

# **An Empirical Study by Applying Multi-Criteria Expertise Analytic Hierarchy Process Model in Evaluation**

**Thanh- Tuyen Tran<sup>1</sup>**

## **Abstract**

Financial organizations have been globally studied, but few of these studies have examined the strategies used by banks in Vietnam for making decisions regarding bank rankings. This research is objective to explore and to demonstrate utility of Analytic Hierarchy Process (AHP) application in banking for the purpose of proposing a suitable model for partners evaluation and selecting banking strategic alliances in Vietnam. The AHP is applied to examine what criteria should be encompassed in evaluating and examining the importance weightings of influential criteria when ranking the bank system. After a long process of calculation based on AHP, the author has come up with the final rankings according expert's interview: ACB's percentages have change widely from each sub-criterion. By this thesis, author would contribute to the ranking process of the banking system, in general, and the special case of Vietnamese banking a very modern model to apply, then to choose the right alliance for further cooperation, not only for banking system but it can be applied for a lot of industries.

**JEL classification numbers:** G22, G21

**Keywords:** AHP, banking system, evaluating, rankings, experts

## **1 Introduction**

Bank rankings 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 strategies carefully. Factors

---

<sup>1</sup> Scientific Research Office, Lac Hong University, Vietnam

requiring consideration include various internal, external, qualitative and quantitative attributes, indicating that the selected problem is an analytical hierarchy issue (Kurttila et al, 2000). A well-known approach that can effectively deal with this problem is the analytic hierarchy process (AHP) (Saaty, 2008). 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, pair-wise comparisons of the relative importance of elements are conducted at each level to establish a set of priorities.

Analytic hierarchy process (AHP) is widely employed in diverse fields, especially growing its effectiveness among the financial industry (Ngai, 2003; Salmeron & Herrero, 2005; Yu, Lee, & Chang, 2005). For example, Korhonen and Voutilainen (2006) studied alternative alliances between banks and insurance companies. Six different possible structure models for such alliances and nine criteria are used to evaluate the models. The use of the AHP focused the discussions on pair-wise comparisons. Based on the evaluations of the panel, the alternatives *financial conglomerate* and *cross-selling agreement*, and *no overlapping service channels* are most preferred. Seçme et al. (2009) proposed a fuzzy multi-criteria decision model to evaluate the performances of banks. The largest five commercial banks of Turkish banking sector are examined and these banks are evaluated in terms of several financial and non-financial indicators. Fuzzy Analytic Hierarchy Process (FAHP) and Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) methods are integrated in the proposed model. After the weights for a number of criteria are determined based on the opinions of experts using the FAHP method, these weights is input to the TOPSIS method to rank the banks. The results show that not only *financial performance* but also *non-financial performance* should be taken into account in a competitive environment.

Financial organizations have been globally studied, but few of these studies have examined the strategies used by banks in Vietnam for making decisions regarding bank rankings. Basing on the successful experiences of rankings which raises some rules for choosing strategic alliance partners, and gives a description of how to choose the best partner with AHP, in this paper we have studied the bank rankings between 10 top Vietnamese banks that are already on the financial industry for the purpose of proposing suitable model for partner evaluation and selecting banking strategic alliance for any financial organizations. The main objective of this study is applying AHP to examine what criteria should be encompassed in evaluating and examining the importance weightings of influential criteria when ranking the bank system.

Our research objectives are to explore and to demonstrate utility of AHP application in banking for the purpose of proposing suitable model for partners evaluation and selecting banking strategic alliances in Vietnam. We want to apply AHP to examine what criteria should be encompassed in evaluating and examining the importance weightings of influential criteria when ranking the bank system. In this study, a short review of literature regarding application AHP in

banking decision-making is presented, focusing on partner evaluation criteria and methods to propose model for partner evaluation and selecting strategic banking for the current study. Analytic Hierarchy Process (AHP) application in banking sector is growing most recently and has been seen as a high potential decision support tool in banking sector in the days to come. The use of AHP as a decision support tool is appreciated and interested by the author. This study reviews application of AHP in the finance sector with specific reference to banking.

Implications of the findings of this analysis for strategic planning in the areas of marketing mix and organizational characteristics of a bank are explored. Suggestions for application of AHP to other areas of financial services management are included.

The research method was applied in this research includes:

- (1) Research discovery: to explore preliminary research issues that need as well as claims the research problem.
- (2) Method of describing and comparing or the method of decision-making.
- (3) Method of intergrated analysis towards the problem of assessing the quality and selecting suitable model for partner evaluation and bank rankings in Vietnam.
- (4) Qualitative amd expert methods: to review evaluation criteria for selecting suitable model for partner evaluation and bank rankings in Vietnam.
- (5) Quantitative research method: Collecting information and data in quantitative form. This method is used in the process of applying AHP to evaluate and bank rankings in Vietnam.
- (6) Data are collected through the process of surveying and interviewing representatives of banks chief executives, managers and staff; practicing outdoor activities; company file documents; journal and newspapers.

## **2 Literature Review**

In this section, we will describe problem with the Analytic Hierarchy Process which include its concept, functions, basic scales, practical applications, and illustrative examples. Finally, we analyse the advantages and limitations of AHP method.

### *Concepts*

In previous studies, AHP was implemented to help decision maker to choose the best solution among several alternatives across multiple criteria. Decision-making is related to the level of intelligence, wisdom and creativity to satisfy basic needs, to have better selective choices and to increase productivity for the enterprises. Evaluating a decision requires several considerations such as the benefits derived from making the right decision, the costs, the risks, and losses resulting from the actions taken if the wrong decision is made.

Decision-making methods range from variety of choices in order to use more suitable decision-making tools. In the 1970s, Thomas Saaty developed AHP as a way of making decision dealing with weapons trade-offs, resource and asset allocation when he was a professor at the Wharton School of Business and a consultant with the Arms Control Disarmament Agency.

### *Functions of AHP*

AHP is a time-tested method that has been used to decide for many successful businesses worldwide. It uses the judgments of decision makers to form a decomposition of problems into hierarchies. Problem complexity is represented by the number of levels in the hierarchy which combine with the decision-makers model of the problem to be solved (Saaty, 1999). The hierarchy, as shown in figure 1, is used to derive ratio-scaled measures for decision alternatives and the relative value that alternatives have against organizational goals (customer satisfaction, product/service, financial, human resource, and organizational effectiveness) and project risks.

AHP uses matrix algebra to sort out factors to arrive at a mathematically optimal solution and derives ratio scales from paired comparisons of factors and choice options. AHP consists of four steps (Sevкли et al, 2008). In the first step, the author defines the problem and state the goal or objective. In part two, the criteria or factors that influence the goal are made clear. In this step, the structure of these factors into levels and sublevels are also formed. In part three, the author uses paired comparisons of each factor with respect to each other that forms a comparison matrix with calculated weights, ranked eigen values, and consistency measures. In the final step, synthesize the ranks of alternatives until the final choice is made (Figure 2.1).

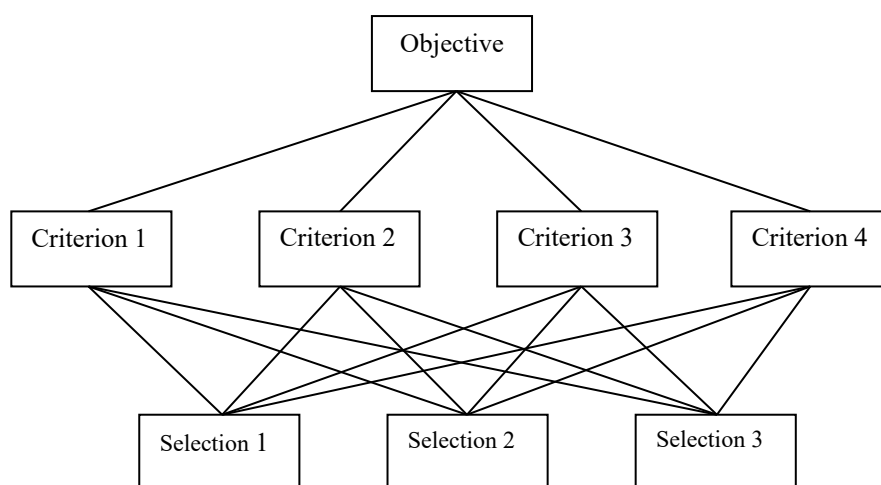


Figure 2.1: AHP hierarchy

*AHP basic scales*

The paired comparison scales between the comparison pair (aij) of two items (item i and item j) is as follows:

(itemi) 9-8-7-6-5-4-3-2-1-2-3-4-5-6-7-8-9 (item j)

The preference scale for pair-wise comparisons of two items ranges from the maximum value 9 to 1/9 (0.111 in decimal from). Let aij represent the comparison between item-i (left) and item-j (right). If item-i is 5 times (strong importance) more important than item-j for a given criteria or product, then the comparison aji = 1/aij = 1/5 (0.200) or the reciprocal value for the paired comparison between both items.

After the comparison matrix is formed, AHP terminates by computing an eigenvector (also called a priority vector) that represents the relative ranking of importance (or preference) attached to the criteria or objects being compared. The largest eigenvalue provides a measure of consistency. Consistency is a matrix algebraic property of cardinal transitivity where the equality  $a(ij) = 1/a(ji) = a(ji)-1$ , and  $a(ij) = a(ik) a(kj)$  for any index i, j, k. Inconsistencies arise if the transitive property is not satisfied as determined when the largest eigenvalue from the comparison matrix far exceeds the number of items being compared.

The AHP preference scale shows in Table 2.1 to form the comparison matrices (Saaty, 2000).

Table 2.1: Preferences made on 1-9 scale

AHP Scale of Importance for comparison pair (Aij)	Numeric Rating	Reciprocal (decimal)
Extreme Importance	9	1/9 (0.111)
<i>Very strong to extremely</i>	8	1/8 (0.125)
Very strong importance	7	1/7 (0.143)
<i>Strongly to very strong</i>	6	1/6 (0.167)
Strong Importance	5	1/5(0.200)
<i>Moderately to Strong</i>	4	1/4(0.250)
Moderate Importance	3	1/3(0.333)
<i>Equally to Moderately</i>	2	1.2(0.500)
Equal Importance	1	1(1.000)

The Geometric Mean is an alternative measure of the Priority and was formed by taking the n-th root of the product matrix of row elements divided by the column sum of row geometric means. The Geometric Mean agrees closely with the Priority.

Lambdamax (4.2385) is an eigenvalue scalar that solved the characteristic equation of the input comparison matrix. Ideally, the Lambdamax value should equal the number of factors in the comparison (n=4) for total consistency.

The consistency index (ci) measures the degree of logical consistency among pair-wise comparisons. The random index (ri) is the average CI value of randomly-

generated comparison matrices using Saaty's preference scale (Table 3) sorted by the number of items being considered. If  $|CI| < 0.05$ , it shows good consistency of pair-wise comparisons. If  $|CI| > 0.05$  1 means the pair-wise comparison should be revised.

$$CI = \frac{(\lambda \max - n)}{(n - 1)}$$

Consistency ratio (cr) indicates the amount of allowed inconsistency (0.10 or 10%). Higher numbers mean the comparisons are less consistent. Smaller numbers mean comparisons are more consistent. CRs above 0.1 means the pair-wise comparison should be revisited or revised.

$$CR = \frac{|CI|}{RI}$$

Random Index (RI) is the average value of CI for random matrices using the Saaty scale obtained by Forman (Geoff, 2004). To determine the goodness of CI, AHP compares it by Random Index (RI), and the result is what we call Consistency Ratio (CR). Random Index is the Consistency Index of a randomly generated reciprocal matrix from the scale 1 to 9 (Geoff, 2004). Table 2.2 below shows the values R.I. sorted out by order 1 to 15 matrix. The CR can then be calculated.

Table 2.2: RI index

n=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0.0	0.0	0.5	0.9	1.1	1.2	1.3	1.4	1.4	1.4	1.5	1.4	1.5	1.5	1.5
=	0	0	8	0	2	4	2	1	5	9	1	8	6	7	9

### 3 Methodology

#### 3.1 Selection of Banks for the Purpose of the Study

In this paper, expert opinions are collected for the generation of criteria and sub criteria weights through a questionnaire containing fuzzy pair wise comparisons using linguistic terms. Further the alternative Banks are given weights based on the size of the stock market.

Ten banks were selected purposively for the purpose of the study. The banks selected for the purpose for the study are traded in Hanoi and Ho Chi Minh City stock markets whose selection of the index set is based on the following criteria, which are referenced from *thebanker.com* – 500 banking brands in 2014:

1. *Company's market capitalization rank in the universe should be less than 500*
2. *Company's turnover rank in the universe should be less than 500*
3. *Company's trading frequency should be at least 90% in the last six months.*
4. *Company should have a positive Net-worth.*
5. *A company that comes out with an Initial Public Offering (IPO) will be eligible for inclusion in the index, if it fulfills the normal eligibility criteria for the index for a 3 month period instead of a 6 month period.*

The banks selected for the purpose of the study are BIDV, VietinBank, ACB, SacomBank, DAB, HDBank, SeABank, SGB, MBB, and SHB (listed in Table 3.1). Moreover, the author has many friends who are current working in the banking system. The banks are selected to administer survey questionnaires are SGB (Ho Chi Minh City branch); DAB (Ho Chi Minh City branch); and Vietcombank (Ho Chi Minh City branch). Customers who have high frequent bank transactions were also invited to participate in this study.

Table 3. 1: List of Selected Banks

Code	Full Name	Stock Market
BIDV	Joint Stock Commercial Bank for Investment and Development of Vietnam	<a href="http://goo.gl/q4bpQ8">http://goo.gl/q4bpQ8</a>
VietinBank	Vietnam Joint Stock Commercial Bank for Industry and Trade	<a href="http://goo.gl/uoAGub">http://goo.gl/uoAGub</a>
ACB	Asia Commercial Bank	<a href="http://goo.gl/E06zxG">http://goo.gl/E06zxG</a>
SacomBank	Sai GonThuong Tin Commercial Joint Stock Bank	<a href="http://goo.gl/0i5gGG">http://goo.gl/0i5gGG</a>
DongABank	Dong A Commercial Joint Stock Bank	<a href="http://goo.gl/daH42K">http://goo.gl/daH42K</a>
HDBank	Ho Chi Minh Development Joint Stock Commercial Bank	<a href="http://goo.gl/b93BeJ">http://goo.gl/b93BeJ</a>
SeABank	Southeast Asia Commercial Joint Stock Bank	<a href="http://goo.gl/6CJgBR">http://goo.gl/6CJgBR</a>
SGB	Saigon Bank for Industry and Trade	<a href="http://goo.gl/cn1CKO">http://goo.gl/cn1CKO</a>
MBB	Military Commercial Joint Stock Bank	<a href="http://goo.gl/QyWCm5">http://goo.gl/QyWCm5</a>
SHB	Saigon Hanoi Commercial Joint Stock Bank	<a href="http://goo.gl/uNuKsS">http://goo.gl/uNuKsS</a>

### 3.2 Evaluation Criteria and Sub-criteria

The first step of the proposed model is to determine all the important criteria and their relationship with the decision variables in the form of a hierarchy. This step is crucial because the selected criteria can influence the final choice.

These questions are always raised whenever we have contacts with the people we want to survey on. And these are asked by short interviews. This step is crucial because it can raise that the data used in this study is provided and confirmed by the experts in the field of banking and customers using banking services.

1. *Are you an expert in this field, working in it daily?*
2. *Do you work in this field occasionally?*
3. *Are you knowledgeable about this field through occasional professional reading?*
4. *Would you classify yourself as an informed layman?*
5. *Are you uninformed about this field?*

After we have 5 main criteria, the experts were asked to list down sub-criteria of each main criterion. This process is called second round selection, which are listed in the following tables. This process will be taken placed right after we summarized the main criteria, which was during the period of 13 November to 16 November, 2014. Moreover, they are also asked to fulfill one more point before we go the survey of AHP to do the ranking of the field.

The hierarchy is structured from the top (the overall goal of the problem) through the intermediate levels (criteria and sub-criteria on which subsequent levels depend) to the bottom level (the list of alternatives). The structure of the above-mentioned hierarchy is given in Figure 3.1. Figure 3.1 just summarizes and visualizes what have mentioned. We have here 5 main criteria, 19 sub-criteria and 10 alternatives i.e. banking brands.

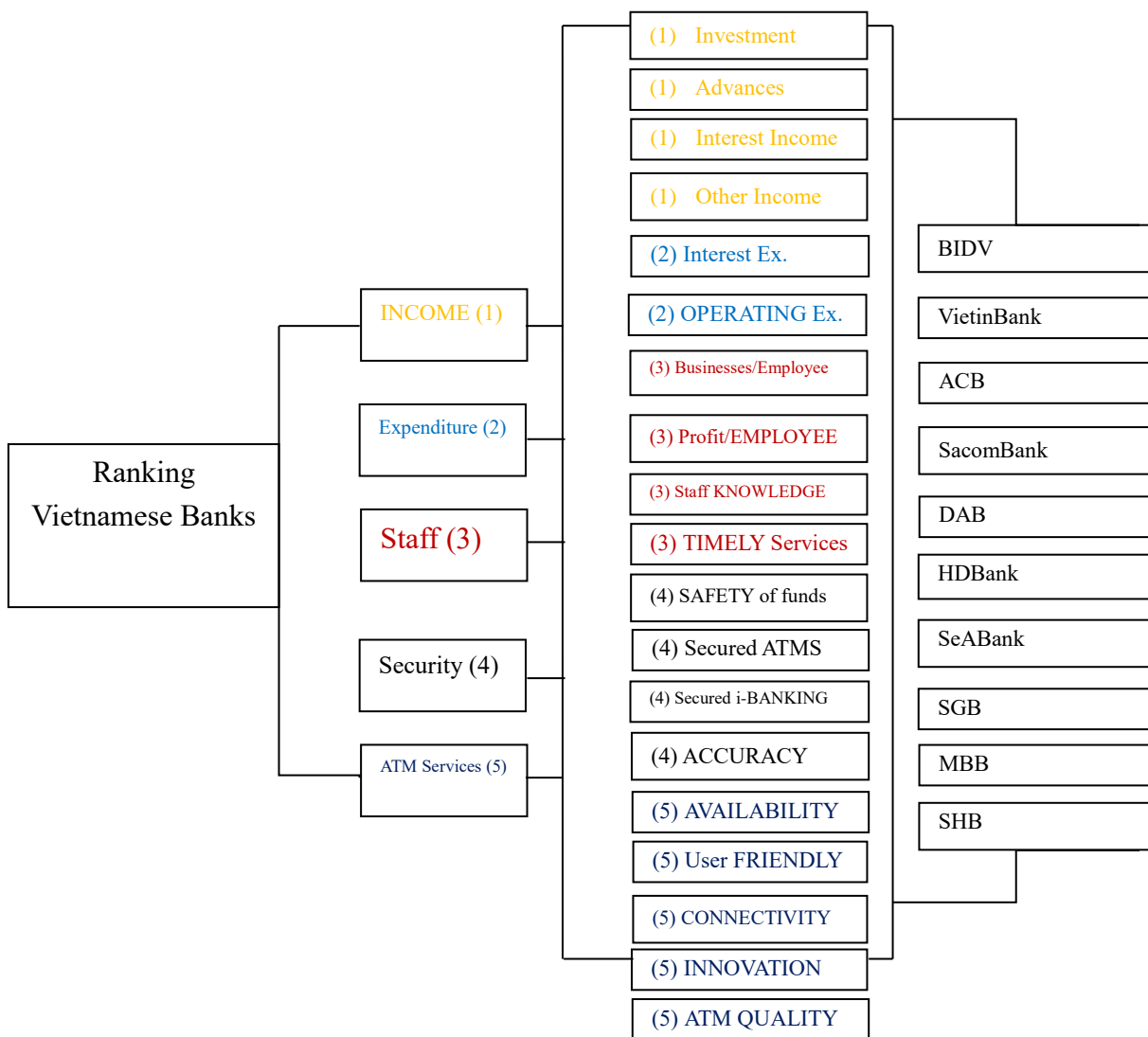


Figure3.1: Research Hierarchy



Table 3.2: Descriptions of Participants into Selecting Research Elements

Positions Financial Market	Number	Gender	Years of Working	Working and Professional Experience
Management Board	1	Male	8	Tracking the evolution of the project and monitor the operation of financial organizations.
	2	Female	6	Being responsible for management of the sales stages, maintaining the operation of financial companies
	3	Male	7	Managing and monitoring the contracts with suppliers, partners and other out sources.
Group Leaders	4	Male	3	Responsible for reporting status financial products/services to higher levels. Responsible for the formulation according to reports in financial companies; criteria given by the managers.
	5	Male	4	
	6	Male	3	
	7	Female	4	
Store Managers (5people)	8	Female Male	1-3	Time management of shipping – delivering financial products/services. Counting and reporting to high levels about the status.
Sale person (5 people)	9	Female Male	0.5-3	Selling and marketing products/services to customers. Monitoring the interaction process.
Customers	97	Female Male		Have used banking services for years

These experts are working in the financial organizations e.g., Prudential; Bao Viet Insurance, AIA Vietnam etc. They are all anonymous in this study. Customers are described to use the banking services for years. They are employees in organizations in Hanoi City. They are the researchers' friends and are willing to participate in this study. These organizations have the connection with banks in this study. They have the salary paying interactions by months.

### 3.3 The Process to Select the Right Target of the AHP Method

This section presents the process according to the method of calculation process of AHP. Start with a hierarchical diagram level 5 main criteria governing the evaluation of the bank industry (see figure 3.1). This matrix shows the relationship between the main criteria according to the scale of the AHP. Based on this table can determine the correlation between the level of importance of the variables.

The whole process of this study is present in figure 3.2. There are 9 phases to run, select and analysis based on the applied method – AHP.

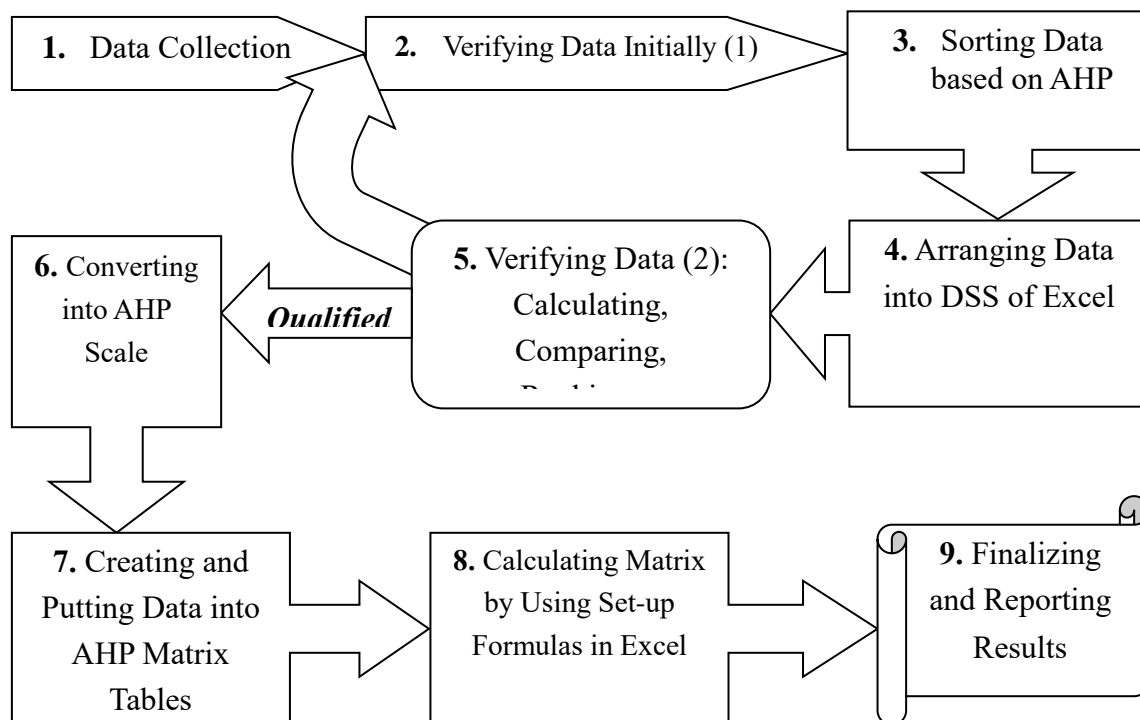


Figure 3.2: Flowchart of Phases to Carry Research

### Phase 1: data collection

Delphi method: 1st round (14-18th November, 2014); 2nd round (13-16 December, 2014)

AHP questionnaire: 18-25th January, 2015

The process of data collection is carried out according to the method of experts:

**Step 1:** based on assessment model has been developed, author use pilot interviews to experts to verify the appropriateness of the 6 main criteria KPI in level one and 16 in level two, together with confirming the identification actual business reality.

**Step 2:** based on the results of step 1 to adjust the model and building surveys/questionnaires (attached in appendix).

**Step 3:** surveys combined with direct interviews to each expert. At the request should have over 30 experts but by the actual situation should be reduced to 26experts. Moreover, customers who have used banking services for years are also involved in this study.

**Step 4:** collect other data through reports and documents related

### **Phase 2: a batch process data**

After collecting a full range of primary data through surveys and interviews with experts' opinions, together with the secondary data through reports: financial, production, performance, etc., these data are processed through the steps of a batch filtering criteria of the main criteria, then filter by the KPI side, verify authenticity versus reality and reliability of the data.

### **Phase 3: sorting data and KPI main criteria of the model**

A batch is classified according to six main criteria, and then they are further classified according to 16 KPI sub-criteria of the model

### **Phase 4: enter the model created by Excel**

Excel is as a DSS generator: it is used to construct the computational model, and to handle data for each KPI fitting main criteria in the evaluation model. After setup is complete, the DSS model is to conduct verification of scale, the formula to ensure the appropriateness and scientific. Then, we enter the processed and classified data prior to the DSS model to prepare for phase 5.

### **Phase 5: data processing secondly**

After entering the data, we conducted calculations, check, and then evaluate for each scale suitably.

### **Phase 6: scale transition to AHP**

AHP method using pair wise comparison scale separately on a scale from one to nine, so after the calculation results ranking suppliers, we must make the transition scales corresponding to the AHP under the own standards of this method. This stage aims to prepare for entering data into the matrix of pair wise comparison at a later stage.

### **Phase 7: Creating and Putting Data into AHP matrix table**

The first boot after the application of the AHP hierarchy drawing assessment model, enter the criteria in a level floor, then to the sub-criteria floor level to level two to n, and finally enter choice alternatives. Then enter the data were processed in each pair wise comparison matrices, respectively. Inside is under processing data has been entered into the pair wise comparison matrix between the six main criteria in the evaluation model.

### **Phase 8: Calculating Matrix by Using Set-up Formulas in Excel**

After we have the AHP tables, we use Excel as a tool to calculate these matrices. Inputting all the data surveyed is a careful step to do to make sure that the calculation is accurate.

### Phase 9: Finalizing and Reporting Results

This is the final step of the process. We just see and report results. This will be illustrated carefully in chapter 4.

Once the hierarchy is established, the fuzzy pair wise comparison takes place. The experts compare all the criteria on the same level of the hierarchy. A pair wise comparison is performed by using Fuzzy linguistic terms in the scale of 0 – 10 described by the Triangular Fuzzy Numbers in the Table 1.1. In Buckley's method, the element of the negative judgment is treated as an inverse and reversed order of the fuzzy number of the corresponding positive judgment. Thus it requires not only a rigorous manipulation in the construction of reciprocal matrix but also due to transitivity the result becomes inconsistent. Again to reflect pessimistic, most likely and optimistic decision making environment, triangular fuzzy numbers with minimum value, most plausible value & maximum value are considered.

$$A = \begin{pmatrix} 1 & a_{12} & a_{1n} \\ a_{21} & 1 & a_{2n} \\ a_{31} & a_{32} & a_{3n} \end{pmatrix}$$

To simplify the calculation of element weight the fuzzy pair wise comparison matrix is broken into crisp matrices where the crisp matrices are formed by taking the minimum values, most plausible values & maximum values from the triangular fuzzy numbers, which were mentioned in section 2.

## 4 Results

### 4.1 Setting Stage

In this section, the whole process of calculation will be analysed. Then the results of each weight of the alternatives will be illustrated. And finally, the final results of selection the right instant coffee supplier will be displayed according to experts' interview.

Comparable data are collected by the method of survey experts through interviews and direct the relevant agencies. Homogeneity index (incon) 0.05 of AHP is satisfactory. The main criteria are comparable bond correlation pairs separate to produce detailed data calculations. The tables above are typical illustrations for pair wised comparison matrices need to enter the data set gathered from interviews of experts in the relevant industry. There are 23 matrices developed to cater for the processing of the data model. And following authors quote a matrix in which to further illustrate this problem.

**Denoting:** Income – IC  
 Expenditure – Exp  
 Staff – St  
 Security – Sec  
 ATM Service – ATM

Table 4.1: Matrix of Pair Wise Comparison

Criteria	IC	Exp	St	Sec	ATM
IC	1.0110	2.00000	2.00000	2.00000	4.00000
Exp	0.50	1.00	1.00000	0.20000	2.00000
St	0.50	1.00	1.00	0.33333	1.00000
Sec	0.50	5.00	3.00	1.00	4.00000
ATM	0.25	0.50	1.00	0.25	1.00
<b>Total</b>	2.7500	9.50	8.00	3.7833	12.00

$$\lambda_{\max} = \sum \frac{\text{SUM Weight}}{n} = \frac{26.33}{5} = 5.27$$

$$CI = \frac{\lambda_{\max} - n}{n - 1} = \frac{5.27 - 5}{5} = 0.066$$

CI=0.066<0.05, it shows good consistency of pair-wise comparisons.

$$CR = \frac{|CI|}{RI} = \frac{0.066}{1.12} = 0.059$$

As mentioned in chapter 2, there are 6 criteria so RI=1.12.

CR=0.059 = 5.9% <10%, that means consistent.

CR=0.083 = 8.3% <10%, that means consistent.

**Table 4.2:** Summary of Evaluation Process

	<b>BIDV</b>	<b>VietinBank</b>	<b>ACB</b>	<b>Sacombank</b>	<b>DAB</b>	<b>HDBank</b>	<b>SeABank</b>	<b>SGB</b>	<b>MBB</b>	<b>SHB</b>
Investment (22.7%)	2.11%	1.77%	2.98%	1.97%	3.13%	1.88%	2.87%	1.66%	1.46%	2.44%
Advances (6.40%)	0.47%	0.67%	0.82%	0.70%	0.88%	0.50%	0.87%	0.44%	0.37%	0.67%
Interest Income (3.30%)	0.31%	0.36%	0.31%	0.45%	0.41%	0.26%	0.49%	0.23%	0.19%	0.30%
Other Income (1.73%)	0.21%	0.15%	0.16%	0.19%	0.27%	0.14%	0.23%	0.14%	0.10%	0.14%
Interest Ex. (8.40%)	1.09%	1.12%	0.93%	0.91%	1.21%	0.55%	0.91%	0.66%	0.48%	0.55%
Operating Ex. (4.20%)	0.44%	0.41%	0.62%	0.47%	0.44%	0.27%	0.35%	0.43%	0.36%	0.41%
Biz/Employee (2.51%)	0.27%	0.17%	0.24%	0.29%	0.37%	0.21%	0.29%	0.24%	0.24%	0.19%
Profit/Employee (1.74%)	0.16%	0.14%	0.19%	0.15%	0.26%	0.20%	0.21%	0.15%	0.12%	0.16%
Staff Knowledge (1.47%)	0.14%	0.13%	0.16%	0.15%	0.14%	0.14%	0.13%	0.12%	0.17%	0.19%
Timely Service (5.99%)	0.60%	0.58%	0.76%	0.82%	0.55%	0.51%	0.64%	0.41%	0.45%	0.66%
Safety of Funds (12.36%)	1.25%	1.13%	1.97%	1.43%	1.26%	1.09%	1.09%	0.80%	1.25%	1.10%
Secured ATMs (6.19%)	0.79%	0.37%	0.63%	0.59%	0.80%	0.55%	0.93%	0.44%	0.55%	0.53%
Secured i-Banking (9.56%)	0.98%	0.94%	1.68%	1.09%	0.85%	0.84%	1.01%	0.72%	0.52%	0.92%
Accuracy (5.48%)	0.53%	0.56%	0.64%	0.64%	0.51%	0.50%	0.48%	0.35%	0.63%	0.63%
Availability (0.85%)	0.11%	0.07%	0.08%	0.09%	0.10%	0.07%	0.11%	0.05%	0.08%	0.07%
User friendly (1.31%)	0.17%	0.09%	0.12%	0.13%	0.15%	0.12%	0.19%	0.11%	0.11%	0.12%
Connectivity (3.08%)	0.38%	0.27%	0.29%	0.33%	0.48%	0.25%	0.41%	0.24%	0.18%	0.25%
Innovation (2.03%)	0.24%	0.22%	0.25%	0.22%	0.19%	0.18%	0.21%	0.13%	0.18%	0.21%
ATM Quality (1.14%)	0.13%	0.14%	0.15%	0.12%	0.11%	0.09%	0.12%	0.09%	0.08%	0.12%
<b>Total</b>	<b>10.38%</b>	<b>9.29%</b>	<b>12.98%</b>	<b>10.74%</b>	<b>12.11%</b>	<b>8.35%</b>	<b>11.54%</b>	<b>7.41%</b>	<b>7.52%</b>	<b>9.66%</b>

### 4.3 The Final Rankings

After respectively calculating, analysis and evaluating of suppliers through each sub-criterion of six main criteria in Balanced Scorecard of AHP model, we have been solving the second floor of AHP hierarchy. And this is the final calculation results which are obtained after running the data through the two floors of the criteria assessment model according to the method of AHP. The percentages are of banks shown in the table. Based on these values, we can rank as well as further analysis of the selected alternatives. Plus we can evaluate each bank. Besides, to compare the degree of difference between the alternatives, any financial organizations can make a decision in choosing the best suppliers and the most suitable.

**Table 4.3:** The Final Rankings

Ranking	Banks	Global Weight
1	ACB	12.98%
2	DAB	12.11%
3	SeABank	11.54%
4	SacomBank	10.74%
5	BIDV	10.38%
6	SHB	9.66%
7	VietinBank	9.29%
8	HDBank	8.35%
9	MBB	7.52%
10	SGB	7.41%

Table 4.3 summarizes the final results in evaluating and rankings after applying AHP method. We can see the changes of percentage of banks by criteria. ACB's percentages have change widely from each sub-criterion; finally it gets 12.98% at the top of the list. Coming very closely downwards are DAB, SeAbank etc., at the bottom of the table is SGB at 7.41%.

This chapter discusses data analysis and the results of the current study. We first conduct setting to categorize the focused characteristics and steps towards this study will take place. Then, the selection analysis of each supplier is summarized in detail. The purpose is to find the final rankings of Vietnamese banking system according to the survey results from experts. From that, the final rankings were set up to get the results, which can be further discussed in the next section.

## 5 Conclusions

### 5.1 Discussions and Managerial Implications

This final section will give comments on the results achieved, pointed out the conclusions and recommendations presented by the author, and the limitations encountered. On the other hand, the author gives a number of research directions for the development of the subject in the future and expands the application of AHP in practice.

In fact, many scholars and experts have already studied the related subjects of measurement performance, which includes the meaning of performance management,

its elements and contents, and the measurement index. On the contrary, the study of performance management is still not sufficient so far. In this study, the author concedes corporate intangible value and clearly understands performance management ability of each Vietnamese banking system by AHP. Besides, performance management is the key factor of high-tech companies' operation outcome, the author hopes those results can offer performance management as reference for the academia and professionals.

The results from the model are evaluated using the method of AHP quantification. AHP can compare the tiniest differences between providers through the numbers, charts and graphs. The results of detailed calculations to each level of the ladder system provide multi-faceted perspective. Strong ability to synthesize the components of the hierarchy and logic algorithms are not too complicated, but also help managers can examine each aspect and see the overview are all issues are considered.

In an organization that has always existed three important lines: The first line of communication throughout the system, the second is financial flows, also known simply as cash flow, and finally the material flow. Purchasing is one of the important tasks of the business because it is responsible for the physical input line of the organization. Increasing awareness of purchasing should be advanced position and its role in the enterprise is increasing. Most organizations now recognize closely related to purchasing strategy should the company access to parts purchasing increasingly more difficult. Information security requirements for these departments are increasingly stringent.

The process of evaluation and selection of suppliers has long held bias in a qualitative sense, dependent on experience and emotions of those who have related responsibilities. Therefore, it is necessary to apply the typical methods such as quantitative analysis of this process - AHP presented in this study. With the aim of increasing the computational content of the evaluation process suppliers, especially the comparison of suppliers in the same industry as AHP has shown. This enables the analysis of all the providers and more scientific. Thus, this thesis would help the facility managers ensure objectivity to the reasonable decision.

Through the application of analytical methods to process steps or methods to compare providers evaluate other qualitative factors could improve and contribute to the financial organizations which then in the future they can apply and expand their business.

Moreover, the main evaluation criteria and sub-criteria have been quantified to ensure that most of the stages in the purchasing process. When evaluating partners is well supplied, all stages in the process of purchasing them achieve flawless collaboration.

## **5.2 Limitations and Future Research**

This thesis utilizes the interview method access the expert groups and questionnaire surveys with data collected to be slightly biased and subjective experience.

The data primarily comes from the documents and reports out there, not yet homogeneous. Years missing data so that comparisons between providers and become limp.

The process measurement data collected are processed and applied scales also unsettled. The comparison between the criteria in suppliers has not yet met the stringent requirements of the equivalent. The transformation scales to scales AHP has many limitations.

It is possible to dig more theoretical model further evaluation. There are many criteria that can be used for model assessment. Every type of business and every business will



have specific criteria in accordance with the individual's typical enterprise. It is important to note build an assessment model provider in accordance with industry characteristics and distinctions of the business. It should be tried to reach deep to the data source to the enterprise purchasing the thesis topic under direction of this form of anonymous real close to reality than now.

Finally, the different measures provide distinct perspectives which help us have deeper conclusion about the association between working capital management and firm performance. Therefore, future researches should fill this research gap by generalizing findings using larger sample size in order to have more general, imperative vision as well as solutions for enterprises in many other fields. More measures of firm performance management as well as measurement performance components should be applied in future researches have better evaluation.

### **5.3 Conclusions**

By this thesis, author would contribute to the banking system by providing the evaluating by the discussed criteria and sub-criteria. The research results suggest that performance management, which invest technology, improving quality, and structural management, is one of the main sources of competitive advantage for firms. This study argues that performance management is a necessary strategic tool for use against competitors. The emphasis on intellectual capital can help firms implement new initiatives for enhancing their performance. That means the technology on the security should be focused. Moreover, many experts and customers rate the INCOMES of a bank is really important, so that banks should build up the structural and marketing management to boost the IMCOMES. Other factors, including ATM and STAFF, are chosen at the certain level to evaluate a bank.

### **References**

- [1] Arbel, A., &Orgler, Y. E. (1990). An application of the AHP to bank strategic planning: the mergers and acquisitions process. *European Journal of Operational Research*, 48(1), 27-37.
- [2] Beyer, A., Cohen, D. A., Lys, T. Z., & Walther, B. R. (2010). The financial reporting environment: Review of the recent literature. *Journal of accounting and economics*, 50(2), 296-343.
- [3] Chan, Felix T.S., Kumar, N., Tiwari, M.K., LAU, H.C.V., Choy,K.L. (2008). Global supplier selection: a fuzzy-AHP approach. *International Journal of Production Research*, Vol. 46, No. 14, 15 July. Pages 3825–3857.
- [4] Chen, Z., & Tan, J. (2011). Does bancassurance add value for banks?—Evidence from mergers and acquisitions between European banks and insurance companies. *Research in International Business and Finance*, 25(1), 104-112.
- [5] Faisal, M. N., &Banwet, D. K. (2009). Analysing alternatives for information technology outsourcing decision: an analytic network process approach. *International Journal of Business Information Systems*, 4(1), 47-62.
- [6] Gordon, T. J. (1994). The delphi method. *Futures research methodology*, 2..
- [7] Gorgievski, M. J., Ascalon, M. E., & Stephan, U. (2011). Small business owners' success criteria, a values approach to personal differences. *Journal of Small Business Management*, 49(2), 207-232.
- [8] Ho, A., & Baxter, R. A. (2011). Banking reform in Vietnam. *Asia focus*, (June).

- [9] Korhonen, P., & Voutilainen, R. (2006). Finding the most preferred alliance structure between banks and insurance companies. *European Journal of Operational Research*, 175(2), 1285-1299.
- [10] Korhonen, P., & Voutilainen, R. (2006). Finding the most preferred alliance structure between banks and insurance companies. *European Journal of Operational Research*, 175(2), 1285-1299.
- [11] Kurttila, M., Pesonen, M., Kangas, J., & Kajanus, M. (2000). Utilizing the analytic hierarchy process (AHP) in SWOT analysis—a hybrid method and its application to a forest-certification case. *Forest Policy and Economics*, 1(1), 41-52.
- [12] Min, D. M., Kim, J. R., Kim, W. C., Min, D., & Ku, S. (1996). IBRS: Intelligent bank reengineering system. *Decision Support Systems*, 18(1), 97-105.
- [13] Ngai, E. W. T. (2003). Selection of web sites for online advertising using the AHP. *Information & Management*, 40(4), 233-242.
- [14] Saaty, T. L. (2008). Decision making with the analytic hierarchy process. *International journal of services sciences*, 1(1), 83-98.
- [15] Salmeron, J. L., & Herrero, I. (2005). An AHP-based methodology to rank critical success factors of executive information systems. *Computer Standards & Interfaces*, 28(1), 1-12.
- [16] Seçme, N. Y., Bayraktaroglu, A., & Kahraman, C. (2009). Fuzzy performance evaluation in Turkish banking sector using analytic hierarchy process and TOPSIS. *Expert Systems with Applications*, 36(9), 11699-11709.
- [17] Sevkli, Mehmet., Koh, S.C. Lenny., Zaim, Selim., Demirbag, Mehmet., Tatoglu, Ekrem. (2008). Hybrid analytical hierarchy process model for supplier selection. *Industrial Management & Data Systems*, Vol. 108 No. 1. Pages 122–142.
- [18] Wang, T. C., & Lin, Y. L. (2009). Applying the consistent fuzzy preference relations to select merger strategy for commercial banks in new financial environments. *Expert Systems with Applications*, 36(3), 7019-7026.
- [19] Yang, Ching-Chow., Chen, Bai-Sheng. (2006). Supplier selection using combined analytical hierarchy process and grey relational analysis. *Journal of Manufacturing Technology, Management*, Vol., 17 No. 7. Pages 926–941..
- [20] Yong-gang, C. U. I. (2004). A Method Based AHP: To Choose the Best Strategic Alliance Partner [J]. *Journal of Tianjin University of Commerce*, 1, 004.
- [21] Yu, H. C., Lee, Z. Y., & Chang, S. C. (2005). Using a fuzzy multi-criteria decision making approach to evaluate alternative licensing mechanisms. *Information & management*, 42(4), 517-531.