Research on Key Factors’ Weight Evaluation in a Manager’s Personality Traits on Job Performance in the Listed IC Design Houses in Taiwan

Yung-Chieh Chien
I-Chao Lee
Department of Business Management, Kao-Yuan University, Kao-Hsiung City, Taiwan.

ABSTRACT

The purpose of this study is to evaluate the weight values of key factors in a manager’s personality traits 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 study adopted 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 showed, in the personality traits sub-dimensions that affected the managerial job performance in the listed IC design houses in Taiwan, that both the weights from academic scholars’ perspective and industry operators’ perspective were over 0.1. This result indicated that both scholars and operators believe that Conscientiousness, Openness to Experience, and Emotional Stability are three of the most important indicators affecting personality traits. Although operators’ perspectives on the weights of the above mentioned three indicators were different from the scholars’, the difference arises because scholars take on a theoretical viewpoint, believing that Conscientiousness impacts personality traits the most, while business operators take on a more practical view, believing that Openness to Experience impacts personality traits the most, which in turn, affects job performance. The analytical findings of this phase can serve as a reference for decision-makers of the listed IC design houses in Taiwan to use in talent selection.

Keywords: Personality Traits (PT), job performance, Analytic Network Process (ANP)

INTRODUCTION

IC design is in the forefront of the supply chain process, including IC manufacturing, packaging, testing, and support, of the IC industry. Its technology and output dominate the development of the IC industry in Taiwan. Therefore, improving the productivity factor of technical efficiency is relevant to the operating performance of the industry (Chen and Lee, 2012).

While the semiconductor industry is important to the economic development of a country, it is highly capital- and technology-intensive. Among the countries with leading positions in the semiconductor industry, Taiwan is the only country with a vertically disintegrated supply chain. The government seeks to boost the productivity of the industry by passing legislation to establish science parks, and thus create massive cluster effects. Taiwan is becoming the role model for the countries who seek to develop their semiconductor industries. The semiconductor industry in Taiwan has 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 (Peng, 2009; Chen and Lee, 2012).

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 (Chen & 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 (Si, 2004). In addition, 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. According to the personality-job fit theory proposed by Holland (1985), consistency in personality traits and job characteristics is relevant to job performance (Chien, 2014).

Summarizing the above-mentioned research motives, this study chose three of the typically listed IC design houses in Taiwan as the research targets, and focused the research on the personality traits of the business operators, that included: (1) Openness; (2) Conscientiousness; (3) Extraversion; (4) Agreeableness; and (5) Emotional Stability. This study constructed a research framework to analyze, evaluate, and to determine the weight values of the key factors of the managerial personality traits within the listed IC design houses in Taiwan that affected job performance. We hope to assist the industry in establishing an evaluation standard to use in the future hiring and selecting 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 study determines that the key factors that affect financial performance in a business are summarized in the following sub-dimensions, that include:

Personality Traits

Allport (1937) defined personality as "the dynamic organization within the individual of those psychophysical systems that determine his characteristic behavior and thought." He believed that psychological factors should be considered.

Chi, Li, and Chen (2008) believed that there are two major components to a personality, i.e. individuality and character, and that individuality consists of multiple characters. In other words, an individual has only one individuality; however, there are many characteristics that form that one individuality, and such characteristics contain both persistence and integration. Because the real differences between personalities lie in an individual’s inherent tendencies. Psychologists call these inherent tendencies, when studying and measuring personalities, the Personality Traits.

Costa & McCrae (1992) believed that individual behavior reflects unique Personality Characteristics of an individual. If these characteristics appear under certain conditions persistently, we may call them Personality Traits. The personality traits of an individual are stable throughout one’s life and are important composition factors (Chi et al., 2008).

Eysenck, who was the first to define Personality Traits, defined Extraversion and Neuroticism as major psychological factors of personality traits in a questionnaire analysis, which is also the same concept as the Big-Tow proposed by Wiggins (1996). The most popular classification nowadays is the one proposed by Casta and McCrae (1986), which divides personality traits into five categories: (1) Agreeableness: referring to the extent that a person may abide to the norm set by others. The more a
person complies with the norm set by his supervisor, or spouse, the more agreeable he is. A person with this trait is characterized by his politeness, trustworthiness, friendliness and easygoing. (2) Conscientiousness: referring to the concentration and focus a person has in pursuit of the goals. If a person is more focused on fewer goals, then he is more conscientious. A person with this trait is usually hard working, achievement-oriented, and persevering. It also implies that the person is well disciplined, conventional, cautious and responsible. (3) Extraversion: referring to a person’s comfort level when interacting with other people. If a person frequently has a high degree of comfort in social interactions, then he is more extraverted. A person with this trait is usually self-assertive, active, and likes to show-off; in addition, he likes to make friends, loves lively occasions, and is outgoing. (4) Neuroticism: referring to the frequency and intensity of actions required to stimulate one’s negative emotions. The less stimulation one can handle, the more sensitive one is. A person with this trait is usually highly anxious, easily frustrated, highly nervous, overly worried, insecure, afraid for no reason, and less capable of controlling one’s temper. A person with highly unstable emotions usually has two distinct emotions: fear and anger, finally (5) Openness to Experience: referring to the breadth and depth of one's interests. If a person is interested in a variety of things, but the depth of interest is shallow, then he is more open to experience. A person with this trait is usually open-minded, imaginative, curious, full of originality, who likes to think, and is innovative. These traits are commonly known as the "Big Five".

In summary, this study defined personality traits as the inherent tendencies of a personality; while the five-factor taxonomy of personality traits proposed by Casta and McCrae (1986) was adopted for the sub-dimensions of personality traits.

Job Performance

Borman & Motowidlo (1993) believed job performance is “an individual’s behavior towards an organization, and that the levels of contribution to organizational goals can be measured.” In addition, Chi et al. (2008) regarded the so-called Job Performance as “the quality and quantity of mission-accomplishment that a working individual or a group achieves.

In terms of the sub-dimension of job performance, Borman & Motowidlo (1993) divided job performance into Task Performance and Contextual Performance. In summation, in terms of definition and dimension, this study adopted the definition proposed by Chi et al (2008) and the dimension taxonomy proposed by Borman & Motowidlo (1993) respectively.

The Relationship between Personality Traits and Job Performance

Barrick & Mount (1991) and Tett, Jackson & Rothstein (1991) believed that the Big Five personality traits are correlated with job performance.

Motowidlo & Van Scotter (1994) confirmed that the distinction between task performance and contextual performance is meaningful, because it can independently measure the full value of an individual’s contribution to an organization. Their research results also indicated that using experience as the predictor for task performance is more significant than for contextual performance; in addition, using all the variables of personality traits to predict contextual performance shows a significant relationship.

Lepak & Snell (1999) pointed out that good human capital should have the characteristics of value and uniqueness. In terms of value, the person should be able to promote the core competitiveness of the organization, and create customer-awareness value.
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; Chen, 2004). This study applied the ANP method in the analysis of the relationships between the green design criteria and sought to identify the relative weights and importance rankings of individual criteria. The analytical findings during this phase could 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 that affect financial performance and the strategic decisions over business management.

The ANP networks are comprised of decision criteria (clusters), elements (nodes) and links. If a node in a given cluster exhibits interdependence or feedback relationships with a node in another cluster, there is a 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 (Sun, 1997; Liu, 2002; Tu and Hsu, 2008; Chien, 2014).

The ANP model is suitable to use in solving the problems of structures that may contain one or multiple networks. The construction of the network when applied to an ANP model should contain the following issues: (1) Whether the classification of elements and clusters are required for problem solving. (2) The 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 nodes in the cluster are affected by the parent node. The affected nodes are child nodes. The child 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 child 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. (6) Finally, it is necessary to confirm the accuracy of the links for the influencing nodes and the influenced nodes by performing 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 each 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 the weighted matrix multiplying itself until all the values in the straight column become equal. Therefore, 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, then \(\lim SV=[w,\ldots,w]\). At this juncture, all the straight columns in the matrix will be identical and equivalent to vector \(w\), and hence converge (Tu and
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, test of homogeneity (<0.1) and calculation of super/limit matrixes; (3) the calculation of global weight for all the hierarchical levels (Hu and Wang, 2008; Chien, 2014).

**Questionnaire Design**

Using the research framework as the base, this study constructed the ANP model of the managerial job performance dimensions of the IC design houses listed in Taiwan and established the interconnections between criteria. The analytical figure of the ANP model was referred to for the design of the questionnaire aiming to evaluate the inter-relationships between criteria of the managerial job performance dimensions, because the ANP method is suitable for handling the data collected via small-scale expert interviews. This study conducted expert interviews 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.

**Research Targets Questionnaire distributions:**

1. A total of 6 questionnaires were released to scholars and a total of 6 questionnaires recovered, an effective recovery rate of 100%.
2. A total of 8 questionnaires were released to business operators and a total of 7 questionnaires recovered, an effective recovery rate of 87.5%. The high recovery rate was the result of using Convenience Sampling.

**Research Framework**

The following Tables 1, 2 and 3: (1) evaluate the structure of managerial job performances of IC design houses listed in Taiwan; (2) illustrate the dimensions and definitions of managerial job performances of IC design houses listed in Taiwan; and (3) illustrate the correlations between each sub-dimension.

Table 3 shows that the sub-dimensions are not entirely independent from each other and that 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 adopted the ANP method to replace AHP (Hu and Wang, 2008).

**Table 1: Evaluation Structure of Managerial Job Performance 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>Personality Traits (PT)</td>
<td>You have the Agreeable personality traits of being friendly, easygoing, tolerant, considerate, empathetic, interdependent, witty, open-minded, and trusting. (PT1)</td>
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<tr>
<td></td>
<td></td>
<td>You have the Conscientious personality traits of being hard-working, persevering, excellence-oriented, attentive, well-behaved, responsible, detail-oriented, and focused. (PT2)</td>
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<tr>
<td></td>
<td></td>
<td>You have the Extraversion personality traits of being confident, talkative, attention getting, having initiative, able to make many friends, attracted to lively occasions, outgoing, adaptive, competitive, influential and willing to take risks. (PT3)</td>
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<tr>
<td></td>
<td></td>
<td>You have the Emotionally Stable personality traits of being optimistic, stress-tolerant, confident, calm, and adaptable. (PT4)</td>
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<td></td>
<td></td>
<td>You have the Open-to-Experience personality traits of being imaginative, creative, innovative, focused, and liking to think. (PT5)</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>Personality Traits (PT)</td>
<td><em>Personality Traits are defined as the inherent tendencies of a personality.</em></td>
<td>Casta and McCrae(1986)</td>
</tr>
</tbody>
</table>

Table 3: Relationships between each Sub-dimension

<table>
<thead>
<tr>
<th>Dimension/Criteria</th>
<th>PT1</th>
<th>PT2</th>
<th>PT3</th>
<th>PT4</th>
<th>PT5</th>
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<tbody>
<tr>
<td>PT</td>
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<td>v</td>
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<td>PT1</td>
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<td>v</td>
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<td>PT4</td>
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<td>PT5</td>
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<td>x</td>
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<td>v</td>
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</table>

Note:
(1) Please refer to “straight” columns for inputs;
(2) Please refer to “horizontal” rows when plotting in a Word document.
(3) PT: Personality Traits

ANP Analytical Procedures

1. Construction of Decision-Making Systems

The first step in the ANP method 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 is at least one 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 Supermatrices

After performing the pairwise comparisons on the clusters and criteria described in Step (2), the eigenvector of individual criteria in the control level can be calculated in the same manner as with the AHP method. All the eigenvectors are expressed in the form of Supermatrices.

If the normalized row vectors in the super matrix add up to 1, it is called Stochastic Matrix or Weighted Supermatrix; if not, it becomes an Un-weighted Supermatrix. The advantage of a stochastic matrix is that the maximum eigenvalue is 1, making the calculations easier.

4. Calculation of Limit Supermatrices for decision-making

Step (3) classifies the Supermatrices into different types on the basis of eigenvalues. The next step is to multiply the Weighted Supermatrix to derive Limit Supermatrix. Different system structures result from the calculations for different Supermatrices (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 the intensity of managerial job performance dimensions of IC design houses listed in Taiwan (Chien, 2014).

RESEARCH FINDINGS

According to the above descriptions, the value of each row and column of the Limit Supermatrix of the decision problems computed in this study is nearly the same (Table 4), which indicates that the results are stable.

<table>
<thead>
<tr>
<th>Synthesized</th>
<th>PT1</th>
<th>PT2</th>
<th>PT3</th>
<th>PT4</th>
<th>PT5</th>
<th>LA6</th>
<th>LA7</th>
<th>LA8</th>
<th>PT1</th>
<th>PT2</th>
<th>PT3</th>
<th>PT4</th>
<th>PT5</th>
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<td>LA6</td>
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<td>PT2</td>
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<td>PT4</td>
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<td>PT5</td>
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</table>
In addition, using the research framework as the base, this study constructed the ANP model of the managerial job performance dimensions of the IC design houses listed in Taiwan and established the interconnections between criteria. The analytical figure of the ANP model was referred to for the design of the questionnaire aiming to evaluate the inter-relationships between criteria of the managerial job performance dimensions of IC design houses listed in Taiwan. This study conducted expert interviews 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 were translated into values and the geometric means of respective criteria were computed. Finally, the software package for ANP analysis, Super Decisions, was run to rank the criteria concerned in order of importance, and these rankings can be effectively applied in the assessment of the job performance dimensions of IC design houses listed in Taiwan.

Tables 5 and 6 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 5: CI Values, Weights and Rankings of Managerial Job Performance Dimensions According to Feedback from Scholars and Businesses

<table>
<thead>
<tr>
<th>Overall dimension</th>
<th>CI value</th>
<th>Sub-dimension</th>
<th>CI value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholars</td>
<td>Businesses</td>
<td>Operators</td>
<td>Scholars</td>
</tr>
<tr>
<td>Job Performance</td>
<td>0.01</td>
<td>0.01</td>
<td>Personality Traits (PT)</td>
</tr>
</tbody>
</table>

Table 5 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; Chien, 2014).

Table 6: The Weight and Priority Ranking of Each Criterion of Job-Performance Dimensions Between Scholars and Business Operators

<table>
<thead>
<tr>
<th>Sub-dimension</th>
<th>Criteria</th>
<th>Weight</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholars</td>
<td>Businesses</td>
<td>Operators</td>
<td>Scholars</td>
</tr>
<tr>
<td>Personality Traits (PT)</td>
<td>You have the Agreeable personality traits of being friendly, easygoing, tolerant, considerate, empathetic, interdependent, witty, open-minded, and trusting. (PT1)</td>
<td>.184</td>
<td>.178</td>
</tr>
<tr>
<td>You have the Conscientious personality traits of being hard-working, persevering, excellence-oriented, attentive, well-behaved, responsible, detail-oriented, and focused. (PT2)</td>
<td>.232</td>
<td>.223</td>
<td>1</td>
</tr>
<tr>
<td>You have the Extraversion personality traits of being confident, talkative, attention getting, initiative, able to make many friends, attracted to lively occasions, outgoing, adaptive, competitive, influential and willing to take risks. (PT3)</td>
<td>.171</td>
<td>.174</td>
<td>5</td>
</tr>
<tr>
<td>You have the Emotionally Stable personality traits of being optimistic, stress-tolerant, confident, calm, and adaptable. (PT4)</td>
<td>.191</td>
<td>.192</td>
<td>3</td>
</tr>
<tr>
<td>You have the Open-to-Experience personality traits of being imaginative, creative, innovative, focused, and liking to think. (PT5)</td>
<td>.222</td>
<td>.233</td>
<td>2</td>
</tr>
</tbody>
</table>
As shown in Table 6, regarding personality traits that affect job performance, this study discusses each criterion of its sub-dimensions as follows:

Scholars believe that Conscientiousness is the most important criterion in the sub-dimensions of Personality Traits, and that Extraversion is the least important criterion in the importance sort-order. While businesses believe that Openness to Experience is the most important criterion in the sub-dimensions of Personality Traits, and that Extraversion is the least important criterion in the importance sort-order.

CONCLUSIONS AND FUTURE STUDIES

Conclusions
1. Sub-dimensions: The ANP analysis result showed that the CI values based on the reviews from scholars and businesses are all smaller than 0.1, the requirement as proposed by Satty, for the overall dimensions and sub-dimensions
2. Criteria: As for the sub-dimensions of personality traits, the scholars’ perspective on the criteria ranking in terms of importance is (1) Conscientiousness; (2) Openness to Experience; (3) Emotional Stability; (4) Agreeableness; (5) Extraversion. While the business operators’ perspective on the criteria ranking in terms of importance is (1) Openness to Experience; (2) Conscientiousness; (3) Emotional Stability; (4) Agreeableness; (5) Extraversion.

The priority order in the above description shows that the weights of personality traits sub-dimensions, which affect managerial job performance of listed IC design houses in Taiwan, from both scholars and businesses operators are higher than 0.1. This result shows that both scholars and operators believe that Conscientiousness, Openness to Experience, and Emotional Stability are three of the most important indicators affecting personality traits. Although operators’ perspectives on the weights of the above-mentioned three indicators are different from the scholars’, the differences arose because scholars take on a theoretical viewpoint, believing that Conscientiousness impacts personality traits the most, while business operators take on a more practical view, believing that Openness to Experience impacts personality traits the most, which in turn, affects job performance.

RESEARCH CONTRIBUTIONS

This study applies ANP method to evaluate the key factors that affect the managerial job performances of IC design houses listed in Taiwan. This approach is an innovative application of the theory in the field of management and accounting. In practice, the research results can serve as a reference to decision-makers in the IC design industry for talent selections.

Research Limitation
(1) This study adopts the ANP method; thus, 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 study carries out research specifically on IC design houses. The results may be different if researching different industries.
Suggestions for Future Studies

(1) Future researchers may compare weights of key factors in a manager’s personality traits that affect job performance from other industries.

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

(1) 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. Future studies can still apply the ANP method to management proposal evaluations.

REFERENCES