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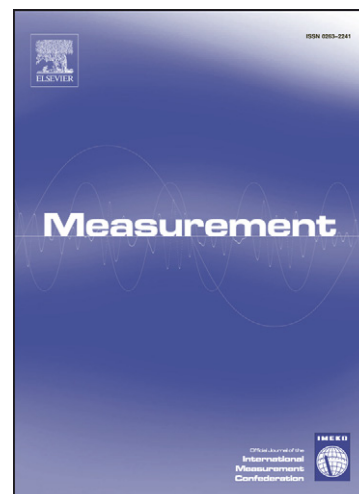
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Highlights

We weight the performance indices based on the official performance evaluation structure of TWAEA.> We apply a hybrid multiple-criteria decision-making (MCDM) model.> We also compare the official rankings of the 12 private universities with our results.> We endeavor to help universities optimize their performances with efficiency.>

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Abstract

The aims of this study are to weight the performance evaluation indices for higher education based on the official performance evaluation structure developed by the Taiwan Assessment and Evaluation Association (TWAEA) and to rank 12 private universities listed by the Ministry of Education as a case study. We apply a hybrid multiple-criteria decision-making (MCDM) model to accomplish these objectives. Specifically, we utilize the analytic hierarchy process (AHP) to accomplish the first aim, but we adopt the VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method for the second aim by utilizing the AHP outcome. We also compare the official rankings of the 12 private universities with our ranking of the same universities. Our study endeavors to help universities optimize their performances with efficiency. In addition, the results of this study could provide a reference point for other universities and related educational institutions in their efforts to conduct evaluations, improve their performances and form educational policies.

Keywords: University; Performance evaluation; Analytic Hierarchy Process (AHP);

VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR); Multiple-Criteria Decision Making (MCDM)

Ranking Universities Based on Performance Evaluation by a Hybrid MCDM Model

1. Introduction

Educational institutions play a critical role in national and global development. They support global development strategies by providing the highly qualified manpower and research necessary for further growth (AI-Turki & Duffuaa, 2003). Among the different levels of education, higher education is especially conducive to fostering high-tech talent, which is the key factor in increasing national quality and the main path to improving a nation's competitiveness (Fairweather, 2000; Meek, 2000). Thus, higher education has a great impact on the development of a nation's competitive advantage (Dill, 1997; Dill & Teixeira, 2000).

During the past ten years, private universities have played crucial roles in developing the education system and increasing opportunities for employment. Specifically, in 2006, approximately 66% of all college students were studying at private universities. Currently, the number of universities is increasing. Previous estimates have suggested that 162 universities existed in Taiwan in 2006 (Ministry of Education, 2006), and this number is still increasing today. Unfortunately, a certain imbalance exists between the quality of universities and the number of universities in general. In particular, the overall qualities of the teaching process, the faculty, and the universities' development have not improved significantly (Ministry of Education, 2006). Given the societal pressure for radical changes in Taiwanese higher education, the improvement of the educational system has become a critical issue for the government, the universities, and the researchers (Department of Higher Education, 2004).

Because the importance of performance evaluation and improvement has received increasing emphasis as of late, the official mechanism used to evaluate Taiwanese universities plays a key role in guiding the development of and the government's financial support for each university. After investigating the history of higher education around the

world, we found that most nations contain comprehensive mechanisms for evaluating universities, with the evaluation results serving as a reference point for decisions to choose a university, hire employees, and provide financial support for students, entrepreneurs, and citizens (Department of Higher Education, 2004). These mechanisms can also help universities develop better research and teaching processes (Barnabè & Riccaboni, 2007). However, there is neither a convincing evaluation mechanism nor ranking standard for Taiwanese higher education, as all of the evaluation indices appear to be equal. As a result, no university can provide the highest quality of faculty, curriculum, and teaching because of limited resources.

Because Taiwan has joined the WTO and experienced recent drops in the birth rate, Taiwanese universities are losing their competitive advantages relative to universities in the Occident and Asia (Chen, 2005). Therefore, it is necessary to construct a useful performance evaluation mechanism that can provide precise information for both universities and related educational institutions. Doing so can effectively improve the performance, decision making, and adaptability of Taiwanese universities. Thus, creating a performance evaluation mechanism can fulfill the aim of this study. In addition, private universities are encountering their largest revenue challenges because of reduced student enrollment and retention as well as the aforementioned domestic and international sources of pressure. With the increasing competition, students are looking for a quality and economic educational environment; therefore, private universities must improve their performances (Liu & Liu, 2010). In this regard, we compare our private university rankings, which were based on the proposed performance evaluation mechanism, with the official rankings of the Taiwanese Ministry of Education. Such a comparison may provide private universities with necessary and effective references because these universities can consider not only the differences in the two rankings but also the importance of the evaluation indices when searching for ways to improve their performances.

To accomplish our goals, we utilized a hybrid multiple-criteria decision-making (MCDM) model comprising the analytic hierarchy process (AHP) and the

VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method. We adopted this model because it considers numerous evaluation indices and alternatives. Specifically, the AHP is used to explore the relative weights of the evaluation indices, and the VIKOR method is utilized to rank the performance of each private university with respect to the relative weight of each evaluation index. Both the AHP (Barbarosoglu & Yazgac, 1997; Goh, 1997; Dong et al., 2010) and the VIKOR method (Chang & Hsu, 2009; Kuo & Liang, 2011; San Cristóbal, 2011) have been utilized in prior research concerned with weighting and selecting issues, and the reliabilities of both methods have also been verified.

The rest of this paper is organized as follows. In Section 2, we discuss the performance evaluation mechanisms in higher education. In Section 3, we propose a hybrid MCDM model. In Section 4, we conduct an empirical study. Finally, we provide our concluding remarks in the final section.

2. Performance Evaluation in Higher Education

Because the world's universities are ushering in a new age of anxiety and higher education in not of its last stability (Clark, 1998), continiously improving university's performance in accordance with precise conceptual frameworks is thus critical (Amiz, 2010). Specifically, performance evaluations must be based on a set of objectives that are linked to the mission and the vision of the future. In addition, these evaluations must define the customers, the unique requirements, and the level of satisfaction that the organization needs to achieve. This mechanism should not only equally evaluate both internal quality improvement and external benchmarks but should also evaluate factors that can be improved (AI-Turki & Duffuaa, 2003). Furthermore, prior studies have confirmed that key performance indices constitute the most comprehensive objectives in all organizations and that these indices can assist a manager with attain his or her goals. Given their importance, key performance indices are significant factors in promoting quality improvement and goal fulfillment (Amiz, 2010).

With regard to higher education, a stream of studies has indicated that if no

evaluation mechanism in accordance with key performance indices exists, then any improvement in the quality and performance of a university will be short-lived and limited in scope (Amiz, 2010). Thus, the key performance indices are one of the principal steps in evaluating the performances of universities. Numerous studies have also suggested that key performance indices are critical to performance improvement (Birch, 1977; Shavelson et al., 1987; Windham, 1988; Johnes & Taylor, 1990; Cave et al., 1991; Borden, 1994; Dolence & Norris, 1994; Boatright, 1995; Avkiran, 2001; Hsieh, 2004; Strand, 2004; Sydman, 2003) and improved decision making in universities (Amiz, 2010).

Recently, a number of university categories have been developed to help define the characteristics and to aid the future development of universities. Unfortunately, categorization without clear and convincing standards results in numerous arguments and conflicts, especially with respect to financial support, in the educational field. Without a set of solid and comprehensive performance evaluation metrics, the governments and education-related institutes that provide financial support to universities will find it difficult to make fair decisions. As a result, universities will have less opportunity to comprehensively improve their performances and thereby gain financial support from external sources. Thus, a useful performance evaluation mechanism that can adequately provide precise information to universities and education-related institutes is needed.

Hence, to accomplish our aim, we must first explore a set of key performance indices. Currently, two major professional institutes evaluate the performances of universities in Taiwan. One institute is the Taiwan Assessment and Evaluation Association (TWAEA) and the other is the Higher Education Evaluation & Accreditation Council of Taiwan (HEEACT). Because the TWAEA is a service unit that has been officially authorized by the Ministry of Education to evaluate the performances of Taiwanese universities, the performance evaluation indices proposed by the TWAEA are used as the basis of our research structure.

3. A Hybrid MCDM Model

3.1. Analytic Hierarchy Process (AHP)

Proposed by Thomas L. Saaty in 1971, the analytic hierarchy process (AHP) is a multiple-criteria decision-making method that is normally applied to overcome problems in uncertain conditions or to consider several evaluation criteria during the decision-making process. The MCDM model aims to provide a decision maker with a precise reference for decision making and to reduce the risk of making the wrong decision. By decomposing the decision problem into a hierarchy of more comprehensible sub-problems, each problem can be evaluated independently, which reduces the potential for error. The elements of the hierarchy can relate to any aspect of the decision problem, such as tangible or intangible, carefully measured or roughly estimated, well understood or poorly understood; that is, the elements can relate to anything that applies to the decision at hand. This hierarchy has been utilized in several fields (Saaty, 1980) that require one to choose among multiple alternatives and explore the weights of several evaluation indices, such as business (Angelou & Economides, 2009), industry (Chen & Wang, 2010), and healthcare (Liberatore & Nydick, 2008).

In the past, scholars have found that the AHP is effectively utilized in 13 major conditions: setting priorities, generating a set of alternatives, choosing a best policy among multiple alternatives, determining requirements, allocating resources, predicting outcomes, measuring performances, designing systems, ensuring system stability, optimizing processes, planning, resolving conflict, and assessing risk (Saaty, 1980). In addition, the AHP has been found to be useful in more recent conditions, including reducing the influence of global climate change (Berrittella et al., 2007), quantifying the quality of software systems (McCaffrey, 2005), choosing university faculty (Grandzol, 2005), deciding the location of offshore manufacturing plants (Walailak & McCarthy, 2002), evaluating the risk in conducting cross-country petroleum pipelines (Dey, 2003), and managing U.S. watersheds (de Steiguer et al., 2003).

The calculations of the AHP adopt a ratio scale to develop a pair-wise comparison

matrix. The ratio scale can typically be categorized into 5 subscales based on different levels of importance: Equal importance, Somewhat more important, More important, Much more important, and Absolutely more important. Furthermore, 4 subscales exist within each level of importance between and above the 5 major subscales. Therefore, a total of nine subscales exist. The ratio values from 1 to 9 are given to each subscale, as Table 1 shows.

Insert Table 1 about here

The calculation steps of the AHP are presented as follows (Saaty, 1990; Wu et al., 2009):

Step 1. Establish the pair-wise comparison matrix A by using the ratio scale in Table 1.

Step 2. Let C_1, C_2, $\cdots$, and C_n denote the set of elements, although a_{ij} represents a quantified judgment on a pair of elements C_i, C_j. It yields an n-by-n matrix A as follows:

$$
A = [a_{ij}] = \begin{array}{c} \\ C_1 \\ C_2 \\ \vdots \\ C_n \end{array} \overset{\begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array}}{\begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ \dfrac{1}{a_{12}} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ \dfrac{1}{a_{1n}} & \dfrac{1}{a_{2n}} & \cdots & 1 \end{bmatrix}} \tag{1}
$$

where $a_{ij} = 1$ and $a_{ij} = \dfrac{1}{a_{ij}}$, $i, j = 1, 2 \ldots, n$.

In matrix A, the problem lies in assigning to the n elements C_1, $C_2 \ldots C_n$ a set of numerical weights W_1, W_2, $\cdots$, W_n that reflect the recorded judgments. If A is a consistency matrix, then the relations between weights W_i and judgments a_{ij} are given by

$\dfrac{W_j}{W_i} = a_{ij}$ (for $i, j = 1, 2, 3 \ldots n$). Saaty (Saaty, 1990) suggested that the largest eigenvalue λmax would be

$$\lambda_{m\,a} = \sum_{j=1}^{n} a \frac{W_j}{W_i}$$

(2)

If *A* is a consistency matrix, then eigenvector *X* can be calculated by

$$(A - \lambda_{m\,a} I)\,X = 0$$

(3)

Saaty proposed utilizing the consistency index (*C.I.*) and random index (*R.I.*) verify the consistency of the comparison matrix (consistency ratio, *C.R.*). *C.I.* and *C.R.* are defined as follows (Saaty, 1990):

$$C.I. = \frac{\lambda_{max} - n}{n-1}$$

(4)

$$C.R. = \frac{C.I.}{R.I.}$$

(5)

where the *R.I.* represents the average consistency index (i.e., the random index). Saaty (1977) computed the *R.I.* as the average consistency of square matrices coming from various orders *n*, which he filled with random entries. The average consistency values of these matrices are given by Saaty and Vargas (1991), as shown in Table 2. If the *C.R*<0.1, then the estimate is accepted; otherwise, a new comparison matrix is solicited until *C.R* <0.1.

Insert Table 2 about here

3.2 VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR)

The VIKOR method was developed by Opricovic and Tzeng (2004). This method is based on the compromise programming utilized in multi-criteria decision making (MCDM). We assume that each alternative is evaluated according to a separate criterion function, and we could utilize the compromise ranking method by comparing the measure of closeness to the ideal alternative (Tzeng et al., 2005). The multicriteria measure for the compromise ranking method is developed from the $L_p\text{-}metric$, which is used as an aggregating function

in a compromise programming method (Zeleny, 1982). The numerous J alternatives are represented as $a_1, a_2, \cdots, a_J$. For each alternative a_j, the rating of the ith aspect is denoted as f_{ij} (i.e., f_{ij} is the value of ith criterion function for the alternative a_j), and n is the number of criteria (Tzeng et al., 2005). The development of the VIKOR method started with the form of $L_p\text{-}metric$, which is shown as follows (Opricovic & Tzeng, 2004):

$$L_{P,j} = \left\{ \sum_{i=1}^{n} \left(w_i \frac{|f_i^* - f_{ij}|}{|f_i^* - f_i^-|} \right)^p \right\}^{1/p} , \quad j = 1, 2, \ldots, m \quad 1 \le p \le \infty \tag{6}$$

In the VIKOR method, $L_{1,j}$ (represent S_j as followed) and $L_{\infty,j}$ (represent R_j as followed) are used to formulate the ranking measure. $\min_j S_j$ gains a solution with a maximum group utility, and $\min_j R_j$ gains a solution with a mix individual regret of the "opponent". The compromise solution F^c is a solution that most closely resembles the ideal F^*, and the compromise denotes an agreement established by mutual concessions; the compromise solution is shown in Figure 1 by $\Delta f_1 = f_1^* - f_1^c$ and $\Delta f_2 = f_2^* - f_2^c$ (Opricovic & Tzeng, 2004).

Insert Figure 1 about here

The VIKOR calculation steps are five-fold and are shown as follows (Opricovic & Tzeng, 2004; Tzeng et al., 2005; Opricovic & Tzeng, 2007):

Step 1. Decide the best f_i^* and the worst f_i^- values of all of the criterion functions $i = 1, 2, \ldots, n$. If the ith function represents a benefit, then the following equations result: $f_i^* = \max_j f_{ij}$, $f_i^- = \min_j f_{ij}$.

Step 2. Calculate the values S_j and R_j where $j = 1, 2, \ldots, J$ by utilizing the equations

$$S_j = \sum_{i=1}^{n} w_i (f_i^* - f_{ij})/(f_i^* - f_i^-) \tag{7}$$

and $R_j = \max_i [w_i (f_i^* - f_{ij})/(f_i^* - f_i^-)]$ (8)

In equations 7 and 8, w_i are the weights of the criteria and express the relative

importance of each criterion.

Step 3. Calculate the values $Q_j, j = 1, 2, \ldots, J$ by the equations

$$Q_j = v(S_j - S^*)/(S^- - S^*)$$
$$+ (1-v)(R_j - R^*)/(R^- - R^*),$$ (9)
$$S^* = \min_j S_j, \quad S^- = \max_j S_j$$
$$R^* = \min_j R_j, \quad R^- = \max_j R_j$$

In equation 9, v is introduced as the weight of the strategy with the maximum group utility. Here, $v = 0.5$.

Step 4. Calculate the alternatives ranking, which are sorted by the values S, R and Q in decreasing order. The results are the three ranking lists.

Step 5. Calculate a compromise solution in which the alternative (d) is ranked the best by the measure Q (min) if it satisfies the following two conditions:

1. $Q(a'') - Q(a') \geq DQ$, which is called an acceptable advantage.

In this equation, a'' is the alternative with the second position in the ranking list according to $DQ = 1/(J-1)$. J is the number of alternatives.

2. The decision-making process demonstrates acceptable stability. Alternative d must also be ranked the best by S and/or R. This solution is stable in a decision-making process, which could consist of "voting by majority rule" (when $v > 0.5$ is needed), "by consensus" $v \approx 0.5$, or "with veto" ($v < 0.5$). Here, v is the weight of the decision-making strategy with the max group utility.

If conditions are not fully satisfied, then a set of compromise solutions is proposed, as shown by the following two alternatives:

1. Alternatives a' and a'' are used only if condition 2 is not satisfied.

2. Alternatives a'; $a'', \ldots, a^{(M)}$ are used if condition 1 is not satisfied. $a^{(M)}$ is determined by the equation $Q(a^{(M)}) - Q(a') < DQ$ for Max$M$.

The best alternative, ranked by Q, is the one with the minimum value of Q; the main ranking result is the compromise ranking list of alternatives and the compromise solution with the advantage rate (Tzeng et al., 2002).

11

Ranking obtained by the VIKOR method needs to utilize different values of the criteria weights and analyze the impact of the criteria weights on the proposed compromise solution. We determine the weight stability intervals by using the methodology cited in Opricovic (1998). The compromise solution gained with the initial weights (w_i, $i = 1, \ldots, n$) will be replaced if the value of a weight is missing from the stability interval. The analysis of the weight stability intervals for a single criterion is utilized for all criterion functions with the initial values of the weights. By doing so, the stability of the preferences in a gained compromise solution may be analyzed using the VIKOR program (Opricovic & Tzeng, 2004).

VIKOR is a tool that benefits MCDM in situations where the decision maker is unstable at the beginning of the system's design. In addition, decision makers accept the compromise solution because it provides a maximum group utility, which is represented by Min Q, and a minimum individual regret, which is represented by Min R (Tzeng et al., 2002).

4. An Empirical Study

4.1 Research structure and sampling

The goals of this study are to evaluate the initial weights of a university's official evaluation indices, to rank 12 private universities based on their weighted performance evaluation, and to compare the result with the formal ranking established by the Ministry of Education. Before exploring the goals, we first construct the research structure. The Taiwan Assessment and Evaluation Association (TWAEA) that produces the evaluation indices for each university originally had a quantitative and a qualitative part. For the sake of consistency, we focus only on the quantitative part. Based on the quantitative part (TWAEA, 2004), the research structure of this study is further developed (see Figure 2). The official definitions for the evaluation indices are provided in Table 3 for the Administration category (A) and Table 4 for the Professional category (P) (TWAEA, 2004).

Insert Figure 2 about here

Insert Table 3 about here

Insert Table 4 about here

We sent a questionnaire to a group comprising 54 senior experts on October, 2006 and received the feedback by December, 2006. All of the senior experts served on an evaluation committee of higher education that had been officially listed by TWAEA. Of the 54 questionnaires, 9 were used in this study for a total response rate of 16.67%. The demographic information is summarized in Table 5. All of the respondents were male. Half (77.78%) of the respondents were over 51 years old, with the second most between 41-50 years old (22.22%). Approximately 88.89% of the respondents worked over 21 years and approximately 11.11% served between 11-20 years. All (100%) of the respondents had reached the doctorate level. All (100%) of the respondents worked as academics. Their weightings utilized the ratio scale given in Table 1 with respect to the importance of the evaluation categories, dimensions, criteria, and indices.

Insert Table 5 about here

4.2 Weighting performance evaluation indices by using the AHP

Based on the questionnaires, in this section, we apply the AHP to compute the weight of each performance evaluation category, dimension, criterion, and index. The overall results and the ranking of the evaluation indices are summarized in Table 6. The resulting consistency of the comparison matrix (consistency ratio, $C.R.$) reveals the reliability of this study.

A total of nine evaluation dimensions exist at the third level of this study. These

13

dimensions include 6 in Administration (A): Teaching Resources (AT), Internationalization (AI), Extension Education Service (AE), Discipline and Guidance (AD), General Education (AG), and Administrative Support (AA). Three dimensions belong to Professional (P): Faculty (PF), Teaching (PT), and Research (PR). The top three relative weights of the dimensions are Faculty (PF) (0.2317), Teaching (PT) (0.1949), and Research (PR) (0.1548). Because the local weight of Professional (P) is 0.5815 and the local weight of Administration (A) is 0.4185, the weight of Professional (P) is higher, and the relative weights of the top three evaluation dimensions among the nine evaluation dimensions all included Professional (P).

The pros and cons of the universities' operational performances are highly related to their Faculty (PF). Relevant factors include the teacher's qualification structure, teacher-student ratio, the instructor's expertise and adaptability at teaching subjects, the full-time teacher's academic experiences, and the instructor's ability to multitask between teaching and researching. Teaching (PT) is also likely to affect operational performances through the following factors: the classification and development conditions in each department, the teaching evaluation results and specific application conditions, and the results and performances generated by upgrading the teaching quality. With respect to Research (PR), the results applied to the social and industrial sectors. Research resulted in a degree of innovation and contributions toward academic research and the examination mechanism used in various exhibitions, creations, competitions and other organizing conditions. These three dimensions played an important role in the operational performances of the universities. Therefore, our senior experts emphasized these dimensions.

In addition, a total of 27 evaluation criteria on the fourth level are related to the university evaluation indices in this study. Among them, the top five evaluation criteria are as follows: Teacher-student ratio (PF2) (0.0988), Ratio of foreign faculty classes (PF3) (0.0710), Credits of general education course (AG1) (0.0680), Full-time faculty (PF1) (0.0619), and Status of students (PT2) (0.0614).

Among these five evaluation criteria, Ratio of foreign faculty classes (PF3), Teacher-student ratio (PF2), and Full-time faculty (PF1) are all included in Faculty (PF). The Ratio of foreign faculty classes (PF3) focuses on the Ratio of full-time foreign faculty classes. The Teacher-student ratio (PF2) includes the Weighted ratio of the faculty to students (PF2.1) and the Ratio of faculty to students (PF2.2). The Full-time and part-time faculty (PF1) include the Ratio of full-time assistant professors to all full-time faculty (PF1.1), the Ratio of full-time professors to all full-time faculty (PF1.2), the Ratio of full-time faculty with doctoral degrees to all full-time faculty (PF1.3), and the Ratio of full-time to part-time faculty (PF1.4). The fourth evaluation criteria include the following factors: the teacher's qualification structure, the teacher-student ratio, the implementation status of the teacher's qualification improvement plans and the future growth plan. In addition, the fourth evaluation criteria encompass the number of teachers and students, the academic background of the teachers, age, the distribution of the years spent on teaching, and the ratio of foreign teachers in the school. Thus, the senior experts propose that Faculty (PF) plays an extremely important role in the operational performances of the universities. Because only the Credits of general education course (AG1) of General Education (AG) are found in the third level of the evaluation dimension, its local weight is 1. The relative weight of AG1 tends to be high, but it ranks third among the evaluation criteria. This ranking indicates that the credit proportion of the courses in the schools will affect the learning quality and the overall operational performances of the universities. With a fifth-place ranking, the Status of the students (PT2) includes the Registration rate of the new students (PT2.1), the Graduation rate of the students (PT2.2), and the Dropout rate of the students (PT2.3). The senior experts consider these factors important to the operational performances of the universities.

In addition, a total of 64 evaluation indices exist at the fifth level of this study. The top ten relative weights in order are as follows: Ratio of full-time foreign faculty to all faculty (PF3.1) (0.0710), Ratio of faculty to students (PF2.2) (0.0499), Weighted ratio of faculty to students (PF2.1) (0.0489), Ratio of weekly hours of regular teaching of both

full-time and part-time faculty to total students (PT4.1) (0.0317), Size of school area (AT3.1) (0.0288), Percentage of general education credits (broad definition) (AG1.1) (0.0273), Ratio of students to administrative manpower (AA1.2) (0.0271), Average number of research rooms for full-time assistant professors (AA2.1) (0.0258), Registration rate of new students (PT2.1) (0.0257), and Number of activities in employment consulting (AD3.1) (0.0242). The C.I. value of the evaluation indices is 0.03. As the C.R. value is smaller than 0.1, these weight indices are consistent.

Upon joining the World Trade Organization (WTO), Taiwan had to upgrade the quality of its university education system because of the intense competition from various countries. Because the Ratio of full-time foreign faculty and all faculty (PF3.1) is the most important evaluation index among the indices assessed by the senior experts, all universities should actively increase the number of foreign teachers in their faculties to promote domestic and overseas knowledge exchange among students and to enhance the university's international education standards. As the Ratio of faculty to students (PF2.2) and the Weighted ratio of faculty to students (PF2.1) both have a strong relationship with the quality of education, the senior experts listed these two ratios as important evaluation indices. In addition, the Size of the school area (AT3.1) is also regarded as an important evaluation index because the application space (e.g., the total space of classrooms, research rooms, and laboratories) and the distribution conditions will indirectly affect the quality of education and the quality of instruction.

The Ratio of students to administrative manpower (AA1.2) exerts a significant impact on the updating speed of the department's website information, the ability to handle inquiries of department-related information, the attitudes and quality of the administrative staff, and the communication among the teachers, students, and the university's operations. The Number of activities in employment consulting (AD3.1) is particularly important for the students and the university. These activities include employment consulting lectures, campus job fairs and tools to process the conditions of the market. Employment counseling activities help students acquire a better

understanding of the job market and help them find jobs more smoothly.

Among all of the evaluation indices, the first-ranked Ratio of full-time foreign faculty and all faculty (PF3.1), the third-ranked Size of school area (AT3.1), and the tenth-ranked Number of activities in employment consulting (AD3.1) have a local weight of 1. As a result, these indices tend to have high overall weights. The Ratio of foreign faculty classes (PF3) in the fourth level ranked second among the relative weights, and the Ratio of full-time foreign faculty and all faculties (PF3.1) is included in the foreign class proportion. Therefore, we argue that an increase in the Ratio of foreign faculty classes can improve the exchange of domestic and overseas knowledge among the students and upgrade the education quality of the universities. Thus, the senior experts consider these evaluation indices to be important. However, the Employment Consulting (AD3) ranks first among the local weights at the fourth level, and the Number of activities in employment consulting (AD3.1) ranks tenth among the evaluation indices. These ratios pertain to the university's ability to organize employment consulting lectures and campus job fairs. The higher the frequency of these activities, the greater is the impact on the students. Hence, the senior experts consider these ratios to be important evaluation indices.

Insert Table 6 about here

4.3 Ranking the private universities by utilizing the VIKOR method

After identifying the relative weights of the performance evaluation indices, we rank the private universities that are officially listed by the Ministry of Education in this section. To maintain consistency with the official data, we only focus on the private universities that are oriented towards literature, law, and business. We initially selected 13 private universities (i.e., THU, FJU, SCU, TKU, PCCU, PU, HFU, SHU, MCU, USC, NHU, AU, and CJCU). Because our research focuses on the scope of social science, which includes education in the Professional category (P), we discard one of the 13

17

private universities (e.g., HFU), as it existed outside of our scope. Therefore, we use a total of 12 private universities in this study.

The original performance values of these 12 private universities were based on the Ministry of Education's evaluations of Taiwan's public and private universities in the year 2005 (as provided in Tables 1A-9A in Appendix A). We first summarize all of the data and then standardized the different units of each evaluation index. In particular, among the 64 evaluation indices, 8 indices (i.e., Percentage of student loan applications (AD2.1), Ratio of full-time faculty and administrative manpower (AA1.1), Ratio of student and administrative manpower (AA1.2), Ratio of full-time and part-time faculty (PF1.4), Weighted ratio of faculty and students (PF2.1), Ratio of faculty and students (PF2.2), Ratio of weekly hours of regular teaching of both full-time and part-time faculty and total students (PT4.1), and Average number of weekly teaching hours for each full-time faculty member (PT4.2)) show that smaller is better, whereas the rest of the indices indicate that larger is better.

Next, we performed the VIKOR method by using the relative weights acquired from the AHP in the previous section to calculate the weighted performance values of each university. Afterwards, we executed the ranking process. In our study, v is set as 0.5 for VIKOR; that is, the findings of the VIKOR method are in accordance with the voting results by consensus. The rankings of the private universities based on the evaluation dimensions in the Administration category (A) are integrated in Table 7. Table 8 shows both the rankings based on the scope of social science and the overall rankings based on both evaluation categories.

Insert Table 7 about here

Insert Table 8 about here

With respect to the ranking results of the Administration category, because the

18

Teaching Resources (AT) dimension satisfies both rules, we found that PU is better than the other private universities at providing their students with superior Teaching Resources (AT) (e.g., the total space and distribution conditions of classrooms, laboratories, books, journals and other resources that would satisfy the students' and teachers' needs). In addition, because the Internationalization (AI) dimension only satisfies the second rule, we found that THU and SCU are superior to the other universities in terms of their Internationalization (AI) (e.g., the conditions in which foreign scholars come visit, the participation rates of teachers in important international academic activities, and the requirements for students to pass English tests). Because both rules are satisfied by the Extension Education Service (AE), we found that PCCU is better than other private universities at providing Extension Education Service (AE) (e.g., more community-based promotion measures, different educational cooperation measures, and specific results).

Because Discipline and Guidance (AD) satisfy both rules, we found that MCU is superior to other private universities at providing Discipline and Guidance (AD) (e.g., investment in manpower and funds to involve more students in work-study related measures as well as close monitoring of graduate employment consultations, the processing conditions, and the results of the graduate employment consultations). Moreover, as General Education (AG) only satisfies the second rule, we found that MCU and NHU are better than the other private universities at providing General Education (AG) activities (e.g., General education planning, more keynote speeches, and training camps). Lastly, because Administrative Support (AA) satisfies both rules, we found that SHU is better than the other private universities in terms of its ability to provide Administrative Support (AA) (e.g., the service attitudes and quality of the administrative staff, the communications among teachers and students, and the higher degree of information publicity).

In accordance with the ranking results of the Professional category (e.g., Faculty (PF), Teaching (PT), and Research (PR)), because the Professional category only satisfies the second rule, we found that TKU and FJU are more competent at the social sciences

(including education) than the other private universities. Then, based on the ranking result of taken two categories altogether into consideration, since both rules are satisfied, we found that TKU has the best overall operational performance among all of the private universities studied in this paper.

Table 9 summarizes the rankings for each performance evaluation among the 12 private universities. Table 9 shows that, in terms of the Professional category (P) (e.g., faculty, teaching, and research) and the overall operational performance, the rankings of THU, FJU, SCU, TKU, NHU, and PCCU remain the same. Two reasons may explain this result. First, this ranking is due to the impact of the weighted evaluation produced by the AHP. Specifically, the weight of the Professional category (P) (w=0.5815) is higher than that of the Administration category (A) (w=0.4185). Second, the aforementioned 6 private universities primarily channeled their efforts into their profession (e.g., faculty, teaching, and research) in the past. Thus, each private university could optimize its use of school resources and, therefore, attain a better overall operational performance.

Insert Table 9 about here

4.4 Ranking comparison between research result and official report

The Ministry of Education's evaluations of the officially listed private universities were determined by an evaluation committee. This committee conducted a comprehensive analysis of the schools' quantitative indexes, qualitative indexes, statistical tables utilized in the questionnaire, field study results, and so on. This study adopted an AHP expert questionnaire approach to calculate the weight of each index, used the VIKOR method to calculate the weight performances of each school, and ranked the schools by grouping the 12 universities through a quartile deviation approach. A top 25% ranking (i.e., top-three ranking subjects) was considered a Good (G) performance. A ranking between 15%~75% (i.e., 4~9 ranking subjects) was considered a Medium (M) performance, and the lowest 25% ranking (i.e., 3 lowest ranking subjects) was considered

a Weak (W) performance. Table 10 compiles the evaluation performances of these 12 private schools and the results published by the Ministry of Education.

Insert Table 10 about here

From the results indicated in Table 10, we discovered that all six subjects of THU and TKU in the Administrative (A) published by the Ministry of Education showed Good (G) performances. The Professional (P) in the social science field, which included education, also showed a Good (G) performance grade, which indicates that, regardless of Administration (A) or Professional (P), TKU and THU provided the best instructional resources and faculty members as well as better quality of instruction and environments for students who wish to learn. Thus, based on the results of the evaluations conducted by the Ministry of Education, these seven subjects were rated with a Good (G) performance grade. Among these seven subjects, five subjects in SCU and FJU had also shown Good (G) performances, but SCU should strengthen the school's Internationalization (AI) and General Education (AG), whereas FJU should strengthen the school's Extension Education Service (AE) and Administrative Support (AA) to achieve better ratings. Based on the results of the evaluations conducted by the Ministry of Education, CJCU, AU, NHU and USC did not show Good (G) ratings in Administration (A) and Professional (P), which indicates that these schools had shown Weak (W) performances and should therefore be watchful.

From the research findings, only Teaching Resources (AT) of TKU showed a Weak (W) performance (i.e., lowest 25% ranking) in the performance evaluation of Administrative (A). Its performances in the other subjects were rated Medium (M). In Professional (P), the subjects that showed Good (G) performances (top 25% ranking) were Faculty (PF), Teaching (PT) and Research (PR). In Professional (P), FJU showed Good (G) performances in Faculty (PF), Teaching (PT) and Research (PR), but Weak (W) performances in Discipline and Guidance (AD). It showed Medium (M) performances in

the remaining subjects. Thus, FJU needs to strengthen its Discipline and Guidance. With respect to Administrative (A), SCU showed Good (G) performances in three subjects: Internationalization (AI), Extension Education Service (AE) and Administrative Support (AA). In the other subjects, SCU showed Medium (M) performances.

In Table 10, the evaluation results in Administrative (A) from two schools were found to have a great impact on Teaching Resources (AT), Discipline and Guidance (AD), and General Education (AG). The gray-colored section showed a great difference in the evaluation results in Administrative (A) between this study and the Ministry of Education. The Ministry of Education rated the Discipline and Guidance (AD) of THU and FJU as Good (G) performances, but this study rated the same areas as having shown Weak (W) performances. The Ministry of Education rated the Teaching Resources (AT) of TKU as a Good (G) performance, but this study rated these performances as Weak (W). The Ministry of Education rated the Teaching Resources (AT) of AU as Weak (W), but we found a Good (G) performance in this study. In Professional (P), seven schools (FJU, TKU, PU, MCU, USC, AU and CJCU) assessed by this study and the Ministry of Education were consistent (indicated in "italics") and showed no significant differences.

A comparison of the evaluations performed by this study and those of the Ministry of Education revealed several explanations for the different results. First, this study analyzed the evaluation indices by calculating the AHP weight values with the aid of the senior experts' opinions. Doing so led to a discrepancy in the results between our study and that of the Ministry of Education. Second, this study only evaluated the quantitative evaluation indices, but the Ministry of Education evaluated both qualitative and quantitative evaluation indices. Lastly, this study conducted VIKOR ranking results and then compared them with the Ministry of Education's results through a grade differential method. However, the Ministry of Education only published its results without providing detailed explanation on how to evaluate the results. Thus, we witnessed different interpretations of the results.

5. Conclusion and Remarks

This study adopted the quantitative evaluation indices developed by the Taiwan Assessment and Evaluation Association (TWAEA) to establish a hierarchical structure. The opinions from the various experts were compiled using the AHP to perform weight analysis on the various evaluation indices. The relevant performance data from the 12 literature-, law- and business-oriented private universities were then added to the index weights to discover the values of the comprehensive weight performances at each school. In the end, we conducted an empirical analysis by using the VIKOR method. The important research conclusions, practical management implications, and suggestions for future research are summarized in the following sections.

5.1 Research conclusions

Because of the complexity and diversified viewpoints of higher education functions, performance evaluations of higher education have always been a hot debate topic among educators, managers, and policymakers. Thus, previous investigations of this subject mostly stressed the significance of performance evaluations, methods, indices and modes. Unlike previous scholars, this study utilized the overall content of the university evaluation indices published by the Ministry of Education as basis of exploration. We used MCDM to verify the mutual competition problems through a compromise deal of the evaluation criteria and the program ranking method. After compilation, we listed the empirical results of the study as follows.

First, from the weight results of the AHP analysis, Professional (P) was found to be most important among the second-level dimensions (including two evaluation categories). Faculty (PF) in the third level was an important evaluation dimension that affected the evaluation results. Teacher-student ratio (PF2) in the fourth level (including 27 evaluation criteria) was the most important criterion, and at the fifth level (including 64 evaluation indices), Fantasy (PF) contained the three most important indices: Ratio of full-time foreign faculty and all faculty (PF3.1) (0.0710), Ratio of faculty and students (PF2.2)

(0.0499), and Weighted ratio of faculty and students (PF2.1) (0.0489). Hence, poor overall teacher qualifications have a high impact on the students, as higher education institutions are important premises for nurturing knowledge innovation and management. Universities need to recruit teachers who can cultivate the research abilities of new generations. Therefore, the higher education experts considered teacher qualifications to have a crucial impact on a school's performance.

Second, this study conducted a comprehensive performance evaluation through the university's Administration (A) (e.g., Teaching Resources (AT), Internationalization (AI), Extension Education Service (AE), Discipline and Guidance (AD), General Education (AG), and Administrative Support (AA)), and Professional (P) (e.g., scope of social science including the education). Among the 12 literature-, law-, and business-oriented private universities, TKU ranked first. The seven evaluation dimensions from TKU showed better performances on the evaluation results published by the Ministry of Education, which indicated that the performances from TKU were excellent.

Third, universities that showed poor performances (NHU, AU and CJCU) should strengthen Administration (A) (e.g., Teaching Resources (AT), Internationalization (AI), Extension Education Service (AE), Discipline and Guidance (AD), General Education (AG), and Administrative Support (AA)) and Professional (P) (e.g., Faculty (PF), Teaching (PT) and Research (PR)). Schools that showed Weak (W) evaluations must do their best to upgrade their performances despite their limited resources.

Fourth, the establishment of evaluation indices is core to evaluating a university. Although there are different levels of index weights, they must be corrected sequentially and continuously to continue the trend worldwide. This study used the AHP to calculate the weights of various evaluation indices. In doing so, we provided students, industries, and the public with a reference point for selecting universities, talents, or contributions to educational industries. In addition, based on the index weight analysis, each university should self-evaluate to identify its key evaluation indices and commit to full-scale improvements in the quality of its education to upgrade its operational performances.

Furthermore, the empirical results of the weighted performance ranking in conjunction with secondary information (including Administration (A) and Overall operation performance) showed that the universities' performances in some key evaluation indices affect the ranking results. However, these evaluation results reflected the management flaws of each university such that the evaluations helped each university to weight its evaluation indices for reviewing and improving purposes. Thus, these universities optimized their performances under limited resources.

Finally, this study discovered that, in the previous research on the impact of evaluation indices on universities' performance evaluations, some evaluation indices lacked weighted distributions, which caused difficulties in their overall evaluations. However, many indices existed for evaluating the universities' performances, and it was necessary to list the relative weights of each index to allow the universities to understand the key evaluation indices that affected their performances. These universities would then provide the best teachers, courses and educational quality that they could muster given their limited resources for the students. In doing so, they created a good learning environment, helped maintain the universities' educational standards, improved the operational performances and finally, helped upgrade the quality of higher education. As many past studies did not take the weights of the evaluation indices into consideration, this study has established the comprehensive, quantitative, weighted evaluation indices for all university affairs and established a perfect university evaluation model with the objective of evaluating the competitive niches that are dominated by domestic universities and colleges.

5.2 Practical management implications

Based on the process and results of this study, we offer the following management implications for the government agencies and university administrators who wish to take countermeasures.

First, according to the past implementation of the evaluation system, the government

started to deal with university evaluation work in 1975. The implementation generated different opinions on the evaluation mechanism. Generally, most people supported the functions of university evaluation, but many of those who held opposite views had criticized from the perspective of the evaluation processing units, evaluation methods and the credibility of the evaluation results. In 1997, the government organized a "Comprehensive University Evaluation," which specified the characteristics, advantages and disadvantages of each university. The evaluation system gradually took shape, but the lack of a management and supervision mechanism rendered the system just another form of description. Not until the Ministry of Education had commissioned TWAEA to conduct the "University Evaluation" in 2004 did the evaluation indices become set. However, the indices still lacked a weight ratio. As the evaluation indices on the performance of each aspect tended to be different, the evaluation committee had to grade the evaluation indices to set up a fair evaluation system. Hence, this study established the weighted evaluation indices, the sequence of the evaluation indices through the AHP structure and an expert questionnaire. The goal of our study was to provide the students of each university with the best educational quality, despite limited resources. Thus, the purpose was to provide the universities and relevant education units with the evaluation system as an important reference point for implementing performance evaluation systems in the future.

Second, in each period since 1975, Taiwanese universities have developed different evaluation methods or indices. In the developed countries, the university evaluation results, regardless of ranking or reports, are published on certain websites. Although our education evaluation system has constantly improved, we fear that publicizing the school ranking results would generate many disputes. Thus, the results are published in grade form instead. In this study, we collected the secondary information by adding the rank in the VIKOR sequence method of the MCDM model upon evaluating the performances of the 12 literature-, law- and business-oriented private universities. Although the explorations of the evaluation indices in conjunction with the weight issue were able to

generate different results, they were unable to provide the educational institutions or school administrators with a reference source.

Finally, universities are able to self-evaluate by using the varied, weighted evaluation indices complied by this study. They can then make their own plans based on the external evaluation criteria. For example, a university administrator may execute the evaluation activities, gather and analyze the relevant data, write and publish the self-evaluation reports, and conduct self-examination to induce improvements. These strategies would be useful for evaluating organizational performances or for realizing self-improvement.

5.3 Suggestions for Future Researches

This study referred to the university evaluation indices from the TWAEA to construct the hierarchy of relationships. We developed various weighted evaluation indices by utilizing the questionnaire analysis performed by senior education experts. Because of the number of evaluation indices, the TWAEA did not set up a weight ratio for the evaluation indices. We suggest that future research conduct in-depth exploration through the use of the weighted evaluation indices obtained from this study. These studies may add a fuzzy theory (e.g., Fuzzy AHP) or use other analytical methods to build the weighted evaluation indices and compare the weights with the research findings of this study.

In addition, we collected the secondary information in the empirical section of this study from the Ministry of Education's evaluation of 12 private universities in the year 2005. Future research may add qualitative evaluation indices (e.g., examine the self-evaluation process or develop the characteristics and goals) into the performance evaluation mechanism presented in this study.

Moreover, because the completion time of this study was quite long, the performance data used are unfortunately no longer the most current (i.e., 2005). It is reasonable to conclude that performance evaluation in terms of performance data will

have changed as time passed due to the fact that the 12 private universities would have contributed different levels of effort into performance improvement in accordance with their development direction and organizational resources. Future research is therefore encouraged to utilize the latest performance data to investigate the potential performance change of these 12 private universities over the past 6 years.

Lastly, because globalization creates fierce competition among universities nationally, private universities can no longer just compete with each other but with national universities, i.e., those owned by Taiwanese government, have fewer financial concerns while undertaking performance improvement. To accurately reflect the real performance situations of both private universities and Taiwanese higher educational institutions, future research is recommended to take national universities into consideration.

Appendix A

Table 1A. Original value of teaching resources (AT)

Teaching Resources	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Average funds for student facilities	**6,797**	**8,840**	**4,245**	**5,979**	**31,602**	**6,681**	**9290**	**8218**	**6107**	**5865**	**118,634**	**6,117**
Funds for instrument equipment at the university	109,005,539	209,260,920	63,249,395	150,963,708	768,283,933	70,848,268	96,220,525	143,573,389	86,211,181	32,930,804	138,935,646	60,344,467
Number of students	16,038	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Average funds for student books	**1,264**	**558**	**1,117**	**936**	**1,295**	**1,440**	**896**	**2188**	**434**	**13,765**	**577**	**682**
Funds for books at the university	20,274,820	13,215,880	16,637,547	23,625,892	31,487,314	15,272,671	9,282,545	38,218,215	6,130,263	7,727,411	6,755,607	6,727,783
Number of students	16,038	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Average funds for student research and training	**354**	**1,252**	**1,727**	**1,017**	**350**	**3,629**	**1,509**	**1,475**	**843**	**620**	**688**	**322**
Funds for research and training for each student	5,678,092	29,646,465	25,734,976	25,675,756	8,518,407	38,484,705	15,630,116	25,770,452	11,895,994	3,479,900	8,060,600	3,177,622
Number of students	16,038	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Average number of domestic and foreign books for students	**42**	**43**	**43**	**35**	**40**	**49**	**40**	**329**	**20**	**48**	**20**	**23**
Number of books including Chinese or another foreign language	679,687	1,007,414	637,412	881,864	971,275	524,505	417,247	5,745,446	281,723	267,636	238,981	226,793
Number of students	16,038	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Number of types of domestic and foreign journals (in hard copy)	**6,681**	**7,254**	**2,464**	**8,263**	**6,327**	**4,133**	**4,507**	**2,872**	**2,101**	**3,201**	**1,537**	**1,375**
Size of school area	**0.417062**	**0.460111**	**0.318485**	**0.041120**	**0.248959**	**3.067053**	**0.0717**	**0.0339**	**0.1415**	**1.1013**	**0.8433**	**0.4552**
Real size of school area	224,362	285,132	127,719	259,091	284,529	433,255	88,553	179,095	143,958	104,755	187,338	127,266
Required size of school area	158,329	195,281	96,868	248,858	227,813	106,528	82,625	173,220	126,115	49,852	101,631	87,458

Note: S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

Table 2A. Original value of internationalization (AI)

Internationalization	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Ratio of foreign students	**0.0014**	**0.0022**	**0.0020**	**0.0023**	**0.0021**	**0.0029**	**0.0041**	**0.0143**	**0.0011**	**0.0084**	**0.0000**	**0.0001**
Number of accepted foreign students	23	53	30	57	51	31	42	249	15	47	0	1
Total students *100%	16,038	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Ratio of foreign faculty members	**0.0940**	**0.0601**	**0.0533**	**0.0566**	**0.0757**	**0.0474**	**0.0173**	**0.1000**	**0.0686**	**0.0294**	**0.0417**	**0.0326**
Number of foreign faculty members	47	43	24	43	51	17	5	58	24	5	12	10
Number of full-time faculty members	500	715	450	760	674	359	289	580	350	170	288	307
Ratio of courses taught in English	**0.0624**	**0.0176**	**0.0525**	**0.0726**	**0.0121**	**0.0661**	**0.0078**	**0.1958**	**0.0568**	**0.0461**	**0.0363**	**0.0406**
Number of courses taught in English	263	108	266	495	95	295	19	566	268	85	135	144
Total courses *100%	4,214	6,127	5,067	6,814	7,837	4,465	2,435	2,891	4,718	1,843	3,721	3,550
Ratio of students with General English Proficiency Test in mid-level certificates	**0.0297**	**0.0433**	**0.0766**	**0.0060**	**0.0144**	**0.0220**	**0.0385**	**0.0085**	**0.0281**	**0.0087**	**0.0086**	**0.0258**
Number of students who passed General English Proficiency Test in mid-level	477	1,026	1,141	151	350	233	399	148	397	49	101	255
Total students*100%	16,038	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Average number of accepted journal papers per full-time faculty member（SCI、SSCI、AHCI）	**0.3120**	**0.2392**	**0.1067**	**0.3789**	**0.1202**	**0.2228**	**0.0588**	**0.1500**	**0.1171**	**0.2000**	**0.0486**	**0.1726**
Number of accepted journal papers produced by full-time faculty members (SCI, SSCI, and AHCI)	156	171	48	288	81	80	17	87	41	34	14	53
Number of full-time faculty members	500	715	450	760	674	359	289	580	350	170	288	307
Number of international conference papers per full-time faculty member (Restricted by conferences that have external announcement of calls for papers and formal review process)	**0.3520**	**0.2098**	**0.1733**	**0.4987**	**0.1751**	**0.3398**	**0.1696**	**0.1810**	**0.2457**	**0.2588**	**0.1771**	**0.2866**
Number of conference papers of full-time faculty members (Restricted by conferences that have external announcement of calls for papers and formal review process)	176	150	78	379	118	122	49	105	86	44	51	88
Number of full-time faculty members	500	715	450	760	674	359	289	580	350	170	288	307
Number of international cooperation projects/research	**9**	**8**	**2**	**3**	**0**	**3**	**0**	**380,000**	**86**	**0**	**0**	**1**
Number of international cooperation projects/research (including Mainland China)	9	8	2	3	0	3	0	380,000	86	0	0	1

Note: S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

Table 3A. Original value of extension education service (AE)

Extension education service	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Amount of income of extension education	95,003,593	31,408,636	110,011,351	104,782,723	605,246,400	29,382,793	39,551,387	19,725,599	86,411,317	9,036,192	43,753,311	16,356,608
Amount of income of promotion education	95,003,593	31,408,636	110,011,351	104,782,723	605,246,400	29,382,793	39,551,387	19,725,599	86,411,317	9,036,192	43,753,311	16,356,608
Average income of extension education for each full-time faculty member	190,007	43,928	244,470	14,188	897,992	81,846	136,856	34,010	246,889	53,154	151,921	53,279
Amount of income of extension education	95,003,593	31,408,636	110,011,351	10,782,723	605,246,400	29,382,793	39,551,387	19,725,599	86,411,317	9,036,192	43,753,311	16,356,608
Number of full-time faculty members	500	715	450	760	674	359	289	580	350	170	288	307
Ratio of full-time faculty members to part-time faculty members of extension education	0.4186	2.3834	0.3478	1.0894	0.0839	1.5701	0.2189	2.0385	0.5588	1.7703	0.6039	0.6918
Number of full-time faculty members for extension education	445	460	56	134	138	168	109	265	171	131	93	211
Number of part-time faculty members for extension education	1,063	193	161	123	1,645	107	498	130	306	74	154	305
Ratio of extension education hours and regular education hours	1.0619	1.1024	3.1458	2.1862	7.2652	1.0588	0.6000	0.8720	1.4956	1.5392	3.0423	1.9061
Number of hours for opened extension education classes	27,254	27,639	46,640	47,013	153,281	11,029	12,172	12,456	17,529	9,748	27,591	17,376
Number of teaching hours for regular education	25,666	25,071	14,826	21,504	21,098	10,417	20,287	14,284	11,720	6,333	9,069	9,116

Note: S1=THU, S2=FJU, S3=S CU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

Table 4A. Original value of discipline and guidance (AD)

Discipline and guidance	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Average number of clubs joined by each student	0.6859	0.4647	0.5939	0.6989	0.8823	0.6982	0.4459	1.8695	0.3560	0.7020	0.2508	0.4562
Number of clubs joined by the students	11,000	11,000	8,850	17,646	21,449	7,404	4,618	32,662	5,025	3,942	2,937	4,500
Number of students	16,038	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Average hours of part-time jobs per student	28.2439	18.0693	16.2566	7.1494	20.8213	23.5206	28.3754	33.2742	21.0145	22.3270	27.8096	21.9419
Number of hours students spent on	452,975	427,719	242,240	180,514	506,186	249,436	293,884	581,333	296,661	125,366	325,678	216,457

part-time jobs												
Number of students	16,038	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Percentage of student loan applications	**0.4731**	**0.4177**	**0.3487**	**0.4575**	**0.4945**	**0.5888**	**0.5068**	**0.4276**	**0.4222**	**0.5411**	**0.4783**	**0.5758**
Number of students	16,038	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Number of activities in employment consulting	**76**	**34**	**59**	**201**	**628**	**380**	**922**	**851**	**827**	**360**	**204**	**1,348**
Number of activities in employment consulting held by university	76	34	59	201	628	380	922	851	827	360	204	1,348

Note: S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

Table 5A. Original value of general education (AG)

General education	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Percentage of general education credits (broad definition)	**0.2529**	**0.2297**	**0.2152**	**0.2550**	**0.2135**	**0.2538**	**0.2901**	**0.3577**	**0.1925**	**0.3439**	**0.3593**	**0.1824**
Percentage of general education credits	**0.0717**	**0.0860**	**0.0559**	**0.2552**	**0.0540**	**0.1509**	**0.0074**	**0.1431**	**0.1925**	**0.1984**	**0.3593**	**0.0676**
Percentage of common curriculum credits	**0.1813**	**0.1437**	**0.1594**	**0.0000**	**0.1596**	**0.1029**	**0.2161**	**0.2146**	**0.0000**	**0.1455**	**0.0000**	**0.1148**

Note: S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

Table 6A. Original value of administrative support (AA)

Administrative support	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Ratio of full-time faculty members to administrative manpower	**1.1848**	**1.1051**	**0.9165**	**1.0873**	**0.9084**	**1.2088**	**0.8705**	**1.0211**	**1.2681**	**1.3077**	**1.4400**	**1.6505**
Number of full-time faculty members	500	715	450	760	674	359	289	580	350	170	288	307
Amount of administrative manpower	422	647	491	699	742	297	332	568	276	130	200	186
Ratio of students to administrative manpower	**25.2085**	**36.5858**	**30.3483**	**36.1216**	**32.7642**	**35.7071**	**31.1958**	**30.7588**	**51.1486**	**43.1923**	**58.5550**	**53.0376**
Number of students	10,638	23,671	14,901	25,249	24,311	10,605	10,357	17,471	14,117	5,615	11,711	9,865
Amount of administrative manpower	422	647	491	699	742	297	332	568	276	130	200	186
Average number of research rooms for full-time assistant professors	**1.1352**	**1.3125**	**0.7437**	**1.1494**	**0.5158**	**1.3130**	**26.2788**	**0.5985**	**1.0885**	**1.3380**	**1.4574**	**1.2969**
Number of research rooms for assistant professors	445	714	264	777	277	344	5,939	243	246	190	274	297
Number of full-time assistant professors	392	544	355	676	537	262	226	406	226	142	188	229
Average number of research rooms for full-time lecturers	**0.9310**	**1.0288**	**0.6183**	**1.0717**	**0.4295**	**0.9971**	**21.4404**	**0.6103**	**0.7410**	**1.1446**	**0.7409**	**0.8350**
Number of research rooms for full-time lecturers	445	714	264	777	277	344	5,939	343	246	190	203	248

| Number of full-time lecturers | 478 | 694 | 427 | 725 | 645 | 345 | 277 | 562 | 332 | 166 | 274 | 297 |

Note: S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

Table 7A. Original value of faculty members (PF)

Faculty members	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Ratio of full-time assistant professors and all full-time faculty members	**0.8915**	**0.9128**	**0.8901**	**3.0420**	**0.8693**	**0.7105**	**0.8544**	**0.8566**	**0.7616**	**0.8788**	**0.6617**	**0.8246**
Number of full-time assistant professors	115	178	162	870	173	81	176	221	131	87	88	94
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	133	114
Ratio of full-time professors and all full-time faculty members	**0.1783**	**0.2615**	**0.2912**	**0.2552**	**0.1859**	**0.0614**	**0.1602**	**0.0620**	**0.0988**	**0.0808**	**0.0451**	**0.1053**
Number of full-time professors	23	51	53	73	37	7	33	16	17	8	6	12
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	133	114
Ratio of full-time faculty members with doctoral degrees and all full-time faculty members	**0.7597**	**0.8051**	**0.7527**	**0.8741**	**0.7739**	**0.6579**	**0.7670**	**0.8140**	**0.6802**	**0.8586**	**0.5338**	**0.7719**
Number of full-time faculty members with doctoral degrees	98	157	137	250	154	75	158	210	117	85	71	88
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	133	114
Ratio of full-time and part-time faculty members	**1.5581**	**1.2359**	**1.8407**	**0.8881**	**1.9497**	**0.8333**	**1.3883**	**0.9264**	**1.8256**	**1.4646**	**1.1203**	**1.2632**
Number of part-time faculty members	201	241	335	254	388	95	286	239	314	145	149	144
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	133	114
Weighted ratio of faculty members and students	--	--	--	--	--	--	--	--	--	--	--	--
Weighted number of students	--	--	--	--	--	--	--	--	--	--	--	--
Number of full-time and part-time faculty members	--	--	--	--	--	--	--	--	--	--	--	--
Ratio of faculty members and students	**22.1939**	**17.0069**	**14.3037**	**23.0833**	**22.1312**	**22.3110**	**19.2703**	**23.2877**	**20.1070**	**16.2459**	**28.6809**	**20.5581**
Number of students	7,324	7,415	7,395	12,465	12,991	4,663	9,481	11,574	9,772	3,964	8,088	5,304
Number of full-time and part-time faculty members	330	436	517	540	587	209	492	497	486	244	282	258
Ratio of full-time foreign faculty members and all faculty members	**0.0030**	**0.0161**	**0.0019**	**0.0167**	**0.0136**	**0.0048**	**0.0000**	**0.0060**	**0.0062**	**0.0000**	**0.0000**	**0.0000**
Number of hired full-time foreign faculty members	1	7	1	9	8	1	0	3	3	0	0	0
Number of full-time and part-time faculty members	330	436	517	540	587	209	492	497	486	244	282	258

33

Note: S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

Table 8A. Original value of teaching (PT)

Teaching	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Average credits requirements for graduation with bachelor's degree	**132**	**134**	**130**	**131**	**129**	**140**	**133**	**140**	**148**	**152**	**128**	**145**
Number of graduation credits for bachelor's degrees of each department	132	134	130	131	129	140	133	140	148	152	128	145
Number of bachelor's degrees within each department in the university	11	17	10	19	19	7	14	19	21	8	22	8
Average credits requirements for graduation master's degree	**40**	**40**	**38**	**34**	**32**	**41**	**32**	**49**	**41**	**33**	**41**	**41**
Number of graduation credits for master's degrees of each department	40	40	38	34	32	41	32	49	41	33	41	41
Number of master's degrees within each department in the university	11	19	9	26	17	4	17	14	3	8	3	5
Average number of course credits opened by department	**116.5135**	**89.5846**	**145.9189**	**84.3523**	**107.9206**	**239.5625**	**92.4516**	**144.7241**	**213.2222**	**63.9783**	**167.6207**	**212.3500**
Number of course credits for each department	4,311	5,823	5,399	7,423	6,799	3,833	5,732	8,394	5,757	2,943	4,861	4,247
Number of departments	37	65	37	88	63	16	62	58	27	46	29	20
Average number of credits for selective courses by department	**46.1081**	**37.2615**	**66.5676**	**33.3295**	**50.6508**	**91.9375**	**39.3226**	**43.2931**	**76.2222**	**31.3696**	**20.2414**	**86.7500**
Number of credits of selective courses for each department	1,706	2,422	2,463	2,933	3,191	1,471	2,438	2,511	2,058	1,443	587	1,735
Number of departments	37	65	37	88	63	16	62	58	27	46	29	20
Average ratio of credits of selective courses by department	**0.2681**	**0.2141**	**0.3962**	**0.2020**	**0.3146**	**0.5079**	**0.2383**	**0.2291**	**0.4033**	**0.1696**	**0.1198**	**0.4664**
Number of credits of selective courses in each department	1,706	2,422	2,463	2,933	3,191	1,471	2,438	2,511	2,058	1,443	587	1,735
Number of credits requirements for graduation	172	174	168	165	161	181	165	189	189	185	169	186
Number of departments	37	65	37	88	63	16	62	58	27	46	29	20
Registration rate of new students	**0.9604**	**0.9757**	**0.9574**	**0.9563**	**0.9424**	**0.9559**	**0.9758**	**0.9665**	**0.9151**	**0.6977**	**0.7787**	**0.8687**
Number of registered students	1,771	1,848	1,596	2,889	3,549	1,191	2,019	2,858	2,802	1,103	1,875	1,330
Number of accepted students *100%	1,844	1,894	1,667	3,021	3,766	1,246	2,069	2,957	3,062	1,581	2,408	1,531
Graduation rate of students	**0.9206**	**1.0288**	**1.2825**	**1.1921**	**0.9771**	**1.0097**	**1.0005**	**0.9044**	**0.9782**	**0.8245**	**0.9766**	**0.9529**
Number of graduated students in certain academic year	1,460	1,467	1,412	2,861	2,907	1,040	1,965	2,659	2,428	573	1,712	1,315

Number of students registered in certain academic year *100%	1,586	1,426	1,101	2,400	2,975	1,030	1,964	2,940	2,482	695	1,753	1,380
Dropout rate of students	**0.0117**	**0.0301**	**0.0342**	**0.0400**	**0.0825**	**0.0309**	**0.0306**	**0.0391**	**0.0537**	**0.0454**	**0.0827**	**0.0605**
Number of dropout students in certain academic year	86	223	253	499	1,072	144	290	452	525	180	669	321
Number of students registered in certain academic year *100%	7,324	7,415	7,395	12,465	12,991	4,663	9,481	11,574	9,772	3,964	8,088	5,304
Ratio of students taking minor degrees	**0.0100**	**0.0475**	**0.0107**	**0.0452**	**0.0259**	**0.1010**	**0.0261**	**0.0041**	**0.0074**	**0.0086**	**0.0046**	**0.0013**
Number of students taking minor degrees	73	352	79	564	337	471	247	48	72	34	37	7
Number of students	7,324	7,415	7,395	12,465	12,991	4,663	9,481	11,574	9,772	3,964	8,088	5,304
Ratio of students taking double majors	**0.008192**	**0.011868**	**0.011494**	**0.011552**	**0.019629**	**0.037958**	**0.0027**	**0.0007**	**0.0007**	**0.0008**	**0.0004**	**0.0008**
Number of student taking double majors	60	88	85	144	255	177	26	8	7	3	3	4
Number of students	7,324	7,415	7,395	12,465	12,991	4,663	9,481	11,574	9,772	3,964	8,088	5,304
Ratio of courses taken by off-campus students	**0.0004**	**0.0101**	**0.0119**	**0.0116**	**0.0012**	**0.0084**	**0.0114**	**0.0067**	**0.0359**	**0.0103**	**0.0011**	**0.0096**
Number of off-campus students taking courses	3	75	88	145	16	39	108	78	351	41	9	51
Number of students	7,324	7,415	7,395	12,465	12,991	4,663	9,481	11,574	9,772	3,964	8,088	5,304
Ratio of weekly hours of regular teaching of both full-time and part-time faculty members and total students	**0.5922**	**0.8361**	**0.7903**	**0.6018**	**0.5234**	**0.8981**	**0.8717**	**0.5639**	**0.5330**	**0.7351**	**0.6084**	**0.4987**
Number of weekly hours of regular teaching of both full-time and part-time faculty members	4,337	6,200	5,844	7,501	6,799	4,188	8,265	6,527	5,208	2,914	4,921	2,645
Number of students	7,324	7,415	7,395	12,465	12,991	4,663	9,481	11,574	9,772	3,964	8,088	5,304
Average number of weekly teaching hours per full-time faculty member	**36.8915**	**24.2872**	**32.1813**	**31.9021**	**63.2663**	**27.0175**	**66.1699**	**41.9341**	**33.2035**	**48.4747**	**52.4564**	**69.6930**
Number of weekly teaching hours of full-time faculty members	4,759	4,736	5,857	9,124	12,590	3,080	13,631	10,819	5,711	4,799	7,816	7,945
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	149	114

Note: S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

Table 9A. Original value of research (PR)

Research	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Number of published books (with formal review process) by full-time faculty	**16**	**24**	**40**	**29**	**29**	**9**	**28**	**37**	**21**	**41**	**5**	**5**

members

Average number of published books (with formal review process) by full-time faculty members	**16**	**42**	**5**	**20**	**1**	**1**	**38**	**2**	**0**	**0**	**0**	**0**
Number of published professional book, chapters of encyclopedia, and biography (with formal review process) by full-time faculty members	**10**	**1**	**19**	**54**	**10**	**3**	**22**	**18**	**3**	**0**	**7**	**7**
Number of published journal papers not listed in SCI, SSCI, AHCI, and TSSCI (with formal review process) by full-time faculty members	**109**	**166**	**101**	**343**	**125**	**84**	**144**	**228**	**119**	**169**	**111**	**113**
Average number of published SCI, SSCI, and AHCI journal papers by each full-time faculty members	**0.0698**	**0.1179**	**0.0440**	**0.1993**	**0.0352**	**0.0789**	**0.0874**	**0.1047**	**0.0465**	**0.3030**	**0.0671**	**0.1579**
Number of published SCI, SSCI, and AHCI journal papers by full-time faculty members	9	23	8	57	7	9	18	27	8	30	10	18
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	149	114
Average number of published TSSCI journal papers by each full-time faculty member	--	--	--	--	--	--	--	--	--	--	--	--
Average number of citations of each journal paper published in SCI-, SSCI-, and AHCI-listed journals	--	--	--	--	--	--	--	--	--	--	--	--
Number of citations of journal papers published in SCI-, SSCI-, and AHCI-listed journals within five years	--	--	--	--	--	--	--	--	--	--	--	--
Number of journal papers that published in SCI-, SSCI-, and AHCI-listed journals within five years	--	--	--	--	--	--	--	--	--	--	--	--
Average number of National Science Council projects by each full-time faculty member	**0.3411**	**0.3077**	**0.1978**	**0.2517**	**0.1256**	**0.2632**	**0.1845**	**0.1318**	**0.0814**	**0.2424**	**0.0738**	**0.2719**
Number of National Science Council projects by full-time faculty members	44	60	36	72	25	30	38	34	14	24	11	31
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	149	114
Average amount of financial support from National Science Council for each full-time faculty member	**181,822**	**162,509**	**97,621**	**113,026**	**71,937**	**88,049**	**128,938**	**44,991**	**31,360**	**122,343.**	**23,993**	**95,649**
Amount of financial support from National Science Council projects	23,455,000	31,689,194	17,767,000	32,325,397	14,315,408	10,037,600	26,561,310	11,607,600	5,394,000	12,112,000	3,575,000	10,904,029

Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	149	114
Average amount of financial support from projects (other than National Science Council) for each full-time faculty members	**210,461**	**753,942**	**207,132**	**139,422**	**65,725**	**58,560**	**288,425**	**86,248**	**512,602**	**40,735**	**7,206**	**6,524**
Amount of financial support from projects (other than National Science Council)	27,149,411	147,018,596	37,698,019	39,874,670	13,079,204	6,675,880	59,415,553	22,252,002	88,167,572	4,032,770	1,073,761	743,711
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	149	114
Average number of international conference papers by each full-time faculty member (with external announcement of calls for papers and formal review process)	**0.2636**	**0.2154**	**0.2033**	**0.4965**	**0.1910**	**0.3860**	**0.2330**	**0.2248**	**0.1802**	**0.3131**	**0.2282**	**0.3421**
Number of international conference papers by full-time faculty members (with external announcement of calls for papers and formal review process)	34	42	37	142	38	44	48	58	31	31	34	39
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	149	114
Average number of domestic conference papers by each full-time faculty member (with external announcement of calls for papers and formal review process)	**0.8295**	**0.8256**	**0.3462**	**1.0385**	**0.8040**	**0.9737**	**0.7767**	**1.0620**	**0.9593**	**1.6566**	**1.2013**	**1.5175**
Number of domestic conference papers by full-time faculty members (with external announcement of calls for papers and formal review process)	107	161	63	297	160	111	160	274	165	164	179	173
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	149	114
Ratio of participation as editorial board members/reviewers of journals (with formal review process) by each full-time faculty member	**1.4264**	**0.5692**	**1.3407**	**1.0070**	**0.4925**	**0.4474**	**0.5583**	**0.2752**	**0.0000**	**0.0000**	**0.1879**	**0.2632**
Number of full-time faculty members who served as editorial board members/reviewers of journals (with formal review process)	184	111	244	288	98	51	115	71	0	0	28	30
Number of full-time faculty members	129	195	182	286	199	114	206	258	172	99	149	114
Number of full-time faculty members with national and/or international academic awards/honors	**0**	**10**	**1**	**4**	**3**	**6**	**7**	**0**	**0**	**0**	**1**	**0**
Percentage of doctoral students over overall students	**0.0102**	**0.0069**	**0.0054**	**0.0058**	**0.0064**	**0.0000**	**0.0033**	**0.0013**	**0.0000**	**0.0028**	**0.0000**	**0.0028**

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Number of doctoral students	75	51	40	72	83	0	31	15	0	11	0	15
Number of students	7,324	7,415	7,395	12,465	12,991	4,663	9,481	11,574	9,772	3,964	8,088	5,304
Percentage of doctoral students over graduate students	**0.1016**	**0.0423**	**0.0281**	**0.0404**	**0.0713**	**0.0000**	**0.0267**	**0.0135**	**0.0000**	**0.0166**	**0.0000**	**0.0526**
Number of doctoral students	75	51	40	72	83	0	31	15	0	11	0	15
Number of graduate students	738	1,205	1,423	1,783	1,164	192	1,163	1,111	165	662	124	285

Note: S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

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Tables with Captions

Table 1. The ratio scale and definition of AHP

Intensity of importance	Definition	Description
1	Equal importance	Two factors contribute equally to the objective.
3	Somewhat more important	Experience and judgement slightly favor one over the other.
5	More important	Experience and judgement strongly favor one over the other.
7	Much more important	Experience and judgement very strongly favor one over the other. Its importance is demonstrated in practice.
9	Absolutely more important	The evidence favoring one over the other is of the highest possible validity.
2,4,6,8	Intermediate values	Compromise is needed.

Resource: Saaty (1990)

Table 2. Values for RI

n	2	3	4	5	6	7	8
RI	0.00	0.52	0.90	1.12	1.24	1.32	1.41

Resource: Saaty & Vargas (1991)

Table 3 Evaluation indices for Administration category (A)

Teaching Resources (AT)	
Evaluation Indices	Definition
AT1.1: Average Funds for student facilities	Funds spent on instrument equipment in the university / Number of students
AT1.2: Average funds for student books	Funds spent on books in the university / Number of students
AT1.3: Average funds for students' research and training	Funds spent on research and training for all students / Number of students
AT2.1: Average number of students' domestic and foreign books	Number of books including Chinese or foreign languages / Number of students
AT2.2: Number of types of domestic and foreign journals (in hard copy)	Number of types of domestic and foreign journals (based on paper)
AT3.1: Size of school area	(Real size of school area - Required size of school area / Required size of school area) *100%

Internationalization (AI)	
Evaluation Indices	Definition
AI1.1: Ratio of foreign students	Number of accepted foreign students / Total students *100%
AI1.2: Ratio of foreign faculty members	Number of foreign faculty members / Number of full-time faculty members
AI2.1: Ratio of courses taught in English	Number of courses taught in English / Total courses *100%
AI2.2: Ratio of students with General English Proficiency Test in mid-level certificates	Number of students who passed General English Proficiency Test in mid-level / Total students
AI3.1: Average number of accepted journal papers per full-time faculty member (SCI、SSCI、AHCI)	Number of accepted journal papers by full-time faculty members (SCI, SSCI, and AHCI) / Number of full-time faculty members

AI3.2: Number of international conference papers per full-time faculty member (Restricted by conferences that have external announcement of calls for papers and formal review process)	Number of conference papers of full-time faculty members (Restricted by conferences that have external announcement of calls for papers and formal review process) / Number of full-time faculty members
AI3.3: Number of international cooperation projects/research	Number of international cooperation projects/research (including Mainland China)

Extension Education Service (AE)	
Evaluation Indices	Definition
AE1.1: Amount of income of extension education	Amount of income of promotion education
AE1.2: Average income of extension education per full-time faculty members	Amount of income of extension education / Number of full-time faculty members
AE2.1: Ratio of full-time faculty members to part-time faculty members of extension education	Number of full-time faculty members for extension education / Number of part-time faculty members for extension education
AE2.2: Ratio of extension education hours to regular education hours	Number of hours for opened extension education classes / Number of teaching hours for regular education

Discipline and Guidance (AD)	
Evaluation Indices	Definition
AD1.1: Average number of clubs joined by each student	Number of clubs joined by the students / Number of students
AD1.2: Average hours of part-time jobs per student	Number of hours that students spent on part-time jobs / Number of students
AD2.1: Percentage of student loan applications	Number of student loan applications / Number of students
AD3.1: Number of activities in employment consulting	Number of activities in employment consulting held by university

General Education（AG）	
Evaluation Indices	Definition
AG1.1: Percentage of general education credits (broad definition)	$\sum$ (Number of credits requirements for both general education and common curriculum in each department / credits requirements for graduation from each department) / total number of departments
AG1.2: Percentage of general education credits	$\sum$ (Number of credits requirements in general for each department / credits requirements for graduation from each department) / total number of departments
AG1.3: Percentage of common curriculum credits	$\sum$ (Number of credits requirements for common curriculum of each department / credits requirements for graduation from each department) / total number of departments

Administrative Support (AA)	
Evaluation Indices	Definition
AA1.1: Ratio of full-time faculty members to administrative manpower	Number of full-time faculty members / Amount of administrative manpower
AA1.2: Ratio of students to administrative manpower	Number of students / Amount of administrative manpower
AA2.1: Average number of research rooms for full-time assistant professors	Number of research rooms for assistant professors / Number of full-time assistant professors
AA2.2: Average number of research rooms for full-time lecturers	Number of research rooms for full-time lecturers / Number of full-time lecturers

Table 4 Evaluation indices for Professional category (P)

Faculty (PF)	
Evaluation Indices	Definition
PF1.1: Ratio of full-time assistant professors to all full-time faculty members	Number of full-time assistant professors / Number of full-time faculty members

PF1.2: Ratio of full-time professors to all full-time faculty members	Number of full-time professor / Number of full-time faculty members
PF1.3: Ratio of full-time faculty members with doctoral degrees to all full-time faculty members	Number of full-time faculty members with doctoral degrees / Number of full-time faculty members
PF1.4: Ratio of part-time faculty members to full-time faculty members	Number of part-time faculty members / Number of full-time faculty members
PF2.1: Weighted ratio of faculty members to students	Weighted number of students / Number of full-time and part-time faculty members
PF2.2: Ratio of faculty members to students	Number of students / Number of full-time and part-time faculty members
PF3.1: Ratio of full-time foreign faculty members to all faculty members	Number of hired full-time foreign faculty members / Number of full-time and part-time faculty members

Teaching（PT）	
Evaluation Indices	Definition
PT1.1:Average credits requirements for graduation with bachelor's degree	Number of graduation credits for bachelor's degrees in each department / Number of bachelor's degrees within each department in the university
PT1.2: Average credits requirements for graduation with master's degree	Number of graduation credits for master's degrees in each department / Number of master's degrees within each department in the university
PT1.3: Average number of course credits opened by department	Number of course credits by each department / Number of departments
PT1.4: Average number of credits of selective courses by department	Number of credits of selective courses by each department / Number of departments
PT1.5:Average ratio of credits of selective courses by department	Σ（Number of credits of selective courses in each department / Number of credits required for graduation）/ Number of departments
PT2.1: Registration rate of new students	Number of registered students / Number of accepted students *100%
PT2.2: Graduation rate of students	Number of graduated student in certain academic year / Number of students registered in certain academic year *100%
PT2.3: Dropout rate of students	Number of dropout students in certain academic year / Number of students registered in certain academic year *100%
PT3.1: Ratio of students taking minor degrees	Number of students taking minor degrees / Number of students
PT3.2: Ratio of students taking double majors	Number of student taking double majors / Number of students
PT3.3: Ratio of courses taken by off-campus students	Number of off-campus students taking courses / Number of students
PT4.1: Ratio of weekly hours of regular teaching of both full-time and part-time faculty members to total students	Number of weekly hours of regular teaching for both full-time and part-time faculty members / Number of student
PT4.2: Average number of weekly teaching hours of per full-time faculty members	Number of weekly teaching hours for full-time faculty members / Number of full-time faculty members

Research（PR）	
Evaluation Indices	Definition
PR1.1: Number of published books (with formal review process) by full-time faculty members	Number of published books, including series publication of full-time faculty members that have formal review processes
PR1.2: Average number of published books (with formal review process) by full-time faculty members	Number of published books including series publication for full-time faculty members
PR1.3: Number of published professional books, encyclopedia chapters, and	Number of published professional books, encyclopedia chapters, and biography that has formal

biographies (with formal review process) by full-time faculty members	review process by each full-time faculty member
PR1.4: Number of published journal papers not listed in SCI, SSCI, AHCI, and TSSCI (with formal review process) by full-time faculty members	Number of published journal papers not listed in SCI, SSCI, AHCI, and TSSCI (with formal review process) by full-time faculty members
PR2.1: Average number of published SCI, SSCI, and AHCI journal papers by each full-time faculty member	Number of published SCI, SSCI, and AHCI journal papers by full-time faculty members / Number of full-time faculty members
PR2.2: Average number of published TSSCI journal papers by each full-time faculty member	Number of published TSSCI journal papers by full-time faculty members / Number of full-time faculty members
PR2.3: Average number of citations of each journal paper published in SCI-, SSCI-, and AHCI-listed journals	Number of citations of journal papers that published in SCI-, SSCI-, and AHCI-listed journals within five years / Number of journal papers that published in SCI-, SSCI-, and AHCI-listed journals within five years
PR3.1: Average number of National Science Council projects by each full-time faculty member	Number of National Science Council projects by full-time faculty members / Number of full-time faculty members
PR3.2: Average amount of financial support from National Science Council for each full-time faculty member	Amount of financial support from National Science Council projects/ Number of full-time faculty members
PR3.3: Average amount of financial support for projects (other than National Science Council) for each full-time faculty members	Amount of financial support from projects (other than National Science Council) / Number of full-time faculty members
PR4.1: Average number of international conference papers by each full-time faculty member (with external announcement of calls for papers and formal review process)	Number of international conference papers by full-time faculty members (with external announcement of calls for paper and formal review process) / Number of full-time faculty members
PR4.2: Average number of domestic conference papers published by each full-time faculty member (with external announcement of call for paper and formal review process)	Number of domestic conference papers by full-time faculty members (with external announcement of calls for paper and formal review process) / Number of full-time faculty members
PR5.1: Ratio of participation as editorial board members/reviewers of journals (with formal review process) by each full-time faculty member	Number of full-time faculty members serving as editorial board members / reviewers of journals (with formal review process) / Number of full-time faculty members
PR5.2: Number of full-time faculty members with national and/or international academic awards/honors	Number of full-time faculty members having national and/or international academic awards/honors
PR6.1: Percentage of doctoral students over overall students	Number of doctoral students / Number of students
PR6.2: Percentage of doctoral students over graduate students	Number of doctoral students / Number of graduate students

Table 5. The demographic information

Variable	Items	N	Percentage	Variable	Items	N	Percentage
1.Sex	(1) Male	9	100%		(1) Vocational	0	0%
	(2) Female	0	0%	4.Education background	(2) Bachelor	0	0%
	(1) Under 30	0	0%		(3) Master	0	0%
					(4) Doctoral	9	100%
2.Age	(2) 31-40	0	0%		(1) Academic	9	100%
	(3) 41-50	2	22.22%	5.Occupational background	(2) Industrial	0	0%
	(4) Above 51	7	77.78%		(3) Governmental	0	0%

	(1) Under 5	0	0%
3.Service	(2) 6-10	0	0%
tenure	(3) 11-20	1	11.11%
	(4) Above 21	8	88.89%

Table 6. The analysis result of the AHP and the ranking of evaluation indices

1st Evaluation Goal	2nd Evaluation Categories	Relative eweights	3rd Evaluation Dimensions	Local Weights	Relative Weights	4th Evaluation Criteria	Local Weights	Relative Weights	5th Evaluation Indices	Local Weights	Relative Weights	Ranking
The official evaluation indices of the university (C.I.=0) (C.R.=0)	(A) (C.I.=0.023) (C.R.=0.01)	0.4185	(AT) (C.I.=0) (C.R.=0)	0.2876	0.1204	(AT1)	0.4495	0.0541	(AT1.1)	0.3304	0.0179	21
									(AT1.2)	0.3855	0.0209	14
									(AT1.3)	0.2841	0.0154	27
						(AT2)	0.3111	0.0374	(AT2.1)	0.5528	0.0207	15
									(AT2.2)	0.4472	0.0167	24
						(AT3)	0.2394	0.0288	(AT3.1)	1.0000	0.0288	5*
			(AI) (C.I.=0.013) (C.R.=0.022)	0.1032	0.0432	(AI1)	0.2449	0.0106	(AI1.1)	0.5192	0.0055	56
									(AI1.2)	0.4808	0.0051	59
						(AI2)	0.3777	0.0163	(AI2.1)	0.4687	0.0076	48
									(AI2.2)	0.5313	0.0089	43
						(AI3)	0.3775	0.0163	(AI3.1)	0.4120	0.0067	51
									(AI3.2)	0.3320	0.0054	57
									(AI3.3)	0.2560	0.0042	62
			(AE) (C.I.=0) (C.R.=0)	0.1092	0.0457	(AE1)	0.5728	0.0262	(AE1.1	0.6680	0.0175	22
									(AE1.2)	0.3320	0.0087	44
						(AE2)	0.4272	0.0195	(AE2.1)	0.4144	0.0081	46
									(AE2.2)	0.3320	0.0114	36
			(AD) (C.I.=0) (C.R.=0)	0.1404	0.0588	(AD1)	0.3441	0.0202	(AD1.1)	0.7678	0.0156	26
									(AD1.2)	0.2322	0.0047	61
						(AD2)	0.2448	0.0144	(AD2.1)	1.0000	0.0144	31
						(AD3)	0.4111	0.0242	(AD3.1)	1.0000	0.0242	10*
			(AG) (C.I.=n/a) (C.R.=n/a)	0.1624	0.0680	(AG1	1.0000	0.0680[b]	(AG1.1)	0.4023	0.0273	6*
									(AG1.2)	0.3243	0.0220	12
									(AG1.3)	0.2734	0.0186	19
			(AA) (C.I.=0) (C.R.=0)	0.1972	0.0825	(AA1)	0.5557	0.0459	(AA1.1)	0.4087	0.0187	18
									(AA1.2)	0.5913	0.0271	7*
						(AA2)	0.4443	0.0367	(AA2.1)	0.7048	0.0258	8*
									(AA2.2)	0.2952	0.0109	38

Note: 1. C.I=0.03 < 0.1、C.R.=0.05 < 0.1; 2. [a] Top three within the 3rd Evaluation Dimensions；[b] Top five within 4th Evaluation Criteria；* Top ten within the 5th Evaluation Indices

47

Table 6. The analysis result of the AHP and the ranking of evaluation indices (con.)

1st Evaluation Goal	2nd Evaluation Categories	Relative weights	3rd Evaluation Dimensions	Local Weights	Relative Weights	4th Evaluation Criteria	Local Weights	Relative Weights	5th Evaluation Indices	Local Weights	Relative Weights	Ranking
The official evaluation indices of the university (C.I.=0) (C.R.=0)	(P) (C.I.=0) (C.R.=0)	0.5815	(PF) (C.I.=0.0003) (C.R.=0.0005)	0.3985	0.2317[a]	(PF1)	0.2761	0.0619[b]	(PF1.1)	0.2406	0.0149	30
									(PF1.2)	0.2544	0.0157	25
									(PF1.3)	0.3545	0.0219	13
									(PF1.4)	0.1505	0.0093	42
						(PF2)	0.4265	0.0988[b]	(PF2.1)	0.4949	0.0489	3*
									(PF2.2)	0.5051	0.0499	2*
						(PF3)	0.3064	0.0710[b]	(PF3.1)	1.0000	0.0710	1*
			(PT) (C.I.=0.013) (C.R.=0.014)	0.3352	0.1949[a]	(PT1)	0.1585	0.0309	(PT1.1)	0.1894	0.0059	54
									(PT1.2)	0.1717	0.0053	58
									(PT1.3)	0.2276	0.0070	49
									(PT1.4)	0.2257	0.0070	49
									(PT1.5)	0.1856	0.0057	55
						(PT2)	0.3148	0.0614[b]	(PT2.1)	0.4190	0.0257	9*
									(PT2.2)	0.2800	0.0172	23
									(PT2.3)	0.3010	0.0185	20
						(PT3)	0.2413	0.0470	(PT3.1)	0.2964	0.0139	33
									(PT3.2)	0.4032	0.0190	17
									(PT3.3)	0.3004	0.0141	32
						(PT4)	0.2854	0.0556	(PT4.1)	0.5697	0.0317	4*
									(PT4.2)	0.4303	0.0239	11
			(PR) (C.I.=0.026) (C.R.=0.021)	0.2663	0.1548[a]	(PR1)	0.1096	0.0170	(PR1.1)	0.1421	0.0024	64
									(PR1.2)	0.2892	0.0049	60
									(PR1.3)	0.2154	0.0037	63
									(PR1.4)	0.3533	0.0060	52
						(PR2)	0.2526	0.0391	(PR2.1)	0.3866	0.0151	29
									(PR2.2)	0.2209	0.0086	45
									(PR2.3)	0.3925	0.0153	28
						(PR3)	0.2063	0.0319	(PR3.1)	0.3534	0.0113	37
									(PR3.2)	0.3075	0.0098	40
									(PR3.3)	0.3391	0.0108	39
						(PR4)	0.1641	0.0254	(PR4.1)	0.7642	0.0194	16
									(PR4.2)	0.2358	0.0060	52
						(PR5)	0.1560	0.0242	(PR5.1)	0.4839	0.0117	35
									(PR5.2)	0.1561	0.0125	34
						(PR6)	0.1114	0.0172	(PR6.1)	0.4535	0.0078	47
									(PR6.2)	0.5465	0.0094	41

Note: 1. C.I=0.03 ＜ 0.1、C.R.=0.05 ＜ 0.1; 2. [a] Top three within the 3rd Evaluation Dimensions ; [b] Top five within 4th Evaluation Criteria ; * Top ten within the 5th Evaluation Indices

48

Table 7. The ranking result of each evaluation dimension

School	Teaching resources (AT)						Internationalization (AI)						Extension education service (AE)						Discipline and guidance (AD)						General education (AG)						Administrative support (AA)					
	Q_i	O	S_i	O	R_i	O	Q_i	O	S_i	O	R_i	O	Q_i	O	S_i	O	R_i	O	Q_i	O	S_i	O	R_i	O	Q_i	O	S_i	O	R_i	O	Q_i	O	S_i	O	R_i	O
S1	0.623	7	0.092	5	0.025	6	0.142	1	0.025	2	0.006	1	0.448	2	0.040	10	0.007	1	0.939	11	0.043	8	0.023	10	0.517	5	0.037	5	0.018	4	0.749	5	0.047	5	0.025	6
S2	0.616	6	0.093	6	0.025	4	0.518	7	0.030	6	0.007	7	0.865	6	0.036	3	0.017	8	0.987	12	0.045	10	0.024	12	0.648	8	0.043	8	0.020	7	0.767	7	0.050	7	0.025	3
S3	0.737	8	0.100	9	0.026	7	0.235	2	0.029	4	0.006	1	0.743	3	0.036	2	0.015	3	0.884	9	0.039	6	0.024	11	0.747	9	0.046	9	0.022	9	0.718	2	0.041	2	0.026	9
S4	0.815	10	0.094	7	0.029	11	0.661	9	0.026	3	0.009	12	0.772	4	0.037	4	0.015	4	0.869	8	0.044	9	0.021	8	0.582	7	0.041	7	0.019	5	0.766	6	0.049	6	0.025	6
S5	0.587	4	0.078	3	0.027	10	0.731	10	0.036	10	0.008	8	0.047	1	0.008	1	0.008	2	0.452	5	0.034	5	0.013	2	0.759	10	0.046	10	0.023	10	0.732	3	0.042	3	0.026	11
S6	0.000	1	0.055	1	0.019	1	0.423	4	0.030	5	0.007	6	0.905	8	0.039	9	0.017	9	0.786	7	0.045	11	0.018	6	0.488	4	0.039	6	0.016	3	0.788	8	0.053	8	0.025	3
S7	0.837	11	0.098	8	0.028	9	0.536	8	0.038	11	0.007	5	0.957	12	0.044	12	0.017	7	0.438	3	0.032	4	0.014	4	0.576	6	0.033	4	0.022	8	0.000	1	0.003	1	0.003	1
S8	0.604	5	0.067	2	0.029	12	0.448	6	0.018	1	0.009	9	0.911	9	0.039	7	0.017	10	0.000	1	0.014	1	0.009	1	0.100	2	0.014	1	0.014	2	0.747	4	0.045	4	0.026	10
S9	0.949	12	0.116	12	0.028	8	0.355	3	0.033	7	0.006	3	0.817	5	0.039	7	0.015	5	0.449	4	0.031	3	0.015	5	0.955	11	0.055	12	0.026	11	0.867	10	0.064	10	0.025	6
S10	0.305	2	0.091	4	0.019	2	0.776	11	0.033	8	0.009	9	0.924	10	0.038	6	0.018	12	0.761	6	0.043	7	0.018	7	0.057	1	0.019	2	0.010	1	0.838	9	0.061	9	0.025	3
S11	0.535	3	0.106	10	0.021	3	0.944	12	0.040	12	0.009	9	0.867	7	0.038	5	0.017	6	0.896	10	0.045	12	0.021	8	0.305	3	0.019	3	0.019	5	0.924	11	0.074	11	0.025	2
S12	0.784	9	0.114	11	0.025	4	0.442	5	0.034	9	0.006	4	0.955	11	0.041	11	0.017	11	0.393	2	0.029	2	0.014	3	0.994	12	0.054	11	0.027	12	1.000	12	0.078	12	0.027	12
Rule 1			√												√						√												√			
Rule 2			√						√						√						√						√						√			

Note: O: Order

S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

Table 8. The ranking result of the professional (P) scope of social science and overall operation ranking

	Professional (P) (teaching (PT), research (PR), and faculty (PF))						Overall operation performance					
	Q_i	O	S_i	O	R_i	O	Q_i	O	S_i	O	R_i	O
S1	0.608	7	0.295	5	0.058	6	0.568	7	0.579	7	0.058	7
S2	0.059	2	0.198	2	0.027	1	0.067	2	0.496	2	0.027	1
S3	0.630	8	0.280	4	0.063	8	0.605	8	0.570	6	0.063	8
S4	0.042	1	0.168	1	0.031	3	0.042	1	0.458	1	0.031	3
S5	0.209	3	0.270	3	0.027	2	0.105	3	0.515	4	0.027	2
S6	0.292	4	0.295	5	0.058	6	0.427	5	0.547	5	0.051	6
S7	0.847	11	0.342	10	0.071	9	0.732	9	0.589	8	0.071	9
S8	0.503	6	0.315	8	0.045	5	0.304	4	0.512	3	0.045	5
S9	0.470	5	0.302	7	0.045	4	0.522	6	0.639	10	0.045	4
S10	0.843	10	0.340	9	0.071	9	0.795	10	0.625	9	0.071	9
S11	1.000	12	0.419	12	0.071	9	1.000	12	0.740	12	0.071	9
S12	0.796	9	0.342	10	0.071	9	0.871	11	0.668	11	0.071	9
Rule 1									√			
Rule 2			√						√			

Note: O: Order
S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU

51

Table 9. The summary of rankings for each performance evaluation

Evaluation Category	R / S / D	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Administration (A)	(AT)	7	5	8	10^a	4	1*	11^a	6	12^a	2*	3*	9
	(AI)	1*	7	2*	9	10^a	5	8	6	3*	11^a	12^a	4
	(AE)	2*	6	3*	4	1	8	12^a	9	5	10^a	7	11^a
	(AD)	11^a	12^a	9	8	5	7	3*	1*	4	6	10^a	2*
	(AG)	5	8	9	7	10^a	4	6	2*	11^a	1*	3*	12^a
	(AA)	4	7	2*	6	3*	8	1*	5	10^a	9	11^a	12^a
Profession (P)	SS & E	7	2*	8	1*	3*	4	11^a	6	5	10^a	12^a	9
Overall performance		7	2*	8	1*	3*	5	9	4	6	10^a	11^a	12^a

Note: S: University; R: Ranking; D: Evaluation dimension
* Top 3 within each evaluation dimension; ^{a} Last 3 within each evaluation dimension
S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU
SS & E: Social Science including Education

Table 10. The comparison of the Ministry of Education's evaluations and the research findings

12 private universities		S1		S2		S3		S4		S5		S6		S7		S8		S9		S10		S11		S12	
EC / CP / ED		ED	RF	ED	RF	ED	RF	ED	RF	ED	RF	ED	RF	ED	RF	ED	RF	ED	RF	ED	RF	ED	RF	ED	RF
A	(AT)	G	M	G	M	G	M	G	W	M	M	M	G	M	W	M	M	M	W	M	G	W	G	W	M
	(AI)	G	G	G	M	M	G	G	M	M	W	M	M	G	M	M	M	M	G	M	W	M	W	W	M
	(AE)	G	G	M	M	G	G	G	M	G	G	M	M	M	W	M	M	M	M	M	W	M	W	W	W
	(AD)	G	W	G	W	G	M	G	M	M	M	G	M	M	M	G	M	M	M	M	M	M	W	M	M
	(AG)	G	M	G	M	M	M	G	M	M	W	M	M	M	M	M	M	G	M	W	G	W	G	M	W
	(AA)	G	M	M	M	G	G	G	M	M	G	G	M	G	G	M	M	W	W	M	M	W	W	M	W
P	SS & E	G	M	*G*	*G*	G	M	*G*	*G*	M	G	*M*	*M*	M	W	*M*	*M*	*M*	*M*	M	W	*W*	*W*	*M*	*M*

Note: S1=THU, S2=FJU, S3=SCU, S4=TKU, S5=PCCU, S6=PU, S7=SHU, S8=MCU, S9=USC, S10=NHU, S11=AU, and S12=CJCU
CP: comparison
ED: Evaluation dimensions; EC: Evaluation category
A; Administration (A); P: Professional (P)
ED: Ministry of Education; RF: Research finding
SS & E: Social Science including Education
G: Good; M: Midium (based on Ministry of Education, those who are not considered as G or W are deemed as M); W: Weak
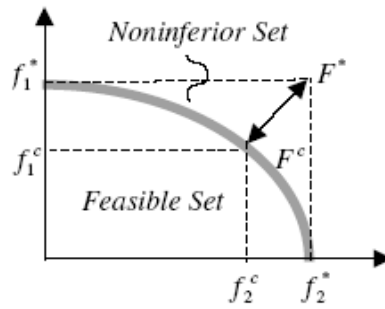
Figures with Captions

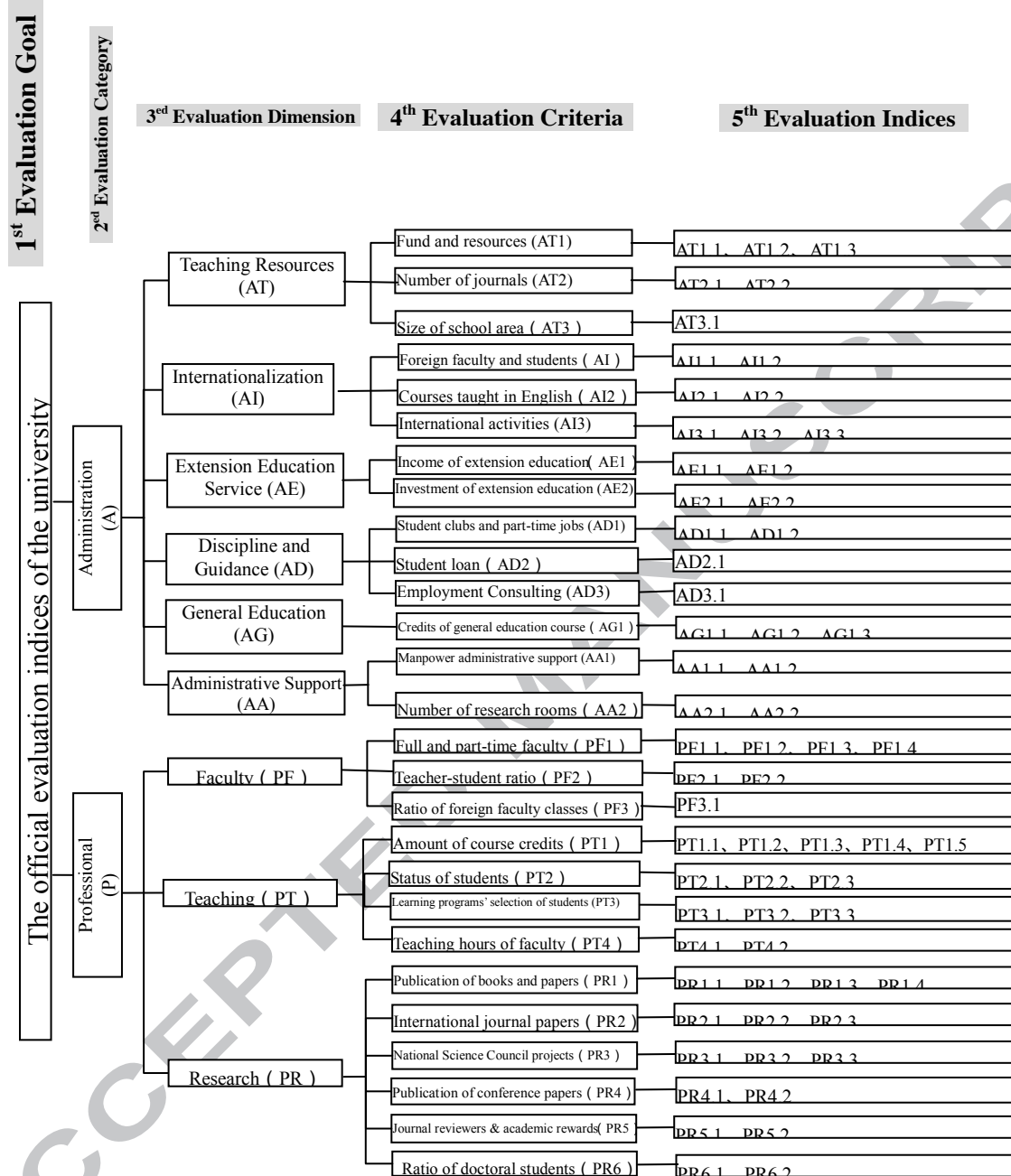Fig. 1 Ideal and compromise solutions

1st Evaluation Goal

2ed Evaluation Category

3ed Evaluation Dimension   **4th Evaluation Criteria**   **5th Evaluation Indices**

The official evaluation indices of the university

Administration (A)
- Teaching Resources (AT)
  - Fund and resources (AT1) — AT1.1、AT1.2、AT1.3
  - Number of journals (AT2) — AT2.1、AT2.2
  - Size of school area（AT3） — AT3.1
- Internationalization (AI)
  - Foreign faculty and students（AI） — AI1.1、AI1.2
  - Courses taught in English（AI2） — AI2.1、AI2.2
  - International activities (AI3) — AI3.1、AI3.2、AI3.3
- Extension Education Service (AE)
  - Income of extension education（AE1） — AE1.1、AE1.2
  - Investment of extension education (AE2) — AE2.1、AE2.2
- Discipline and Guidance (AD)
  - Student clubs and part-time jobs (AD1) — AD1.1、AD1.2
  - Student loan（AD2） — AD2.1
  - Employment Consulting (AD3) — AD3.1
- General Education (AG)
  - Credits of general education course（AG1） — AG1.1、AG1.2、AG1.3
- Administrative Support (AA)
  - Manpower administrative support (AA1) — AA1.1、AA1.2
  - Number of research rooms（AA2） — AA2.1、AA2.2

Professional (P)
- Faculty（PF）
  - Full and part-time faculty（PF1） — PF1.1、PF1.2、PF1.3、PF1.4
  - Teacher-student ratio（PF2） — PF2.1、PF2.2
  - Ratio of foreign faculty classes（PF3） — PF3.1
- Teaching（PT）
  - Amount of course credits（PT1） — PT1.1、PT1.2、PT1.3、PT1.4、PT1.5
  - Status of students（PT2） — PT2.1、PT2.2、PT2.3
  - Learning programs' selection of students (PT3) — PT3.1、PT3.2、PT3.3
  - Teaching hours of faculty（PT4） — PT4.1、PT4.2
- Research（PR）
  - Publication of books and papers（PR1） — PR1.1、PR1.2、PR1.3、PR1.4
  - International journal papers（PR2） — PR2.1、PR2.2、PR2.3
  - National Science Council projects（PR3） — PR3.1、PR3.2、PR3.3
  - Publication of conference papers（PR4） — PR4.1、PR4.2
  - Journal reviewers & academic rewards（PR5） — PR5.1、PR5.2
  - Ratio of doctoral students（PR6） — PR6.1、PR6.2

Fig. 2 Research structure of this study

Note:

AT1.1: Average funds for student facilities

AT1.2: Average funds for student books

AT1.3: Average funds for student research and training

AT2.1: Average number of domestic and foreign books per student

AT2.2: Number of types of domestic and foreign journals (in hard copy)

AT3.1: Size of school area

AI1.1: Ratio of foreign students

AI1.2: Ratio of foreign faculty members

AI2.1: Ratio of courses taught in English

AI2.2: Ratio of students with General English Proficiency Test in mid-level certificates

AI3.1: Average number of accepted journal papers per full-time faculty member（SCI、SSCI、AHCI）

AI3.3: Number of international cooperation projects/research

AI3.2: Number of international conference papers per full-time faculty member

AE1.1: Amount of income of extension education

AE1.2: Average income of extension education per full-time faculty member

AE2.1: Ratio of full-time faculty members to part-time faculty members of extension education

AE2.2: Ratio of extension education hours to regular education hours

AD1.1: Average number of clubs joined by each student

AD1.2: Average hours spent on part-time jobs per student

AD2.1: Percentage of student loan applications

AD3.1: Number of activities of employment consulting

AG1.1: Percentage of general education credits (broad definition)

AG1.2: Percentage of general education credits

AG1.3: Percentage of common curriculum credits

AA1.1: Ratio of full-time faculty members to administrative manpower

AA1.2: Ratio of students to administrative manpower

AA2.1: Average number of research rooms for full-time assistant professors

AA2.2: Average number of research rooms for full-time lecturers

PF1.1: Ratio of full-time assistant professors to all full-time faculty members

PF1.2: Ratio of full-time professors to all full-time faculty members

PF1.3: Ratio of full-time faculty members with doctoral degrees to all full-time faculty members

PF1.4: Ratio of part-time to full-time faculty members

PF2.1: Weighted ratio of faculty members to students

PF2.2: Ratio of faculty members to students

PF3.1: Ratio of full-time foreign faculty members to all faculty members

PT1.1: Average credits required to graduate with bachelor's degree

PT1.2: Average credits requirements for graduation with master's degree

PT1.3: Average number of course credits opened by department

PT1.4: Average number of credits of selective courses by department

PT1.5: Average ratio of credits of selective courses by department

PT2.1: Registration rate of new students

PT2.2: Graduation rate of students

PT2.3: Dropout rate of students

PT3.1: Ratio of students taking minor degrees

PT3.2: Ratio of students taking double majors

PT3.3: Ratio of courses taken by off-campus students

PT4.1: Ratio of weekly hours of regular teaching for both full-time and part-time faculty members to total students

PT4.2: Average number of weekly teaching hours for full-time faculty members

PR1.1: Number of published books (with formal review process) by full-time faculty members

PR1.2: Average number of published books (with formal review process) by full-time faculty members

PR1.4: Number of published journal papers not listed in SCI, SSCI, AHCI, and TSSCI (with formal review process) by full-time faculty members

PR1.3: Number of published professional books, encyclopedia chapters, and biographies (with formal review process) by full-time faculty members

PR2.1: Average number of published SCI, SSCI, and AHCI journal papers by each full-time faculty member

PR2.2: Average number of published TSSCI journal papers for each full-time faculty member

PR2.3: Average number of citations of each journal paper published in SCI-, SSCI-, and AHCI-listed journals

PR3.1: Average number of National Science Council projects for each full-time faculty member

PR3.2: Average amount of financial support from National Science Council for each full-time faculty member

PR3.3: Average amount of financial support of projects (other than National Science Council) for each full-time faculty member

PR4.1: Average number of international conference papers by each full-time faculty member (with external announcement of calls for papers and formal review process)

PR4.2: Average number of domestic conference papers produced by each full-time faculty member (with external announcement of calls for papers and formal review process)

PR5.1: Ratio of participation as editorial board members/reviewers of journals (with formal review process) for each full-time faculty member

PR5.2: Number of full-time faculty members with national and/or international academic awards/honors

PR6.1: Percentage of doctoral students on overall students

PR6.2: Percentage of doctoral students over graduate students