Applying Fuzzy AHP to Study the Key Factor of internal control of China Construction Bank

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ABSTRACT: A commerce bank with a sound control mechanism won't solely enhance his business aggressiveness, however additionally generate positive in operation effects and potency. On the negative aspect, it will still pay a preventive perform to cut back and stop the incidence of internal non-legal incidents. The purpose of this paper is to construct an evaluation model for the internal control of commerce bank. Firstly, review the relevant literature and summaries the factors that will be thought of in evaluating the inner management of business bank. And then based on the importance that staffs value on these factors, five evaluative dimensions are extracted by factor analysis, and a structure of three evaluation framework is constructed. Secondly, the weight of each evaluative criterion in each evaluation level is calculated using the fuzzy analytic hierarchy process (FAHP). The findings that the internal environment, risk assessment and control activities are more important to staffs. Among the fifteen criteria within the third-level, five criteria are more valued, they are organizational structure, risk identification, risk analysis, allocation of authority and responsibility and independence of supervision. At last, the paper, based on the results, proposed management suggestions for the concerned banks.
KEYWORDS: Commerce bank, Internal control, Fuzzy analytic hierarchy process (FAHP).

I. INTRODUCTION

Commercial banks, as the main body of financial institutions, have evolved from simple businesses like exchange and currency exchange to functional institutions that combine deposit and loan, payment and settlement, financial management, and other functions. They play a critical role in modern society. However, as the financial industry liberalizes, innovates, and internationalizes, banks are confronted with a complicated and changing competitive environment, and the risks they face are increasing. In addition, over ten bank failures have occurred in the last 20 years, and staff violations, senior manager crime, and loan loss are all common occurrences. The primary cause is a lack of internal control.

Internal control is a set of artificial disciplinary standard processes whose development is dependent on the functional upkeep of control points in the operation process. Where transactions are not operated by one person to the end, each operation process must be reviewed by another person. The control point is guarded by the person; if the person's vulnerability is exploited, the control point's function will be basically non-existent, resulting in loopholes, thus the case occurred [3].

Financial institutions, on the other hand, have distinct characteristics from conventional businesses. Their operating capital originates from the general public, and they are also in charge of the payment function's circulation and liquidation. If a problem arises, the consumer will lose faith in the company, resulting in a financial meltdown and a chain reaction that would jeopardize the safety of the entire society and economy. As a result, if financial institutions maintain a good internal control system, they can regulate and check each other according to certain regulations to avoid the occurrence of negligence and fraud; on the plus side, we can achieve the best configuration for each operation to reduce operating costs, improve operating efficiency, and ensure compliance [13].

Many diverse elements, such as organizational structure, risk analysis, and information control, must be considered when evaluating internal control. It's a multi-criteria decision-making problem (MCDM), which means that numerous criteria may clash with one another,

and there's also the possibility of ambiguity and doubt about the relative importance of multiple standards. As a result, the fuzzy analytic hierarchy process (Fuzzy AHP) is used as the evaluation model for the important aspects of commercial bank internal control in this study. The study analyzes the preferred attribute and the weight of the attribute of the staff in internal control using the fuzzy AHP, and gives research results and recommendations for other commercial banks in the implementation of internal control management reference.

II. LITERATURE REVIEWS
2.1- Internal control
Internal control is a management technique used by a company's board of directors, management, and other workers to ensure that the three main objectives of business operations, information, and compliance are met, as well as to improve performance and avoid fraud [12]. As a result, the internal control mechanism includes the principles listed below.

(1)   The internal control is a "process" that serves as a means to an end rather than an end in and of itself.

(2)   People must perform internal control, which includes not only workbooks and management reports, but people at all levels of the organization.

(3)   Only "reasonable assurance," not "perfect assurance," is expected from internal control.

(4)   The implementation of "internal control" aids in the achievement of the enterprise's overall or stage-by-stage and level-by –stage and level-by-level objectives.

Furthermore, commercial bank internal control aims to ensure that the business conducted by commercial banks complies with the regulatory authorities' regulations and standards, as well as to prevent and resolve potential financial risks, ensure the consistent implementation of the bank's operating policies, and maximize the interests of commercial bank shareholders [20]. Its infrastructure is based on national principles and guidelines established by the CBRC to ensure that each business follows the rules. It will ensure that it can reasonably predict the many risks it may face and effectively control them to the lowest tolerance level, reducing the potential of systemic risks to zero and reducing the Bank's losses. And to ensure that the accounting is accurate and dependable, and that the financial statements can withstand external inspection; and to ensure that authority and responsibility are clearly separated amongst departments. In addition to ensuring that commercial banks operate normally and develop in

a stable and orderly manner, the industry's financial stability must be maintained [7].

2.2- The evaluative factors of internal control in commercial banks
The actual economic activities in modern economic society are inextricably linked to the financial activities. Financial intermediaries not only make economic operations run more smoothly, but they also have a significant impact on savings, investment, and financial management [15]. Banks, on the other hand, are financed by the general public, and their operations are not solely motivated by their own interests. Banks function differently than other businesses, primarily because they are in charge of ensuring that the financial system runs smoothly and reliably. In the event of a bank crisis, not only would a single bank's viability be threatened, but so will the survival of other financial institutions engaged in comparable activities. As a result, in the quest of profitability, banks must also address safety concerns. The internal environment, risk assessment, control activities, information and communication, and internal supervision are the five factors that determine the execution of internal control. The goal is to increase the bank's internal control system and meet the goal of smooth operations by eliminating errors and frauds [16].

The greater the number of internal control elements, the less likely they are to cause duplication and interfere with the assessment results. However, a small number of criteria will be unrepresentative, resulting in one-sided assessment outcomes [18]. As a result, in order to get objective and realistic evaluation results of commercial bank internal control, it is important to create an adequate framework of internal control evaluation elements for commercial banks. This study will gather the elements that are acceptable for evaluating the internal control of commercial banks for the upcoming investigation on the relative importance of these factors based on research on internal control of banks in domestic and foreign literature.

Moreover, the COSO Committee in the U. S. A. proposed an overall framework for internal control in 1992 [4], which contains five dimensions and 19 elements, such as control environment, risk assessment, control activities, information and communication, and supervision. Subsequently, changes in the business environment, the increasing complexity of the organizational structure, and the emergence of new technologies and an ever-expanding value chain have created new changes in internal control. In 2013, the COSO Committee promulgated a new overall framework for internal control, which extended the definition of internal

control from the old framework, except that the 19 elements under the five dimensions were reduced to 17 elements [5]. Therefore, these 17 elements are used whenever researched on internal control are conducted. Yu and Jiang [21] used fuzzy mathematical synthesis to evaluate the internal control of international business of a commercial bank, and selected five dimensions i.e. internal control environment, risk identification and assessment, internal control measures, supervisory evaluation and correction, and information exchange and feedback, and 18 evaluative criteria to conduct a comprehensive evaluation. Its evaluative score is biased toward the better situation. However, it compared with excellent bank, there is still a large gap. As for the research of Hsieh et al. [8] used 19 evaluative criteria such as employee competency, managerial supervision, management style, organizational structure, human resources, assignment of authority and responsibility, risk identification, risk analysis, risk response, high-level review, information processing, physical control, target adjustment, information quality, information identification, communication style, continuous supervision, independent evaluation and completeness of evaluation report to evaluate the internal control evaluation for a department in the head office of Agricultural Bank of China through AHP, and their evaluation result was that the internal control system of the department was relatively complete, but the assessment indicators in the way of control activity indicators were to be strengthened. In addition, Yang [19] redefined the five dimensions of internal control (internal environment, risk assessment, control activities, information and communication, and internal supervision) and 23 assessment indicators to evaluate internal control of 16 commercial banks in China through the integration of related literature. Firstly, the weights of indicator were determined by AHP; secondly, ranked 16 commercial banks by grey relational analysis (GRA). Finally, the corresponding problems and related recommendations were proposed and discussed.

In research of Mrs. and Senior [10], they examined the effectiveness of internal control of private banks in Trincomalee through five independent variables - control environment, risk assessment, accounting, information and communication, control activities, and self-assessment. The results found that the internal control of bank is at a moderately supportive level. However, the effectiveness of internal control is still affected by some other unexplained factors and it is recommended that these unexplained factors should be reduced in order to maintain the effectiveness of internal control. And then the study by William et al. [18], they examined the internal control of GM commercial banks in Canaan, and after examining the five dimensions of internal environment, risk assessment, control activities, information and communication, and internal supervision. It was found that the board of directors and senior managers have a high level of internal control relationship, and they need to work together to establish high ethical and integrity standards and a culture of internal control within the organization in order to be able to detect and prevent internal fraudulent acts and practices.

From the above compilation of literature [2, 4-6, 8-10, 18, 19, 21], it can be summarized that the evaluative factors of internal control in commercial banks are: internal control culture, allocation of authority and responsibility, organizational structure, incentive mechanism, education and training, organizational relationship, risk identification, risk analysis, operational analysis control, information control, budget control, performance evaluation control, information quality, equipment support, effectiveness of channels, communication methods, existence of supervisory activities, and independence of supervision, etc. 18 criteria.

2.3- Fuzzy analytic hierarchy process (FAHP)

The analytic hierarchy process (AHP) is a decision-making method invented by Saaty in 1980. [11] It is primarily used to solve problems involving uncertainty and several assessment criteria [14]. Complex problems can be dissected and viewed through hierarchical structure by breaking them down from high to low levels. The AHP technique, on the other hand, is concerned with the importance of the elements; nevertheless, in human thinking, which is characterized by ambiguity. Experts, for example, do not always apply clear boundaries when judging the relevance of elements, which might lead to skewed outcomes. Furthermore, when the number of orders increases, so does the number of comparisons between the evaluation elements, which can easily confuse responders owing to too many inquiries, resulting in decreased assessment efficiency. To address the aforementioned issues, Buckley presented the fuzzy hierarchical analysis (FAHP) method in 1985 [1]. This method combines fuzzy theory and AHP to account for the ambiguity that arises when experts compare the relevance of two items in the evaluation hierarchy and to more accurately reflect reality.

The process of FAHP can be divided into the following eight steps [17].

Step 1. Constructing a hierarchical structure. Applying the characteristics of AHP to decompose complex problem, and a hierarchical structure is constructed for the main indicators that affect internal control factors. The first level is the final goal, which is the internal control evaluative mode; the second level is the dimension that affects the internal control evaluative model, and the third level is the internal control evaluative criterion.

Step 2. Design expert questionnaire. The questionnaire was designed to identify the relative importance of the decision elements at each level using pairwise comparison. The evaluative method is to compare the importance of the elements at the next level with the elements of the previous level as the benchmark, and pairwise comparison the importance of any two elements to the elements of the upper level. The linguistic variable of this evaluation scale adopted the membership function of the 9 scale linguistic variable, which defined as follows.

Table 1: The linguisticvariable of evaluation scale

Evaluation scale	Fuzzy number
Equally important	(1, 1, 2)
Intermediate	(1, 2, 3)
Weakly more important	(2, 3, 4)
Intermediate	(3, 4, 5)
Strongly more important	(4, 5, 6)
Intermediate	(5, 6, 7)
Very strongly more important	(6, 7, 8)
Intermediate	(7, 8, 9)
Absolutely more important	(8, 9, 9)

Step 3. Group integration. The relative importance of each element is integrated by each expert.

$$\tilde{a}_{ij} = (\frac{1}{N}) \otimes (\tilde{a}_{ij}^1 \oplus \tilde{a}_{ij}^2 \oplus \cdots \oplus \tilde{a}_{ij}^k) \quad (1)$$

$\tilde{a}_{ij}$, fuzzy number after integration; N, total number of experts, $\forall$ N = 1, 2,…, k ; $\tilde{a}_{ij}^k$, the expert k compares the value of element iwith that of element j.

Step 4. Construct fuzzy pairwise comparison matrix. It is mainly about the elements of a certain level in the level hierarchy, and the pairwise comparison between the elements is carried out with an element in the previous level as the evaluation benchmark. If the hierarchical level has n elements, n(n-1)/2 pairwise comparisons must be performed. And the evaluation results between elements by experts, and use Table 1 to construct a fuzzy pairwise comparison matrix.

$$[\tilde{A}] = \begin{bmatrix} 1 & \tilde{a}_{12} & \tilde{a}_{13} & \tilde{a}_{1n} \\ \tilde{a}_{21} & 1 & \tilde{a}_{23} & \tilde{a}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \tilde{a}_{n3} & 1 \end{bmatrix} \quad (2)$$

$\tilde{A}$, fuzzy pairwise comparison matrix; n. total number of elements; $\tilde{a}_{ij}$: the pairwise comparison fuzzy number of element iwith that of element j.

Step 5. Calculate fuzzy weight. In this paper, the approximate method proposed by Buckley (1985) is used for weight calculation. This method not only considers consistency, but also includes the concept of normalization. The steps are as follows:

$$\tilde{Z}_i = \sqrt[n]{\tilde{a}_{i1} \otimes \tilde{a}_{i2} \otimes \cdots \otimes \tilde{a}_{in}} \ , \ \forall \ i = 1, 2,…, n \quad (3)$$

$$\tilde{W}_i = \tilde{Z}_i \otimes (\tilde{Z}_1 \oplus \cdots \oplus \tilde{Z}_n)^{-1} , \ \forall \ i = 1, 2,…, n \quad (4)$$

$\tilde{Z}_i$, the geometric mean of the triangular fuzzy numbers of the indicator i; $\tilde{W}_i$, the fuzzy weight of indicator i.

Step 6. Defuzzification. After the fuzzy weights of each criterion are obtained through FAHP, the fuzzy values must be converted into crisp value via defuzzification. This are many methods for defuzzification. This paper adopts the COA method to handle and the calculation formula is as follows:

$$DF_{ij} = \frac{[(u_{ij} - l_{ij}) + (m_{ij} - l_{ij})]}{3} + l_{ij} \ , \ \forall \ i = 1, 2,…, n$$

(5)

Step 7. Normalization the crisp weights. In order to compare the importance of different main dimensions and various evaluative criteria, the defuzzification weight value is normalized, and the process is as follows:

$$NW_i = \frac{DF_{ij}}{\sum DF_{ij}} \quad (6)$$

Step 8. Calculating the integrated weights for each layer. After the aforementioned steps, the weight NW_i of the ith main factor in the second layer under the final goal and the important NW_{ij} of the jth evaluation criterion under the ith main factor in the second layer can be obtained. If the weight of the jth evaluation criterion of the second layer under the final goal is required, an integrated weights must be performed, as shown below.

$$NW_j = NW_i \times NW_{ij} \quad (7)$$

The NW_j value of each criterion obtained from the above can be used to evaluate the priority order of alternatives or elements.

When the NW_j value for an alternative or element is larger, it indicates that the order of the alternative or element should be prioritized.

III. RESEARCH METHOD
3.1- Research design
A two-stage research design is used in this paper. The first stage was aimed to measure the elements regarded by China Construction Bank (CCB) staffs for internal control and conduct factor analysis based on their importance in order to build a hierarchical structure for evaluating CCB's internal control. The second stage entails creating a questionnaire for FAHP based on the hierarchical structure constructed in the first. That is, pairwise comparison is used to determine the relative importance of the two components in the same level criterion. In addition, the questionnaire's rating scale is separated into nine grades, with the fuzzy number determined by linguistic variables. Table 1 displays the content.

3.2- Data collection and analysis
Convenience sampling was used in the first stage of the survey because CCB has a large number of staffs, and the locations were chosen from three areas with a large number of staffs, including Fuzhou, Quanzhou, and Xiamen. The respondents to the survey are CCB employees with at least one year of experience. At this point, 200 questionnaires were distributed between December 2019 and mid-January 2020. A total of 182 questionnaires were collected, with a 91 percent recovery rate. SPSS 22.0 was used to derive the factor dimensions of the evaluation criteria from the data acquired by the questionnaires. In the meantime, each dimension that was extracted was subjected to a reliability analysis and an internal consistency test.

The second-stage questionnaire survey was place between March 4 and April 6, 2020. A total of 50 questionnaires were distributed, 42 of which were collected, with an 80 percent recovery rate. EXCEL is used to individually calculate the weight of each evaluative criterion for each responder and assess consistency for the data acquired by the questionnaire, according to formulas (1)-(7). Following the consistency check, FAHP is utilized to calculate the weights of various evaluative criteria for internal control.

IV. THE EMPRICAL RESUTLS AND ANALYSIS
4.1- The first stage of survey and construction of hierarchical structure
In this paper, factor analysis and reliability were subjected on the 18 evaluative criteria data collected from the first-stage survey. The factor analysis was performed using principal component analysis (PCA) to extract factors with eigenvalues greater than 1 and factor loadings greater than 0.5, and the maximum variance method was used to rotate the factors to facilitate factor naming. After the factor analysis of the 18 evaluation criteria, the factor loadings of the other functions did not reach 0.5 and were deleted, thus leaving only 15 items. Next, the five major dimensions of the reduction framework are named as internal environment, risk assessment, control activities, information and communication, and internal supervision according to the issues they cover, with a total explanation capability of 72.9%. And then the KMO value of 0.722 and the p-value of less than 0.5 indicate that the 15 evaluative criteria are suitable for factor analysis. Simultaneously, the reliability of Cronbach's was also used to test the internal consistency of each dimension. The Cronbach's values for all five dimensions were greater than 0.7, indicating that the consistency of these five dimensions are acceptable. The results of the factor analysis and reliability of the 15 evaluative criteria are shown in Table 2.

As shown in Table 2, the dimension of "internal environment" includes four items, including allocation of authority and responsibility, organization structure, motivation mechanism and education and training. Following, the "risk assessment" dimension consists of two items: risk identification and risk analysis. Moreover, the dimension of "control activities" includes four

items, such as operational analysis control, information control, budget control and performance appraisal control. As for the dimensions of "information and communication" includes information quality, equipment support and effectiveness of channels. Finally, the dimension of "internal supervision" includes presence of supervisory activities and independence of supervision. Based on the above-mentioned factor analysis results, this paper constructs an evaluative framework for international control of CCB. The first level of the framework is the final goal, and the second and third level are the evaluative levels. The second level is the five evaluation dimensions extracted by factor analysis, and the third level is the evaluative criteria of each evaluative dimension. The evaluative framework is shown in Figure 1.

Table 2: Factor and reliabilities of each dimension

| Measurementitems	Factor loading	Eigenvalue	Cumulative percentage of variance
Internal environment (Cronbach's value = 0.8329)		3.218	21.3%
Allocation of authority and responsibility	0.861		
Organizational structure	0.790		
Motivation mechanism	0.654		
Education and training	0.622		
Risk assessment (Cronbach's value = 0.7291)		2.244	37.0%
Risk identification	0.763		
Risk analysis	0.649		
Control activities (Cronbach's value = 0.7016)		1.683	50.9%
Operationalanalysis control	0.812		
Information control	0.750		
Budget control	0.610		
Performance appraisal control	0.586		
Information and communication (Cronbach's value = 0.7851)		1.380	62.7%
Information quality	0.862		
Equipment support	0.820		
Effectivenessof channels	0.677		
Internal supervision (Cronbach's value = 0.7722)		1.081	72.9%
Presence of supervisory activities	0.806		
Independence of supervision	0.597		
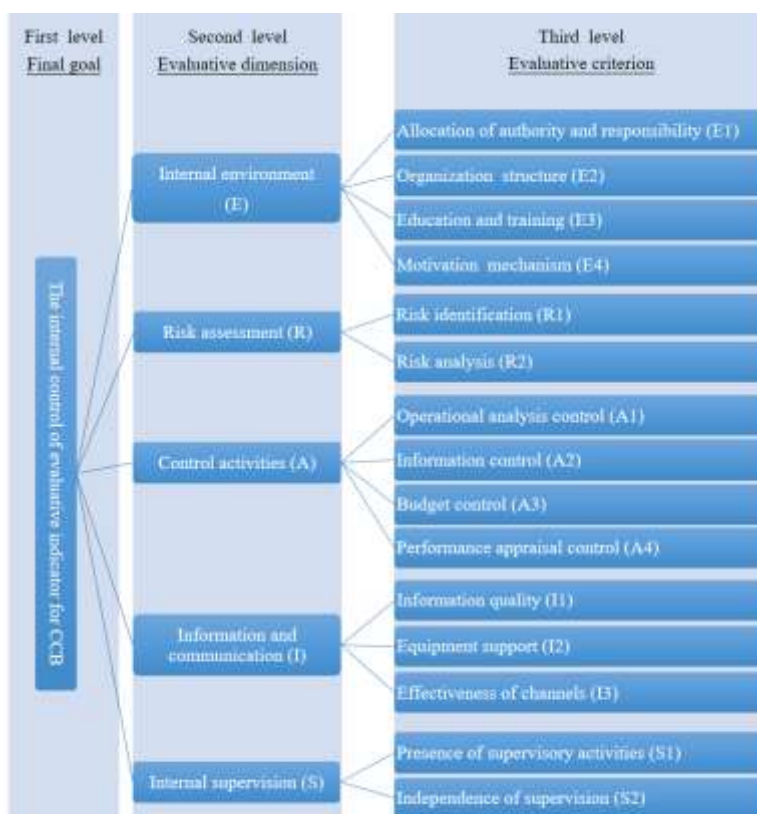
Figure 1: The hierarchical framework of internal control evaluative indicator for CCB

4.2- The second stage of survey for FAHP

In the second stage, a total of 42 questionnaires were recovered. The bulk of the 42 respondents were account managers, with a bachelor's degree in education and 5-7 years of experience. They were female, 31-40 years old, married, and had a bachelor's degree in education. The weights of 42 respondents on each dimension and evaluative criterion were determined independently in this paper using equations (1)-(7). The pairwise comparison matrix's C.I. and C.R. values are then less than 0.1 as the consistency testing verification standard. The calculations suggest that ten people failed the test and will be removed from the list. Thus, for the following analysis, the data provided by the 32 respondents who passed the consistency test were used.

According to the hierarchical structured in Figure 1, this paper used FAHP to calculate the relative weight value of each dimension and criterion, and calculate the weight value after the integrated weights for each layer. The results are shown in Table 4. The weight values and ranking data in Table 4 show that among the five dimensions in level 2, the dimensions that staffs value in order are "internal environment" (0.318), "risk assessment" (0.220), "control activities" (0.201), "information and communication" (0.138), and "internal supervision" (0.123). The results show that staffs give primary importance to "internal environment" and less importance to "internal supervision" when implementing internal control. In addition, there is a significant difference between the weight values of the top three dimensions and the fourth and fifth dimensions, indicating that staffs attach more importance to the internal environment, risk assessment and control activities than the other two dimensions in the implementation of internal control. For internal control, this results means than then three dimensions are well implemented, the bank has a stronger competitive advantage and, so that three dimensions should be the main key factors. And the internal environment is the most important factor. As far as the internal control environment, the organization structure is properly set up with clearly allocation of authority and responsibility of the respective functional departments, and there is a perfect incentive mechanism and a complete training mechanism for staffs to promote staff growth. In the part of risk assessment, it is necessary to boldly innovate in risk identification and risk analysis, and use a variety of methods and technologies to comprehensively explore and analyze. As for the control activities, with the continuous growth of business and scale, the best systems and measures will inevitably be

flawed. Regularly evaluate internal control to identify control blind spots, improve problematic measures, and eliminate redundant measures. Therefore, how to emphasize the implementation of control activities and enhance the motivation of staffs in the bank is an important issue that commercial banks must face implementing internal control.

In the analysis of the criteria weights and ranking of the criteria in the third level after integrated, Table 4 shows that the top five evaluative criteria most valued by staffs are: "organizational structure (0.128)", "risk identification (0.126)", "risk analysis (0.094)", "allocation of authority and responsibility (0.086)" and independence of supervision (0.073)". Among the top five evaluation criteria in this ranking, two criteria belong to the "internal environment" dimension, and the other two criteria belong to the "risk assessment" dimension, and the coverage rate is 100%. The remaining one criterion is "internal supervision", and the sum of these five criteria is 50.7%. In addition to the internal environment and risk assessment criteria, the independence of supervision is also an important factor for the bank's

management. Because of commercial banks need to supervision and evaluate their own internal control, and timely remedy related problems and loopholes in internal control. If the self-supervision awareness and independence of the relevant personnel are weak, the independence of supervision will not be implemented, and the relevant reports and suggestions for improvement will not be timely, which will ultimately make the independence of supervision a mere formality. Therefore, it is necessary to vigorously improve the independent awareness of staff supervision and effectively play the role of self-supervision. Further, the evaluative criteria that staffs pay less attention to include "budget control (0.047)", "information quality (0.045)", "performance appraisal control (0.044)" and "equipment support (0.041)". This shows that these criteria are not an important consideration when implementing internal control by the management of the bank. The reason may be that if the internal control cannot be effectively implemented, it will direct other factors, which will make the control and the information unable to play their due role. Therefore, it is more important to strengthen the implementation of internal control.

Table 3: The weights and overall ranking of evaluation criterion after integrated

Dimension	Criterion	Normalization Weights	Integrated Weights	Ranking
Internal environment (0.318)	Allocation of authority and responsibility	0.271	0.086	4
	Organizational structure	0.402	0.128	1
	Motivation mechanism	0.174	0.055	7
	Education and training	0.153	0.049	11
Risk assessment (0.220)	Risk identification	0.572	0.126	2
	Risk analysis	0.428	0.094	3
control activities (0.201)	Operationalanalysis control	0.286	0.057	6
	Information control	0.261	0.052	8
	Budget control	0.233	0.047	12
	Performance appraisal control	0.220	0.044	14
Information and communication (0.138)	Information quality	0.328	0.045	13
	Equipment support	0.296	0.041	15
	Effectivenessof channels	0.376	0.052	8
Internal supervision (0.123)	Presence of supervisory activities	0.407	0.050	10
	Independence of supervision	0.593	0.073	5

V. CONCLUSIONS AND SUGGESTIONS
Internal control evaluation for commercial banks is one of the MCDM challenges. Many factors must be considered while putting in place an internal control system in a bank. Whether the mechanisms given by internal control are capable of

satisfying these factors has a considerable impact on commercial banking's decision-making in their operations. As a result, one of the most important methods for commercial banks to improve their competitiveness in the face of a strong competitive market is to understand the factors considered by

employees in a commercial bank and the weight of these elements in the minds of staff. The literature on internal control evaluation in commercial banks, both domestic and international, was evaluated in this paper. To begin, we summarize the potential criteria evaluated by commercial bank staffs for internal control, depending on the importance of these quantitative elements to staffs. Factor analysis is used to extract five evaluative dimensions, which are then used to build a three-level evaluative framework. Second, FAHP is utilized to figure out how much each evaluative criterion in each evaluation level is worth. The findings revealed that the weight values of the five key evaluative dimensions are in order at the second-level evaluation level: internal environment, risk assessment, control activities, information and communication, and internal supervision. The top three dimensions have much higher weight values than the other two dimensions, and the sum of these three dimensions is as high as 73 percent. Furthermore, at the third-level evaluation level, the top five criteria are: organization structure, risk identification, risk analysis, allocation of authority and responsibility, and independence of supervision, in that order. And these five criteria are part of the three dimensions of internal environment, risk assessment, and internal supervision, but not the dimensions of control activities and information and communication, which are given less weight by staffs. It is considered that the implementation of internal control has led most staffs to feel that the existing scenario permits each level and department to conduct its own job, and as a result, the variability of these two dimensions from department to department is given less regard.

It can be observed from the ranking of the weight values of the evaluative criterion that "organization structure" is the most essential concern for internal control employees. This identifies whether the internal hierarchical structure is scientifically designed, efficient, and capable of checking and balancing each other. Staff members are concerned by inappropriate settings and unclear responsibility and authority, which will certainly lead to internal control concerns. In terms of managerial implications, it is recommended that senior management of commercial banks establish more systems and define their respective responsibilities in the internal environment, as well as adopt detailed rules and regulations to allow staffs and departments to participate in the practice to the greatest extent possible, so that all levels and departments can truly perform their respective duties and have their rights and obligations fulfilled. Furthermore, risk assessment and management

actions are also critical concerns for staffs. In managerial implications, commercial banks should have well defined control objectives, be able to effectively identify risks, and use advanced risk analysis and technology to provide risk analysis remedies, according to managerial implications. Furthermore, it is required to make corresponding control measures and specifications on a constant basis in order to enhance control blind spots and include new control measures in control activities.

In the future, this paper will only summarize the internal control consideration factors for commercial banks based on domestic and foreign literature, and these factors may be covered extensively enough, so future research should include expert interviews (such as industry, government, and academia) or focused interviews to include all quantitative factors as much as possible. Furthermore, this paper employed factor analysis to develop an evaluative framework for internal control, however the results revealed that only 72.9 percent of the variation was explained, and the KMO value was not optimum. It is suggested that the fuzzy Delphi method be used to classify the assessment criteria or develop the evaluation framework in future research.

VI. ACKNOWLEDGEMENT

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