Applying the consistent fuzzy preference relations to select merger strategy for commercial banks in new financial environments

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A B S T R A C T

Generally, financial mergers can bring some advantages in terms of improving financial structures, and promoting the operating performance of financial organizations. Meanwhile, official reports demonstrate that the policy of bank mergers has fallen short of expectations, and the choice of managerial strategies remains a major issue for bank administrators. This investigation establishes an analytical hierarchy framework to help banks choose merger strategies based on six main criteria, including management performance, staff rights and interests, customer orientation, financial analysis, government policy and risk management. The consistent fuzzy preference relation is used to improve decision making consistency and effectiveness. The analytical results demonstrate that risk management and financial composition of banks are the major considerations for banks in strategy selection. Furthermore, analytical results demonstrate the best futuristic policy is “merging with other financial organizations to become part of an existing bank.”

1. Introduction

Soon after the Taiwanese government lifted its ban on the establishment of new banks in 1992, numerous new banks began operations. In 2001, the government responded to the excessive number of banks in the market by encouraging the establishment of financial holding companies. However, various forms of competitive pressure, such as retaining new customers, providing new financial services and holding available businesses, resulted from the Asian Financial Crisis and the WTO (Min, Kim, Kim, Min, & Ku, 1996). The rapid development of new banks created an unprecedented managerial and competitive crisis.

Numerous enterprises have encountered problems of economic instability, fierce competition, reduced budgets and diverse customer requirements during the past decade (Mihelis, Grigoroudis, Siskos, Politis, & Malandrakis, 2001). Owing to its small organizational scale and lack of financial liberalization, the innovativeness and variety of financial products have failed to reach expectations. By using mergers to increase operational scale of organization, 14 financial holding companies were formed from among the 47 domestic banks and 31 credit cooperatives that had previously existed. The Ministry of Finance is encouraging these companies to conduct further mergers to reduce the number of banks and improve national competitiveness. Therefore, either financial holding companies or domestic banks will face pressure to reorganize or merge.

Mergers of financial organizations are closely linked to organizational performance, government policy, shareholder rights and customer satisfaction. It is essential for financial organizations to select their merger strategy carefully. Factors requiring consideration include various internal, external, qualitative and quantitative attributes, indicating that the selected problem is an analytical hierarchy issue (Kerzner, 1989). A well-known approach that can effectively deal with this problem is the analytic hierarchy process (AHP) proposed by Saaty (1980). The AHP methodology involves separating a complex decision issue into elemental problems to establish a hierarchical model. When the decision problem is divided into smaller constituent parts in a hierarchy, pairwise comparisons of the relative importance of elements are conducted at each level to establish a set of priorities. Although AHP is widely employed in diverse fields (Choi & Hartley, 1996; Ngai, 2003; Saaty, 1980; Salmeron & Herrero, 2005; Wang & Chen, 2005a, 2005b; Wei, Chien, & Wang, 2005; Yu, Lee, & Chang, 2005), inconsistency occurs given increasing hierarchies of criteria or alternatives. To alleviate this dilemma, Herrera-Viedma, Herrera, Chiclana, and Luque (2004) presented the consistent fuzzy preference relations for facilitating decision making, thus enhancing its effectiveness and accuracy of selections. This study utilizes this method as the basis for selecting merging financial organizations.

Financial organizations (primarily banks) face more government restrictions than other enterprises. Financial organizations
have been widely studied, but few of these studies have examined the strategies used by banks for making decisions regarding mergers under a new financial environment. Numerous factors influence the selection of financial merger policies, including the focus on improving operating performances, customer satisfaction (Gerson, 1993), government policies, shareholder rights, risk management and so on. In this study, the influences were derived from an investigation conducted by several experts, including bank superintendents (Department of Finance), economists, shareholders, customers, executives and staff. The main objectives of this study include: (1) examining what criteria should be encompassed in evaluating and examining the importance weightings of influential criteria when choosing organizational mergers in new financial environments; (2) to establish a decision making model for selecting from among different financial merger policies.

2. Operating environment and merger strategy adopted by financial organizations

2.1. Financial holding company and operational environment

The Taiwanese government passed the Financial Holding Company Law in response to weaknesses of the Financial Organization Merging Law, which limited mergers of organizations sharing similar characteristics, to reduce the number of financial organizations and enhance national competitiveness by establishing financial holding companies. Following rapid economic development and population growth, Taiwan currently has 47 domestic banks and 31 credit cooperatives (Banking Bureau, 2006). The total output value of the Taiwanese financial service industry increased from 9.43% to 11.57% during this decade. To keep up with international financial trends and the domestic economic environment, the Taiwanese government has determined to pursue a second stage of financial innovations and enhancing the overall competitiveness of its financial service industry (Banking Bureau, 2006). Additionally, the Taiwanese government has also supported the establishment of the Financial Organization Merging Law and the Financial Company Holding Law, thus providing a legal structure for the merger of heterogeneous or homogenous financial organizations. Tax incentives along with benefits of scale and increased competition when facing an increasingly internationalized environment are the main drivers of the integration of financial organizations.

Given government encouragement of integrations and mergers of financial organizations to extend their basis and operating scale, 14 financial holding companies were established in Taiwan. In the future, the government intends to establish one or two large and competitive leaders to reduce the total number of financial organizations. Both general banks and large financial holding companies face pressure to reorganize and merge. The establishment of the New Basel II protocol will represent a further test for financial organizations.

2.2. Financial organization merger strategies

Generally, financial mergers can create advantages in terms of improvements in financial structure and the improvement of organization operating performance. Meanwhile, official reports (Peristiani, 1996) indicate that bank mergers have failed to reach expectations regarding improvements in financial structure, and have even increased some types of risks.

Various alternative merger policies exist for financial organizations, namely, (i) merging with other financial organizations to become an existing bank; (ii) merging with other financial organizations to become a merged bank; (iii) focusing on enhancing core business competitiveness to become a specialized and stable bank (Bank of Kaohsiung Workers Union, 2006). These alternatives are briefly described as follows:

(i) Merging with other financial organizations to become an existing bank:
Financial mergers help with improving national competitiveness, expanding organizational scale and giving access to favourable tax treatment. Such mergers can be performed via cross-operation and reorganization. Previous experiences indicate that return on equity decreases with increasing capital stock.

(ii) Merging with other financial organizations to become a merged bank:
Financial mergers, while they generally bring improvements in stock price, fail to consider that not all existing customers will remain with the new bank post merger. Additionally, the merged bank will lose its right to operate independently.

(iii) Focusing on enhancing core business competitiveness to become a specialized and stable bank:
Both existing and merged banks change their organizational framework through financial mergers. Importantly, such mergers impact the rights of both employees and customers. Focusing on core business competition and becoming a specialized and stable bank can reduce charges for customers and employees.

3. Research methodology

This study is based on the methodology of consistent fuzzy preference relations, which is presented below.

3.1. Consistent fuzzy preference relations

Herrera-Viedma et al. (2004) proposed the consistent fuzzy preference relations in accordance with two preference relations, namely multiplicative preference relation and fuzzy preference relation (Wang & Chen, 2005a, 2005b, 2007).

(1) Multiplicative preference relation. Experts express their preferences regarding a set of alternatives since X can be denoted by a preference relation matrix \( A \subset X \times X \), where \( a_{ij} \) denotes the ratio of the preference degree of alternative \( x_i \) over \( x_j \). As \( a_{ij} = 1 \) indicates no difference between \( x_i \) and \( x_j \), \( a_{ij} = 9 \) indicates that \( x_i \) is strongly preferable to \( x_j \). A is assumed to be a multiplicative reciprocal, that is
\[
a_{ij} \cdot a_{ji} = 1
\]

(2) Fuzzy preference relation. Expert preferences over a set of alternatives where \( x \) is denoted by a positive preference relation matrix \( P \subset X \times X \) with membership function: 
\[
\mu_{ij}(x_i, x_j) = p_{ij}
\]
where \( \mu_{ij}(x_i, x_j) \) indicates the ratio of the preference intensity of alternative \( x_i \) to that of \( x_j \). Moreover, if \( p_{ij} = \frac{1}{2} \) implies indifference between \( x_i \) and \( x_j \) \( (x_i \sim x_j) \), \( p_{ij} = 1 \) indicates that \( x_i \) is absolutely preferred to \( x_j \), \( p_{ij} = 0 \) indicates \( x_j \) is absolutely preferred to \( x_i \), and \( p_{ij} > \frac{1}{2} \) indicates that \( x_i \) is preferred to \( x_j \) \( (x_i > x_j) \). Meanwhile, \( P \) is assumed to be an additive reciprocal, given by
\[
p_{ij} + p_{ji} = 1
\]

Proposition 1. Reciprocal additive fuzzy preference relation
\[
p_{ij} + p_{jk} + p_{ki} = \frac{3}{2} \quad \forall i, j, k
\]
\[ p_j + p_k + p_{jk} = \frac{3}{2} \quad \forall i < j < k \]  
\[ p_{(i+1)} + p_{(i+1)(i+2)} + \cdots + p_{(j-1)j} + p_{jj} = \frac{j - i + 1}{2} \quad \forall i < j \]  

**Proposition 2.** Suppose the existence of a set of alternatives \( X = \{x_1, x_2, \ldots, x_n\} \), which is associated with a multiplicative preference relation \( A = (a_{ij}), \ a_{ij} \in [0,1] \), then the corresponding reciprocal additive fuzzy preference relation \( P = (p_{ij}) \) with \( p_{ij} \in [0,1] \) to \( A = (a_{ij}) \) is defined as follows:

\[ p_{ij} = g(a_{ij}) = \frac{1}{2} (1 + \log_a a_{ij}) \]  

Using the transformation function \( g(a_{ij}) \), a multiplicative preference relation matrix can be transformed into various preference relations.

Notably, according to **Proposition 1**, only \( n - 1 \) \( ([p_{12}, p_{23}, \ldots, p_{n-1n}]) \) judgements are required to construct consistent fuzzy preference relations. The other incomplete elements can be done by additive transitivity. If the preference matrix contains values that are not in the interval \([0,1]\), but rather in \([-a,1+a]\), a linear transformation is required to preserve the additive transitivity, that is \( f : [-a,1+a] \to [0,1] \). For further detail see **Herrera-Viedma et al. (2004)**.

### 4. Framework for merged strategy selection under multi-criteria decision making

#### 4.1 Evaluator criteria and framework of the evaluation model

For daily reinforcement of customer orientation, an increasing number of companies have chosen customer satisfaction as their main performance indicator. The main satisfaction criteria comprise (1) personnel quality, (2) product quality, (3) bank image, (4) service quality, and (5) accessibility (Mihelis et al., 2001). **Luo (2003)** employed employees, assets, and equity to assess bank profitability. Bad debts influence bank achievements. Moreover, the subjective judgements of creditors may produce incorrect risk measurements (Chen, Chiang, & Lai, 2003).

**Thomson (1991)** demonstrated that bank failure is a function of multiple variables, including management quality and profitability. Notably, risk and profitability management are closely related. Risk-taking is fundamental to future profitability. That is, present risks and satisfaction. Bank financial composition comprises profitability, risk management, and creating a culture of enterprise vision.

- **Stiffs rights (C2)** – human resource training (such as enhancing pre-job training and on-the-job training, cultivating international finance professionals, carrying out a system of specialization, and implementing a knowledge management system), human resource planning (such as human resource allocation, building a system of rewards and penalties, and implementing a rotation of work system), staff satisfaction (such as creating a fair system of rewards and penalties, establishing a humanistic management system, and considering both work and entertainment of employees).
- **Customers service (C1)** – implementing a full-teller mechanism, generating a business information center, and creating a customer service center.
- **Financial composition of bank (C4)** – profitability efficiency (such as decreasing capital costs and expenses, increasing the market share of deposits and loans, increasing fee income, reducing the pressure from bad debts), capital manipulation (managing capital utilization flow, keeping capital float, and improving asset and debt management).
- **Government finance policy (C5)** – improving domestic financial markets and promoting national competitiveness.
- **Risk management (C6)** – credit risk (such as strict internal controls, fulfilling the system of review credit, enhancing employee credit knowledge and providing Basel II guidance for credit risks), operation risk (such as preventing computer crime, improving moral education, and providing Basel II guidance for operation risks), market risk (such as interest risk management, foreign exchange risk management, credit derivative risk management, and providing Basel II guidance for market risks).

**Fig. 1** shows the analytical framework. As for the financial merger strategy, there are three candidate solutions:

- Merge with other financial organizations to become part of an existing bank (A1).
- Merge with other financial organizations to become a merged bank (A2).
- Focus on core business competitiveness and become a specialized and stable bank (A3).

#### 4.2 Hierarchical analytical process for selection of merger strategy

**4.2.1 Linguistic variables**

This study compares pairs of criteria using expressions such as "equally important (EQ)", "slightly more important (WK)", "strongly more important (ST)", "extremely strongly more important (VS)", and "absolutely more important (AB)", using a five level scale with values indicated by actual numbers (see **Table 1**). Additionally, three linguistic variables, namely "very high (VH)", "high (H)", and "fair (F)", are used to measure the merger strategies of commercial banks (see **Table 2**).

**4.2.2 Reciprocal additive consistent fuzzy preference relation for prioritizing the evaluation criteria**

AHP separates a complex decision issue into elemental problems to produce a hierarchical model. Each of these preference relations necessitates the completion of all \( \frac{n(n-1)}{2} \) judgments for a preference matrix containing \( n \) elements. To reduce the judgment times, this study employs the reciprocal additive consistent fuzzy preference relation designed by Herrera-Viedma et al. because it only requires \( n - 1 \) judgments from a set of \( n \) elements.

The procedures of the reciprocal additive consistent fuzzy preference relation for prioritizing the assessment criteria are given below:
(1) Establish pairwise comparison matrices among all the criteria \(C_i, i = 1, 2, \ldots, n\) in the dimensions of the hierarchy system. The evaluators \(E_k, k = 1, 2, \ldots, m\) provide the more important of each of the pairs of considered criteria for a set of \(n/C_0\) preference values \((a_{12}, a_{23}, \ldots, a_{(n-1)n})\), for example:

\[
A^k = \begin{bmatrix}
C_1 & C_2 & \cdots & C_n \\
1 & a_{12}^k & x & x \\
a_{21}^k & 1 & a_{23}^k & x \\
\vdots & \vdots & \ddots & \vdots \\
a_{n-1,1}^k & \cdots & a_{n-1,n}^k & 1
\end{bmatrix}
\]

where \(a_{ij}^k\) denotes the preference intensity toward considered criteria \(i\) and \(j\) are assessed by evaluator \(k\); \(a_{ij} = 1\) indicates no difference between considered criteria \(i\) and \(j\); \(a_{ij} = 3, 5, 7, 9\) reveals that criteria \(i\) relatively important to criteria \(j\), and \(a_{ij} = 1, 3, 5, 7\) indicates that considered criteria \(i\) is less important than criteria \(j\). The sign “\(x\)” indicates the remaining \(a_{ij}^k\), which can be done via inverse comparison.

(2) Transform the preference value \(a_{ij}^k\) into \(p_{ij}^k\) using an interval scale \([0,1]\), then derive the remaining \(p_{ij}^k\) based on the reciprocal transitivity property, as follows:

\[
P^k = \frac{1}{2}(1 + \log_n A^k)
\]

where \(p_{ij} = 0.5\) indicates no difference between criteria \(i\) and \(j\), \(p_{ij} = 1\) demonstrates that criteria \(i\) is absolutely important to criteria \(j\), and \(p_{ij} = 0\) illustrates that considered criteria \(i\) is absolutely less important to criteria \(j\). The remaining \(p_{ij}^k\) can be calculated using Eqs. (2) and (5), but in an interval \([-a, 1+a]\), and a transformation function is required to preserve the reciprocity and additive transitivity. The transformation function is

\[
f(p_{ij}^k) = \frac{(p_{ij}^k + a)}{(1 + 2a)}
\]

where \(a\) denotes the absolute value of the minimum negative value in this preference matrix.

(3) Pull the opinions of evaluators to obtain the aggregated weights of the criteria. Moreover, let \(p_{ij}^k\) denote the transformed fuzzy preference value of evaluator \(k\) for assessing the criteria \(i\) and \(j\). This study uses the notation of the average value to integrate the judgment values of \(m\) evaluators, namely

\[
p_{ij} = \frac{1}{m} \sum_{k=1}^{m} p_{ij}^k
\]

(4) Normalizing the aggregated fuzzy preference relation matrices \(r_y\) is used to indicate the normalized fuzzy preference values of each considered criteria, such as

\[
r_y = p_y / \sum_{i=1}^{n} p_y
\]

(5) Using the \(r_y\) denoting the average priority weight of considered criteria \(i\), the priority of each criteria can be obtained, that is

\[
r_i = \frac{1}{n} \sum_{j=1}^{n} r_y
\]

where \(n\) denotes the number of criteria considered.

4.2.3. Obtaining the synthetic utility value for merger strategies with respect to each criteria

The evaluators were asked to express their subjective judgments regarding the preference ratings of merger strategies.
For each considered criteria, the evaluators were asked to choose the best among three merger strategies for a set of \( s - 1 \) preference data \( \{ g_{12}, g_{23}, \ldots, g_{(s-1)2} \} \), for example

\[
G = \begin{bmatrix}
A_1 & A_2 & \ldots & A_s \\
1 & g_{12}^k & x & x \\
A_1 & x & 1 & g_{23}^k \\
A_1 & x & x & \ldots & x \\
A_1 & x & x & \ldots & 1 
\end{bmatrix}
\]

where \( g_{ik}^k \) represents the performance value assigned by evaluator \( k \) to merger strategies \( u \) and \( v \) based on considered criteria \( i \).

Next, the preference value \( \varphi_{uv}^i \) is transformed within the range \([-1, 5]\) into \( q_{uv}^i \) in an interval scale \([0, 1]\), and the remaining \( q_{uv}^i \) are obtained via the transitivity property, as follows:

\[
Q = \frac{1}{2} (1 + \log_9 G) = \begin{bmatrix}
A_1 & A_2 & \ldots & A_s \\
0.5 & q_{12}^i & x & x \\
A_1 & x & 0.5 & q_{23}^i \\
\vdots & \vdots & \vdots & \vdots \\
A_1 & x & x & \ldots & 0.5 
\end{bmatrix}
\]

The opinions of evaluators then are taken to obtain the transformed synthetic rating of the merged strategy for each considered criteria \( q_{uv}^i \) which denotes the transformed fuzzy preference value of evaluator \( k \) for assessing merger strategies \( u \) and \( v \) in terms of considered criteria \( i \). This study uses the notation of average value to integrate the judgment values of \( m \) evaluators; that is

\[
q_{uv} = \frac{1}{m} \sum_{j=1}^{m} q_{uv}^j 
\]

(4) Following normalizing the synthetic fuzzy preference rating of the merged strategy for each considered criteria, \( \bar{v}_{uv}^i \) is adopted to indicate the normalized rating of merger strategies \( u \) and \( v \) with respect to considered criteria \( i \), for example

\[
\bar{v}_{uv}^i = \frac{q_{uv}^i}{\sum_{u=1}^{s} q_{uv}}
\]

Consequently, \( \bar{v}_{uv}^i \) denotes the average rating of merged strategy \( u \) with respect to considered criteria \( i \). The desired rating of each merger strategy can be derived for each considered criteria, that is

\[
\bar{v}_{uv}^i = \frac{1}{s} \sum_{u=1}^{s} \bar{v}_{uv}^i
\]

where \( s \) represents the number of the merged strategy.

### 4.2.4. Obtaining the priority weight for selection

A preferred value \( R_u \) for commercial banks is obtained by multiplying the priority weights of considered criteria by the ratings of merged strategies. That is

\[
R_u = \sum_{i=1}^{n} \bar{v}_{ui} \cdot \bar{m}_i
\]

where \( \bar{m}_i \) denotes the aggregated weight of considered criteria \( i \).

### 4.3. Empirical case for merged strategy selection

This study used a commercial bank in Taiwan as an example to demonstrate the framework. A total of 12 questionnaires were dispatched, survey candidates included: superintendents of banks (specifically from the Department of Finance), economists, shareholders, customers, executives and staff of the bank.

#### 4.3.1. Weighting calculation of the evaluating criteria

Six major evaluating criteria are considered in the problem of merger strategy selection considered here. The pairwise comparisons for these six criteria are obtained via interviews with the assessment representatives.

The following examples clarify the computational process used to derive the priority weights using the reciprocal additive consistent fuzzy preference relation approach:

(1) Based on interviews with 12 representatives regarding the importance of six evaluation criteria, Table 3 lists the pairwise comparison matrices for a set of \( n - 1 \) neighbouring criteria \( \{ d_{12}, d_{23}, \ldots, d_{32} \} \).

(2) The assessment of evaluator 1 (\( E_1 \)) is served as an example and listed in Table 4. Meanwhile, Table 1 listed the fuzzy preference degree while Table 5 listed the linguistic terms which can be transferred into corresponding numbers.

(3) Eq. (6) was used to transform the elements (listed in Table 5) into an interval \([0, 1]\), yielding the following values:

\[
p_{12} = \frac{1 + \log_9 5}{2} = 0.375, \quad p_{23} = \frac{1 + \log_9 6}{2} = 0.902
\]

The remaining values then can be calculated using Eqs. (2) and (5), with \( p_{31}, p_{13}, p_{52} \) being used as examples,

\[
p_{31} = \frac{3 + 1 + 1}{2} - p_{12} - p_{23} = 1.5 - 0.750 - 0.092 = 0.658
\]

\[
p_{13} = 1 - p_{31} = 1 - 0.658 = 0.342
\]

\[
p_{52} = \frac{5 + 2 + 1}{2} - p_{23} - p_{34} - p_{45}
\]

\[
= 2 - 0.092 - 0.134 - 0.908 = 0.866
\]

The fuzzy preference relation matrix for six evaluation criteria assessed by evaluator 1 is established in Table 6. Table 6 lists \( p_{12}, p_{13}, p_{24}, p_{26} \) elements not in the interval \([0, 1]\), and thus a linear transformation stated in Eq. (7) is employed to ensure the reciprocity and additive transitivity for the preference relation matrix. Table 7 lists the transformation matrix.

(4) Likewise, the above computational procedures can calculate the fuzzy preference relation matrices of the other 11 evaluators; therefore, using Eq. (8), the aggregated pairwise comparison matrix of twelve evaluators can be derived, as listed in Table 8.

(5) Eq. (9) is applied to normalize the aggregated pairwise comparison matrix. Taking \( r_{21} \) as an example:

\[
r_{21} = \frac{0.332}{0.5 + 0.332 + 0.519 + 0.574 + 0.342 + 0.620} = 0.115
\]

The priority weight of each evaluation criteria can then be obtained by Eq. (10). The priority weight and rank of each influence assessed by twelve evaluators is listed in Table 9. The ranks of the evaluation criteria weights thus are substituted as
The preferred weights for the merger strategies are calculated as

\[
\text{priority weights of all criteria.}
\]

<p>| Table 5 |</p>
<table>
<thead>
<tr>
<th>Translated linguistic terms into corresponding number</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E_1 )</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>( C_1 )</td>
</tr>
<tr>
<td>( C_2 )</td>
</tr>
<tr>
<td>( C_3 )</td>
</tr>
<tr>
<td>( C_4 )</td>
</tr>
<tr>
<td>( C_5 )</td>
</tr>
<tr>
<td>( C_6 )</td>
</tr>
</tbody>
</table>

The results show that the three main assessment attributes are risk management (0.215), financial composition of bank (0.199) and operating performance (0.173), government finance policy (0.119) and staff rights (0.115).

### 4.3.2. Calculation of the weights for merged strategies with respect to evaluation criteria

To determine the priority weight matrix for merged strategies with respect to each evaluation criterion, Table 2 lists the linguistic variables for evaluators. The priority weights of three merged strategies are calculated as follows:

1. Examining the situation of this bank, the 12 evaluators are interviewed to assess the likelihood of each occurring according to each evaluation criterion. Table 10 lists the opinions of these 12 evaluators regarding their preference intensities regarding the merger strategies with respect to each evaluation criterion.

2. The linguistic variables are translated into the corresponding numbers listed in Table 2. Then use this function, \( p_i = \frac{1}{2} (1 + \log_{10} q_{iv}) \), to transform the values in the scale \([1/2, 5]\) into the interval \([0, 1]\). Table 11 lists the transformed preference data.

3. Using Eq. (11), and taking \( q_{uv} \) as an example, the synthetic rating of merger strategies can be obtained, as listed in Table 12, where \( q_{uv} \) represented the transformed fuzzy preference value of 12 evaluators for assessing merger strategies \( u \) and \( v \) in terms of evaluating criteria. Eqs. (12) and (13) can then be employed to normalize and synthesize the fuzzy preference rating of three merger strategies based on six evaluation criteria. Table 13 lists the normalized values and priority weights, while Table 14 lists the normalized values and priority weights of all criteria.

### 4.3.3. Weighting the selection priorities

Using Eq. (14), the priority weights of six evaluation criteria and the priority ratings of three merged strategies, in addition to the preference weightings of the candidates, are listed in Table 14. The preferred weights for the merger strategies are calculated as
Table 10
The linguistic variables given to the priority weight of three merged strategies

<table>
<thead>
<tr>
<th>C1</th>
<th>A1</th>
<th>LHV</th>
<th>VH</th>
<th>VH</th>
<th>LHVF</th>
<th>LVH</th>
<th>VH</th>
<th>F</th>
<th>F</th>
<th>F</th>
<th>VH</th>
<th>VH</th>
<th>VH</th>
<th>HF</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>A1</td>
<td>LHF</td>
<td>HF</td>
<td>H</td>
<td>F</td>
<td>VH</td>
<td>HF</td>
<td>HF</td>
<td>HF</td>
<td>HF</td>
<td>H</td>
<td>VH</td>
<td>HF</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>A1</td>
<td>LVH</td>
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<td>H</td>
<td>LVH</td>
<td>VH</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>VH</td>
<td>VH</td>
<td>LVH</td>
<td>F</td>
<td>A2</td>
</tr>
<tr>
<td>C4</td>
<td>A1</td>
<td>LVH</td>
<td>VH</td>
<td>VH</td>
<td>VH</td>
<td>VH</td>
<td>L</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>LVH</td>
<td>VH</td>
<td>LF</td>
<td>L</td>
<td>A2</td>
</tr>
<tr>
<td>C5</td>
<td>A1</td>
<td>LHV</td>
<td>VG</td>
<td>VH</td>
<td>VH</td>
<td>VH</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>LVH</td>
<td>VH</td>
<td>HF</td>
<td>A2</td>
<td></td>
</tr>
<tr>
<td>C6</td>
<td>A1</td>
<td>LHV</td>
<td>VH</td>
<td>VH</td>
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<td>VH</td>
<td>H</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>VH</td>
<td>VH</td>
<td>HF</td>
<td>A2</td>
<td></td>
</tr>
</tbody>
</table>

Table 11
Transformed preference weight of three merged strategies in relation to factors

<table>
<thead>
<tr>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
<th>E6</th>
<th>E7</th>
<th>E8</th>
<th>E9</th>
<th>E10</th>
<th>E11</th>
<th>E12</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>A1</td>
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<td>0.500</td>
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<td>0.285</td>
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</tr>
</tbody>
</table>

Table 12
Aggregated pairwise comparison matrices of C1 evaluators

<table>
<thead>
<tr>
<th>C1</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.500</td>
<td>0.715</td>
<td>0.601</td>
</tr>
<tr>
<td>C2</td>
<td>0.285</td>
<td>0.500</td>
<td>0.387</td>
</tr>
<tr>
<td>C3</td>
<td>0.399</td>
<td>0.613</td>
<td>0.500</td>
</tr>
<tr>
<td>Total</td>
<td>1.184</td>
<td>1.828</td>
<td>1.488</td>
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</tbody>
</table>

Table 13
Normalized matrix of priority weight of C1

<table>
<thead>
<tr>
<th>C1</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>0.422</td>
<td>0.391</td>
<td>0.329</td>
<td>1.142</td>
<td>0.381</td>
</tr>
<tr>
<td>A2</td>
<td>0.241</td>
<td>0.273</td>
<td>0.211</td>
<td>0.726</td>
<td>0.242</td>
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<tr>
<td>A3</td>
<td>0.337</td>
<td>0.336</td>
<td>0.273</td>
<td>0.946</td>
<td>0.315</td>
</tr>
<tr>
<td>Total</td>
<td>2.814</td>
<td>0.938</td>
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</tr>
</tbody>
</table>

Table 14
Normalized matrix of priority weight of all criteria and preference rate of candidates

<table>
<thead>
<tr>
<th>Weight</th>
<th>Priority weight</th>
<th>Weighted rate</th>
</tr>
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<tbody>
<tr>
<td>A1</td>
<td>A2</td>
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<tr>
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<td>0.173</td>
<td>0.381</td>
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<tr>
<td>C2</td>
<td>0.115</td>
<td>0.393</td>
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<tr>
<td>C3</td>
<td>0.180</td>
<td>0.367</td>
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<tr>
<td>C4</td>
<td>0.199</td>
<td>0.393</td>
</tr>
<tr>
<td>C5</td>
<td>0.119</td>
<td>0.382</td>
</tr>
<tr>
<td>C6</td>
<td>0.215</td>
<td>0.392</td>
</tr>
<tr>
<td>Total</td>
<td>0.377</td>
<td>0.271</td>
</tr>
</tbody>
</table>

From Table 14, the ranking of alternative solutions is obtained as follows: alternative A1 (0.377) > alternative A3 (0.314) > alternative A2 (0.271). Evaluators clearly believe that the best policy for the bank is “Merging with other finance organizations to become an existing bank”.

5. Conclusions

This study surveyed approximately 12 stakeholders in a commercial bank to identify their prioritization of the goals and assessment criteria discussed above. Based on the opinions of all survey respondents, the following findings were obtained:

1. “Risk management” is the most important criteria considered by banks in selecting merger strategies. The Asian Financial Crisis and WTO entry have increased uncertainty, and have pushed stakeholders to pay increased attention to risk management. “Customer service” and “financial composition” have also received high weightings in merger strategy selection. Notably, “staff rights” are not taken seriously.

2. All survey evaluators agreed that “merging with other financial organizations to become an existing bank” is the best merger strategy for banks, followed by “focusing on core business competitiveness to become a specialized and stable bank.”
The multi-criteria decision making model for merger strategy selection presented here clearly is applicable to the evaluation process. The proposed strategy also reveals the concerns and preferences of most bank stakeholders. The results of this study provide a valuable reference for bank administrators.

References