

# A Research on the Evaluation and Selection of Taiwan's Competitiveness Indexes – Application of the AHP Methodology

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## ABSTRACT

*The purpose of this article is to use the Analytic Hierarchy Process (AHP) for the evaluation and selection of the items to be emphasized on regarding Taiwan's competitiveness indexes, which will benefit the upgrade of Taiwan's competitiveness. The article evaluated and selected the competitiveness index items to be emphasized, according to the world competitiveness indexes published by the International Institute for Management Development (IMD) as the basis of study, through interviewing experts and scholars followed by questionnaire survey, then using the 3 major policy programs proposed by Taiwan's Executive Yuan in May, 2008 – which are “Expansion of Domestic Demand”, “Open for Mainland Capital” and “Stabilization of Goods Prices” as the base to establish the research structure, from which to select the items to be emphasized as the competitiveness indexes by the AHP methodology under the grand objective of upgrading “Taiwan's competitiveness” according to the weighted priority (i.e. the weighted scale). The research results showed: (1) in respect of “Objective Hierarchy”: under the grand objective of upgrading “Taiwan's competitiveness”, “Government Efficiency” should be the first priority consideration as the competitiveness index item to be emphasized; (2) in respect of “Criteria Hierarchy”: the major policy should take “Financial Policy” as first priority; and (3) in respect of the “Alternative Hierarchy” to be adopted, “Stabilization of Goods Prices” should be the first priority for the selection of alternative followed by “Expansion of Domestic Demand” and at last the “Open for Mainland Capital”.*

**Keywords:** *Analytic Hierarchy Process (AHP), International Institute for Management Development (IMD), Taiwan's Competitiveness Index*

## INTRODUCTION

According to the IMD published world competitiveness ranking, Taiwan's overall competitiveness performance from 2004 to 2009 was ranked at the 12<sup>th</sup> place, 11<sup>th</sup> place, 17<sup>th</sup> place, 18<sup>th</sup> place, 13<sup>th</sup> place, and 23<sup>rd</sup> place respectively; while China's overall competitiveness performance in the recent 6 years was ranked at the 22<sup>nd</sup> place, 29<sup>th</sup> place, 18<sup>th</sup> place, 15<sup>th</sup> place, 17<sup>th</sup> place and 20<sup>th</sup> place. Taiwan improved from the 18<sup>th</sup> place in 2007 to the 13<sup>th</sup> place in 2008. Although the ranking improved in comparison to which 2 years previously, it was seriously impacted by the 2008 financial tsunami and fell back to the 23<sup>rd</sup> place in 2009. Moreover, Taiwan is under pressure of competition from the Newly Industrialized Countries (NICs). Therefore, from which aspect Taiwan should improve its competitiveness is an important issue (Google: IMD website). The Council for Economic Planning and Development of the Executive Yuan (2007) started from the end of 2004 to review and improve Taiwan's policy in response to the inferior items of Taiwan's competitiveness according to such competitiveness evaluation ranking. The article evaluated and selected the competitiveness index items to be emphasized according to the

world competitiveness indexes (published by the International Institute for Management Development (IMD) as the basis of study and through interviewing experts and scholars visiting), followed by questionnaire survey, The three major policy programs proposed by Taiwan's Executive Yuan in May, 2008 – which are “Expansion of Domestic Demand”, “Open for Mainland Capital” and “Stabilization of Goods Prices” were then used as the base to establish the research structure, from which selected the items emphasized the competitiveness indexes by the AHP methodology under the grand objective of upgrading “Taiwan's competitiveness” according to the weighted priority (i.e. the weighted scale). That is to say, the evaluation and selection indexes for Taiwan's competitiveness were analyzed so as to establish the evaluation and selection indexes and to evaluate the alternative programs.

Measurement of international competitiveness involves considerably complicated aspects. In order to be objective, there is the composite evaluation by pure quantification; or for overall consideration, there is the evaluation by pure experts scoring total. This research adopted the AHP methodology that considers “quantification orientation” and “qualification orientation” research for the benefit of cross-compensation. Though much of the past literatures has applied AHP as the tool for index evaluation and selection, very few studies have applied AHP for measured evaluation of strategic planning issues for Taiwan's competitiveness index, therefore, this research attempted to use this methodology for the comparison of alternative programs to evaluate which items should be emphasized for Taiwan's competitiveness index with the intention that verification by this research may contribute to actual practices.

## **LITERATURE REVIEW**

When we look at the traditional competitive analysis, the more commonly used indexes are mainly divided into two categories: the first category is the pre-trade index, such as resource elements contained, factor pricing, factor efficiency, technical innovation, and productivity. Adam Smith proposed the "theory of absolute advantages" that explained the reasons for the occurrence of international trading, and David Ricardo explained the "theory of comparative advantages" from cost differences to fill the deficiency in Adam Smith's theory; while the H-O-S model theoretically considered the difference in factor price to compensate the shortcomings in David Ricardo theory. The Neo-Factor-Proportion theory emphasized factor efficiency; while the technology gap and product cycle theory focused on technical innovation.

The second category is the post-trade index, such as export market share, revealed comparative advantage index, and constant market share. The export market share theory considers export market share for each industry. The revealed comparative advantage (RCA) index provides comparative advantage moving index for a certain area, which was used by Balassa in as early as 1965 for international comparative advantage model analysis (Balassa, 1979). Its advantage is to consider each country's economic scale for each industry's export market share, so as to use the same index to express the relative competitiveness for the same products between each country or the relative competitiveness for different products within one country. Its shortcoming is contributing the reason for export market share change completely to the increase in competitiveness of the industry itself without discussing other changes due to the overall structural factors (Liu Pang-tien, Chien Chen-lin, 1988).

Therefore, generally in the literature, another index frequently adopted by scholars to explore the current situation and variation analysis for industrial export competitiveness is the Constant Market Share (CMS) Model. This model was earliest used by Tyszynski (1951) for export growth analysis. Fleming & Tsiang (1956) proposed that within a period of time, the reason for variation in industrial export market

share on the one hand contributes to the change in competitiveness, and on the other hand contributes to other overall structural factors. Leamer & Stern (1970) further detailed the correlation between world trade structural change and export. Richardson (1971) pointed out that if market element effect is added into analysis, then the product and market element effect will affect the calculated results (Chien Chen-lin 2005). Bowen & Pelzman (1984) added Richardson proposed sensitivity analysis into their practical verification. Fagerberg & Sollie (1987) analyzed and separated export change into five effects for measurement of each country's capability in export structural change in response to the combination of importation product and the import market change. Later, Kellman, Roxo & Shachmurove (2003) added the factor of relative currency exchange rate variation to explore the sensitivity for CMS variation and relative currency exchange rate variation and found that the higher the sensitivity of the product, the more the exportation competitiveness it will have (Chien Chen-lin, 2006).

The recent national competitiveness related research Memedovic (1994) believed that national status and government policy can all result in more favorable changes. The contents of the IMD published "World Competitiveness Yearbook" also made overall consideration and believed that competitiveness is the capability of a country to create added value. A product must have competitiveness in its process and overall structure to be competitive. Its contents include Economic Performance, Government Efficiency, Business Efficiency, Infrastructure, all four items, and four major items with 20 sub-items as indexes for integrated calculation are used to list each country's world competitiveness ranking. In summary of the above, this research tried adding the IMD published indexes evaluation principle into the major policy programs proposed by Taiwan's Executive Yuan for 2008 to establish the research structure accordingly.

## METHODOLOGY

### Questionnaire Survey and Processing

This article is aimed at the 2008 Taiwan's hot 100 large enterprises, from which 20 enterprises were selected by using telephone interviews or face-to-face interviews to rule out companies that did not exist or were unwilling to fill out the questionnaires. A total of 20 sets of questionnaires were delivered to experts and scholars whose background include service in state-owned enterprises, private enterprises, educational organizations, information technology, and financial institutions, with 17 sets returned at a return rate of 85%. The recovered questionnaires were analyzed by AHP computer package software simulation. Among them, 14 sets of sample that complied with passing the CR-value test was accounted for the priority evaluation after calculation of total and average. The basic division of the AHP assessment scale includes five items, which is the measurement value of 1, 2, 3, 4, and 5. According to Teng Chen-yuan, Tseng Kuo-hsiung (1989): "Green, P. and Yoram Wind explained before that a person's judgment for quality cannot be more than a scale value of 7". In order to reduce the degree of complication for the questioned persons, the research only adopted five basic evaluation scale values. Besides, the evaluation elements in this research will use seven as its upper limit however, since the number of evaluation elements will directly affect the evaluation results of the relative weighted ratio. In order to reduce the situation of negative effect, this research suggested taking 4, the medium digit of 1-7, as the base number for setting the evaluation elements, and taking the 3 to 5 evaluation elements to solve the contradictory situation where the more the elements to evaluate, the less will be the relative weighted value (Wang Min-shun, 2001).

## **Introduction of the Research Flow**

This research went through interviews with experts to combine experts and scholars with their backgrounds in state-owned enterprises, private enterprises, educational organizations, information technology, financial institutions for questionnaire survey, and attempted using the IMD published evaluation content indexes with the addition of the major policy programs proposed by Taiwan's Executive Yuan to establish the selection of evaluation model and the evaluation of alternative programs, to separate out the competitiveness index items that our country should emphasize, through the AHP computer package software (Chen Wen-hsien, 1987) model analysis.

Therefore, the article under the goal of "Upgrading Taiwan's Competitiveness", established "Objective Hierarchy", "Criteria Hierarchy", "Alternative Hierarchy", through interviews and questionnaire survey, using pair-wise comparison matrices to calculate eigenvalues and eigenvectors, and used computer software to calculate the C.R. (Consistent Ratio) value. When the C.R. value is smaller than 0.1, it means the result is in compliance with consistency for evaluation with no contradiction.

Using the valid samples to calculate the relative weights, the criteria occupied portion of weight relative to goal hierarchy, and with respect to the alternative programs, the relative importance of the criteria. Standardized pair-wise comparison matrices were used to multiply the relative weight at the evaluated hierarchy to explore the overall implementation strategy for Taiwan's future competitiveness and select the competitiveness index items to be emphasized for priority weight to analyze Taiwan's competitiveness evaluation indexes and to establish the selection of evaluation model and the evaluation of alternative programs, from which the priority of competitiveness index items that Taiwan should emphasize were then determined.

## **The Hierarchy Structure**

According to the overall AHP goal system, this research constructed the Goal Hierarchy, Objective Hierarchy, Criteria Hierarchy, and Alternative Hierarchy. The factors in each hierarchy are listed as follows:

- (1) Goal Hierarchy: A: Upgrading Taiwan's Competitiveness.
- (2) Objective Hierarchy: B1: Economic Performance, B2: Government Efficiency, B3: Business Efficiency, B4: Infrastructure.
- (3) Criteria Hierarchy: B1 subdivided into five items:  
C1: Domestic Economy, C2: International trade, C3: International Investment, C4: Employment, C5: Prices.  
B2 subdivided into five items:  
C6: Public Finance, C7: Fiscal Policy, C8: Institutional Framework, C9: Business Legislation, C10: Social Framework.  
B3 subdivided into five items:  
C11: Productivity and Efficiency, C12: Labor Market, C13: Finance, C14: Management Practices, C15: Attitudes and Values.  
B4 subdivided into five items:  
C16: Basic Infrastructure, C17: Tech. Infrastructure, C18: Scientific Infrastructure, C19: Health and Environment, C20: Education.
- (4) Alternative Hierarchy: D1: Expansion of Domestic Demand, D2: Open for Mainland Capital, D3: Stabilization of Goods Prices.

## The Overall Goal System Structure

The overall goal system structure is shown in Figure 3-1 as follows:

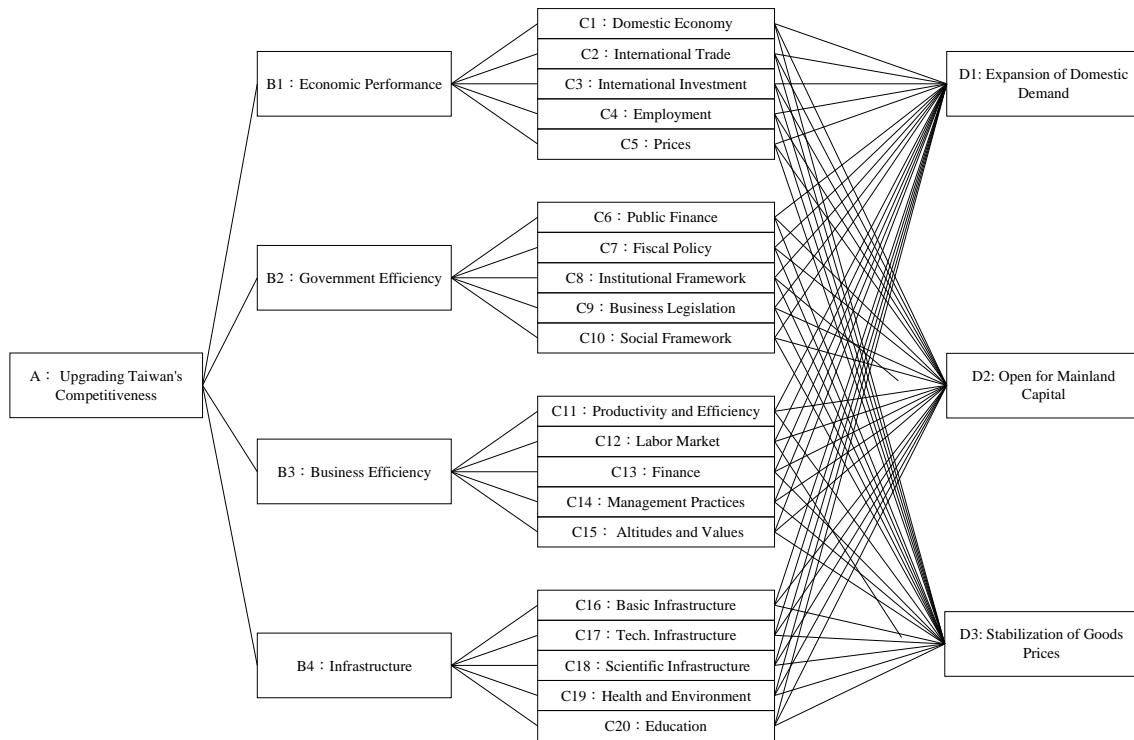


Figure 3-1. The Overall AHP Goal System Structure Diagram

## Evidence Analysis

### AHP Questionnaire Survey Evaluation Analysis

Data collected through questionnaire survey were quantitatively analyzed by computer software as follows:

#### "Objective Hierarchy" Evaluation Analysis from the AHP Questionnaire Survey

In order to achieve the "Objective Index" of goal A (i.e. upgrading Taiwan's competitiveness), as shown in Table 4-1, the "Objective Hierarchy" evaluation analysis indicated: The composite ranking shows B2 "Government Efficiency" as first priority (priority value = 0.298357), the next priority is B1 "Economic Performance" (priority value=0.282143), and next again is B4 "Infrastructure" (priority value=0.211143), and the last is B3 "Business Efficiency" (priority value=0.208357). Therefore, in order to upgrade Taiwan's competitiveness, improving "Government Efficiency" should be carried out as the first important issue.

According to the IMD competitiveness evaluation ranking for 2007, China was ranked at the 15<sup>th</sup> place while Taiwan was ranked at the 18<sup>th</sup> place, the first time China surpassed Taiwan. However in 2008, Taiwan rose to the 13<sup>th</sup> place while China fell to the 17<sup>th</sup> place (Nownews, 2008), mainly because of the completion and operation of the Taiwan High Speed Rail in 2007 as well as the release of the government sector's promotion of regulations for foreign professionals that gave significant growth to the evaluation for Taiwan's "Government Efficiency". Under "Economic Performance", "International Investment" was obviously rather low which ranked at the 44<sup>th</sup> place among the evaluated 55 economic

entities, and it was a drop by 2 rankings from the previous year; “International Trade” also dropped by 12 rankings to the 28<sup>th</sup> place; indicating that these two items had room for improvement.

**Table 4-1. Evaluation Analysis for “Objective Hierarchy” (B1—B4) by AHP Questionnaire Survey from Experts and Scholars**

Objective Hierarchy	B1 Economic Performance	B2 Government Efficiency	B3 Business Efficiency	B4 Infrastructure	
Sample No.	Priority Value	Priority Value	Priority Value	Priority Value	CR Value*
1	0.432	0.195	0.177	0.195	0.008
2	0.532	0.128	0.257	0.083	0.040
3	0.503	0.241	0.125	0.132	0.073
4	0.100	0.438	0.244	0.219	0.008
5	0.340	0.340	0.227	0.093	0.046
6	0.323	0.224	0.323	0.130	0.058
7	0.160	0.238	0.293	0.309	0.090
8	0.096	0.466	0.161	0.277	0.011
9	0.263	0.455	0.141	0.141	0.004
10	0.462	0.112	0.175	0.251	0.100
11	0.115	0.577	0.105	0.202	0.100
12	0.250	0.250	0.250	0.250	0
13	0.265	0.162	0.250	0.323	0.100
14	0.109	0.351	0.189	0.351	0.004
Total Value	<b>3.950</b>	<b>4.177</b>	<b>2.917</b>	<b>2.956</b>	<b>0.642</b>
Average Value	<b>0.282143</b>	<b>0.298357</b>	<b>0.208357</b>	<b>0.211143</b>	<b>0.045857</b>
Compositive Ranking	<b>2</b>	<b>1</b>	<b>4</b>	<b>3</b>	

Remarks: \*The test is qualified when consistent ratio CR value  $\leq$  0.1.

*“Criteria Hierarchy” Evaluation Analysis from the AHP Questionnaire Survey*

1. Analysis of criteria to achieve objective B1 “Economic Performance”

As shown in Table 4-2, the evaluation analysis indicates C4 “Employment” as first priority (priority value=0.239571), the next priority is C1 “Domestic Economy” (priority value=0.217786), and to its next is C2 “International trade” (priority value=0.201214), and next again is C5 “Prices” (priority value=0.187643) and the last is C3 “International Investment” (priority value=0.154000). Therefore, in order to upgrade Taiwan’s economic performance, increasing employment rate is the first important issue.

Taiwan’s low unemployment rate has been an economic achievement to be proud of however the unemployment rate jumped from 1.79% to 2.6% from 1995 to 1996: till 2001 it was as high as 4.57%, and it also reached 3.89% in 2008 (Table 4-3). Therefore, increasing the employment rate is indeed the wish that most people heartily expect.

**Table 4-2. Evaluation Analysis for the evaluation items of B1 “Economic Performance” (C1—C5) by AHP Questionnaire Survey from Experts and Scholars**

Criteria	C1 Domestic Economy	C2 International Trade	C3 International Investment	C4 Employment	C5 Prices	
Sample No.	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	CR Value*
1	0.158	0.296	0.298	0.158	0.089	0.003

2	0.409	0.097	0.062	0.282	0.150	0.027
3	0.301	0.138	0.091	0.195	0.276	0.100
4	0.165	0.401	0.247	0.093	0.094	0.062
5	0.058	0.301	0.145	0.301	0.195	0.100
6	0.106	0.189	0.189	0.256	0.259	0.049
7	0.129	0.124	0.164	0.279	0.304	0.018
8	0.271	0.107	0.081	0.271	0.271	0.013
9	0.349	0.184	0.098	0.184	0.184	0.002
10	0.416	0.262	0.062	0.161	0.099	0.015
11	0.158	0.171	0.157	0.371	0.144	0.047
12	0.300	0.229	0.083	0.211	0.177	0.035
13	0.132	0.113	0.113	0.387	0.256	0.039
14	0.097	0.205	0.366	0.205	0.129	0.016
Total Value	<b>3.049</b>	<b>2.817</b>	<b>2.156</b>	<b>3.354</b>	<b>2.627</b>	<b>0.526</b>
Average Value	<b>0.217786</b>	<b>0.201214</b>	<b>0.154000</b>	<b>0.239571</b>	<b>0.187643</b>	<b>0.037571</b>
Compositive Ranking	<b>2</b>	<b>3</b>	<b>5</b>	<b>1</b>	<b>4</b>	

Remarks: \*The test is qualified when consistent ratio CR value  $\leq 0.1$ .

**Table 4-3. Taiwan's unemployment rate in the past years from 1995 to 2008 unit: %**

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Unemployment Rate	1.79	2.60	2.72	2.69	2.92	2.99	4.57	5.17	4.99	4.44	4.13	3.91	3.91	3.89

Sources: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.

## 2. Analysis of criteria to achieve objective B2 "Government Efficiency"

As shown in Table 4-4, the evaluation analysis indicates a compositive ranking with C7 "Fiscal Policy" as first priority (priority value=0.258143), the next priority is C10 "Social Framework" (priority value=0.219929), and to its next is C6 "Public Finance" (priority value=0.196071), and next again is C8 "Institutional Framework" (priority value=0.192786) and the last is C9 "Business Legislation" (priority value=0.178286). According to IMD published world competitiveness evaluation ranking, among the sub-factors that Taiwan performed best was Fiscal Policy at the 3<sup>rd</sup> place (HiNet News website, 2008), which basically reflected that Taiwan government's encouragement for investments and control on fiscal expenditures in recent years had exerted strong effectiveness, however the weak index items such as political instability, social binding force and policy consistency should be enhanced.

**Table 4-4. Evaluation Analysis for the evaluation items of B2 "Government Efficiency" (C6—C10) by AHP Questionnaire Survey from Experts and Scholars**

Criteria	C6 Public Finance	C7 Fiscal Policy	C8 Institutional Framework	C9 Business Legislation	C10 Social Framework	
Sample No.	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	CR Value*
1	0.134	0.410	0.253	0.134	0.070	0.004
2	0.100	0.468	0.225	0.138	0.700	0.029
3	0.222	0.175	0.183	0.198	0.222	0.100
4	0.309	0.271	0.187	0.116	0.118	0.100
5	0.424	0.090	0.128	0.198	0.161	0.100
6	0.093	0.172	0.189	0.362	0.185	0.096
7	0.200	0.200	0.200	0.200	0.200	0

8	0.182	0.320	0.111	0.111	0.276	0.013
9	0.206	0.368	0.206	0.109	0.109	0.003
10	0.416	0.262	0.161	0.099	0.062	0.015
11	0.068	0.177	0.284	0.347	0.125	0.033
12	0.118	0.252	0.241	0.171	0.218	0.027
13	0.194	0.205	0.194	0.176	0.231	0.036
14	0.079	0.244	0.137	0.137	0.402	0.007
Total Value	<b>2.745</b>	<b>3.614</b>	<b>2.699</b>	<b>2.496</b>	<b>3.079</b>	<b>0.563</b>
Average Value	<b>0.196071</b>	<b>0.258143</b>	<b>0.192786</b>	<b>0.178286</b>	<b>0.219929</b>	<b>0.040214</b>
Compositive Ranking	<b>3</b>	<b>1</b>	<b>4</b>	<b>5</b>	<b>2</b>	

Remarks: \* The test is qualified when consistent ratio CR value  $\leq 0.1$ .

### 3. Analysis of criteria to achieve objective B3 “Business Efficiency”

As shown in Table 4-5, the evaluation analysis indicates C11 “Productivity and Efficiency” as first priority (priority value=0.254286), the next priority is C14 “Management Practices” (priority value=0.254286), and to its next is C15 “Altitudes and Values” (priority value=0.222500), and next again is C13 “Finance” (priority value=0.152143) and the last is C12 “Labor Market” (priority value=0.124286). In order to upgrade Taiwan’s business efficiency, increasing productivity and efficiency and management practices are most important. In the year 2006 and 2007, Taiwan was extended over by the “eruption of credit card debts” and the “Rebar incident” that affected the competitiveness performance of business efficiency, which gradually returned to normal in 2008 and improved from the 17<sup>th</sup> place in 2007 to the 7<sup>th</sup> place this year (HiNet News website, 2008).

**Table 4-5. Evaluation Analysis for the evaluation items of B3 “Business Efficiency” (C11—C15) by AHP Questionnaire Survey from Experts and Scholars**

Criteria	C11 Productivity and Efficiency	C12 Labor Market	C13 Finance	C14 Management Practices	C15 Altitudes and Values	
Sample No.	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	CR Value*
1	0.393	0.070	0.188	0.161	0.188	0.007
2	0.401	0.061	0.110	0.270	0.159	0.100
3	0.210	0.170	0.195	0.256	0.170	0.085
4	0.170	0.064	0.119	0.356	0.290	0.018
5	0.083	0.083	0.182	0.216	0.435	0.030
6	0.109	0.165	0.185	0.216	0.325	0.026
7	0.229	0.173	0.173	0.229	0.196	0.026
8	0.199	0.118	0.093	0.412	0.178	0.046
9	0.206	0.109	0.109	0.206	0.368	0.003
10	0.427	0.227	0.154	0.106	0.087	0.100
11	0.217	0.106	0.145	0.266	0.266	0.019
12	0.244	0.138	0.147	0.248	0.223	0.041
13	0.278	0.132	0.206	0.278	0.106	0.100
14	0.394	0.124	0.124	0.234	0.124	0.002
Total Value	<b>3.560</b>	<b>1.740</b>	<b>2.130</b>	<b>3.454</b>	<b>3.115</b>	<b>0.603</b>
Average Value	<b>0.254286</b>	<b>0.124286</b>	<b>0.152143</b>	<b>0.246714</b>	<b>0.222500</b>	<b>0.043071</b>
Compositive Ranking	<b>1</b>	<b>5</b>	<b>4</b>	<b>2</b>	<b>3</b>	

Remarks: \*The test is qualified when consistent ratio CR value  $\leq 0.1$ .

#### 4. Analysis of criteria to achieve objective B4 “Infrastructure”

As shown in Table 4-6, the evaluation analysis indicates C20 “Education” as first priority (priority value=0.257643), the next priority is C18 “Scientific Infrastructure” (priority value=0.219571), and to its next is C16 “Basic Infrastructure” (priority value=0.202143), and next again is C19 “Health and Environment” (priority value=0.174214) and the last is C17 “Tech. Infrastructure” (priority value=0.146643). That is to say, in order to upgrade Taiwan’s infrastructure, increasing educational quality is the first important issue. Education is the base of infrastructure and cultivation of talents is the key issue to facilitate future basic infrastructure. A country’s competitiveness would naturally be upgraded along with superior human resources capital. The internationally well-known economic scholar Thurow (1999) pointed out: “We must emphasize investment on basic knowledge, education and basic infrastructure.” From which, we can see the importance of education. In addition, Taiwan’s scientific infrastructure and basic infrastructure are ranked at the 4<sup>th</sup> and 5<sup>th</sup> place respectively on the IMD competitiveness ranking list, indicating that Taiwan is working hard towards this direction.

**Table 4-6. Evaluation Analysis for the evaluation items of B4 “Infrastructure” (C16—C20) by AHP Questionnaire Survey from Experts and Scholars**

Criteria	C16 Basic Infrastructure	C17 Tech. Infrastructure	C18 Scientific Infrastructure	C19 Health and Environment	C20 Education	
Sample No.	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	CR Value*
1	0.313	0.176	0.313	0.099	0.099	0.003
2	0.061	0.087	0.407	0.229	0.217	0.055
3	0.094	0.154	0.355	0.218	0.178	0.071
4	0.383	0.135	0.256	0.065	0.161	0.012
5	0.088	0.088	0.154	0.257	0.413	0.008
6	0.110	0.195	0.256	0.220	0.220	0.013
7	0.172	0.172	0.197	0.197	0.263	0.017
8	0.231	0.164	0.100	0.071	0.434	0.038
9	0.206	0.109	0.109	0.206	0.368	0.003
10	0.427	0.227	0.154	0.106	0.087	0.100
11	0.199	0.152	0.260	0.195	0.195	0.030
12	0.231	0.176	0.198	0.198	0.198	0.013
13	0.109	0.109	0.109	0.269	0.406	0.033
14	0.206	0.109	0.206	0.109	0.368	0.003
Total Value	<b>2.830</b>	<b>2.053</b>	<b>3.074</b>	<b>2.439</b>	<b>3.607</b>	<b>0.399</b>
Average Value	<b>0.202143</b>	<b>0.146643</b>	<b>0.219571</b>	<b>0.174214</b>	<b>0.257643</b>	<b>0.0285</b>
Compositive Ranking	<b>3</b>	<b>5</b>	<b>2</b>	<b>4</b>	<b>1</b>	

Remarks: \*The test is qualified when consistent ratio CR value  $\leq$  0.1.

#### *Compositive Analysis of the Evaluated Items for Achieving Goal A (Upgrading Taiwan’s Competitiveness)*

Table 4-7 shows: Among the 20 items evaluated composively for achieving goal A (Upgrading Taiwan’s Competitiveness), the first priority is C7 “Fiscal Policy” (priority value=0.072429), the second is C1 “Domestic Economy” (priority value=0.069786), the third is C4 “Employment” (priority value=0.066), the fourth is C10 “Social Framework” (priority value=0.0592856), and the fifth is C8 “Institutional Framework” (priority value=0.057643). The top five priority rankings are all focused in B2 (Government Efficiency) and B1 (Economic Performance). According to this, it also indicates the important points to be enhanced for upgrading Taiwan’s competitiveness.

**Table 4-7. Composite evaluation analysis of the AHP questionnaire survey (C1-C20) from experts and scholars**

Criteria	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20
Sample No.	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value	Priority Value
1	0.068	0.129	0.129	0.068	0.038	0.026	0.080	0.049	0.026	0.014	0.070	0.012	0.033	0.028	0.033	0.061	0.034	0.061	0.019	0.019
2	0.218	0.052	0.033	0.150	0.080	0.013	0.060	0.029	0.018	0.090	0.103	0.016	0.028	0.069	0.041	0.005	0.007	0.034	0.019	0.018
3	0.151	0.069	0.046	0.098	0.139	0.054	0.042	0.044	0.048	0.053	0.026	0.021	0.024	0.032	0.021	0.012	0.020	0.047	0.029	0.024
4	0.017	0.04	0.025	0.009	0.009	0.135	0.119	0.082	0.051	0.051	0.042	0.016	0.029	0.087	0.070	0.084	0.029	0.056	0.014	0.035
5	0.020	0.102	0.049	0.102	0.066	0.144	0.031	0.043	0.067	0.055	0.019	0.019	0.041	0.049	0.099	0.008	0.008	0.014	0.024	0.039
6	0.034	0.061	0.061	0.083	0.084	0.021	0.038	0.042	0.081	0.041	0.035	0.053	0.060	0.070	0.105	0.014	0.025	0.033	0.029	0.029
7	0.021	0.02	0.026	0.045	0.049	0.048	0.048	0.048	0.048	0.048	0.067	0.051	0.051	0.067	0.057	0.053	0.053	0.061	0.061	0.081
8	0.026	0.01	0.008	0.026	0.026	0.085	0.149	0.052	0.052	0.128	0.032	0.019	0.015	0.066	0.029	0.064	0.045	0.028	0.020	0.120
9	0.092	0.049	0.026	0.048	0.049	0.094	0.167	0.094	0.050	0.050	0.029	0.015	0.015	0.029	0.052	0.029	0.015	0.015	0.029	0.052
10	0.192	0.121	0.029	0.074	0.046	0.047	0.029	0.018	0.011	0.007	0.075	0.040	0.027	0.019	0.015	0.107	0.057	0.039	0.027	0.022
11	0.018	0.02	0.018	0.043	0.017	0.039	0.102	0.164	0.200	0.072	0.023	0.011	0.015	0.028	0.028	0.040	0.031	0.053	0.039	0.039
12	0.075	0.057	0.021	0.053	0.044	0.030	0.030	0.063	0.06	0.043	0.055	0.035	0.035	0.037	0.062	0.056	0.058	0.044	0.049	0.049
13	0.035	0.03	0.030	0.103	0.068	0.031	0.033	0.031	0.029	0.037	0.070	0.033	0.052	0.070	0.027	0.035	0.035	0.035	0.087	0.131
14	0.010	0.022	0.040	0.022	0.014	0.028	0.086	0.048	0.048	0.141	0.075	0.023	0.023	0.044	0.023	0.072	0.038	0.072	0.038	0.129
Total Value	0.977	0.782	0.541	0.924	0.729	0.795	1.014	0.807	0.789	0.830	0.721	0.364	0.448	0.695	0.662	0.640	0.455	0.592	0.484	0.787
Average Value	0.069786	0.055857	0.038643	0.066000	0.052071	0.056786	0.072429	0.057643	0.056357	0.059286	0.051500	0.026000	0.032000	0.049643	0.047286	0.045714	0.0325	0.042286	0.034571	0.056214
Compositive Ranking	2	9	16	3	10	6	1	5	7	4	11	20	19	12	13	14	18	15	17	8

Remarks: The test is qualified when consistent ratio CR value  $\leq 0.1$ . The consistent ratio CR value =  $0.037339 \leq 0.1$  in this hierarchy.

**Alternative Hierarchy Evaluation Analysis from the AHP Questionnaire Survey**

Opinions of exports and scholars on the improvement alternatives (D1, D2, D3) to achieve the upgrade of Taiwan’s competitiveness goal were analyzed by AHP analysis, and the results are compiled as shown in Table 4-8. It indicates that: The priority of improvement alternatives is ranked with D3 (Stabilization of Goods Prices) as first priority (priority value=0.369214), D1 (Expansion of Domestic Demand) as the next priority (priority value=0.355071), and D2 (Open for Mainland Capital) as the last priority (priority value=0.269714). Accordingly, it shows that: in order to upgrade Taiwan’s competitiveness, stabilization of goods prices and expansion of domestic demand are currently the urgent issues among the government improvement alternatives, especially when the priority value for stabilization of goods prices nearly reaches 37%, which is the economic problem that Taiwan should resolve most urgently. While the priority value for the “Open for Mainland Capital” only reaches 27%, it is the item in lower priority order among the improvement alternatives.

**Table 4-8. Evaluation analysis of improvement alternatives to achieve upgrading Taiwan’s competitiveness goal from opinions of experts and scholars**

Improvement Alternative	D1 Alternative Expansion of domestic Demand	D2 Alternative Open for Mainland Capital	D3 Alternative Stabilization of Goods Prices		
Sample No.	Priority Value	Priority Value	Priority Value	Overall Hierarchy CR Value*	
1		0.498	0.215	0.287	0.005
2		0.373	0.283	0.341	0.043
3		0.440	0.240	0.320	0.078

4	0.439	0.219	0.342	0.052
5	0.345	0.402	0.254	0.091
6	0.184	0.290	0.526	0.051
7	0.332	0.280	0.388	0.042
8	0.362	0.215	0.423	0.020
9	0.297	0.164	0.539	0.004
10	0.364	0.236	0.344	0.096
11	0.311	0.353	0.336	0.096
12	0.404	0.248	0.348	0.014
13	0.280	0.153	0.541	0.084
14	0.342	0.478	0.180	0.005
Total Value	<b>4.971</b>	<b>3.776</b>	<b>5.169</b>	<b>0.681</b>
Average Value	<b>0.355071</b>	<b>0.269714</b>	<b>0.369214</b>	<b>0.048643</b>
Compositive Ranking	<b>2</b>	<b>3</b>	<b>1</b>	

Remarks: \*The test is qualified when overall hierarchy CR value  $\leq 0.1$ .

A summary of the above compositive analysis derives: the competitiveness index items to be emphasized and major policy alternatives in order of priority (Table 4-9) for upgrading Taiwan's competitiveness. It indicates that: The selected alternative takes "Stabilization of Goods Prices" as first priority (the relative weight at 0.369214), and the next priority is "Expansion of Domestic Demand", but the relative weight difference between these two is very small. Accordingly, it reflects that: "Stabilization of Goods Prices" is the public's most expected policy direction. Currently, the major reason for the increase in the ratio of consumption expenditure over income is the goods prices factor, and the above findings are the directions for what we should continue to work towards. Overall speaking, strengthening government efficiency is the first issue towards upgrading Taiwan's competitiveness as well as establishing clear fiscal policy to stabilize goods prices fluctuation, thus these are the best alternatives to upgrade Taiwan's competitiveness.

**Table 4-9. Composite evaluation analysis for achieving the increase of Taiwan's competitiveness goal from opinions of experts and scholars**

First Hierarchy	Single Goal: Upgrade Our National Competitiveness	Second Hierarchy Objective	Relative Weight of Second Hierarchy to First Hierarchy	Priority Ranking of Second Hierarchy to First Hierarchy	Third Hierarchy Criteria	Relative Weight of Third Hierarchy to First Hierarchy	Priority Ranking of Third Hierarchy to First Hierarchy	Fourth Hierarchy Selected Alternatives	Relative Weight of Fourth Hierarchy to First Hierarchy	Priority Ranking of Fourth Hierarchy to First Hierarchy
A	1	B1 Economic Performance	<b>0.282143</b>	<b>2</b>	C1:Domestic Economy	<b>0.069786</b>	<b>2</b>	D1:Expansion of Domestic Demand	<b>0.355071</b>	<b>2</b>
					C2:International Trade	<b>0.055857</b>	<b>9</b>			
					C3:International Investment	<b>0.038643</b>	<b>16</b>			
					C4:Employment	<b>0.066000</b>	<b>3</b>			
					C5:Prices	<b>0.052071</b>	<b>10</b>			

B2 Government Efficiency	0.298357	1	C6:Public Finance	0.056786	6	D2:Open for Mainland Capital	0.269714	3			
			C7:Fiscal Policy	0.072429	1						
			C8:Institutional Framework	0.057643	5						
B3 Business Efficiency	0.208357	4	C9:Business Legislation	0.056357	7						
			C10:Social Framework	0.059286	4						
			C11:Productivity and Efficiency	0.051500	11						
			C12:Labor Market	0.026000	20				D3:Stabilization of Goods Prices	0.369214	1
			C13:Finance	0.032000	19						
			C14:Management Practices	0.049643	12						
			C15:Attitudes and Values	0.047286	13						
B4 Infrastructure	0.211143	3	C16:Basic Infrastructure	0.045714	14						
			C17:Tech. Infrastructure	0.032500	18						
			C18:Scientific Infrastructure	0.042286	15						
			C19:Health and Environment	0.034571	17						
			C20:Education	0.056214	8						
	CR= 0.0459						CR <sub>H</sub> = 0.048643				

Sources: Data collected from questionnaire survey in this research were compiled through AHP computer software quantitative analysis. Among them, the relative weights for each hierarchy are the relative weight ratios of each hierarchy goal compositively calculated from results obtained through evaluation and calculation for each factor and sub-factor, to provide for priority ranking of factors in each hierarchy accordingly.

### Comparative Analysis of AHP Priority Rankings and IMD Rankings

This research wishes to understand the goal of upgrading “Taiwan’s Competitiveness” for Taiwanese enterprises, and to explore the priority rankings of competitiveness index items to be emphasized under the IMD evaluation system for the purpose to explore the overall implementation strategy for Taiwan’s future competitiveness. It is found from Table 4-9 and Table 4-10 that: (1) In summary of the 20 items, the research results: “Fiscal Policy” is ranked as 1<sup>st</sup> priority, which was ranked at 3<sup>rd</sup> place among the 55 evaluated economic entities of IMD in 2008, indicating that although Taiwan performed better than other countries in this item, enterprises believed there is room for improvement or to maintain the existing competitiveness advantage and wishes to reach even better extent. (2) Searching of the items listed behind the IMD ranking of 27<sup>th</sup> place for Taiwan in 2008, i.e. items belonging to rankings in the middle-to-bottom section, revealed: “International Investment” (44<sup>th</sup> place), “Health and Environment” (32<sup>nd</sup> place), “Social Framework” (31<sup>st</sup> place), “International Trade” (28<sup>th</sup> place), “Business Legislation” (27<sup>th</sup> place). Among them, the Council for Economic Planning and Development, Executive Yuan (2008) proposed that: “The major reason for [International Trade] to fall on the IMD

ranking by a large scale of 12 rankings to the 28<sup>th</sup> place was because the [Service Trade] export growth rate was less than other countries; in 2008 Taiwan's [Service Trade] was ranked at the 53<sup>rd</sup> place among the 55 economic entities, indicating that Taiwan must enhance tourism, marine and aviation transportation, and cross-boarder financial services." (Council for Economic Planning and Development, 2008). While in this research, "Social Framework" (priority ranking listed at the 4<sup>th</sup> place), "International Trade" (priority ranking listed at the 9<sup>th</sup> place), and "Business Legislation" (priority ranking listed at the 7<sup>th</sup> place), the indexes of the above three items that relatively fell behind are exactly what this research believes are priority items that need to be emphasized and improved on. (3) "International Investment" and "Health and Environment" that are ranked behind on the IMD competitiveness list, however are listed low on priority ranking for emphasis and improvement from the survey in this research, indicating that foreign investment stock in Taiwan and total medical healthcare expenditure occupy a relatively lower ratio of GDP than other countries, however the room for improvement for these two items is rather not urgent for Taiwanese enterprises.

**Table 4-10. Rankings for Taiwan on the IMD World Competitiveness Yearbook in 2008**

ITEMS	2008
Overall Ranking	<b>13</b>
Economic Performance	<b>21</b>
1. Domestic Economy	<b>21</b>
2. International Trade	<b>28</b>
3. International Investment	<b>44</b>
4. Employment	<b>22</b>
5. Prices	<b>14</b>
Government Efficiency	<b>16</b>
1. Public Finance	<b>17</b>
2. Fiscal Policy	<b>3</b>
3. Institutional Framework	<b>23</b>
4. Business Legislation	<b>27</b>
5. Social Framework	<b>31</b>
Business Efficiency	<b>10</b>
1. Productivity and Efficiency	<b>7</b>
2. Labor Market	<b>8</b>
3. Finance	<b>18</b>
4. Management Practices	<b>16</b>
5. Attitudes and Values (called "Global Impact" before)	<b>7</b>
Infrastructure	<b>17</b>
1. Basic Infrastructure	<b>19</b>
2. Tech. Infrastructure	<b>5</b>
3. Scientific Infrastructure	<b>4</b>
4. Health and Environment	<b>32</b>
5. Education	<b>19</b>

Sources: Council for Economic Planning and Development, Executive Yuan, Taiwan (2008): Analysis of the 2008 Taiwan's Rankings by the International Institute for Management Development (IMD) World Competitiveness Ranking.

## CONCLUSION

In summary of the above analysis, the purpose of this article was to use the Analytic Hierarchy Process (AHP) for evaluation and selection of items to be emphasized in Taiwan's competitiveness indexes to increase Taiwan's competitiveness as the grand goal, with the expectation that the evidence produced in this research would contribute to actual practices.

The research found that: From the comparison of Taiwan's IMD rankings with the AHP priority rankings, (1) The item on higher ranking of the IMD list which is also prioritized by AHP as priority is: "Fiscal Strategy", indicating the item should be maintained for its relative superiority; (2) Items listed lower down on the IMD list and stated by AHP as priority are: "Social Framework", "International Trade", "Business Legislation", indicating that these items should be aggressively enhanced in the short term; and (3) Items listed lower down on the IMD list which are also prioritized as lower by the AHP are: "International Investment" and "Health and Environment", indicating that these items should be considered as room for improvement in the future.

In addition, the competitiveness index items that Taiwan should emphasize are: 1 In respect of "Objective Hierarchy": Under the grand goal of "Upgrading Taiwan's Competitiveness", among the competitiveness index items to be emphasized, "Government Efficiency" is first priority, the next priority is "Economic Performance", next again is "Business Efficiency" and the last is "Infrastructure"; 2 In respect of "Criteria Hierarchy": the priority of major policies should be ranked mainly in the order of "Fiscal Strategy" as first priority consideration, the next priority is "Domestic Economy", next again is "Employment", and with the support of "Social Framework", "Institutional Framework" consideration, and 3 In respect of the "Alternative Hierarchy" to be adopted, the selected alternatives take "Stabilization of Goods Prices" as first priority, the next is "Expansion of Domestic Demand", and the last is "Open for Mainland Capital".

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