A Study on Key Factors’ Weight Evaluation in a Manager’s Leadership Skill That Affects Job Performance in the Listed IC Design Houses in Taiwan

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ABSTRACT

The purpose of this paper is to evaluate the weight values of key factors in a manager’s leadership skills that affect job performance in the listed IC Design Houses in Taiwan. The research subjects are three of the typically listed IC design houses in Taiwan. This paper adopts Analytic Network Process (ANP) to analyze the relevance of each criterion, and to identify the important factors of each criterion and the priority ranking of their weights. Research findings show that, in the “leadership ability” sub-dimension that affects the managerial job performance in the listed IC design houses in Taiwan, both the weights from academic scholars’ perspective and industry operators’ perspective are over 0.1. This shows that both scholars and operators believe that innovative creativity, leadership appeal, and the ability to manage time are three of the most important indicators affecting leadership ability. Although operators’ perspectives on the weights of the above mentioned three indicators are different from the scholars’, the difference arises because scholars take on a theoretical viewpoint, believing that innovative creativity impacts leadership ability the most, while operators take on a more practical view, believing that leadership appeal impacts leadership ability the most, then in turn, affects job performance. The analytical findings of this stage can serve as a reference for decision-makers of the listed IC design houses in Taiwan to use in talent selection.

Keywords: Leadership ability, job performance, Analytic Network Process (ANP)

INTRODUCTION

The semiconductor industry is important to the economic development of a country. It is highly capital and technology intensive. Among the countries with leading position in semiconductor, Taiwan is the only country with a vertically integrated supply chain. The government seeks to boost the productivity of the industry by establishing science parks and creating cluster effects. In fact, Taiwan is the role model for the countries who seek to develop their semiconductor industries. The semiconductor industry in Taiwan is known for unparalleled competitiveness in efficiency and cost due to a comprehensive supply chain. This also provides an ideal backdrop for the booming development of IC design houses (Tzu-Feng Peng, 2009; Chen and Lee, 2012).

While IC design is the forefront process of the semiconductor industry, it is also the most important part of the process. In other words, it is the forefront process of the supply chain including: IC manufacturing, packaging, testing and support industries. The technology capabilities and production capacities of these industries dominate the development of the semiconductor industry in Taiwan. Therefore, the enhancing of productivity factors and technical efficiencies is very relevant to the operating performance of these industries.

Furthermore, the three major factors influencing a business operation are manpower, events, and
capital, of which, manpower is the most important resource of a business. The qualities of the manpower and their leadership abilities are equivalent factors affecting their levels of job performance. In contrast, executives or managers play an important role in strategic leadership of manpower quality and performance incentives (Ying-Chang Chen & Wen-Cheng Wang, 2009). The successful development of a high tech company often depends on a few key R&D talents, who create irreplaceable value for the company (Yun-Shan Si, 2004). Being in an industry that is characterized by its fierce competition and rapid change, the ability to quickly identify quality key talents and promote their use is becoming more important to a company.

Basing this paper on the above-mentioned research motives, it chooses three of the typically listed IC design houses in Taiwan as the research targets, and focuses this research on the leadership abilities of the business operators, including: 1. Adversity resilience; 2. Innovative creativity; 3. Emotional control ability; 4. Risk-taking ability; 5. Time-management ability; and 6. Leadership appeal. This paper constructs a research framework that is used to analyze, evaluate, and then determine the weight values of the key factors of the managerial leadership ability within the listed IC design houses in Taiwan that affect job performance. We hope to assist the industry in establishing an evaluation standard to use in future hiring and selection of management personnel, and to formulate a development base for future human resource activities, such as employee training and talent retaining. These are the main objectives of this research.

**LITERATURE REVIEW**

After reviewing domestic and overseas literature, this paper determines that the key factors that affect job performance in a leader’s abilities are summarized in the following sub-dimensions:

**Leadership Ability**

Rost (1991) defines leadership as “a multi-facet influence relationship that exists among leaders and followers, and has an interrelated effect with achieving real change.” While Yukl (2006) believes that leadership is a process of influencing others to understand and to agree on what to do and how to do so effectively, and is also a process that allows individuals and groups to advance towards shared goals. Concerning the definition of leadership ability, You-Long Hei (1994) believes that “leadership ability” means the ability to help others accomplish what their abilities can afford, while its intrinsic contents are to depict future visions, to inspire and to teach others, and to establish and maintain successful interpersonal relationships.

In terms of the sub-dimensions concerning leadership ability, Chao-Jung Hung (1988) categorizes the content of leadership ability into 1. Confidence, which includes: (A) Independence; (B) Individuality; (C) Optimism; and (D) Mobility; 2. Autonomy, which includes: (A) Innovation; (B) Creativity; (C) Information Enrichment; (D) Initiation; (E) Variability; and (F) Knowledge ability; 3. People-oriented, which includes (A) Getting along with others; (B) Flexibility; (C) Ability to accept advice; (D) Ability to accept criticism; and 4. Task-oriented, which includes (A) Demanding accomplishment; (B) Profit-oriented; (C) Insistence; (D) Decisiveness; (E) Rich in Vitality; (F) Diligence; and (G) Foreseeability.

To summarize, this paper categorizes the sub-dimensions of leadership ability into (1) Adversity resilience; (2) Innovative creativity; (3) Emotional control ability; (4) Risk-taking ability; (5) Time management ability; and (6) Leadership appeal. In terms of the definition of leadership ability, this paper adopts You-Long Hei’s (1994) definition.
**Job Performance**

Borman & Motowidlo (1993) believes job performance is “an individual’s behavior towards an organization, and that the levels of contribution to organizational goals can be measured.” In addition, Jin-Tong Chi, Hong-Wen Li, and Fen-Yi Chen (2008) regard the so-called Job Performance as “the quality and quantity of mission-accomplishment that a working individual or a group achieves.


**The Relationship between Leadership Ability and Job Performance**


Chan, Chun Hsin (2009) proposes that a director (or a manager) of an automobile service plant is the soul of that plant, and the amount of profit he can generate for the business depends on his leadership ability. A plant director or manager with good leadership ability can bring more profit to the service plant, and maintain good interaction between the business and employees, thus unifying the business organization in achieving a sustainable operation.

**Research Methodology & Design**

**Theoretical basis — Analytic Network Process (ANP)**

ANP is an extension of AHP (Analytic Hierarchy Process) with the addition of a feedback mechanism. The purpose is to accurately capture and predict the internal relationships among all the criteria, goals and proposals via ratio scales, so as to achieve optimal decisions (Mohamed, 2002; Wan Ching Chen, 2004). This paper applies the ANP method in the analysis of the relationships among the green design criteria and seeks to identify the relative weights and importance rankings of individual criteria. The analytical findings during this stage can serve as a reference to decision-makers of the listed IC design houses in Taiwan regarding the priority and importance of key factors of managerial job performances and the strategic decisions over business management.

The decision rules in ANP networks comprise of clusters, elements, nodes and links. If a node in a given cluster exhibits interdependence or feedback relationships with a node in another cluster, there will be connecting link between these two clusters. ANP assumes and allows the interdependence or feedback relationships among elements within the same or across different decision criteria. If such interdependence or feedback relationships are within the same decision criteria, it is considered “inner dependence”. In the absence of any inner dependence, the node in the same criterion should be compared pairwise with the node in another criterion. The interdependence or feedback relationship between elements in different decision criteria is called “outer dependence” (Satty, 1996). The permission of interdependence or feedback relationships across criteria is in line with the actual situation of tackling complex issues in the human society. This is particularly true when the uncertainties and risks are involved in the decisions in question (Pei-Yu Sun, 1997; Jason Liu, 2002; Jui-Che Tu and Chuan-Ying Hsu, 2008).

The ANP model is suitable to solve the problems whose structures may contain one or multiple networks. The construction of the network applicable to the ANP model should take the following issues: (1) whether the classification of elements and clusters are required for problem solving; (2)
establishment of a cluster takes precedence of nodes (elements); (3) it is necessary to select a node (element) as the parent node and examine whether other notes in the cluster are affected by the parent node. The affected nodes are “children nodes”. The children nodes are compared pairwise in order to determine the effects of parent node. This is followed by the selection of another parent node accordingly; (4) The plotting of the links between the children nodes subject to the influence of the parent node is required for the pairwise comparisons of these nodes; (5) The establishment of the links describing the relationships among all the nodes marks the completion of the links between clusters; and (6) finally, it is necessary to confirm the accuracy of the links for the influencing nodes and the influenced nodes to facilitate the pairwise comparisons of nodes to nodes and clusters to clusters.

The calculation of the ANP network requires three matrixes, i.e. un-weighted super-matrix, weighted super-matrix and limit super-matrix. The un-weighted matrix consists of the weights based on pairwise comparisons in the original network. The weighted matrix is constructed by multiplying the component weight with relevant cluster weight in the un-weighted matrix. If the values in the straight column add up to 1 (stochastic) in the un-weighted matrix, the weighted matrix is equivalent to the un-weighted one.

The limit matrix is established by making the weighted matrix multiplying itself until all the values in the straight column become equal. In other words, the weight of any individual node in the network can be obtained from any of the straight columns. According to the calculation method developed by Saaty (1996) for the ANP model, if the limit matrix is irreducible, \( \lim SV = [w, ..., w] \). At this juncture, all the straight columns in the matrix will be identical and equivalent to vector \( w \), and hence converge (Jui-Che Tu and Chuan-Ying Hsu, 2008). Simply put, the ANP methodology comes in the following stages: (1) the application of the Delphi method or interviews with experts to establish a hierarchical network for the assessment desired; (2) the calculation of the weights for individual elements in the hierarchical levels, such as the establishment of pairwise comparison matrixes (by issuing questionnaires), the computation of eigenvalues and vectors, consistency tests (<0.1) and calculation of super/limit matrixes; and (3) the calculation of global weight for all the hierarchical levels (Yi-Chung Hu and Jen Hung Wang, 2008).

**Questionnaire Design**

According to the research structure, this paper establishes the connection between the managerial job performance dimensions of listed IC design houses in Taiwan and the criteria in the ANP model. The analytical figure of the ANP model is referred to for the design of the questionnaire aiming to evaluate the inter-relationships between criteria of the managerial job performance dimensions of the listed IC design houses in Taiwan. The ANP method is suitable for the data collection via the interviews with a small sample of experts. This paper conducts interviews with experts well-versed in the issues associated with the typical three IC design houses listed in Taiwan in order to understand the perceived importance of individual criteria of the managerial job performance dimensions for these companies.

**Research Targets**

This paper issues questionnaires to the following experts:
(1) A total of 6 questionnaires released to scholars and a total of 6 questionnaires recovered, with an effective recovery rate of 100%;
(2) A total of 8 questionnaires released to scholars and a total of 7 questionnaires recovered, with an effective recovery rate of 87.5%. The high recovery rate is the result of using Convenience Sampling.
Research Structure

The following Tables 1, 2 and 3 are to respectively summarize (1) the evaluation structure of managerial job performances of IC design houses listed in Taiwan; (2) the dimensions and definitions of managerial job performances of IC design houses listed in Taiwan; and (3) the relationships among sub-dimensions.

Table 3 shows that the sub-dimensions are not entirely independent from each other and some of them are interrelated. In other words, the pairwise comparisons of nodes to nodes and clusters to clusters indicate that nodes or clusters are not completely independent from each other. Therefore, this paper uses the ANP method to replace AHP (Yi-Chung Hu and Jen Hung Wang, 2008).

Table 1: Evaluation Structure of Managerial Job performances of IC Design Houses Listed in Taiwan

<table>
<thead>
<tr>
<th>Target</th>
<th>Sub-dimension</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Performance (JP)</td>
<td>Leadership Ability (LA)</td>
<td>When the company encounters external crisis, you have the calm demeanor to respond, and to work together with the staff to fulfill company visions and missions. (LA1)</td>
</tr>
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<td></td>
<td></td>
<td>You feel that emotional control is very important when you encounter a series of difficulties or major complaints from customers. (LA2)</td>
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<td>You feel that company employees, or your subordinates, are pleased to execute planned job items according to the schedule. (LA3)</td>
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<td>When performing a task for the company, you feel time management is very important. (LA4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Facing a never-before executed project, or a new task, you will boldly perform the project. (LA5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>You have the ability to perform organizational innovation and cultural change within the unit under your supervision. (LA6)</td>
</tr>
</tbody>
</table>

Table 2: Dimensions and Definitions that affect managerial job performance of IC Design Houses Listed in Taiwan

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Definition</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership Ability (LA)</td>
<td>&quot;Leadership Ability&quot; is the ability to help others accomplish what their abilities can afford, while its intrinsic contents are to depict future visions, to inspire and to teach others, and to establish and maintain successful interpersonal relationships.</td>
<td>You-Long Hei (1994)</td>
</tr>
</tbody>
</table>

Table 3: Relationships among Sub-dimensions

<table>
<thead>
<tr>
<th>Dimension Criteria</th>
<th>LA</th>
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<tbody>
<tr>
<td></td>
<td>LA1</td>
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<tr>
<td>LA</td>
<td>v</td>
</tr>
<tr>
<td>LA1</td>
<td>v</td>
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<tr>
<td>LA2</td>
<td>v</td>
</tr>
<tr>
<td>LA3</td>
<td>x</td>
</tr>
<tr>
<td>LA4</td>
<td>v</td>
</tr>
<tr>
<td>LA5</td>
<td>x</td>
</tr>
<tr>
<td>LA6</td>
<td>v</td>
</tr>
</tbody>
</table>

Note:
(1) Please refer to "straight" columns for inputs;
(2) Please refer to “horizontal” rows when plotting in a Word document.
(3) LA: Leadership Ability
ANP Analytical Procedures

Figure 1 illustrates the AHP procedures for the analysis:

<table>
<thead>
<tr>
<th>Definition of decision issues</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control level</td>
<td>Criteria</td>
</tr>
<tr>
<td>Network level</td>
<td>Sub-criteria</td>
</tr>
<tr>
<td>Pairwise comparisons of clusters and criteria</td>
<td>Network structure of sub-criteria</td>
</tr>
<tr>
<td>Establishment of super matrixes</td>
<td></td>
</tr>
<tr>
<td>Calculation of limit super matrixes for decision-making</td>
<td></td>
</tr>
<tr>
<td>Criteria rankings in terms of importance and intensity analysis</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Analytical procedures

(1) Construction of Decision-Making Systems

The first step in the ANP methodology is to divide the system into two parts. The first part is the control level, consisting of goals, criteria and sub-criteria. All the decision criteria are considered independent and only subject to the dominance of goal elements. There may not be decision criteria among the control factors but there will be at least a goal. The weight of each criterion in the control level can be obtained with the traditional AHP approach. The second part is the network level, composed of clusters or components subject to the dominance of the control level. Inside the network level are the structures that influence each other.

(2) Pairwise comparisons of individual clusters and criteria

After the construction of the decision-making system and the feedback relationships in Step (1), pairwise comparisons are made on the clusters, criteria and clusters/criteria with feedback relationships in the same manner as the AHP method.

(3) Establishment of super matrixes

After the pairwise comparisons on the clusters and criteria described in Step (2), the feature vector of individual criteria in the control level can be calculated with the AHP method. All the feature vectors are expressed in the form of super matrixes.

If the normalized vectors in the super matrix add up to 1, it is called “stochastic matrix” or “weighted super matrix”; if not, it becomes an un-weighted super matrix. The advantage of a stochastic matrix is that the maximum eigenvalue is 1, making the calculations easier.

(4) Calculation of limit super matrixes for decision-making

Step (3) classifies the super matrixes into different types on the basis of eigenvalues. The next step is to multiply the weighted super matrixes to derive limit super matrixes. Different system structures result in the calculations for different super matrixes (decomposable, non-decomposable, basis and non-basis).
(5) Criteria rankings in terms of importance and intensity analysis
The final step is to rank the criteria based on weights and conduct an analysis on intensity of the managerial job performance dimensions of IC design houses listed in Taiwan.

Research Findings & Conclusions
According to the research structure, this paper conducts the ANP model of the managerial job performance dimensions of the IC design houses listed in Taiwan and establish the connections between criteria. The analytical figure for the ANP model serves as a basis for the design of the questionnaire on the interrelations among the criteria of managerial job performance dimensions of IC design houses listed in Taiwan. This paper conducts interviews with experts concerning the three sampled companies so as to understand the emphasis placed by these experts regarding the relative importance of individual criteria of the managerial job performance dimensions of IC design houses listed in Taiwan. The answers to the questionnaires are translated into values and the geographic means of respective criteria are computed. Finally, the software package for ANP analysis, Super Decisions, is run to rank the criteria concerned in order of importance, and these rankings can be effective in the assessment of the finance performance dimensions of IC design houses listed in Taiwan.

Tables 4 and 5 summarize the CI values, weights and rankings of the managerial job performance dimensions and criteria of IC design houses listed in Taiwan according to the feedback from scholars and businesses.

<table>
<thead>
<tr>
<th>Table 4: CI Values, Weights and Rankings of Managerial Job Performance Dimensions According to Feedback from Scholars and Businesses</th>
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<tbody>
<tr>
<td><strong>Overall dimension</strong></td>
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<tr>
<td>Job Performance</td>
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</table>

Table 4 shows that the CI values based on the reviews from scholars and businesses are all smaller than 0.1 as proposed by Satty for the overall dimensions and sub-dimensions (2008, Yi-chung Hu and Jen Hung Wang).

<table>
<thead>
<tr>
<th>Table 5: The Weight and Priority Ranking of Each Criterion of Job-Performance Dimensions Between Scholars and Operators</th>
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<tbody>
<tr>
<td><strong>Sub-dimension</strong></td>
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<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Leadership Ability (LA)</td>
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<td></td>
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</tbody>
</table>

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You feel that company employees, or your subordinates, are pleased to execute planned job items according to the schedule. (LA3) .178 .195 3 1
When performing a task for the company, you feel time management is very important. (LA4) .183 .184 2 3
Facing a never-before executed project, or a new task, you will boldly perform the project. (LA5) .168 .163 5 5
You have the ability to perform organizational innovation and cultural change within the unit under your supervision. (LA6) .196 .187 1 2

As shown in Table 5, regarding leadership abilities that affect job performance, this paper arranges the priority ranking for each criterion of its sub-dimensions as follows:

The results show that the criteria ranking, from academic scholars’ perspective, in terms of the importance, is: (1) Innovative creativity (LA6); (2) Time management ability (LA4); (3) Leadership appeal (LA3); (4) Adversity resilience (LA1); (5) Risk-taking ability (LA5); and (6) Emotional control ability (LA2). While the criteria ranking from operators’ perspective, in terms of the importance, is: (1) Leadership appeal (LA3); (2) Innovative creativity (LA6); (3) Time management ability (LA4); (4) Adversity resilience (LA1); (5) Risk-taking ability (LA5); and (6) Emotional control ability (LA2).

Research Conclusions and Follow-Up Studies

Conclusions
The ANP analysis yields the following results:

(1) Sub-dimensions:
As shown in Table 4-1, the CI values of overall dimension and sub-dimensions, from either the scholars or the operators, are less than 0.1, which matches the criterion of Satty’s proposal.

(2) Criteria:
The scholars’ perspective of importance ranking is (1) Innovative creativity (0.196); (2) Time management ability; (3) Leadership appeal (0.178); (4) Adversity resilience (0.171); (5) Risk-taking ability (0.168); and (6) Emotional control ability (0.104). The operators’ perspective of importance ranking is (1) Leadership appeal (0.195); (2) Innovative creativity (0.187); (3) Time management ability (0.184); (4) Adversity resilience (0.169); (5) Risk-taking ability (0.163); and (6) Emotional control ability (0.102).

From the above-mentioned rankings, we find that the weights of the sub-dimensions of “leadership ability” that affect managerial job performance of listed IC design houses in Taiwan are higher than 0.1. This shows that both scholars and operators believe that innovative creativity, leadership appeal, and time management ability are three important indicators that affect leadership ability. Although operators’ perspectives on the weights of the above mentioned three indicators are different, the difference arises because scholars take on a theoretical viewpoint, believing that innovative creativity impacts leadership ability the most, while operators take on a more practical view, believing leadership appeal impacts leadership ability the most, then in turn, affects job performance.
Research Contributions

This paper applies the ANP method to evaluate the key factors that affect the managerial job performances of IC design houses listed in Taiwan. This is an innovative application of theories in the field of management and accounting. The results can serve as a reference to decision-makers in the IC design industry.

Research Limitation

1. This paper adopts the ANP method; thus, the Convenience Sampling method is used for questionnaire interview with a very high valid-return ratio. Because the interviewees are scholars and experts, coupled with a small-scale sampling, the research results may lean to being subjective.
2. This paper carries out research specifically on IC design houses. The results may be different if researching on different industries.

Suggestion to Follow-up Studies

(1) The application of the ANP method with interviews with experts for data collection and the adoption of convenience sampling may be considered an overly “subjective” approach in data gathering. This is the biggest restriction in this paper. That said, as the literature review shows, many scholars resort to the same methodology in the assignment of weights to individual sub-dimensions not mutually independent or even the selection of proposals. In other words, scholars suggest that the ANP method is about the application of “Super Decisions”, a software program” to process the interview data from a small sample of experts. Follow-up studies can still apply the same ANP method in case studies and management proposal evaluations.

(2) This paper only discusses the relationships between dimensions and criteria. Future studies may add proposal evaluations, or other research techniques such as gray correlation analysis.

(3) Future researchers may compare weights of key factors in a manager’s leadership ability that affects job performance from different industries.

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