Applying Fuzzy Analytic Hierarchy Process to Explore the University Organizational Performance in Taiwan

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ABSTRACT

According to the Ministry of Interior, the birth rate in Taiwan reduced from 13.8% to 9% from 2000 to 2006 in Taiwan. The Ministry of Education also indicated that the number of Taiwan's students reduced from 5,384,926 to 5,287,226 from 2003 to 2006. Students reduced about one hundred thousand during this period. The number implied that Taiwan is facing a reduction of enrollment rate in colleges. Therefore, if schools want to increase their enrollment rate in the future, they must have better organizational performance to attract students to join them. This research applied Fuzzy Analytic Hierarchy Process (Fuzzy AHP) to explore the influence of knowledge management (KM), leadership effectiveness (LE) and organizational culture (OC) on the organizational performance (OP). The result showed knowledge management (55.6%) is the most important factor, and the second is leadership effectiveness (28.1%) and the third is organizational culture. Therefore, the study suggested that the university organizations should strengthen the knowledge management and the knowledge transmission to organization members. The university organization should also encourage its members to employ the knowledge management on practical application and to share their knowledge in the organization with each other.

*Keywords***:** *Fuzzy AHP, Knowledge Management, Leadership Effectiveness, Organizational Culture, Organizational Performance*

INTROUDCTION

According to the Ministry of Interior, the birth rate in Taiwan dropped from 13.8% to 9% from 2000 to 2006 in Taiwan. The result indicated that Taiwan faced a low birth rate problem. In turn, it affected the enrollment rate of the universities. The Ministry of Education also indicated that the number of Taiwan's students reduced from 5,384,926 to 5,287,226 from 2003 to 2006. Students reduced about one hundred thousand during this period. The number implied that Taiwan is facing a reduction of enrollment rate in colleges. The influence of the low birth rate on the university cannot be overestimated. It will cause the reduction of the enrollment arte, and the university will encounter a budget shortage to operate further. Therefore, if universities want to run their businesses continuously, the study suggests that universities should promote their efficiency and performance.

Fan (2004) pinpointed that the relationship between transformational and transactional leadership of elementary school principals and school organization performance are closed related. Peng (2005) found that knowledge management is an important factor for organizational performance. Lin (2005) identified that organizational cultural sharing has a direct effect on intellectual capital. Hung (2003) further indicated that knowledge management, organizational culture, leadership style have a positive effect on organizational performance. Now, one can fully understand the importance of knowledge management, leadership effectiveness, and organizational culture on organizational performance. However, the

researches seldom identify the weight ratio of these three factors, i.e. knowledge management, leadership effectiveness, and organizational culture. The identification of these three factors not only can promote performance but also provide important improvement indices to university.

Therefore, the purposes of the study are as follows: (1) to identify the weight ratio of knowledge management, leadership effectiveness, and organizational culture on organizational performance, (2) to find the key performance indicators of organizational performance, and (3) to make a useful suggestion to university organization from this empirical results.

LITERATURE REVIEW

Knowledge Management

For past decade, knowledge management has been given by different definitions. According to Hermans (1999), knowledge management is an intellectual capital which refers to knowledge of employee, professional expertise, know-how, and best practice. PLAUT International Management Consulting (2000) illustrated that knowledge management is an approach in helping employees to share ability and to perform activities effectively. In addition, Sydanmaanlakka (2002) asserted that knowledge management is a process of creation, acquisition, storage, sharing, and application of knowledge.

Knowledge management is a complex cycle. The processes start from creation, discovery, internal knowledge collection, best practice, sharing, understanding useful practice, adjustment, and new contingency application and performance improvement (Yang, 2004). Knowledge management can be regarded as a management process including application, sharing, creation, reconfirmation, collection, introduction, and. Organization (Arthur Andersen, 2000). Tsai (2004) indicated that knowledge management is a management activity of an efficient definition of internal and external knowledge of organization, retrieve, selection, transfer, storage, sharing, application, creation, and utilization to improve organizational advantages.

Leadership Effectiveness

There are about sixty-five classifications on leadership definition. The three major classifications are (a) classified by leaders' trait which means leaders have certain personal characteristics can lead people to accomplish organizational goals, (a) classified by power influence between leaders and subordinates which indicates that leaders will apply power to change subordinates' behavior to finish organizational goals, and (c) classified by means which suggests that leaders set up organizational visions and play an important role to assist members to fulfill organizational goals and satisfy their requirements (Chen, 2004). Leadership effectiveness means that leaders complete organizational or personal goals by affecting organizations and members' behavior and satisfy member's requirement (Chang, 1998).

Most leadership effectiveness evaluations use qualification and output as indices to test the subjects' awareness on the supervisors' leadership effectiveness. The most popular leadership effectiveness indices were directive, supportive, participative, and achievement-oriented (House & Mitchell, 1974). Yukl (1998) suggested that leadership effectiveness includes the degree of organizational goal achievement, the attitude of subordinates toward leader, and the contribution of leaders toward groups' interaction.

Organizational Culture

Organizational culture has a great impact on organizational performance. Gardner (1999) defined that "culture is the invisible force behind the tangibles and observables in any organization, a social

energy that moves people to act. Culture is to the organization what personality is to the individual-a hidden, yet unifying theme that provides meaning, direction and mobilization (p.26)." Gardner further indicated that "because organizational culture has such a profound effect on the behavior of individuals and groups within an organization, it must be clearly understood and appropriately managed to ensure that goals and objectives are achieved." Li (2006) also defined organizational culture into three dimensions: (a) value-sharing belief system, (b) members behavior codes within organization, and (c) interaction results of external environment adjustment.

Schein (2004) divided organizational culture into three levels. At the first and most cursory level is organizational attributes that can be seen, felt and heard by the uninitiated observer. They include the facilities, offices, furnishings, visible awards and recognition, the way that its members dress, and how each person visibly interacts with each other and with organizational outsiders. The next level deals with the professed culture of an organization's members. At this level, company slogans, mission statements and other operational creeds are often expressed, and local and personal values are widely expressed within the organization. Organizational behavior at this level usually can be studied by interviewing the organization's membership and uses questionnaires to gather attitudes about organizational membership. At the third and deepest level, the organization's tacit assumptions are found. These are the elements of culture that are unseen and not cognitively identified in everyday interactions between organizational members. Additionally, these are the elements of culture which are often taboo to discuss inside the organization. Many of these 'unspoken rules' exist without the conscious knowledge of the membership. Those with sufficient experience to understand this deepest level of organizational culture usually become acclimatized to its attributes over time, thus reinforcing the invisibility of their existence.

The approach to study organizational culture will be different depending on the organizational attributes and requirements. Wallach (1983) proposed cultures into three dimensions: (a) bureaucratic cultures which are hierarchical and compartmentalized. These cultures are usually based on control and power, (b) innovative cultures which are exciting and dynamic. People in these cultures fill with challenge and risk, and (c) supportive cultures which are warm and friendly places to work. People in these cultures are friendly, fair and helpful to each other. Wang (1998) also classified school culture into (a) education-directed culture, (b) achievement-directed culture, (c) rule-directed culture, and (d) formalism. Lin & Lin (2005) also indicated that sharing organizational culture has a direct effect on organizational performance.

RESEARCH METHODOLOGY

Fuzzy theory was first proposed by Zadeh in 1965, and its objective is to help in making decisions characterized by imprecise information. However, the traditional Analytic Hierarchy Process (AHP) technique may cause errors and make a difference between evaluation results and real problems because the decision makers' subjective judgment makes the values or relative important inaccurate values into accurate values. Later, the Fuzzy Analytic Hierarchy Process (Fuzzy AHP) was developed to deal with these problems.

The Fuzzy AHP method uses the estimation of an underlying rational scale described by membership functions to express fuzzy information, and allows a more accurate description of the decision making process (Ung, Williams, Chen, Bonsall, & Wang, 2006). Van Larrhoven and Pedrycz (1983) used triangular membership functions to compare fuzzy ratios, and Buckley (1985) use trapezoidal membership functions to determine fuzzy priorities. Therefore, the research applied Fuzzy Analytic

Hierarchy Process (Fuzzy AHP) to evaluate the influence of knowledge management, leadership effectiveness and organizational culture on the organizational performance.

In addition, in order to evaluate the consistency of the judgments, a consistency ratio is introduced. According to Satty (1980), the acceptable level of consistency ratio (CR) was equal to or less than 0.1. If the ratio is greater than 0.1, it indicates an inconsistency in the judgments. The equation of CR equals to CI over RI ($CR=CI/RI$). RI is the random index for the matrix size, and is given in Table 1 (Satty, 1980), and CI is the consistency index.

Table 1: Random Index

m	1	2	3	4	5	6	7	8	9	10
R.I.	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

A questionnaire with the evaluation hierarchy framework was submitted to a related expert group. There are totally 11 education experts from university principals and officers in higher education department in the Ministry of Education of Taiwan to reply the questionnaire. There are three dimensions and twelve measure items (elements) including knowledge management (KM), leadership effectiveness (LE), and organizational culture (OC), and each has four evaluation indicators. The definition is as follows:

1. Knowledge application (KA): to apply knowledge effectively both inside and outside of an organization.
2. Knowledge sharing (KS): to share knowledge both inside and outside of an organization and to be best practice.
3. Knowledge creation (KC): to develop and construct new knowledge of an organization.
4. Knowledge search (KH): to search and collect knowledge both inside and outside of an organization and to be best practice.

The definition of four evaluation indicators of leadership effectiveness is as follows:

1. Directive leadership: leaders give specific instructions on what to do, how to do and set up standards to request subordinates to follow the existing rules and regulations.
2. Supportive: leaders adopt friendly style and care about subordinates. They treat each member equally and create a very heartwarming environment.
3. Participative: Leaders consult opinions with subordinates and take their suggestions as decision references.
4. Achievement-oriented: Leaders set up challenge goals to subordinates and emphasize on excel performance and establish subordinates confidence in order to help them to achieve a high standard performance.

The definition of four evaluation indicators of organizational culture is as follows (Wang, 1998):

1. Education-directed culture which is plans of school culture arrangements, teachers' words and deeds and activities are all directed to the accomplishment of educational goals.
2. Achievement-directed which is the emphasis on the learning achievement, and it means that the concern of the stimulation and learning achievement promotion from education community members.
3. Rule-directed is the emphasis on the regulations. It means that all behavior has to be regulated and can not be over passed.
4. Formalism which is the emphasis on any kind of form, especially the standard formation of grade, gender, and status.

According to the purpose of this study and literature reviews, the frame of the study is shown as follows:
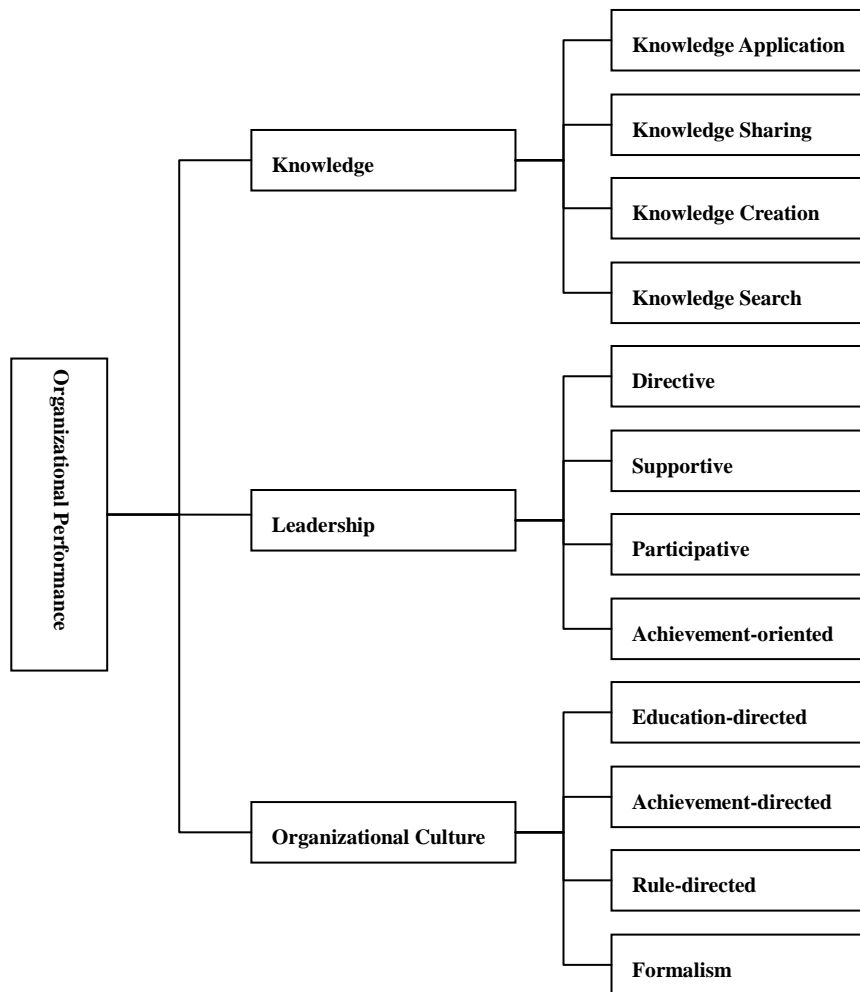
Figure1: Hierarchical Framework

RESULTS AND DISCUSSIONS

As shown in Table 2, the weighting of knowledge management, leadership effectiveness, and organizational culture is 55.6%, 28.1%, and 16.3% respectively. The weighting of four evaluation indicators of knowledge management: knowledge application, knowledge sharing, knowledge creation, knowledge search are 18.385%, 14.084%, 12.732%, and 10.434% respectively. The four items of leadership effectiveness: The weighting of four evaluation indicators of leadership effectiveness: directive leadership, supportive leadership, participative leadership, and achievement-oriented leadership are 12.27%, 7.362%, 4.243% and 4.234% respectively. The weighting of four evaluation indicators of organizational culture: education-directed, achievement-directed, rule-directed, and formalism are 6.02%, 4.613%, 2.988% and 2.684%. The results also indicate that the values of *CR* are all equal to and less than 0.1 which means that there are no inconsistency of judgments (see Table 3).

Table 2: Hierarchical Results

	Weighting	Sequence	Overall indicator sequence
Knowledge Management	0.556	1	
Knowledge Application	0.18385	(1)	1
Knowledge Sharing	0.14084	(2)	2
Knowledge Creation	0.12732	(3)	3
Knowledge Search	0.10434	(4)	5
Leadership Effectiveness	0.281	2	
Directive	0.1227	(1)	4
Supportive	0.07362	(2)	6
Participative	0.04243	(3)	9
Achievement-oriented	0.04234	(4)	10
Organizational Culture	0.163	3	
Education-directed	0.0602	(1)	7
Achievement-directed	0.04613	(2)	8
Rule-directed	0.02988	(3)	11
Formalism	0.02684	(4)	12

Table 3: Consistency Ratio

	C.I.	$\leqq 0.1$	R.I.	C.R.	$\leqq 0.1$
Organizational Performance	0.05	Yes	0.58	0.0862	Yes
Knowledge Management	0.05	Yes	0.9	0.0556	Yes
Leadership Effectiveness	0.02	Yes	0.9	0.0222	Yes
Organizational Culture	0.05	Yes	0.9	0.0556	Yes

The results showed that the weight of knowledge management is the highest (55.6%). It indicated that knowledge management has a great influence on organizational performance. University organizations should emphasize on knowledge management and establish knowledge management team in charge of the integration and interchange of the external and internal knowledge. Then, schools can encourage members to utilization knowledge in the organization practically. Knowledge management also has been applied in many different fields such as high tech industry and insurance industry. Taiwan Semiconductor Manufacturing Company Limited (TSMC) introduced knowledge management to its organization and many employees shared their experiences on network system. The company also applied knowledge management to improve organizational defects and to set up a new business. Thus, the overall company's performances were greatly improved and promoted. Cathy Life Insurance also employed knowledge management by sharing employees' experiences on network system. Their employees can browse predecessors' experiences freely from company's intranet. Therefore, the newly hired employees can learn best practices quickly and effectively and have better performance in the organization.

The results also indicated that knowledge application has a highest weighting (18.385%) among four evaluation indicators items in knowledge management. The original missions of the university education are knowledge creation and development and find a new problem solution method. Besides, the research findings done by any university in any research field are all accessible to the public. Therefore, knowledge circulation, sharing, and creation are a normal practice. If the four items of knowledge management can be regarded as a cycle, and turn internal and external knowledge and best practices into

a knowledge structure to share and apply these experiences in the organization to every member, the overall organizational performance can be promoted.

In addition, leadership effectiveness has the highest weighting in organizational performance (28.1%). The results indicated that the weighting is higher than organizational culture. The directive leadership has a highest weighting among four factors in leadership effectiveness.   It means that in order to promote organizational performance effectively, leaders still need to stand at the foremost position to lead the organization and give subordinates the specific direction to follow.

Finally, the results showed that organizational culture has the lowest weighting (16.3%). It refers that each university has its own organizational culture and difference influence on organizational performance. Also, among four factors in organizational culture, education-directed culture has the highest weighting. It means that university organizational culture does not emphasize on rules or any kind of form rather on plans of school culture arrangement, teachers' behavior, and academic performance to realize the final destination of education.

CONCLUSIONS AND SUGGESTIONS

The study applied Fuzzy AHP to analyze and identify the influence and priority factors on organizational performance of the university in Taiwan. It is the purpose of the study to provide some references to university organizations when they proceed on their organizational development.

The study found that the results of weighting are knowledge management, 55.6%, leadership effectiveness, 28.1%, and organizational culture, 16.3%. The percentage of weighting of knowledge management is more than the sum of leadership effectiveness and organizational culture. Therefore, knowledge management is the most important factor to the organizational development, and knowledge application is the key since it has the highest weighting in four measure items in knowledge management, and it ranks the first in the overall indicator sequence.

The study suggests that university organizations should emphasize on the application of knowledge management. They can establish knowledge management team in charge of the integration and interchange of the external and internal knowledge. Then, they can encourage members to utilization knowledge in the organization practically. By this way, all members will be happy to share their knowledge and become a learning organization.

In addition, leaders in university organization should be very clear to understand the whole organization and the trend of the external environment, and they should give a specific job goal in order to make subordinates understand their job content and how to perform their job. Moreover, university organizations should stick on their educational ideology and promote educational results and academic researches publications. In the meantime, they have to very careful on hiring teachers in order to raise teaching quality and make them have a better learning environment.

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