



Identifying and prioritizing critical intellectual capital for e-learning companies

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Abstract

Purpose – The purpose of this paper is to identify and prioritize the measures of intellectual capital (IC) of e-learning service companies that ultimately influence firms' competitive advantages.

Design/methodology/approach – Through focus group interviews, content analysis, and the analytic hierarchy process, this paper identifies five dimensions and 15 indicators to measure the IC of e-learning service companies in Taiwan.

Findings – The findings and prioritization of ICs can help the e-learning companies to understand the critical success factors that facilitate gaining their competitive advantages in Taiwan.

Research limitations/implications – The focus of this paper is only on e-learning companies located in Taiwan, thus the results cannot be generalized to all e-learning companies. Additionally, only five main dimensions are identified from the study, there is a possibility that this study does not cover all the important dimensions of IC of e-learning companies.

Practical implications – e-Learning companies can use the IC measurement tool developed in this study to detect IC weaknesses and strengths. Moreover, e-learning companies need to re-consider the portfolio of their IC that make e-learning more competitive in industry.

Originality/value – This paper finding contributes to the present body of knowledge and also highlights IC dimensions that can provide a reference for e-learning companies to develop favorable strategies for achieving their goal of enhancing competitive advantages.

Keywords E-learning, Intellectual capital, Taiwan

Paper type Research paper

Introduction

There is no doubt the field of strategic management has been dramatic in the last three decades (Hoskisson *et al.*, 1999; Wright *et al.*, 1994). Plenty of strategic new concepts such as resource-based view (RBV), knowledge-based view, balanced scorecard, and intellectual capital (IC) have emerged. Among them the IC contributes to strategic positioning by providing enhanced understanding of the allocation of organizational resources. Concurrently, IC enables organizations to enhance their performance by providing meaningful information to organizational stakeholders. The importance of IC has grown with the ascendance of arrival of the information age and virtual economy (Litan and Wallison, 2000). As numerous authors have observed, a significant proportion of growth of companies are valued at above book value (Pablos, 2002). Moreover, in the era of information age, the gap between market and book values of a firm has been increasing continuously; consequently, the real value of a firm is no longer correct on its financial statements. Since traditional accounting systems can no longer correctly express the market value of a firm nowadays, to identify the real value of firm should shift from the previous evaluation of tangible assets to the intangible



assets-intellectual capitals. That is why more and more researchers have drawn attention recently on how to evaluate the real value of firms (Stewart, 1997). Although previous scholars had paid great attention to explore IC, little explored IC in e-learning companies the emerging products of information age and virtual economy. Therefore, this study wanted to fill this research gap, which aimed at identifying and prioritizing critical IC for e-learning Companies in Taiwan. This paper referred to the classification of IC adopted by Johnson (1999) and Bontis (1999) as basis and then modified into fit the specific context of E-learning industry by in-depth interviews of focus group. The findings and prioritization of ICs could be helpful to managers for assessing various aspects of IC within an e-learning company, and allocating the company's resources adequately. It also serves as a prototype for setting up a new e-learning company when consider to gauge overall competitive advantages.

On the other side, according to the report of National Science and Technology Program office which indicated, since 2003 Taiwan has integrated e-learning into national projects and many efforts have been made to promote e-learning. Taiwan has promoted the use of digital methods in developing the e-learning Network Science Park. It has encouraged the use of e-learning in government agencies, universities and academic journals, and in business and industry. The Digital Content Development Program Office (Ministry of Economics) conducted an investigation on the production value of the e-learning Industry in Taiwan. The data show that the total production value of this industry in year 2004 was recorded at around US\$0.12 billion, and then fast grew to US\$0.19 billion in 2005. This investigation explores the feasibility of constructing IC indicators of e-learning companies in Taiwan to identify their sources of competitive advantages.

The research proceeds as follows. The following section will provide a brief review of IC. Then we detailed several methodological issues, including data collection, measurements, and analytical procedures. Following, the empirical results and conclusions are presented in Sections 4 and 5, respectively. Finally, in Section 6, we stated the potential contributions of this research to EU-Taiwan partnership relations and worth to be published in professional journal like *European Business Review*.

Theoretical background

Definition, implications of intellectual capital

For a long time the term "intellectual capital" has been used as a synonym for intangible or knowledge assets since the work of Stewart (1991). It has been called "capital" because of its economic roots – the economist Galbraith described it in 1969 as a process of value creation and as a bundle of assets at the same time. The definition by Bueno-Campos (1998) – i.e. "basic competencies of intangible character that allow to create and maintain competitive advantage" – argues how we can tie IC to the RBV. In the mean time, there were still abundant literatures provide a number of definitions of IC (Brooking, 1996; Edvinsson and Sullivan, 1996; Roos *et al.*, 1997; Stewart, 1997; Masoulas, 1998; Nahapiet and Ghoshal, 1998). Brooking (1996) defined IC as the term that given to the combined market, intellectual property, human-centered and infrastructure intangible assets – which enable the company to function. Edvinsson and Sullivan (1996) define IC as knowledge which can be converted to value. Roos *et al.* (1997) define IC as the sum of the "hidden assets" of the company not fully captured on the balanced sheet, and thus it includes both what is in the heads of organizational members, and what is left in the company when they leave. Stewart (1997) defined IC as:

The sum of all the knowledge that all the employees of a company have and which gives it competitive advantages. In other word, it is the intellectual material – knowledge, information, intellectual property, experience – which may be restored to in order to create wealth.

Nahapiet and Ghoshal (1998) defined IC as “the knowledge and knowing capability of a social collectivity, for example an organization, intellectual community, or professional practice.” All of the above definitions agree as to the importance of knowledge to the firm’s value creating process. Another point of consensus is regarding to “intangibles assets” determine the success of companies (Stewart, 1997; Edvinsson and Malone, 1997; Andriessen, 2001). Therefore, managing the IC of the firm has become one of the main tasks on the executive agenda. Nevertheless, this work is especially difficult because of the problems involved in its identification, measurement and strategic assessment (Martin de Castro and López Sáez, 2008). Under this circumstance, to identify the measurements of IC become highly relevant, since they not only allow us to understand the nature of these assets, but also be helpful for firms to conduct strategic management. Yet, despite their strategic nature, all of these assets would not have the same value for the firm, as suggested by Hall (1992, 1993) and Prahalad and Hamel (1990) who both emphasize the importance of certain intangibles. This, prioritizing the kind of difference can be considered as useful help for firm’s strategic management. Such priorities differences in certain ICs can help in making decisions about the actions that the firm must perform and about the implementation of programs that allow maintenance, leverage and building of those more valuable intangible assets (or IC). Hence, in order to explore the relationships between any specific kind of IC and competitive advantage, a clear identification of the main components of IC is required.

Classification and measurements of intellectual capital

There are several frameworks proposed to classify the different components of IC, as well as establish series of indicators for IC measurement. Following the initial IC work, the strategy and economics field began to shift the research to the measurement of IC which dealt with the creation of frameworks, indices and guidelines to support the initial concepts (Sveiby, 1997; Mouritsen *et al.*, 2001; Bontis, 1999; Danish Agency for Trade and Industry – DATI, 2000; Lev, 2001). The literature in the area of IC measurement frameworks is continuously growing as researchers attempt to develop metrics that inform strategy formulation and implementation, improve disclosure, benchmark performance, and predict future business performance (Marr *et al.*, 2003). Despite continuing differences in definitions and conceptualizations, the field is starting to see a consensus is emerging regarding what IC encompasses (Bontis *et al.*, 2002). Generally the measurements of IC have been revisited by different line of research and reconcile components of IC to consist of three basic and strongly interrelated components:

- (1) human capital;
- (2) structural capital; and
- (3) relational capital (Kaplan and Norton, 1992; Saint-Onge, 1996; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997; International Federation of Accountants, 1998; Euroforum, 1998; Bontis, 2001; Meritum, 2002; Warden, 2003).

Human capital represents the individual knowledge stock of an organization as represented by its employees (Bontis *et al.*, 2002). Specifically, human capital includes

employees' capabilities, skills, knowledge, technical expertise, etc. that are currently used (or can potentially be used) in order to create value for the firm (Cohen and Kaimenakis, 2007). Structural capital is the infrastructure firms develop to commercialize their IC (Edvinsson and Sullivan, 1996). Structural capital contains both organizational and technological elements that pursue integration and coordination within the firm. Structural capital was defined as the stocks of patents, trademarks, hardware, software, databases, organizational culture, and organizational capabilities within an organization (Edvinsson and Malone, 1997; Roos *et al.*, 1997). Embedded in organizations, structural capital was the supportive infrastructure of human capital (Bontis, 1999). Initially relational capital was under structural capital in the original model of Edvinsson and Malone (1997). However, Bozbura (2004) argued that relational capital should be separated from structural capital to conduct further discussion. Relational capital was defined as the summation of relationships, interactions, and intimacy of an organization with internal and external stakeholders (Ross *et al.*, 1998); that is to say, relational capital which embraces all the relations the firm has established with its stakeholder groups (such as customers, suppliers, the community, the government, etc).

Besides, Brooking (1996) split the IC of an enterprise into four categories: markets assets, intellectual property assets, human-centered assets, and infrastructure assets. In his classification, he gave a broader concept of market assets which are derived from a company's beneficial relationship with its market and customers. Other IC developed by the intellectus model (IADE-CIC, 2003) which is the result of the work carried out by both academics and practitioners at the Knowledge Society Research Centre in Madrid's Science Park, included five components:

- (1) human capital;
- (2) technological capital;
- (3) organizational capital;
- (4) business capital; and
- (5) social capital.

As can be seen, more detailed classification allows a better understanding of wholly picture of different types of organizational factors and that also encourage dynamic adaptation of IC model to specific context industry, such as the target of this study, e-learning industry. In this study, an adaptive measurement of IC is thus needed in order to reach a better understanding regarding the e-learning companies. Therefore, this study employed the focus group interview techniques to elicited more abundant information from experts who at least work in e-learning industry over three years.

Methods

To identify and prioritize the measurements of IC, this study adopted focus group interviews, content analysis, and the fuzzy analytical hierarchy process (FAHP) for data collection and analysis, respectively.

Sample and data collection

We used convenience sampling to select the interviewees from three e-learning service providers, including SUN NET Technology Corporation Ltd, TSS Technology

Corporation Ltd, and Taiwan Knowledge Bank, which were pioneers in the e-learning market and verified by Sharable Content Object Reference Model. Totally 12 experts from these three companies were participated in focus group interviews, conducted three times and four interviewees by average. The interviewees' age are ranging from 25 to 40, and worked in e-learning industry at least over five years. Among then 64 per cent are male, the rest are female.

Focus group interview

The moderator (researcher) led the group by asking a few open-ended questions and the occasional probe question. A key assumption in focus group research is that individuals possess rich and accurate information, but require moderator help and group interactions before they will volunteer this information (Flores and Alonso, 1995). Focus group interviews may possess the added advantage of increasing participant self-disclosure by reducing power distance. The brainstorming associated with focus group interviews can encourage individuals to divulge information unattainable using traditional information gathering techniques (Bradford *et al.*, 1999). This study gathered some data via focus group interviews conducted in labs fitted with audio/visual equipment and one-way mirrors for observation. Chairs for the moderator and participants were arranged in a circle so that all participants could maintain visual contact with one another. Each interview was recorded by digital recorder. As participants arrived, they were offered refreshments and encouraged to interact with one another to maximize their comfort level prior to starting the interview.

Content analysis method

Based on previous identifications from extant literature review, as well as synthesized from focus group interviews, this study furthermore employed content analysis and fuzzy analytical hierarchical process (AHP) to categorized and analyze the data. To identify the measurement and corresponding indicators of IC, we adopted content analysis to analyze the textual documents (records of focus group meetings). The content analysis is one qualitative research technique that involves classifying textual units into conceptual categories that have particular meanings (Weber, 1990). The goal of content analysis research is to present a systematic and objective description of the attributes of communication. Some researchers have used the frequency with which a conceptual category is discussed in narratives as an indicator of the concept's importance (Abrahamson and Park, 1994; Wade *et al.*, 1997), while others have used the mere presence of a conceptual category as an indication of its salience (Westphal and Zaja, 1998). Since this study is only focus on the appropriateness of measurements, a simple binary code indicating agree or disagree was sufficient for our research purposes. Except the three common dimensions of IC, since e-learning is competent in updating and upgrading with a minimum of cost that make innovation abilities become essential, here we named this abilities as "innovation capital". Service capital defined as organizations to respond fast and accurately to external stimuli (e.g. customer inquiries, complaints, etc.) is another identified capital critical to e-learning service providers.

Totally, this study added two new constructs to the original three elements of IC to form the preliminary measurement framework of IC. A detail description of each dimension and corresponding indicators can be found in Figure 1.

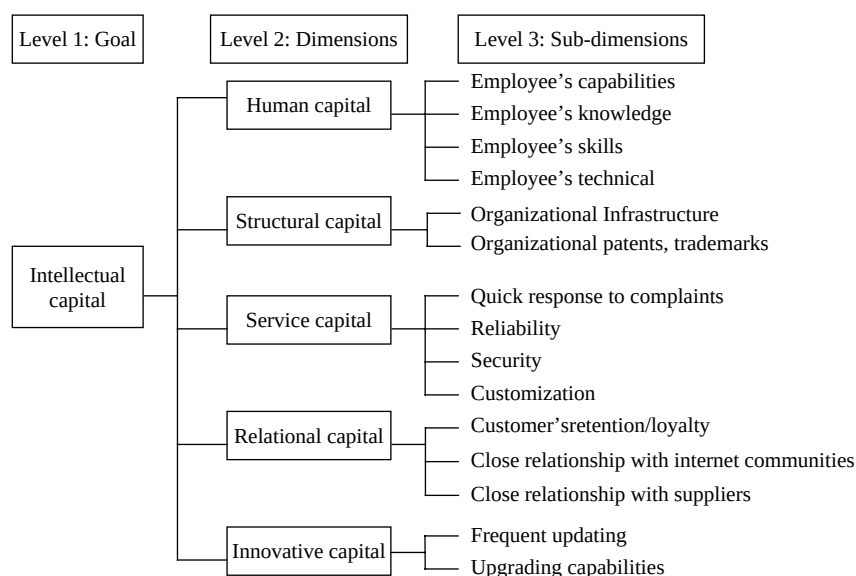


Figure 1.
Hierarchical structure
of intellectual capital

Fuzzy sets theory and fuzzy analytic hierarchy process

Fuzzy sets and membership functions. To deal with the ambiguity of human thought, Zadeh (1965) introduced the concept of fuzzy set theory, which can effectively describe imprecise knowledge or human subjective judgment using linguistic terms. The linguistic terms that people use to express their feelings and judgment are vague. Because linguistic terms merely approximate the subjective judgment of decision makers, the widely adopted triangular fuzzy number technique is used to represent the vagueness of these linguistic terms (Chan *et al.*, 1999). A fuzzy set $\tilde{F}$ in a universe of discourse U is characterized by a membership function $\mu_{\tilde{F}}(x)$ which associates a real number in the interval $[0,1]$ with each element x in X , to represent the grade of membership of x in $\tilde{F}$. A triangular fuzzy number is a special type of fuzzy set, widely used in fuzzy applications. As shown in Figure 2, a triangular fuzzy number can be defined as $\tilde{T} = (l, m, u)$ and its membership function is equal (Kaufmann and Gupta, 1991) to:

$$\mu_{\tilde{T}}(x) = \begin{cases} \frac{x-l}{m-l}, & l \leq x < m \\ \frac{u-x}{u-m}, & m \leq x < u \\ 0, & \text{otherwise} \end{cases}$$

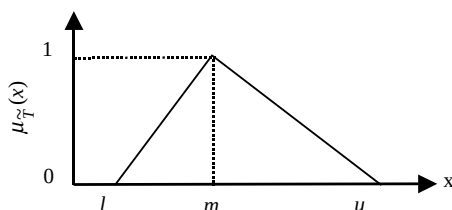


Figure 2.
Triangular fuzzy
number $\tilde{T}$

where l and u are the lower and upper limits of the support of $\tilde{T}$, respectively, and m is the mid-value of $\tilde{T}$.

α -Cut of triangular fuzzy number

The α -cut of a fuzzy number $\tilde{T}$ is the crisp set $\tilde{T}^\alpha$ that contains all the elements of the universal set U whose membership grades in $\tilde{T}$ are greater than or equal to the specified value α , as shown in Figure 3. By defining the interval of confidence at level α , the α -cut of a triangular fuzzy number $\tilde{T}$ is defined (Zimmerman, 1991).

De-fuzzification

As that of most fuzzy model, we had to convert the final fuzzy data into a crisp value. Here, we suggest the distance measurement method which can be used for de-fuzzification. The distance between two triangular fuzzy numbers can be defined using the vertex method (Chen, 2000). Let $\tilde{T}_1 = (l_1, m_1, u_1)$ and $\tilde{T}_2 = (l_2, m_2, u_2)$ be two triangular fuzzy numbers; the distance $d(\tilde{T}_1, \tilde{T}_2)$ between them calculated as:

$$d(\tilde{T}_1, \tilde{T}_2) = \sqrt{\frac{1}{3} [(l_1 - l_2)^2 + (m_1 - m_2)^2 + (u_1 - u_2)^2]}$$

Based on the fuzzy set theory, we interviewed eight middle- or high-level managers from the e-learning service companies in Taiwan to evaluate the IC hierarchical framework. Middle- or high-level managers and the key decision-makers were selected because of their familiarity with multiple aspects of their organizations.

The paper of the interview was to collect participants' opinions, to measure the relative weight of influences of each dimensions of IC on sustainable competitive advantages of e-learning companies. Therefore, these participants were asked to complete the conventional AHP questionnaire by their professional and subjective judgments. Here, we presented some essential calculation steps used in this study and explained as follows:

- (1) *Establishing the hierarchical structure.* Construct the hierarchical structure with decision elements, decision makers are requested to make pair-wise comparisons between decision alternatives and criteria using a nine-point scale. All matrices are developed and all pair-wises comparisons are obtained from each eight decision maker.
- (2) *Constructing the fuzzy positive reciprocal matrix.* The pair-wise comparison scores are transformed into linguistic variables, which are represented by fuzzy

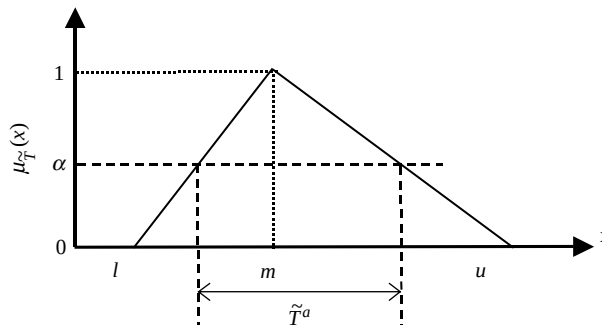


Figure 3.
 α -Cut of triangular fuzzy
number $\tilde{T}$

numbers (Table I). A fuzzy reciprocal judgment matrix $\tilde{A}^k$ (for decision maker k) can be established as $\tilde{A}^k = [\tilde{a}_{ij}]^k$, where $\tilde{a}_{ij}^k = 1$, $\forall i = j$, $\tilde{a}_{ji}^k = 1/(\tilde{a}_{ij}^k)$, $\forall i, j = 1, 2, \dots, n$.

- (3) *Calculating the consistency.* To ensure that the priority of elements is consistent, the maximum eigenvector or relative weights and $\lambda_{\max}$ is calculated. Then, compute the consistency index (CI) for each matrix order n using equation (1). Based on the CI and random index (RI), the consistency ratio (CR) is calculated using equation (2). The CI and CR are defined as follows (Saaty, 1980):

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (1)$$

$$CR = \frac{CI}{RI} \quad (2)$$

where n is the number of items being compared in the matrix, $\lambda_{\max}$ is the largest eigenvalue, and RI is a random CI obtained from a large number of simulation runs and varies upon the order of matrix (Table II).

- (4) *Calculating fuzzy weights value.* In line with the Lambda-Max method proposed by Csutora and Buckley (2001), the fuzzy weights of the hierarchy can be calculated. The calculation process is described as follows:

- Let $\alpha = 1$ to get the positive matrix of decision maker k , $\tilde{A}_m^k = [a_{ijm}]^{nxn}$, then apply the AHP to calculate the weight matrix W_m^k :

$$W_m^k = [w_{im}^k], \quad i = 1, 2, \dots, n$$

- Let $\alpha = 0$ to obtain the lower bound and upper bound of the positive matrix of decision-maker k , $\tilde{A}_l^k = [a_{ijl}^{kn}]$ and $\tilde{A}_u^k = [a_{iju}^{kn}]^{nxn}$, and then, apply the AHP to calculate the weight matrix, W_l^k and W_u^k :

Linguistic variables	Fuzzy number	Triangular fuzzy numbers
Equally important	$\tilde{1}$	(1,1,1)
Intermediate	$\tilde{2}$	(1,2,3)
Weakly more important	$\tilde{3}$	(2,3,4)
Intermediate	$\tilde{4}$	(3,4,5)
Strongly more important	$\tilde{5}$	(4,5,6)
Intermediate	$\tilde{6}$	(5,6,7)
Very strongly more important	$\tilde{7}$	(6,7,8)
Intermediate	$\tilde{8}$	(7,8,9)
Absolutely more important	$\tilde{9}$	(9,9,9)

Table I.
Triangular fuzzy
numbers

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.58

Source: Saaty (1980)

Table II.
Random index

$$W_l^k = [w_{il}^k], \quad i = 1, 2, \dots, n; \quad W_u^k = [w_{iu}^k], \quad i = 1, 2, \dots, n$$

- To ensure the fuzziness of weight, two modified constants, are calculated as follows:

$$S_l^k = \min \left\{ \frac{w_{im}^k}{w_{il}^k} \mid 1 \leq i \leq n \right\}; \quad S_u^k = \max \left\{ \frac{w_{im}^k}{w_{iu}^k} \mid 1 \leq i \leq n \right\}$$

- Then use the modified constants to obtain the lower bound and higher bound of the weight matrix:

$$w_{il}^{*k} = S_l^k w_{il}^k; \quad i = 1, 2, \dots, n \quad w_{iu}^{*k} = S_u^k w_{iu}^k, \quad i = 1, 2, \dots, n$$

Thus, the lower and upper bound weight vectors are w_{il}^{*k} and w_{iu}^{*k} , $i = 1, \dots, n$.

- Aggregating the lower, the middle, and the upper bound weight vectors, the fuzzy weight matrix for decision maker k can be obtained, and is defined as:

$$\tilde{W}_i^k = (w_{il}^{*k}, w_{im}^k, w_{iu}^{*k}), \quad i = 1, 2, \dots, n,$$

and through the arithmetic mean method to incorporate the opinions of decision-makers, calculated as:

$$\tilde{\tilde{W}}_i = \frac{1}{K} (\tilde{W}_i^1 \oplus \tilde{W}_i^2 \oplus \dots \oplus \tilde{W}_i^K)$$

where, $\tilde{\tilde{W}}_i$: the fuzzy weight of decision makers i is incorporated with K decision makers.

The ranking order of the decision elements is determined by $R_{\tilde{w}_i}$, which can be expressed as follows:

$$R_{\tilde{w}_i} = \frac{d^-(\tilde{w}_i, 0)}{d^-(\tilde{w}_i, 0) + d^*(\tilde{w}_i, 1)}, \quad i = 1, \dots, n; \quad 0 \leq R_{\tilde{w}_i} \leq 1$$

where $d^-(\tilde{w}, 0)$ and $d^*(\tilde{w}, 1)$ are the distance measurements between two fuzzy numbers. The weight ω_i for decision element i is the normalization of $R_{\tilde{w}_i}$, which can be expressed as:

$$\omega_i = \frac{R_{\tilde{w}_i}}{\sum_{i=1}^n R_{\tilde{w}_i}}, \quad i = 1, 2, \dots, n.$$

Results and discussions

This study attempts to identify the IC content of Taiwanese e-learning service providers. Through detailed analysis of the pertinent literature of IC and focus group interviews, the fuzzy AHP framework of IC is structured as a hierarchy which includes

three levels: goal, dimensions (five dimensions), and the corresponding descriptions for determining the priority strategies. Accordingly, the results are presented in Table III.

According to the final weights for the five dimensions of IC as shown in Table I, “human capital” (0.256) and “service capital” (0.204) are the two most important dimensions contributed to IC for the Taiwanese e-learning service providers, followed by “innovative capital” (0.200), “Relational capital” (0.195) and “Structural capital” (0.145). The sub-dimensions “Employee’s capabilities” (0.352), “Organizational Infrastructure” (0.672), “Reliability” (0.316), “Customers retention/loyalty” (0.535), and “Frequent updating” (0.752) show the highest importance with respect to each dimension (“human capital”, “structural capital”, “service capital”, “relational capital”, and “Innovative capital”, respectively).

The relatively, slight difference in weights between the five dimensions implies they have equal importance. Nevertheless, the dimension weighting of “human capital” was the highest, which indicates that human-resources (employee’s capabilities, knowledge, skills and technical expertise) is key to construct solid IC in e-learning service companies.

This result provides further support for human capital is the most important intangible assets, because it is the source of other capitals (Bontis, 1998). Human capital builds structural capital, service capital, relational capital and innovative capital which can be seen as a consequence of human creativity, similar to that which occurs with financial capital of Viedma (2001). Also the human element has become increasing important because knowledge has become a crucial competitive advantage, especially in the new economy landscape (Grant, 1996). Firm performance can be

Dimensions/sub-dimensions	Weight of each dimension (ranking)	Weight of within dimensions (ranking)
<i>Human capital</i>	<i>0.256 (1st)</i>	
Employee’s capabilities		<i>0.352 (1st)</i>
Employee’s knowledge		0.252 (3rd)
Employee’s skills		0.123 (4th)
Employee’s technical expertise		0.273 (2nd)
<i>Structural capital</i>	<i>0.145 (5th)</i>	
Organizational infrastructure		<i>0.672 (1st)</i>
Organizational patents, trademarks		0.328 (2nd)
<i>Service capital</i>	<i>0.204 (2nd)</i>	
Quick response to complaints		0.291 (2nd)
Reliability		<i>0.316 (1st)</i>
Security		0.168 (4th)
Customization		0.226 (3rd)
<i>Relational capital</i>	<i>0.195 (4th)</i>	
Customers retention/loyalty		<i>0.535 (1st)</i>
Close relationship with internet communities		0.212 (3rd)
Close relationship with suppliers		0.253 (2nd)
<i>Innovative capital</i>	<i>0.200 (3rd)</i>	
Frequent updating		<i>0.752 (1st)</i>
Upgrading capabilities		0.248 (2nd)

Note: CI and CR values of each dimensions < 0.1

Table III.
Weighted dimensions
and sum-dimensions of
intellectual capital

enhanced by the manner how firms use human resources for strategy development and implementation (McDevitt, 2003; Wright *et al.*, 1995). "Service capital" was weighted as the second most important. The result supports the idea that service organizations should focus on keeps high service quality with reliability and quick response. Therefore, we proposed the FAHP method to identify the priority of IC to implement strategic improvement plans for e-learning companies.

Findings and implications

As shown in Table II, "human capital" (0.256), "service capital" (0.204), and "innovative capital" (0.200) are the top three important dimensions contributed to IC for the Taiwanese e-learning service providers. This implies strong human capital is the dominant factor to succeed in e-learning industry. The types of e-learning offerings are consisting of three major categories: content, technology, and services. Since Taiwan has been known to be one of the key countries in terms of its information technology, e-learning companies are almost indifferent in technology. The reasons of "service capital" and "innovation capital" ranked the top three probably because these two capitals represented the service competencies and innovative capabilities in content, respectively, and these two are more important to win the competitive advantages of e-learning companies in Taiwan. Therefore, the e-learning service companies should put more resources on building human resources, and recruit those who are high in service competences and creativity.

Although the literature has contributed to identifying many dimensions of IC, little is known regarding their relative importance. Prioritizing dimensions and sub-dimensions of IC can be considered as a complex multi-attribute decision-making problem, and the relative importance of dimensions can be effectively obtained using the fuzzy AHP approach. Hence, this study proposes a fuzzy evaluation model for decision makers, to allow them to evaluate the relative weights of dimensions and sub-dimensions of IC. The Taiwanese e-learning service companies are used as an empirical case to illustrate the feasibility of the proposed approach.

The main contributions of this study are twofold. First, based on literature review, focus group interviews, and content analysis technique, an analytic hierarchy is constructed, of the five dimensions comprise of ICs (human capital, structural capital, service capital, relational capital, and innovative capital), which are than subdivided into the 15 most important sub-dimensions. Managers should be able to build more effective IC by focusing on these main dimensions. Second, this study integrates triangular fuzzy numbers and AHP to develop a fuzzy evaluation model which determines the relative weights of these dimensions and sub-dimensions of IC. This evaluation model can provide guidance to managers in identifying the priorities of building IC and thus finding the best policy to promote improvement plans.

From a management perspective, the findings presented in this study provide suggestions to managers regarding the priorities of building IC to gain sustainable competitive advantages. First, make an increased effort to build human capital, and to foster a capable employee teams to enable the function of IC. Second, managers must consider that service characteristics of e-learning, that service quality and customer loyalty are second important for building strong IC.

This research has some potential limitations. However, IC is a complex, intangible subject and undoubtedly the subjectivity of researchers and e-learning service

companies has led to errors. This study is merely exploratory, and represents merely an initial attempt to investigate IC reporting practices in the e-learning service companies in Taiwan, and further work must be required in several ways since the present work suffers from several weaknesses. First, this study used only a small sample, and the first step for any future study should be to use a larger sample to enable the inclusion in the analytical hierarchy process model. Thus, the results cannot be generalized beyond e-learning web professional service firms without further research (Rohm and Rohm, 2004). Also, this study focused on one industry, as it was necessary to compare resource effects across firms. Additionally, the analysis should be extended longitudinally to monitor the progress and development of IC reporting practices. Pursuing these research directions will provide a more complete picture of annual IC reporting practices in the Taiwanese e-learning platform industry. Measurement of IC also offers a means of helping in designing business strategy (Marr *et al.*, 2003; Banerjee and Chau, 2004; Wani *et al.*, 2003). These indicators also provide a basis for evaluation by venture capitalists, and enable the resource allocation for e-learning platform companies. Thus, the findings regarding the content of IC are indeed important.

Taiwan's e-learning to facilitate the EU-Taiwan partnership relations

The European Commission officially opened the European Economic and Trade Office in Taipei on 10 March, 2003. Once in 2004, the EU was Taiwan's largest investor. And Taiwan was the EU's 10th largest source of imports in 2006. Overall, Taiwan is the EU's 14th largest trade partner, reflects the increasingly close economic and trade relations between Europe and Taiwan. Since EU-Taiwan has established a solid relationship, the knowledge of Taiwanese people toward Europe is quite deficient and inadequate, vice versa. In Taiwan, there is a big imbalance in the distribution across the various departments of teachers who studied in Europe. Aside from the academic and research, Taiwan's media report less about the new business opportunities in Europe compare with Asia and USA. Taiwan's business magazines keep talking about China's rise, and lost another important piece of the world – the EU.

Owing to the shortage of knowledge with regard to doing business with each other in EU-Taiwan relations, the e-learning companies could provide a coordination and communication platform to benefit both sides. Therefore, based on the findings of this study, the governments and nongovernment organizations could build an effective e-learning information exchange platform to provide people of EU and Taiwan with excellent opportunities to network and share business experiences that facilitate the EU-Taiwan partnership relations.

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