000), a growing number of firms are placing emphasis on improving quality.

When discussing quality improvement, total quality management is the criteria most often used for enhancing organization quality (Nilsson et al., 2001; Chan & Quazi, 2002). There is a stream of literature suggesting that practicing total quality management within a firm has many advantages including increasing performance (Knod, Jr. & Schonberger, 2001; Wadsworth et al., 2002; Chase et al., 2006; Han et al., 2007). These benefits also include reducing rework and reducing costs related to poor quality such as scrap, rework, late deliveries, warranty, and replacement (Antony et al., 2002). Total quality management also generates more unique competitive advantages (Reed et al., 2000). Hence, understanding the best way to conduct total quality management has been an important issue for all kinds of industries in Taiwan.

Methods of total quality management (TQM) measurement vary from one author to another (Ozden & Birsen, 2006). Saraph et al. conducted early research defining what elements constitute TQM practice (Joo & Yong, 2006). Since then, researchers have proposed many different factors based on different kinds of industries, as shown in Table 1.

In accordance with Table 1, TQM factors can be assigned to four dimensions: leader, employee, customer, IT, and operating process. In addition, the National Quality Award (NQA) is used most frequently in some industries in Taiwan to measure the overall quality of a firm. Because the dimensions of NQA are similar to the afore-mentioned dimensions, the research structure in this study is based on NQA and supplemented through in-depth interviews and literature as shown in Table 1.

Table 1: TQM Measurement Factors

Authors	TQM Factors
Besterfield (2003)	Quality culture, the quality chain, quality assurance, commitment to continuous improvement, and the support of top management
Prajogo & Sohal (2003b)	Product innovation
Jacqueline, Coyle, & Paula (2003)	Statistical process control, commitment of top management, empowerment, and appropriate culture
Wagner & Schaltegger (2004)	Leadership
Kenneth & Cynthia (2004); Escrig-Tena (2004)	Financial performance
Ozden & Birsen (2006)	Customer focus, continuous improvement, and teamwork
Nusrah et al. (2006)	employee empowerment, information and communication, customer focus, and continuous improvement
Ismail (2006)	Leadership, strategic planning, customer focus, information and analysis, human resource management, process management, supplier management, human resource results, customer results, and organizational effectiveness.
Dinh & Triros (2006)	Strategic planning
Keng et al. (2007)	Teamwork, reward and recognition, customer focus, organizational trust, extensive training, high level of communication, management commitment at all levels, employee involvement, empowerment and organizational culture
Han et al. (2007)	Supplier relationship, customer involvement, training, top management commitment, and product design

This table shows the measurement factors of TQM proposed by recent researchers.

FUZZY ANALYTIC NETWORK PROCESS

Analytic Hierarchy Process and Fuzzy Set Theory

Thomas L. Saaty developed the Analytic Hierarchy Process (AHP) in 1971. The AHP method is known as an eigenvector method, which means that the eigenvector corresponding to the largest eigenvalue of the pairwise comparisons matrix gives the relative priorities of the factors and preserves ordinal preferences among the alternatives. This implies that if one alternative is preferred to another, its eigenvector component is larger than that of the other. A vector of weights obtained from the pairwise comparisons matrix reflects the relative performance of the various factors.

However, a growing literature now argues that AHP has its drawbacks. Studies have concluded that AHP can be applied to specific, but not fuzzy decision-making. AHP evaluates questions using different criteria for different parts of the test set. Moreover, AHP cannot include uncertainty factors of people toward objects and that the priority of AHP is unspecific. In addition, AHP is based on an assumption of independence within each factor; however, this does not apply in the real world. Thus, this study used a modified form of AHP called fuzzy ANP (FANP) to obtain more precise results.

Fuzzy set theory was initially developed in 1965 by Professor L.A. Zadeh. He attempted to solve fuzzy phenomenon problems that exist in the real world (e.g., uncertain, incomplete, nonspecific, and fuzzy situations). Fuzzy set theory has an advantage over traditional set theory in describing set concepts in human language. It demonstrates specific and fuzzy characteristics in language on the evaluation and uses a membership function concept. The fuzzy set permits a situation such as "incompletely belongs to" and "incompletely does not belong to."

Fuzzy Number

We order the Universe of Discourse such that U is a whole target, and each target in the Universe of Discourse is called an element. Fuzzy $\tilde{A}$ states for U that random $X \to U$, appointing a real number $\mu_i(x) \to [0,1]$. We call anything above that level of x *under A*.

The set of real numbers R is a triangular fuzzy number (TFN): $\tilde{A}$, which means that $x \in R$, appointing $\mu_A(x) \in [0,1]$, and

$$M = \begin{Bmatrix} x - L/_{M-L}, L \leq x \leq M \\ U - x/_{U-M}, M \leq x \leq U \\ 0 \qquad\qquad , otherwise \end{Bmatrix}$$

The triangular fuzzy number above can be written as $\tilde{A} = (L, M, U)$, where L and U represent the fuzzy probability between the lower and upper boundaries of evaluation information, as shown in Figure 1. Assume two fuzzy numbers $\widetilde{A_1} = (L_1, M_1, U_1)$ and $\widetilde{A_2} = (L_2, M_2, U_2)$:

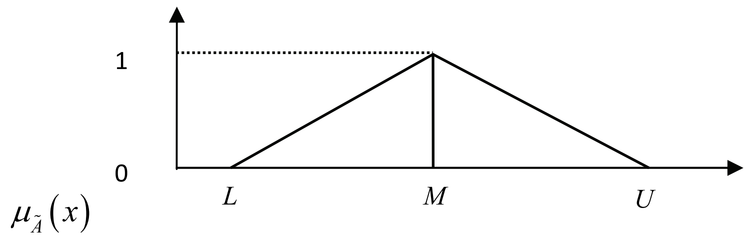
1: $\widetilde{A_1} \oplus \widetilde{A_2} = (L_1, M_1, U_1) \oplus (L_2, M_2, U_2) = (L_1 + L_2, M_1 + M_2, U_1 + U_2)$
2: $\widetilde{A_1} \otimes \widetilde{A_2} = (L_1, M_1, U_1) \otimes (L_2, M_2, U_2) = (L_1 L_2, M_1 M_2, U_1 U_2), L_i > 0, M_i > 0, U_i > 0$
3: $\widetilde{A_1} \ominus \widetilde{A_2} = (L_1, M_1, U_1) \ominus (L_2, M_2, U_2) = (L_1 - L_2, M_1 - M_2, U_1 - U_2)$
4: $\widetilde{A_1} \oslash \widetilde{A_2} = (L_1, M_1, U_1) \oslash (L_2, M_2, U_2) = (L_1/L_2, M_1/M_2, U_1/U_2), L_i > 0, M_i > 0, U_i > 0$

$$\widetilde{A_1}^{-1} = (L_1, M_1, U_1)^{-1} = (1/U_1, 1/M_1, 1/L_1), L_i > 0, M_i > 0, U_i > 0$$

Fuzzy Linguistic Variable

The Fuzzy linguistic variable is a variable that reflects the different levels of the human language. Its value represents the range from natural to artificial language. When precisely reflecting the value or meaning of a linguistic variable, there must be an appropriate way for the variable to change. Variables representing a human word or sentence can be divided into numerous linguistic criteria, such as equally

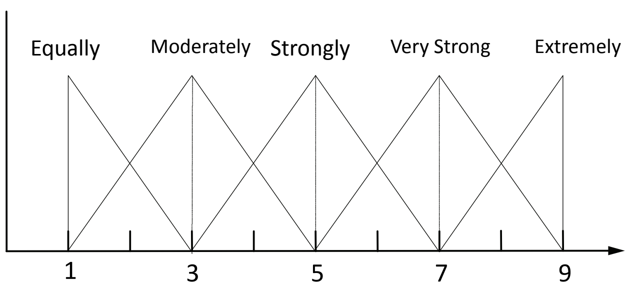
Figure 1: A Triangular Fuzzy Number



This figure shows the presence of opinion decided by each expert. In the form of AHP, each score (number) provided by an expert is marked as M. To obtain results that are more precise, a triangular fuzzy number that involved close numbers, L and U, is utilized.

important, moderately important, strongly important, very strongly important, and extremely important, as shown in Figure 2. The definitions and descriptions of these terms are given in Table 2. For the purposes of the present study, the five labels above are used.

Figure 2: Fuzzy Memberships Function for Linguistic Values of Attributes



This figure shows the meanings of each number (linguistic variable). If there is no difference of importance between two target factors, experts will mark 1, equally. However, if there is a great difference of importance between two target factors, experts will mark 9, extremely.

Table 2: Definition and Membership Function of Fuzzy Numbers

Fuzzy Number	Linguistic Variable	Triangular fuzzy number
$\tilde{9}$	Extremely important/preferred	(7,9,9)
$\tilde{7}$	Very strongly important/preferred	(5,7,9)
$\tilde{5}$	Strongly important/preferred	(3,5,7)
$\tilde{3}$	Moderately important/preferred	(1,3,5)
$\tilde{1}$	Equally important/preferred	(1,1,3)

This table shows the detailed definitions of each number. At the right hand side of column shows triangular fuzzy number and those numbers are the final utilizing in our study.

<u>Analytic Network Process (ANP)</u>

The purpose of the ANP approach is to solve the problem of interdependence and feedback between criteria or alternatives. The ANP is the general form of the analytic hierarchy process (AHP), which has been used in multicriteria decision-making (MCDM) to release the restrictions of hierarchical structure and has been applied to project selection, product planning, strategic decision making, optimal scheduling, etc. (Ong et al., 2004).

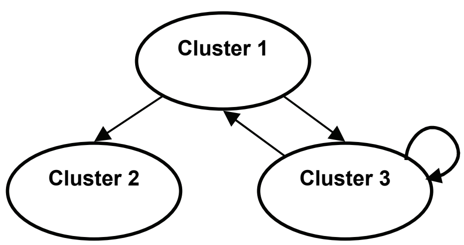
The first phase of the ANP is comparison of the measurement criteria of the overall system to form the super matrix. This step can be accomplished through pairwise comparisons. The relative importance value of pairwise comparisons can be assigned on a scale of 1 to 9, representing equal importance to extreme importance (Saaty, 1980). The following shows the general form of the super matrix:

$$W = \begin{matrix} C_1 \\ \dots \\ C_m \end{matrix} \begin{bmatrix} W_{11} & \cdots & W_{1m} \\ \vdots & \ddots & \vdots \\ W_{m1} & \cdots & W_{mm} \end{bmatrix}$$

where C_m denotes the *m*th cluster, C_{mn} denotes the *m*th element in the *m*th cluster, and W_{ij} is the principal eigenvector influencing the elements compared in the *j*th cluster to the *n*th cluster. In addition, if the *j*th cluster has no influence on the *n*th cluster, then W_{ij}=0.

Based on the above, the form of the super matrix relies on the variety of the structure. Several structures were proposed by Saaty, including hierarchy, holarchy, suparchy, intarchy, etc. (Ong et al., 2004). In order to demonstrate the ways in which the structure is affected by the super matrix, Ong et al. (2004) offer two simple cases, both of which have three clusters, to show how to form the super matrix in accordance with the structures (Figure 3).

Figure 3: Case 1 Structure



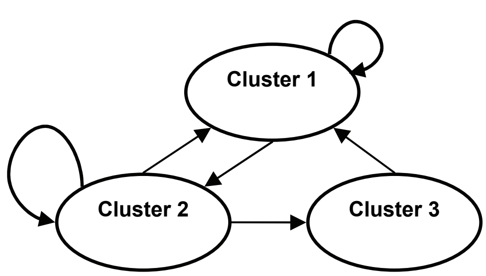
This figure shows the first case which contains three measuring clusters proposed by Ong et al. (2004) to explain how to form the super matrix.

Based on Figure 3, we can form the super matrix as follows:

$$W = \begin{matrix} 0 & 0 & W_{13} \\ W_{21} & 0 & 0 \\ W_{31} & 0 & W_{33} \end{matrix}$$

As it is shown in Figure 4, the second case is more complex than the first.

Figure 4: Case 2 Structure



This figure depicts the second case which contains three measuring clusters as proposed by Ong et al. (2004).

From Figure 4, we can form the super matrix as follows:

$$W = \begin{matrix} W_{11} & W_{12} & W_{13} \\ W_{21} & W_{22} & 0 \\ 0 & W_{32} & 0 \end{matrix}$$

When the super matrix has been formed, the weighted super matrix can then be derived by transforming all columns so that they sum exactly to unity (Ong et al., 2004). This step is similar to the Markov chain concept for ensuring that the sum of the probabilities of all states equals one. We then limit the power of the weighted super matrix by using Eq. (1) to obtain the global weights:

$$\lim_{k\to\infty} W^{k} \tag{1}$$

In this step, if the super matrix is cyclic, then more than one limiting super matrix exists. More precisely, there are two or more limiting super matrices in this case, and the Cesaro sum would be calculated to determine which matrix has priority. The Cesaro sum is formulated as Eq. (2) and is used to calculate the average effect of the limiting super matrix. The super matrix could also be raised to large powers to get the priority weights.

$$\lim_{k\to\infty} \left(\frac{1}{n}\right) \sum_{k=1}^{N} W^{k} \tag{2}$$

Based on the above description of the ANP approach, the critical advantages of this analysis are that first, it is appropriate for both quantitative and qualitative data types; and second, it can solve the problem of interdependence and feedback between whole factors. Thus, the ANP approach is adopted in this study.

Summarizing the above literature, the steps for fuzzy ANP calculation are provided as follows:

1. Confirm both the dimensions and the factors of the model.
2. Hierarchically build up an ANP model containing goals, dimensions, and factors.
3. Determine the local weights of both dimensions and factors by utilizing pairwise comparison matrices (assume that there is no dependence among factors). The relative importance value of pairwise comparisons is provided in Table 2. The dependence of the local weights of the dimensions of the inner matrix has already been done. This step is to calculate the interdependent weights of the dimensions.
4. Determine the inner dependence matrix of each dimension with respect to the other dimensions.
5. Calculate the global weights for the factors. These can be acquired by multiplying the local weight of the factor with the interdependent dimension weights above each.

DATA AND METHODOLOGY

To gather data for the study, we sent 67 questionnaires to the senior managers and related experts of different Taiwanese banks by personal mail. Fifty-one of these were returned. After discarding three due to statistical issues our final sample includes 48 responses. Demographic information on respondents are provided in Table 4. The study first summarized critical quality measuring factors, provided in Table 1, and built up the research structure as provided in Table 3.

Table 3: Research Structure of This Study

Goal	Evaluation Dimensions	Evaluation Factors
Performance Evaluation for Banking Industry	Leadership and Operation Ideals (D1)	Operational Ideals and Values (F1) Organizational Mission and Vision (F2) Leadership Ability of Top Managers (F3) TQM Culture Formation (F4) Social Responsibility (F5)
	Strategy Management (D2)	Overall Strategy Planning (F6) Operation Model (F7) Operation and Improvement of Strategy (F8)
	R&D and Innovation (D3)	Strategy and Process of Innovation (F9) Input of Innovation (F10) Evaluation of Innovation Results (F11)
	The Development of Customers and Market (D4)	Strategy of the Product or Service and Market (F12) Customer and Business Management (F13) Customer Relationship Management (F14)
	Human Resource and Knowledge Management (D5)	Human Resource Planning (F15) Human Resource Development (F16) Use of Human Resources (C17) Employee Relationship Management (F18) Knowledge Management (F19)
	The Application and Management of Information Strategy (D6)	Information Strategy Planning (F20) Internet Applications (F21) Information Applications (F22)
	Process Management (D7)	Product Process Management (F23) Supportive Activity Management (F24) Cross-Organization Management (F25)
	Operation Performance (D8)	Customer Satisfaction (F26) Market Development Performance (F27) Financial Performance (F28) Human Resource Development Performance (F29) Information Management Performance (F30) Process Management Performance (F31) Innovation and Core Competitive Ability Performance (F32) Social Evaluation (F33)

Using NQA and utilizing literature summarization, this table shows the final measurement structure. The main measuring dimensions are Leadership and Operation Ideals, Strategy Management, R&D and Innovation, The Development of Customers and Market, Human Resource and Knowledge Management, The Application and Management of Information Strategy, Process Management, and Operation Performance.

Table 4: Demographic Information

Variable	Item	Distribution	Percentage	Variable	Item	Distribution	Percentage
1. Gender	(1) Male	33	69	3. Years with Company	(1) Under 5	2	4
	(2) Female	15	31		(2) 6 ~ 10	31	65
2. Age	(1) Under 30	19	40		(3) 11 ~ 20	10	21
					(4) Over 21	3	6
	(2) 31 ~ 40	24	50	4.Educational Degree	(1) Bachelor's	4	8
	(3) 41 ~ 50	4	8		(2) Master's	41	85
	(4) Above 51	1	2		(3) Doctoral	3	6
				5. Background	(1) Academia	2	4
					(2) Industrial	46	96
					(3) Gov Unit	0	0

This table shows information on our sample of experts. The background factors we utilized are Gender, Age, Years with Company, Educational Degree, and Background. All experts are currently or had previously worked in Taiwanese banks.48 valid responses were received.

Sixty-nine percent of the respondents were male and 31% were female; half (50%) of the respondents were between 31~40, and 40% were under 30 years old; 65% of the respondents had served their company for between six and ten years, and about 30% had served for between 11 and 20 years. More than half (85%) of the respondents had reached the master's degree; and about 96% of respondents were from industrial background.

RESULTS

In this section, results of the response analysis are reported. The survey responses were evaluated using FANP. The findings are presented in Table 5. The first column indicates the Evaluation Dimension, followed by its Global Weight and Ranking. Next, the individual evaluation factors are reported, along with their local weight, global weight and ranking.

The top five critical factors to improve quality performance are found to be Operation and Improvement of Strategy (0.0814), Customer Relationship Management (0.0800), Evaluation of Innovation Results (0.0756), Cross-Organization Management (0.0565), and Social Responsibility (0.0558). Human Resource Planning (0.0083), Human Resource Development (0.0093), and Information Management Performance (0.0087) were the least critical factors.

CONCLUSIONS AND IMPLICATIONS

Taiwanese companies experience both domestic and international competition. To increase the competitive advantage of Taiwanese industries, research focused on Taiwanese industries has been increasing; however, studies that emphasize the banking industry are rare. Thus, due to limited resources and the rising importance of total quality management, some banks' top managers are trying to utilize total quality management to rebuild their competitive advantage. Unfortunately, some banks are still merging or closing down.

The aim of this study was to explore the most critical and effective factors for efficiently conducting quality improvement. First, the study identified quality measurement factors proposed by recent research; these measures were then adapted via in-depth interviews and fuzzy analytic network processes to develop a TQM measuring model that considers interdependence between a range of dimensions and factors and their weightings.

Based on a survey of 48 bank executives, we identify critical TQM measuring factors for the Taiwanese banking industry. Although several factors in the research structure fit the characteristics of the Taiwanese banking industry, due to limited resources, the study suggests that banks in Taiwan may focus their resources on the five most critical factors, Operation and Improvement of Strategy, Customer Relationship Management, Evaluation of Innovation Results, Cross-Organization Management, and Social Responsibility.

With regard to the first factor, banks are required to handle significant amounts of money each day; hence, they face numerous financial risks. Thus, timely improvement of the operation strategy by the top manager is needed to prevent related financial problems. In addition, banks are also a service industry; therefore, to compete with both domestic and international competitors, attracting and retaining more customers has become a crucial issue. This study suggests that each bank should provide unique services, relying upon its limited resources and own organizational culture.

One branch of literature has indicated that if an organization cannot keep innovating, it will fail (Daft, 2004; Krause, 2004). For Taiwanese banks today, innovative service operation as well as inner management has become crucial for maintaining a substantial competitive advantage. Thus, the study suggests that top managers should speak to customer service personnel often about the needs of customers or use brainstorming to keep the organization creative.

Cross-Organization Management has also been a key factor in the success of an organization. Banks are spread throughout Taiwan. Thus, keeping their service consistent enough to maintain and improve corporate reputation has been an important issue for top managers. This study suggests that top

Table 5: The Result of the Study-Banking Industry Performance Evaluation

Evaluation Dimensions	Global Weight	Ranking	Evaluation Factors	Local Weight	Global Weight	Ranking
Leadership &Operation Ideals (D1)	0.1480	1	Operational Ideals & Values (F1)	0.0979	0.0145	26
			Organizational Mission & Vision (F2)	0.1238	0.0183	22
			Leadership Ability of Top Managers (F3)	0.1629	0.0241	17
			TQM Culture Formation (F4)	0.2379	0.0352	11
Strategy Management (D2)	0.1388	3	Social Responsibility (F5)	0.3774	0.0558	5
			Overall Strategy Planning (F6)	0.1786	0.0248	16
			Operation Model (F7)	0.2345	0.0325	12
R&D and Innovation (D3)	0.1444	2	Operation & Improvement of Strategy (F8)	0.5869	0.0814	1
			Strategy and Process of Innovation (F9)	0.1497	0.0216	19
			Input of Innovation (F10)	.03264	0.0471	6
Development of Customer & Market (D4)	0.1352	4	Evaluation of Innovation Results (F11)	0.5238	0.0756	3
			Strategy of Product or Service & Market (F12)	0.1727	0.0233	18
			Customer and Business Management (F13)	0.2358	0.0319	13
Human Resource &Knowledge (D5)	0.0889	8	Customer Relationship Management (F14)	0.5915	0.0800	2
			Human Resource Planning (F15)	0.0938	0.0083	32
			Human Resource Development (F16)	0.1048	0.0093	30
			Use of Human Resources (C17)	0.1697	0.0151	25
			Employee Relationship Management (F18)	0.3971	0.0353	10
Application &Mgmt. of Info. Strategy (D16)	0.0952	7	Knowledge Management (F19)	0.2347	0.0209	20
			Information Strategy Planning (F20)	0.1717	0.0163	24
			Internet Applications (F21)	0.4229	0.0403	7
Process Management (D7)	0.1186	6	Information Applications (F22)	0.4055	0.0386	8
			Product Process Management (F23)	0.3044	0.0361	9
			Supportive Activity Management (F24)	0.2195	0.0260	15
Operation Performance (D8)	0.1311	5	Cross-Organization Management (F25)	0.4762	0.0565	4
			Customer Satisfaction (F26)	0.2133	0.0279	14
			Market Development Performance (F27)	0.1414	0.0185	21
			Financial Performance (F28)	0.0906	0.0119	28
			Human Resource Develop. Performance (F29)	0.1070	0.014	27
			Information Management Performance (F30)	0.0661	0.0087	31
			Process Management Performance (F31)	0.0892	0.0117	29
			Innovation and Core Competitive Ability Performance (F32)	0.1337	0.0175	23
			Social Evaluation (F33)	0.1586	0.0208	21

This table shows the overall ranking of TQM measuring dimensions and factors. The top five critical factors to improve quality performance are Operation and Improvement of Strategy, Customer Relationship Management, Evaluation of Innovation Results Cross-Organization Management, and Social Responsibility.

managers of different branches should report operation performance and carefully coordinate with the head office to categorize problems and develop consistency.

Finally, due to the rising importance of business ethics, organizations in Taiwan are attempting to demonstrate social responsibility in order to acquire more customers. Recent results on related activities provided by Taiwanese banks confirm the results of this study. Thus, the study suggests that banks develop more positive social activities for their own benefit and the benefit of society.

The main limitation of this study is that critical quality performance measuring factors are developed and identified in the Taiwanese banking industry. The extent to which these findings can be generalized to other markets is unknown. We close by noting that future research might adopting our quality performance measurement structure to other countries and compare those findings with the findings presented here.

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