Journal of Information Hiding and Multimedia Signal Processing ©2016 ISSN 2073-4212
Ubiquitous International Volume **7**, Number **1**, January **2016**

Constructing The Predictive Model for Strategy Execution Problems -The Application of The Two-stage Analytic Network Process

Chih-Chao Chung, Li-Chung Chao

Institute of Engineering Science and Technology
National Kaohsiung First University of Science and Technology
No.2, Jhuoyue Rd., Nanzih Dist., Kaohsiung, 811, Taiwan
justin640513@yahoo.com.tw; chaolc@nkfust.edu.tw

Shi-Jer Lou*

Graduate Institute of Technological and Vocational Education
National Pingtung University of Science and Technology
No.1, Shuefu Rd., Neipu, Pingtung, 912, Taiwan
*Corresponding Author
9915916@gmail.com

Received August, 2014; revised October, 2015

Abstract. *In today's globalized context, corporations striving to gain a competitive marketplace share must develop optional strategies, including coping with environmental trends and establishing a direction for long-term development. Despite these strategies, few corporations successfully execute their strategic plans, and their failure is attributable to weak executive ability. Corporate culture and industrial traits vary even with the same business objectives or strategies; furthermore, most corporations encounter different factors impacting actual implementation. Therefore, the purpose of this study is to apply the two-stage Analytic Network Process (ANP) to develop the predictive model for strategy execution problems. This study seeks to help the case corporation in predicting possible problem types encountered in the strategy execution stage, establishing corresponding executive methods to the problem types that can help the case corporation prepare for strategy execution, and focusing on the strategy execution point that elevates corporate executive ability corresponding directly to the corporation's international competitiveness.*
Keywords: ANP, Executive ability, Strategy execution, Performance indicators, Prediction

1. **Introduction.** Global corporations are encountering serious challenges regarding gaining competitive advantages, which renders their survival to be dependent upon carefully planning their "strategy," establishing long-term development, and measuring performance with corresponding indicators to ascertain the effects of strategic implementation. The simplicity, ease-of-use, and significant effects of Analytic Network Process (ANP) have resulted in the wide application of this process in strategic planning, prediction, resource distribution, and investment portfolios [1, 2]. Every corporation is capable of planning effective strategies, but few companies succeed in this endeavor. Many companies' failures can be attributed to poor executive ability. Such companies may have complex strategies or visions, but fail to practice them and instead fall into the trap of "management by slogans" [3, 4]. The ability to execute strategies is the main resource

for corporations to maintain their competitive edge [5]. The planning and execution of competitive corporate strategies must have equal weight in order to elevate the executive ability of corporations and employees. In fact, execution is not as simple as imagined by managers, but is a systematic engineering process composed of integrated core procedures involved in personnel, strategy, and operations, which involve all aspects of corporate operations and management [6]. Much of the literature about executive ability have comprehensively listed the problems and issues to focus on in the stage strategy execution stage. Nonetheless, most corporations only passively accomplish the preparation work before, during, and after strategy execution. If every corporation has different cultural backgrounds, industrial characteristics, and limited resources, is it possible for corporations to incorporate all aspects and respond to each problem specifically? If the effective predictions strategy execution problems are possible and corporations focus their efforts on preparation, then the result should be a significant elevation of executive strategies. In view of this perspective, this study uses two-stage ANP to develop a predictive model for strategy execution problems, to predict the problem types that might be encountered by corporations in the strategy execution stage, and to place more focus on the important points in strategy execution. This study has three objectives, listed as follows.

1. Use the assessment results from two-stage ANP for analysis and discussion to explore the content.
2. Define the problem types found in strategy execution.
3. Develop the two-stage ANP predictive model for strategy execution problems.

2. **Literature Review.** Based on the research objectives, relevant research literature on executive ability and ANP was explored to understand the content of executive ability and the characteristics of ANP and to find mutual correlations for each application.

2.1. **Executive ability.** Many people believe that execution is in the realm of details and does not need to concern managers. This concept has been proven to be incorrect. Conversely, execution is the most important work of managers; in the process of execution, everything becomes definitive, allowing one to more clearly understand the overall industry [6-8]. Many companies are unable to achieve long-term goals, have poor execution, and are unable to fully express their capabilities. If grand ideas cannot be converted into concrete actions, they become completely meaningless concepts. Without execution, there is no point in breakthrough thinking, there is no value in learning, employees cannot meet their goals, and revolutions break down before achieving their objectives [4, 9]. Therefore, the successes or failures between competing corporations are usually based on executive ability, which is a problem that corporations most frequently overlook. In the book Execution, leaders who are responsible for execution must implement seven important behaviors: (1) understand your corporation and employees; (2) seek facts; (3) establish clear objectives and priorities; (4) follow up; (5) give rewards where they are due; (6) elevate the abilities of employees; and (7) understand oneself [6]. These seven important behaviors are used as the main considerations in designing the predictive model for this study, which defines the first three important behaviors as the preparation for strategy execution and the remaining four behaviors as the backend management behavior. In addition, managers must use a systematic perspective to confront problems [10]. In the execution stage, there must be thought concerning the integration of three core procedures: (a) personnel procedures, (b) strategic procedures, and (c) operational procedures, which can effectively elevate the executive achievements of strategy [4, 6]. This study uses the three core procedures as the approach to predict and analyze issues in the field of strategy execution in order to provide comprehensive problem prediction, to

effectively integrate the execution of the three core procedures into strategy execution, and to elevate the achievements of this execution.

2.2. **Analytic Network Process (ANP).** In 1980, Satty proposed the Analytic Hierarchy Process (AHP), which is suitable for solving complex problems. Alternatives for decisions involving multiple objectives, criteria, and behaviors provide a structure with high compatibility for this application. AHP assumes that the parts or clusters in each hierarchy level are mutually independent. Decision problems in practice may not be established on the hierarchy level when they include mutual effects among criteria or interdependent relationships between higher and lower level elements. In addition, establishing a practical model also requires feedback from the cluster[11, 12]. In 1996, Satty proposed ANP as a solution. AHP structure represents unidirectional hierarchical relationships, while the structure of ANP permits complex mutual relationships in the decision level and traits. The elements in clusters may be affected by any or all of the elements in other clusters. The source clusters, middle clusters, and bottom clusters are organized into a network with mutually reliant and feedback relationships. The main steps of implementation for the application of ANP in decision-making analysis are as follows[12],

(1) Establish the problem structure. Ascertain objectives based on the problem characteristics, and then search for decision criteria and sub-criteria included in the criteria groups to determine the mutual influence among criteria. If mutual influences exist, then there is outer dependence; if the sub-criteria included in the criteria groups mutually influence, then there is inner dependence. This framework is used to sketch the overall structure of the decision problem.

(2) Paired comparison of the decision criteria. Paired comparison compares criteria by two pairs. Comparison can be divided into two parts, including paired comparison among criteria and mutual comparison of criteria within criteria groups. Paired comparison of sub-criteria is divided into paired comparison within the same group and paired comparison of elements in different groups; relative important values uses the 1-9 point scale by Satty, as in Table 1. Scores at level 1 indicate that the two elements have the same level of importance. When the score is 9, it means that this element (horizontal row in the matrix) is absolutely more important than the other element (vertical column in the matrix). In paired comparison, if two elements have opposite positions, the values can be entered using the reciprocal, or

$$A = [a_{\mathrm{ij}}]_{n\times m} = \begin{bmatrix} 1 & a_{12} & \ldots & a_{1n} \\ a_{21} & 1 & \ldots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & 1 \end{bmatrix}, \; among\, others,\; a_{ij} = \frac{1}{a_{ij}};\; i,j = 1,2,...,n \qquad (1)$$

When a_{12}=3, it means that the importance of the first criterion is 3 times of that of the second criterion. On the contrary, a_{12}=1/3 , values of diagonal line are reciprocals; n is number of criteria.

Source: [12] In ANP, paired comparison provides the matrix structure and original preference vector to gain the assessment and comparison of relative importance among elements or matrices. To calculate Eq. (2):

$$A \times \mathrm{w} = \lambda_{\max} \times w \qquad (2)$$

TABLE 1. Explanation of scales of ANP assessment and comparison

Interval scale	Corresponding nominal scale	Explanation
1	Same importance	The importance of parameter a is the same as that of parameter b.
3	Slightly important	There is reason to support that parameter a is more important than parameter b, but it is not decisive.
5	Quite important	There is sufficient reason and reasonable criteria to support that parameter a is more important than parameter b.
7	Extremely important	There are extremely certain reasons for bases to support that parameter a is more important than parameter b.
9	Absolutely important	The highest level of certainty supports that parameter a is more important than parameter b.
2, 4, 6, 8	Medium levels of importance	This scale indicates that two nearby scales need compromise.

A is the matrix for paired comparison, w is the eigenvector, and $\lambda_{\max}$ value is the maximum eigenvalue for A. Based on the questionnaire results for each subject, the rationality of weighted distribution is evaluated using a consistency ratio (C.R.) as the basis of determination, as in Eq. (3).

$$C.R. = C.I./R.I. \tag{3}$$

Consistency ratio (C.R.) is ratio of C.I. and R.I.. If the C.R. value is smaller than 0.1, then the consistency reaches an acceptable standard. If the C.R. value is greater than 0.1, the determination matrices in this level would require adjusting to achieve satisfactory consistency in the overall sequence of the level where C.I. represents the consistency index. In other words, $C.I. = \frac{\lambda_{\max}-n}{n-1}$ and R.I. represents the random inconsistency index and it is based on number of levels of pairwise comparison matrix.

(3) Form a super-matrix. The super-matrix is an effective method for resolving the interdependence of criteria within the system and is formed by multiple sub-matrices that include the mutual relationships of elements in each cluster and are compared to the elements of other clusters in cross-comparisons. The values of each sub-matrix are weighted values based on eigenvectors of paired comparisons, ultimately forming the super-matrix. The computation process of ANP includes the following three matrices: (1) the unweighted super-matrix, (2) the weighted super-matrix, and (3) the limit super-matrix. The unweighted matrix has the weights of original paired comparisons. The weighted matrix refers to the weight of the same element in the unweighted matrix multiplied by the related cluster weight values, such that the vertical columns add up to 1. The limit matrix involves the weighted matrix to multiple powers until it is converged, or the numbers in rows and every column are the same, as in Eq. (4).

$$W_{\lim} = \lim_{k\to\infty} (W_{weighted})^k \tag{4}$$

where w is weighted matrix.

(4) The chosen alternative. Based on multiple computations of the super-matrix, the obtained weight values represent the suggested preference sequence for each alternative

after computation I matrices. The alternative with the greatest values is obtained by ANP or the optimal alternative chosen by the decision-maker.

In summary, when we have several different options for decisions involving multiple objectives, criteria, and actions, ANP can analyze the preferential priority of every option, such that the decision-makers can choose the optimal outcome [2, 13, 14]. In addition, analysis performance indicators relative importance can be based on the corporations current conditions and its future, to serve as an important basis for strategy execution and resource allocation [15, 16]. Through ANP analysis, this study can determine the relative importance of actual current performance indicators and new future strategic performance indicators. Further comparative analysis of changes in relative importance between indicators will reveal their significance. This method is used as the foundation for predicting problems in strategy execution for the future.

3. **Research Design.** The research purpose and literature review show that corporations plan strategies based on their visions, establishing corresponding performance indicators to ascertain the implementation effects of strategy. However, every performance indicator in the performance evaluation system does not have the same level of importance to the organization; some factors or indicators are especially crucial to the success and competitive advantages of corporations [17]. Thus, this study utilizes the two-stage ANP for assessment and analysis. In the first stage, the relative importance of the actual performance indicators of the corporation is assessed based on the corporation's cultural background and industrial traits. In the second stage, the corporation's future vision and strategies are used to plan the future performance indicators, using ANP to conduct relative importance assessment and analysis. This approach is used to understand the relative importance of current conditions and future performance indicators for the company. Finally, the outcomes from both stages are compared to analyze their significance and to serve as a basis for predicting problem types in strategy execution. The implementation procedures of this study are divided into five steps, as in Figure 1, explained as follows.

(1) Assessment of ANP conditions. ANP traits are applied to compute the eigenvectors (or W_{1jk} value) of performance indicators of the corporation based on its cultural background and industrial traits where W is the eigenvector value, i is the ANP assessment model in the *i-th* stage, j represents the *j-th* main criterion, and k represents the *k-th* sub-criterion. Thus, W_{1jk} represents the eigenvector value of *i-th* stage ANP evaluation model, under *j-th* main criterion and *k-th* sub-criterion.

Additionally, this study uses the mean value of eigenvector (AW) to serve as the threshold value to evaluate the importance of indices, as shown in Eq. (5). N_i represents the total number of sub-criteria in i stage of the ANP evaluation model, and is the mean of eigenvector in the th ANP assessment model, or the threshold value.

$$AW_i = 1/N_i \tag{5}$$

(2) Assessment of ANP new strategy platted. The planning and design of future performance indicators are based on the case corporations' future vision and strategy, again applying ANP to compute the eigenvector (the W_{2jk} value) of various performance indicators. Eq. (5) is used to compute the threshold value AW_2, to evaluate the relative importance of performance indicators of the new strategies to be introduced at the corporation, and is the second stage of ANP assessment.

(3) Computation of K value. The outcomes of two-stage ANP are used for composite comparison and to analyze changes of relative importance of each performance indicator. These outcomes use quantitative methods to demonstrate the actual effect and impact of introducing new strategies to corporations in the future. Inconsistencies may

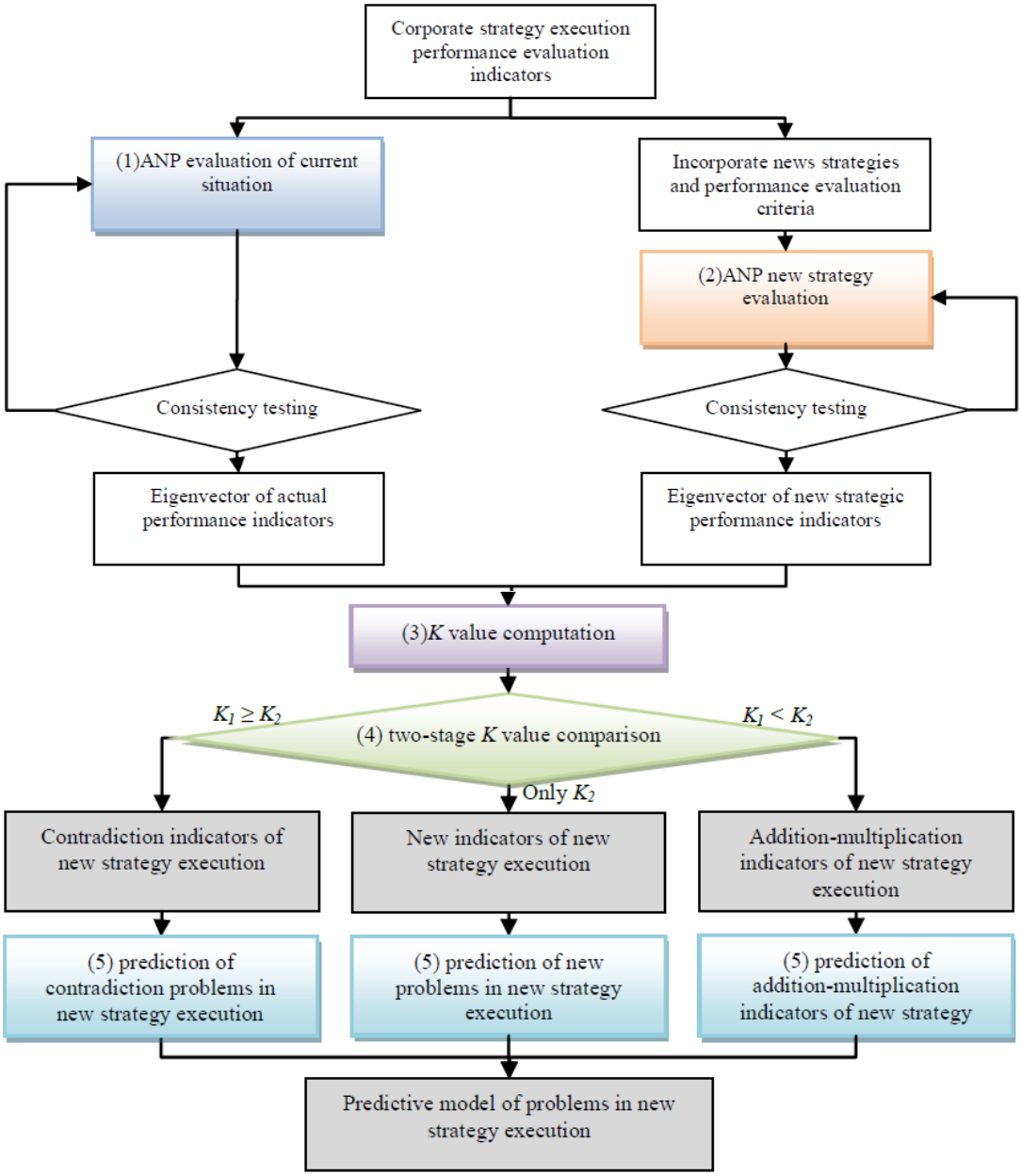

FIGURE 1. Flowchart of research design

exist between the quantities of actual and future indicators, in proposing the ratios of eigenvector value (W_{ijk}) and threshold value (AW_i) of each performance indicator as the basis of comparison, and in preventing lowering the eigenvector value due to an increase in the number of indicators, which may result in discrepancies between comparisons. Here, this ratio is referred to as K_{ijk} value, it means relative importance of sub-criterion k of principle criterion j at phase i, as shown in Eq. (6).

$$K_{ijk} = W_{ijk}/AW_i \tag{6}$$

(4) Two-stage K value comparison and indicator classification. Two-stage K values are compared in accordance with the comparative criteria in Table 2 to obtain the composite comparison value of K value and to classify the indicator categories. The criteria are explained as follows:

TABLE 2. Comparison of results from two-stage ANP analysis

Composite comparison	Comparison criteria	Indicator category
a) $K_{2jk} - K_{1jk}$	≥ 0	addition-multiplication indices of new strategy execution
b) Only K_{2jk} value	No K_{2jk} value	new indices of new strategy execution
c) $K_{2jk} - K_{1jk}$	<0	contradiction indices of new strategy execution

(a) if $K_{2jk} - K_{1jk} \geq 0$, this indicator is an addition-multiplication index;
(b) if only K_{2jk} value, then there is no K_{2jk} value, which shows that this indicator is a new index;
(c) if $K_{2jk} - K_{1jk} < 0$, this indicator is a contradiction index.

(5) Prediction of problems in strategy execution. Based on these comparative criteria, it is possible to classify performance indicators types and explore the correlations and content of the new and old strategies in terms of execution in order to serve as the primary basis for the possible problems encountered in strategy execution. Different categories of indicators can be used to predict the types of problems in strategy execution in the future and can in turn help to discover corresponding solutions.

4. **Results and Discussion.** The literature review and summarization are conducted based on the research purpose, to serve as the foundation for this research design. One case corporation explains the results of implementation, and the research results are used to construct a predictive model.

4.1. **Results of research implementation and discussion.** The case corporation is a mid- to small-cap traditional manufacturing company in Taiwan. Based on the research design, at the end of the year, the case corporation used ANP to analyze the relative importance of the company's actual performance indicators to develop an understanding of the performance indicators' importance and in turn evaluate the extent to which these goals have been met this year; this is the first stage ANP analysis. Next, based on changes in the external environment and conditions within the corporation, the company's future operations are adjusted to establish new performance indicators. The second stage of ANP analysis involves understanding the relative importance of the new performance indicators.. Data from the two stages are compared to analyze their content as follows:

(1) ANP assessment of current indicators. First, the first stage ANP analysis is conducted. The case corporation's senior directors serve as the main assessment team. Performance indicators of the case corporation are divided into the three dimensions of 1) finances; 2) customers, and 3) procedures. In addition, the five performance indicators, as shown in Figure 2, are 1-1 financial indicators and 1-2 productivity indicators; 2-1 customer satisfaction indicators and 2-2 market share indicators; and 3-1 quality rate indicators. According to the ANP evaluation steps, as explained in 2.2, the mutual reliance and feedback among the indicators are compared. The Super Decision program is used to derive three super-matrices (unweighted matrix, weighted matrix, and limit matrix), with the final assessment results shown in Table 3. The eigenvector indicator values are ordered as 1-1 financial indicators (W_{111} =0.320), 1-2 productivity indicators (W_{112} =0.290), 2-1 customer satisfaction indicators (W_{121} =0.210), 2-2 market share indicators (W_{122} =0.120), and 3-1 quality rate indicators (W_{131} =0.060). Additionally, Eq. (4) is used to compute

TABLE 3. Analysis of actual relative importance of performance indicators by case corporation

NO.	Indicators	$W_{1jk}(AW_1 = 0.2)$	Rank
1-1	Financial indicators	0.32	1
1-2	Productivity indicators	0.29	2
2-1	Customer satisfaction indicators	0.21	3
2-2	Market share indicators	0.12	4
3-1	Quality rate indicators	0.06	5

the threshold value of the case corporation of AW_1 as 0.2, as the relative importance of indicators 1-1, 1-2, and 2-1 is greater than that of the threshold value. This analysis shows that the company currently focuses on elevating these three indicators. Thus, the management level of the case corporation can understand the circumstances of actual strategic implementation at the current time, as well as resource allocation, as a basis for the introduction of new strategy.

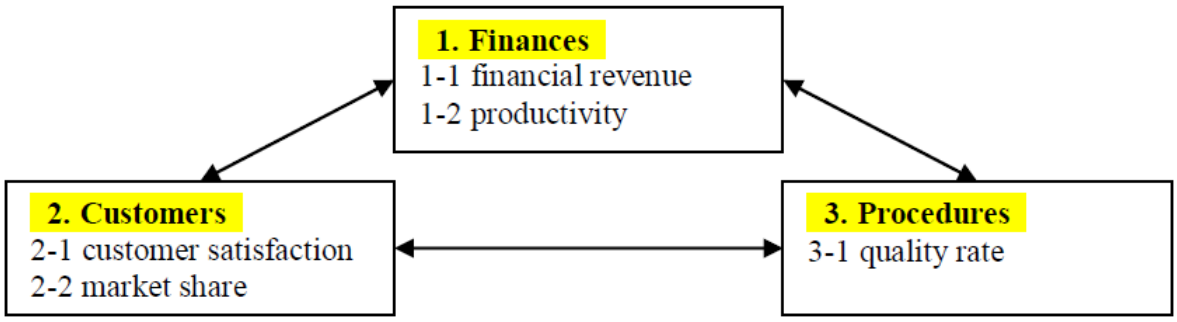

FIGURE 2. Actual performance indicators of case Corporation

(2) ANP assessment of new strategic indicators. Based on the changes in the external environment and the case corporations future vision and strategy, two to three experts are added into the assessment team to plan new strategic performance indicators. Through expert consultation, it is known that the case corporation's production technologies are mature, and in the future the company can focus on innovative research and product development. Therefore, in addition to existing dimensions and indicators, it is necessary to add a fourth dimension for innovation, including two parts of 4-1 education and training indicators and 4-2 innovative research and development indicators. In addition, in the procedures mentioned, 3-2 procedural innovation indicators are added, as in Figure 3. The new assessment team conducts the second stage of ANP assessment of relative importance of strategic performance indicators. The final assessment results are shown in Table 4. To introduce new strategy, the case corporation controls for dimensions by increasing the number of performance indicators to 8. The eigenvector values of indicators are in the order of 1-1 financial indicators (W_{211} =0.180), 4-2 innovative research and development indicators (W_{242} =0.180), 1-2 productivity indicators (W_{212} =0.145), 2-1 customer satisfaction indicators (W_{221} =0.135), 4-1 education and training indicators (W_{241}=0.120), 3-2 procedural innovation indicators (W_{232} =0.110), 2-2 market share indicators (W_{222} =0.090), and 3-1 quality rate indicators (W_{231} =0.040). Most experts believe that indicators 1-1, 4-2, 1-2, and 2-1 are relatively more important for the introduction of new strategy (greater than the threshold value, AW_2=0.125), which shows that the case corporation needs to focus on elevation of these indicators to enhance the effects of

TABLE 4. Relative importance of future performance indicators for the case corporation

NO.	Indicator category	$W_{2jk}(AW_2 = 0.125)$	Ranking
1-1	Financial indicators	0.18	1
1-2	Productivity indicators	0.145	2
2-1	Customer satisfaction indicators	0.135	3
2-2	Market share indicators	0.09	6
3-1	Quality rate indicators	0.04	7
3-2	Procedural innovation indicators	0.11	5
4-1	Education and training indicators	0.12	4
4-2	Innovative research and development indicators	0.18	1

introducing new strategy. Accordingly, all employees of the corporation can understand the direction for future development.

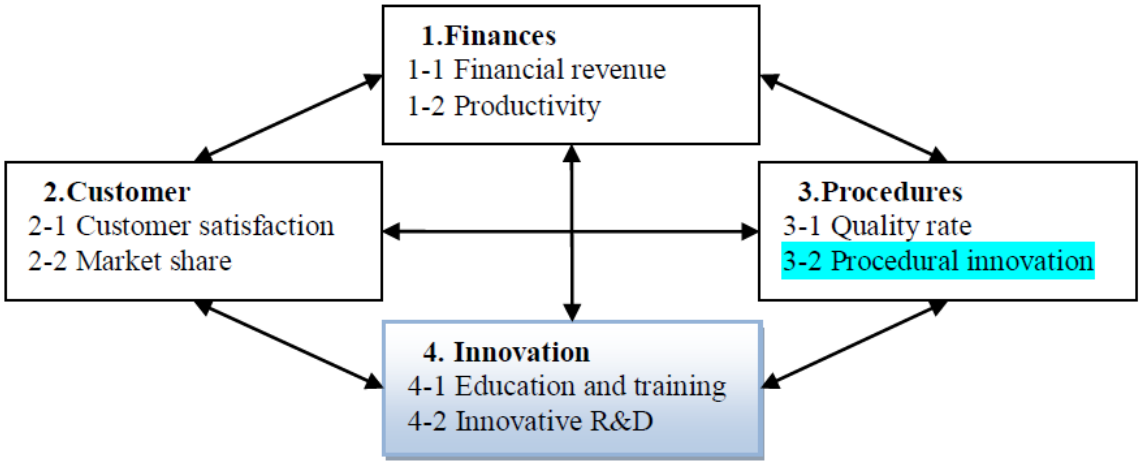

FIGURE 3. Future performance indicators for case corporation

(3) Computation of K value. Eq. (5) can be used to derive the K_{1jk} values of five actual performance indicators currently used by the case company, as well as the K_{2jk} values of eight performance indicators when the case company introduces innovative strategies, as shown in Table 5.

(4) Two-stage K value comparison and indicator classification. The K values of the two stages are further compared according to the comparative criteria of Table 5 to obtain the composite comparisons values of K values and the categories of various indicators. The results are shown in Table 5, which shows that $K_{2jk} - K_{1jk} \geq 0$ has three addition-multiplication indices, which are 2-2 market share indicators ($0.120 \geq 0$), 2-1 customer satisfaction indicators ($0.030 \geq 0$), and 3-1 quality rate indicators ($0.020 \geq 0$). This analysis shows that prior to and after the strategy execution of innovation, the relative importance of these three indicators increased. In addition, $K_{2jk} - K_{1jk} < 0$ has two contradiction indices, which are 1-2 productivity indicators ($-0.290 < 0$) and 1-1 financial indicators ($-0.160 < 0$). Prior to and after the Sherry execution of innovation, the relative importance of these two indicators decreased. There are also three new indices: 3-2 procedural innovation indicators, 4-1 education and training indicators, and 4-2 innovative research and development indicators.

(5) Prediction of problems in strategy execution. Through two-stage ANP analysis, it is possible to understand the important points in current corporate conditions and introduction of innovative strategy and further conduct two-stage K value comparison

Table 5. Composite comparisons of two-stage K values

NO.	Indicator type	K_{1jk}	K_{2jk}	$K_{2jk} - K_{1jk}$	Indicator type
1-1	Financial indicators	1.6	1.44	-0.16	Contradiction indices
1-2	Productivity indicators	1.45	1.16	-0.29	Contradiction indices
2-1	Customer satisfaction indicators	1.05	1.08	0.03	Addition-multiplication indices
2-2	Market share indicators	0.6	0.72	0.12	Addition-multiplication indices
3-1	Quality rate indicators	0.3	0.32	0.02	Addition-multiplication indices
3-2	Procedural innovation indicators	***	0.88	0.88	New indices
4-1	Education and training indicators	***	0.96	0.96	New indices
4-2	Innovative research and development indicators	***	1.44	1.44	New indices

to ascertain the indicator types in innovative strategy introduction. Composite analysis is conducted based on the content of innovative strategy and indicator type, incorporating the three major executive procedures: personnel, strategic, and operational procedures. This analysis serves as the basis for the assessment team in predicting problems for future innovative strategy execution and proposing corresponding solutions, which are explained as follows.

(a) Prediction of problems in the following addition-multiplication indices: 2-2 market share indicators, 2-1 customer satisfaction indicators, and 3-1 quality rate indicators., The predictions show that when the case corporation introduces innovative strategies in the future, the importance of these three existing indicators would increase. The relative importance of 2-2 market share indicators that are shown to have the highest increase explains the benefit of innovative research and development, which would be reflected in the market share. Therefore, when the case corporation implements innovative strategy, it is necessary to enhance the integration of these three addition-multiplication indices in the core procedures to elevate their achievement rates, which would enhance the implementation effects of innovative strategy.

(b) Prediction of problems in new indices: 3-2 procedural innovation indicators; 4-1 education and training indicators; and 4-2 innovative research and development indicators are new indices; among these indices, the 4-2 innovative research and development indicators have the most significance. These three indicators are intended to provide coping strategies for the future introduction of innovative strategies, which indicates that the establishment of these indicators was in response to innovative strategies. The case corporation executes innovative strategies and finds it necessary to design procedures to control these three new indices to ensure their achievement and in turn enhance the effects of introducing further innovative strategies.

(c) Prediction of problems in contradiction indices: 1-1 financial indicators and 1-2 productivity indicators are contradiction indices, which shows that when the case corporation introduces innovative strategy, the relative importance of these indicators to the client declines. In comparison, the 1-2 productivity indicators would decline the most, which also means that execution of innovative strategy may affect the achievement of 1-1 financial indicators and 1-2 productivity indicators. When introducing innovative strategies, it is necessary to take into account the occurrence of these problems and to consider corresponding solutions in advance to achieve a win-win situation.

4.2. **General discussion.** ANP can enhance efficiency of organizational decision-making [18] and precise decision-making can be developed according to evaluation criteria constructed by organization [19]. Therefore, this study treats ANP as the method for case corporation to construct future policies. According to Table 4, future policies of case corporation must be based on enhancement of Index 1-1, 4-2, 1-2 and 2-1. Although future policy direction of case corporation is confirmed, from perspective of policy execution effectiveness, is the case devoted to the enhancement of the previous indices? This study suggests considering ANP analytical result of case corporation and conducting general comparison by two-stage ANP analytical result in order to validate the category of indices as reference for policy execution. General discussion is show as follows,

According to Table 4, Index 1-1 and 1-2 that should be enhanced are allocated as contradictory indices, as shown in Table 5. It shows that case corporation pays high attention to these two indices. Because of introduction of new policy of case corporation, total relative importance of the indices (K_{2jk}) is lowered, though the importance is still Top 1 and Top 2, as shown in Table 4. In integration of limited corporate resources, although Index 1-1 and 1-2 are extremely important, the resources distributed are less. Therefore, we can predict this kind of execution problem. In addition, in Table 4, Index 2-2 and 3-1 which are less important are allocated as multiplied indices, as shown in Table 5. Because of importance of new policy of case corporation, total relative importance of indices (K_{2jk}) is increased, although they are less important (Top 6 and Top 7), as shown in Table 4. Hence, case corporation should invest more resources in these two indices in order to enhance accomplishment rate of index. Finally, with general comparison of two stages of ANP, importance of Top 4, Index 4-1, and Top 5, Index 3-2 in Table 4 is demonstrated, as shown in Table 5, since these two indices are new control ones to respond to new policy introduction of case corporation. Therefore, case corporation did not pay attention to these indices. It should control these new indices in order to reinforce execution effectiveness of new policy of case corporation. Based on the above, it is feasible to construct future policy direction by ANP. However, it might not be suitable for policy execution. It is necessary to analyze current situation of the organization for the execution. Hence, this study proposes two stages of ANP analyze to categorize indices and predict the possible obstacles in future policy execution of case corporation to develop the responses in advance.

4.3. **Predictive model for strategy execution problems.** As the true value of strategies must be expressed in executive ability [8], leaders need to implement seven important actions in strategy execution: (1) understand your corporation and employees; (2) seek facts; (3) establish clear objectives and priorities; (4) use follow-up and tracking methods; (5) give rewards for meritorious work; (6) elevate employee abilities; and (7) understand oneself. Leaders should also emphasize the three core procedures in execution: (a) personnel procedures, (b) strategic procedures, and (c) operational procedures. The predictive model for strategy execution problems developed by this study incorporated these points as the main basis, as shown in Figure 4. Three of the seven important actions in execution are in the preparation stage. The results of actual current conditions in the corporation and two-stage ANP assessment for new strategic introduction allow readers to clearly understand the current state of the corporation and its employees to establish clear objectives and priorities for strategy execution and to take a fact-based attitude to implement the strategy. In addition, through comparison of K values in the model, categories of performance indicators can be discovered with personnel, strategy, and operations procedures for consideration, making possible the discussion of the possible problem types in strategy

execution to enhance the connections among these procedures. Finally, the new performance indicators in strategy execution are used as the basis for control, while feeding back to the execution dimension of the system to strengthen the latter work stages among the seven major actions (the latter four items in the seven major actions). Then, follow-up, tracking, and giving rewards for meritorious work as well as exploring failure causes are used as a reference for improving employability and self-reflection. Regular feedback and examination are used to enhance the prediction precision of strategy execution problems, in turn elevating the effects of strategy execution.

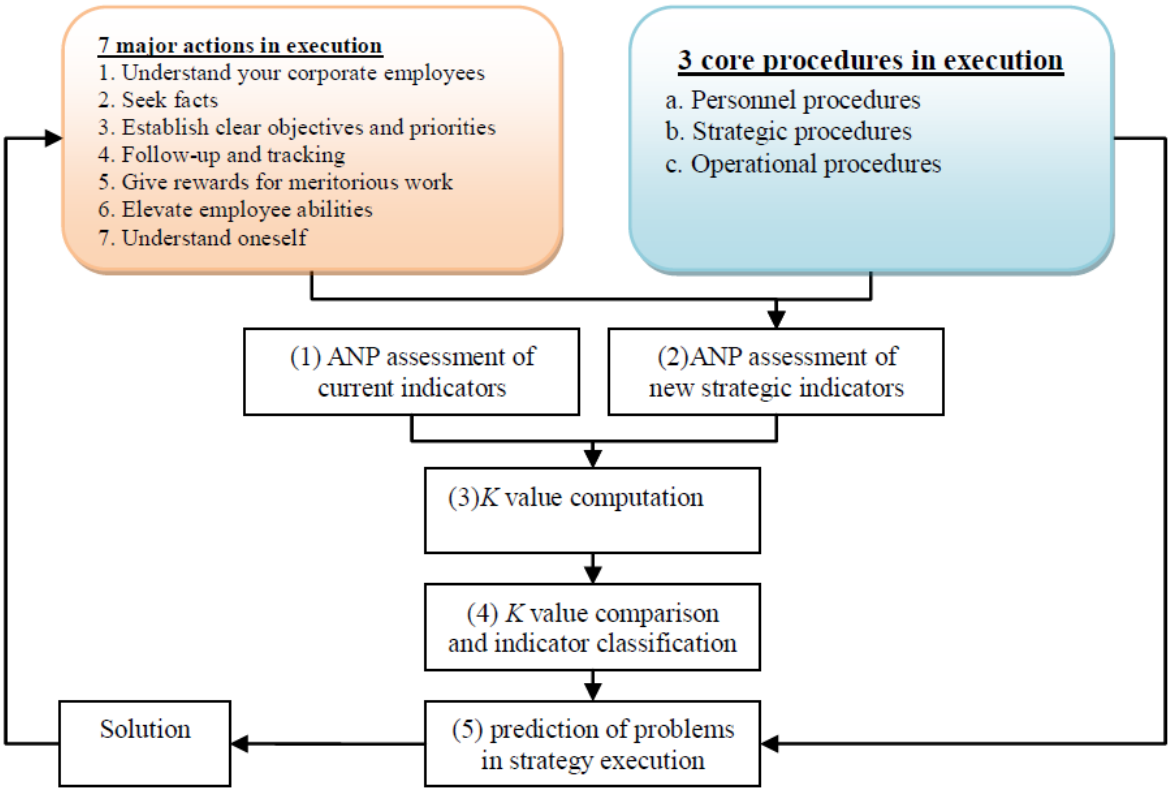

FIGURE 4. Predictive model for strategy execution problems

In summary, this predictive model for strategy execution problems incorporated seven important behaviors and integrated three core procedures to become the focus of the model designed, while the three core procedures serve as the direction for problem prediction and devising solutions. Comprehensive consideration of important items in the model can provide instructive information about strategy execution to corporations and can in turn improve the effects of strategy execution and elevate corporate competitiveness.

5. **Conclusion.** ANP provides for a systematic structure and clear network system, affording element indicators different but related weights, by allowing decision-makers to make better decisions in the application of strategic planning and resource allocation. However, good strategy must have good executive ability to achieve objectives. Therefore, this study proposes a two-stage ANP in the extended application to develop the predictive model for strategy execution problems. Two instances of ANP assessment were incorporated in the model design. The first stage focused on the cultural background and industrial traits of the case corporation to use ANP in analyzing the relative importance of actual execution of performance indicators for the case corporation to assist the company in understanding its current state of strategy execution and resource allocation. The

second stage considers the case corporation in coping with external changes to establish new strategic performance indicators and to use ANP to evaluate the relative importance of new strategic performance indicators so that the entire corporation can clearly understand the significant points in strategy execution for the future. In summation of the two stages' analysis, it is possible to help the management implement the preparation work for strategy execution, as follows: (1) to understand the corporation and employees; (2) to seek facts; and (3) to establish clear objectives and priorities to achieve the goal of knowledge leading to victory. Next, the outcomes analysis was used to compare the K values of the two stages and to define the categories of new strategic performance indicators in the future. The categories of indicators are divided into the three types of addition-multiplication indices, new indices, and contradiction indices. The assessment team used the content of the new strategies and indicator categories, supplemented by the three core procedures of strategy execution, (a) personnel procedures, (b) strategic procedures, and (c) operational procedures as the direction for thought, to conduct composite analysis and discussion. Thus, the study proposes the types of problems that may occur when executing new strategies in order to propose corresponding solutions and in turn to elevate the benefits of corporate strategy execution. Accordingly, feedback is given to the systemic aspect, to strengthen the latter half of the work involved in strategy execution; (4) follow-up in tracking; (5) give rewards for meritorious work; (6) elevate employee abilities; and (7) understand oneself. In summary, the predictive model for strategy execution problems in this study uses the comparison of relative importance of performance indicators in two stages to classify the performance indicators. It is possible to predict the problem types that this corporation would encounter in the strategy execution stage, thus effectively shrinking the company's preparation scope in strategy execution, and to focus on the strategy execution key points. It is hoped that this study provides the corporate leaders with a means to do the "right things right", elevate corporate executive ability, and in turn elevate international competitiveness.

REFERENCES

[1] T. L. Saaty, Decision making with dependence and feedback, *The analytic network process*, RWS Publ.,vol. 4922, 2001.
[2] T. Saaty, The analytic network process, *Iranian Journal of Operations Research*, vol. 1, pp. 1-27, 2008.
[3] M. Lee, Execution, *Taiwan*, Book Zone, 2003.
[4] L. Bossidy, R. Charan, and C. Burck, Execution: The discipline of getting things done, *Random House Business Books*, 2011.
[5] W. R. Bigler, The new science of strategy execution: how incumbents become fast, sleek wealth creators, *Strategy & Leadership*, vol. 29, pp. 29-34, 2001.
[6] L. Bossidy, R. Charan, and C. Burck, Execution: The discipline of getting things done, *Afp Exchange*, vol. 24, pp. 26-29, 2004.
[7] D. N. Sull, Strategy and Execution, *MIT SLOAN MANAGEMENT REVIEW*, 2007.
[8] R. Zagotta and D. Robinson, Keys to successful strategy execution, *Journal of Business Strategy*, vol. 23, pp. 30-34, 2002.
[9] L. Bossidy and R. Charan, Execution: The discipline of getting things done, *Random House*, 2011.
[10] S. C. Harper and T. W. Porter, Traversing the execution minefield, *Engineering Management Review*, IEEE, vol. 32, pp. 33-33, 2004.
[11] T. Saaty, Decision making with dependence and feedback, *The analytic network process*, RWS Publications, Pittsburgh, vol. 17, 1996.
[12] T. Saaty, Multicriteria decision making, *RWS Publications*, 1996.
[13] C. E. Bozdag, C. Kahraman, and D. Ruan, Fuzzy group decision making for selection among computer integrated manufacturing systems, Computers in Industry, vol. 51, pp. 13-29, 2003.
[14] F. Lefley and J. Sarkis, Applying the FAP model to the evaluation of strategic information technology projects, *International Journal of Enterprise Information Systems (IJEIS)*, vol. 1, pp. 69-90, 2005.

[15] M. R. Abdi and A. W. Labib, Performance evaluation of reconfigurable manufacturing systems via holonic architecture and the analytic network process, *International Journal of Production Research*, vol. 49, pp. 1319-1335, 2011.

[16] B. Karpak and I. Topcu, Small medium manufacturing enterprises in Turkey: An analytic network process framework for prioritizing factors affecting success, *International Journal of Production Economics*, vol. 125, pp. 60-70, 2010.

[17] B. Brotherton and J. Shaw, Towards an identification and classification of critical success factors in UK hotels plc, *International Journal of Hospitality Management*, vol. 15, pp. 113-135, 1996.

[18] J. J. Boj, R. Rodriguez-Rodriguez, and J.-J. Alfaro-Saiz, An ANP-multi-criteria-based methodology to link intangible assets and organizational performance in a Balanced Scorecard context, *Decision Support Systems*, vol. 68, pp. 98-110, 2014.

[19] R. Shakoor Shahabi, M. H. Basiri, M. Rashidi Kahag, and S. Ahangar Zonouzi, An ANPSWOT approach for interdependency analysis and prioritizing the Iran's steel scrap industry strategies, *Resources Policy*, vol. 42, pp. 18-26, 2014.