

# Measuring organizational impacts by integrating competitive intelligence into executive information system

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**Abstract** Despite the progress that has been achieved using modern methods of decision support, competitive intelligence is one of the most economical methods of instrument for executive information system with a relatively high rate of effectiveness. The objectives of this study are (1) to investigate the conception of competitive intelligence and the furtherance of competitive intelligence on the executive information system stage; (2) to form an innovative structural equation modelling for executive information system through the perspectives of competitive intelligence; (3) to examine the influences of competitive intelligence on executive information system and organizational performances. Questionnaire survey methodology was applied to receive data from executives in Taiwan. The process, the product of competitive intelligence, and organizational performances were observed as three considerable axes in this investigation. The results reveal testimony that competitive intelligence is positively related to organizational performances, indicating that competitive intelligence does influence the behavior of decision-making both of enterprise executives and the entire organization. The findings of this study disclose that integrating competitive intelligence activities exert a complete function on executive information system for enterprise executives.

**Keywords** Executive information system · The process of competitive intelligence · The product of competitive intelligence · Organizational performances

## Introduction

Competitive intelligence refers to actionable information about external business environment that could influence a competitive position in organization (Fair 1966; Hambrick 1981). Competitive intelligence is not a euphemism of industrial intelligencer or economic espionage (Nolan 1993; Prescott 1995; Chen et al. 2002). A key maxim of competitive intelligence is that 90 % of all information that a company needs to make critical decisions and to understand its market and competitors is already public or can be systematically developed from public data (Hambrick 1981; Gilad and Gilad 1988; Gordon 1989; McGonagle and Vella 1998; Teo and Choo 2001). The concept of competitive intelligence has a rich inheritance (Prescott 1995; Ahituv et al. 1998; Juhari and Stephens 2006) and can be tracked back over 5000 years of Chinese history (Prescott 1995; Subramanian and IsHak 1998; Juhari and Stephens 2006). Blankenship et al. (1998) assert competitive intelligence involves three elementary functions: the collection and storage of data, the analysis and interpretation of information, and the dissemination of intelligence.

Competitive intelligence is the component of business intelligence aimed at gaining strategic advantage (Porter 1980; Gilad and Gilad 1988; Fuld 1995; Prescott 1995; McGonagle and Vella 1998; Zheng et al. 2012). In itself, competitive intelligence is regarded as a system of environmental scanning which also unifies the knowledge of everyone in organization (Daft and Macintosh 1981; Belich and Dubinsky 1999). Competitive intelligence is not just market research or business scanning but both a process and a product (intelligence) (Gilad and Gilad 1988; Ahituv et al. 1998; Kahaner 1998).

Prior studies have paid a great attention to comprehending on the research of competitive intelligence such as the

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design and implementation of effective systems and managerial processes for intelligence gathering and utilization (Babbar and Rai 1993); an empirical study on information collection (Cronin et al. 1994); CEO and CIO perspectives on competitive intelligence (Vedder et al. 1999); competitive intelligence practitioners' moral awareness in business organizations (Butterfield et al. 2000); the quality of competitive intelligence (Teo and Choo 2001); propagation of competitive intelligence (Marin and Poulter 2004); a multi-phase precedent to marketing strategy (Dishman and Calof 2008); the construct exploration, validation and equivalence (Saayman et al. 2008); competitive intelligence process and tools for analysis (Bose 2008); a managerial perspective (Qiu 2008) and other types of studies (Tao and Prescott 2000; Kannan 2002; Calof and Wright 2008; Michaeli and Simon 2008; Zangouinezhad and Moshabaki 2009; Strauss and Toit 2010; Zheng et al. 2012), which probably encourage current and potential researchers to take an innovative research vision on those broad competitive intelligence subjects. Although their findings are meaningful, the actual supporting actor of competitive intelligence in executive information system is still inconclusive.

In order to consolidate aforementioned relationship, this study provides a concept to both academicians and practitioners on how to conduct a comprehensive quantitative strand in terms of competitors, competitive environment, competitive situation and competitive strategy through proactive competitive intelligence activities. It is also necessary to understand how factors related to competitive intelligence and situational factors (e.g., competitors' situation and environmental conditions) that influence the causal relationship between executive information system and organizational performances.

The practice of competitive intelligence is not new (Bergeron and Hiller 2002). A review of previous studies affords no model to represent how to present competitive intelligence as a supporting actor for executive information system in Taiwan (Tao and Prescott 2000; Toit 2003; Tanev and Balletti 2008; Adidam et al. 2012; Yap et al. 2012; Vidigal 2013). This study attempts to form a structural equation model which in consists of competitive intelligence process (Badr et al. 2006), and the product of competitive intelligence (Teo and Choo 2001). The innovative conceptual model is able to support those enterprise executives on decision-making with the perspectives of competitive intelligence (Herring 1992; Calof and Dishman 2002; Marin and Poulter 2004; Badr et al. 2006; Dishman and Calof 2008; Saayman et al. 2008). The study outlines this research purposes as follows:

- (1) To investigate the conception of competitive intelligence and the furtherance of competitive intelligence on the executive information system stage.
- (2) To form an innovative structural equation modelling for executive information system through the perspectives of competitive intelligence.
- (3) To examine the influences of competitive intelligence on executive information system and organizational strategic performances.

## Theoretical framework

### The process of competitive intelligence

The formal exploration process of the marketing strategy paradigm has been linked with the environmental scanning literature as a basis for gathering and processing the information and the information processing theory exemplification (Daft and Macintosh 1981; Culnan 1983; Daft et al. 1988; Marin and Poulter 2004). In fact, the importance of environmental scanning has often been linked to firm performances (Daft and Macintosh 1981; Daft et al. 1988; Glueck and Jauch 1994; Dishman and Calof 2008). Belich and Dubinsky (1999) summarize the integration of environmental scanning and information processing for effective strategic decision making as "The ability to develop adequate organizational mechanisms for information acquisition, dissemination, and effective utilization may be precursors to identifying and effectively adapting to major market shifts".

Strategy is a framework within which decisions are made, reflecting the future of an organization and the direction which it should take (Badr et al. 2006). Feurer and Chaharbaghi (1995) discuss how the formulation of competitive strategies are developed using a structured process which requires a knowledge base of external environment together with an understanding of the potential impact of different strategies. They also identified another important factor in the formulation of strategy, is to reflect the dynamics of change in the market or industry (Feurer and Chaharbaghi 1995). The development of strategies can, and should, rest heavily on the current market situation without considering all potential which could cause the failure of a strategy. Although there is an extensive body of literature on strategic planning and strategy formulation, there is still a lack of a suitable framework, which can provide the basis for integrating competitive intelligence into the executive information system process. Badr et al. (2006) examine four stages of the strategic decision making process and its relationship with competitive intelligence. In addition, competitive intelligence is also a process of knowing what the competition is up to and staying on step ahead of them, by gathering information about competitors and, ideally, applying it to short and long-term strategic planning (Ettorre 1995; Teo and Choo 2001). Kahaner (1998) argues that competitive intelligence is conceptualized as a process of monitoring the competitive environment, with a

goal to provide actionable intelligence that will provide a competitive edge to the organization.

According to well-established theories and previous empirical studies in competitive intelligence (Herring 1992; Calof and Dishman 2002; Badr et al. 2006), the process of competitive intelligence constructs comprises four dimensions: (1) setting strategy objectives; (2) strategic analysis; (3) strategy formulation; and (4) implementation and control (Calof and Dishman 2002; Badr et al. 2006; Dishman and Calof 2008). Saayman et al. (2008) verify the process of competitive intelligence and comprised six primary stages which in terms of planning and focus; collection; analysis; communication; process; organizational awareness which also proposed by Calof and Dishman (2002), to measure the direct impact on all of the various phases in a model of competitive intelligence, the process can have a discrete beginning and end or it can be ongoing and iterative, designed to gather and disseminate information throughout an entire business ecosystem. Therefore, first hypothesis is stated as follows.

**H1.** *The process of competitive intelligence is positively related to executive information system.*

### The product of competitive intelligence

Teo and Choo (2001) reveal the construct of product of competitive intelligence encompasses two dimensions: primary and secondary product. Primary product of competitive intelligence is defined as the gathering of intelligence specifically for the project at hand. Secondary product is determined as the research for available intelligence, which already gathered for some other purpose (Graef 1997; Soh et al. 1997; Gilad and Gilad 1988; Teo and Choo 2001). As the literature review (Prescott 1995; Graef 1997; Yovovich 1997; Haynes et al. 1998) on the product of competitive intelligence, the primary product is a priority which needed to acquire for executives' executive information system (e.g. patent information and new product/service/customer feedback information). The secondary product is a necessary to get which may benefit a firm in a long term business strategy formulation. Teo and Choo (2001) collect the major related competitive intelligence products that a firm may study and evaluation for executive information system. Thus, the following hypothesis is put forth.

**H2.** *The product of competitive intelligence is positively related to executive information system.*

### Executive information system

Executive information system comprises one of the major expansions in information systems discipline (Burststein and Holsapple 2008a,b). Holsapple and Joshi (2001) allege decision-making episodes are knowledge intensive processes, operating on and adding to organizational knowledge

resources. Executive information system performs some of the knowledge management that is integral to these episodes. Executive information system is an information system that provides information, in order to support a decision maker in making decisions effectively in multiple and unstructured tasks (Finlay and Forghani 1998). Liang and Hung (1997) assert the increased competition, along with rapid development of new information technologies. It is often believed that using information properly to support decision making can be powerful weapon for competitive advantage. Simon (1957, 1997) proposes a three-phase process of decision making: the intelligence phase, the design phase and the choice phase. Executives are especially dependent on doing the first of these, the intelligence phase as called the competitive intelligence phase well.

The current competitive environment may be even more volatile and unpredictable due to increased globalization, mergers and acquisitions, and an explosion in technology applications and new business practices (Walters et al. 2003). In particular, executives need the following supporting functions for their decision-making: (1) an early warning of threats and opportunities; (2) support for the strategy development process; (3) assistance within instilling a sense of urgency and motivation toward action; (4) support for strategic and operational decision making (Sauter and Free 2005). Moreover, enterprise executives' cognitive limits require some prioritization of information (Simon 1957, 1997). Enterprise executives need accurate, timely information in order to make effective decision. Attention is often focused on key subsets of the available data, while some potentially external important data sources are ignored (Hair et al. 2006).

Additionally, strategic decisions in many firms are often influenced by design characteristics of the firm's scanning systems (Hambrick 1981; Yasai-Ardekani and Nyström 1996). Daft et al. (1988) claim that as uncertainty increased, information processing activities raised. Environmental uncertainty therefore leads to increasing information processing activities within firms (Daft and Macintosh 1981; Culnan 1983). Regardless of the complexity and uncertainty inherent in any environment, information processing (a firm's ability to adapt to existing market conditions) is largely dependent on its ability to process relevant market information effectively (Egelhoff 1982). Thus, the executive information system is crucial to certain strategic decisions which may instrumental to the growth of strategic effectiveness in organization.

### Organizational performances

Technologies such as executive information systems are helpful in solving many kinds of problems, especially those that are based on quantitative data and/or are tactical in scope (Liang 1988; Walters et al. 2003; Sauter and Free 2005).

Sauter and Free (2005) asserted that decision makers can benefit greatly from an instrument that tracks and organizes qualitative and other nebulous information. Such a tool would help cultivate and leverage an organization's intellectual assets to help executives addressing decision making in a more informed fashion. Glueck and Jauch (1994) examine several studies (e.g. Miller and Friesen 1977; Glueck and Jauch 1994) and determine that in all of the studies that they reviewed, a positive correlation between environmental assessment and performances was demonstrated. A considerable amount of research has emerged on the subject of competitive intelligence and its relationship to the strategic planning process. The literature based on CI often stresses its importance on organizational benefits (Teo and Choo 2001; Dishman and Calof 2008).

Competitive intelligence supports a company a competitive advantage and better organization performances by permitting better business planning; new product introduction success and new market development (Porter 1980; Daft et al. 1988; Gordon 1989; DeWitt 1997; Ahituv et al. 1998). Brockhoff (1998) contends that better information, including competitor technological intelligence information is needed to better support strategic decision (Daft et al. 1988; DeWitt 1997; Teo and Choo 2001).

Enterprise executives are commonly agreed that competitive intelligence directly affect the consequence of a corporation, researches tried to measure the value of competitive intelligence to organizations although a proof for this assumed impact could not be easily identified (Bagozzi et al. 1991; Herring 1992; Calof and Dishman 2002; Saayman et al. 2008). The significant questions that researchers in the field of competitive intelligence have tried to answer but still face whether enterprises are able to quantify the performances.

The organizational performances of improved executive information system are indicated by revenue prospect, cost evaluation and managerial effectiveness. These strategic benefits improve the overall performances of an organization (Stanton et al. 1994; Teo and Choo 2001). Competitive intelligence supports a firm a competitive advantage (Fuld 1995; Kahaner 1998; McGonagle and Vella 1998). Subramanian and IsHak (1998) claimed that firms having advanced systems to monitor their competitors' activities exhibited greater profitability. By integrating competitive intelligence, executive information system makes it possible to take advantage of the cost evaluation of streamlining the supply-to-demand chain to maximize competitive advantage. Managerial effectiveness is also enhanced through the combination of competitive intelligence, which is positively related to firm performances. Improved executive information system through competitive intelligence allows better business programming, enhanced rapidity of decision-making and improved accuracy of decision-making. Customer relationships can be built or strengthened though the improved convenience of on-

demand access to essential information. Consequently, it is expected that better competitive intelligence would enhance organizational flexibility, responsiveness to customer needs and production operations, decision making speed and accuracy, and improving forecasting accuracy (Teo and Choo 2001). Therefore, the following hypothesis is proposed.

**H3.** *Executive information system through competitive intelligence activities will have direct influence on organizational performances.*

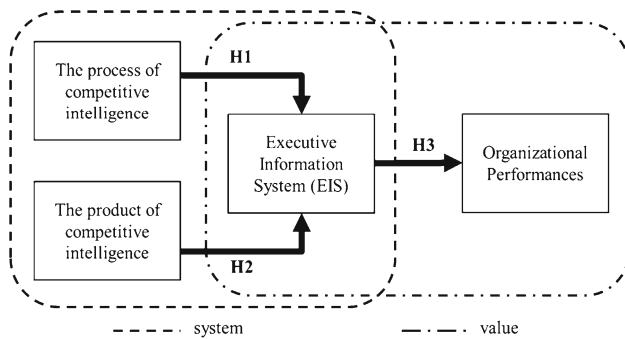
The empirical part of this study does not solely focus on issues like the development of competitive intelligence in Taiwan or the organizational circumstances of competitive intelligence practices in Taiwanese based enterprises, the review of the existing competitive intelligence literatures yielded the blurred in the existing literature that this study wants to close. As a matter of fact, both competitive intelligence academicians and practitioners around the world have to deal with the challenge of justifying their work without being able to measure the outcomes of their activities. In the current academic literature a few attempts were made to fill this gap but they were not quite abundant (Calof and Dishman 2002; Calof and Wright 2008; Dishman and Calof 2008; Saayman et al. 2008).

## Research framework

### Theoretical model

Burstein and Holsapple (2008a) argue that executive information system research is a core area of the information systems discipline. Assessing the value of executive information systems is an important line of research. Traditionally, researchers adopt user satisfaction and decision performance to measure executive information systems success (Hung et al. 2007). Doll and Torkzadeh (1991) describe a system-to-value chain of system success constructs. The constructs vary from beliefs, to attitudes, to behavior (system-use), to the social and economic impacts of information technology. The theory of system-to-value chain suggested an alternative assignment for the usage construct in a downstream research agenda—as an independent variable (Doll and Torkzadeh 1991 as quoted in Teo and Choo 2001). Doll and Torkzadeh (1998) adapt the multidimensional measure of system-to-use which is identified by Hirschhorn and Farduhar (1985) to measure downstream impact of system on work. These researchers assert that a multidimensional system-use measure enables investigation into the patterns and extent of system usage along organizationally relevant dimensions (Doll and Torkzadeh 1998; Teo and Choo 2001). In this similar research vein, this study applies competitive intelligence as an exceptional construct which can support enterprise executive on decision-making. In previ-





**Fig. 1** Research framework

ous literature review, competitive intelligence also provides the systematically continuous external information (Culnan 1983; Prescott 1995; Kahaner 1998). This study examines the consequences of competitive intelligence on executive information system and its subsequent effects on organizational performances (Fig. 1).

## Research methodology

### Operationalization of variables

According to completions of literature review (Simon 1957, 1997; Fair 1966; Porter 1980; Gilad and Gilad 1988; Gordon 1989; Herring 1992; Stanton et al. 1994; Kahaner 1998; McGonagle and Vella 1998; Shane 2000; Teo and Choo 2001; Calof and Dishman 2002; Peyrot et al. 2002; Walters et al. 2003; Sauter and Free 2005; Badr et al. 2006; Calof and Wright 2008; Saayman et al. 2008; Miao and Liu 2010), Table 1 summarizes the operational definitions of constructs, variables and their citations.

### Questionnaire development

A questionnaire survey was conducted to collect data for this empirical study. On the basis of previous literature review, organizational strategic performances appear when enterprise executives adopt competitive intelligence activities on executive information system. Table 2 compiles the questions utilized to assess the extent of competitive intelligence activities on executive information system and expecting the performances of organizational strategy. The constructs are measured by using Likert (1932) five-point scale.

### Sample and procedures

In this study, in order for the sample to be effective, the questionnaire was first pre-test with one professor and three doctoral students. Modifications were made and the revised

questionnaire was pilot-test with five senior executives. After pre-test and pilot-test, since there were no major comments, the questionnaire was deemed ready for data collection.

To ensure the sample is representative, the executives were randomly drawn from 2000 apprentices of EMBA program who have been taught the course either competitive intelligence or advanced competitive intelligence at National Chengchi University in Taiwan. These selected enterprises encompass multinational companies and domestic companies are also representative which screened by admission committee. The questionnaires were sent out to 200 selected executives via e-mail. A follow-up e-mail was made 2 weeks later to non-responding firms.

This research applied partial least squares (afterward PLS) regression as a statistical method that accepts some relation to principal components regression (Bagozzi and Yi 1988; Bagozzi et al. 1991; Hair et al. 2006). PLS is exploited to examine the fundamental relations between two constructs, i.e. a latent variable approach to modeling the covariance structures in these two arrays. PLS regression is particularly suitable when the construct of predictors has more variables than observations. By contrast, standard regression will mis-carry in this study.

The PLS path modelling is a method of modeling a causal network of latent variables. This technique is a form of structural equation modelling, distinguished from the classical method by being component-based rather than covariance-based (Bagozzi and Yi 1988; Bagozzi et al. 1991; Hair et al. 2006). In this study, the structure equation modelling comprises two types, namely formative variable and reflective variable. According to maximum likelihood estimation (MLE), PLS is adequate for small size sample which between 100 and 150 (Sambamurthy and Chin 1994; Chin 1998a, b).

## Result analysis and implications

### Demographics analysis

Table 3 is a detail description of demographic analysis. In this survey, the number of total respondents is 200 (100 %), the number of practical collected sample is 128 (64 %) and the number of appropriate questionnaire sample is 126 (63 %), respectively.

### Reliability analysis

Composite reliability analysis comprises two portions, namely item-to-total correlation and internal consistency analysis. Reliability of a construct refers to the consistency and stability of questions. Hair et al. (2006) recommend an acceptance level of item-to-total correlation is 0.7 on composite reliability analysis. As summarized in Table 4, the

**Table 1** Operational definitions of study constructs

| Constructs/variables                     | Definition   | Source   |
|--|--|--|
| The process of competitive intelligence  | To collect, store, analyze, and provide access data to help enterprises making better business decisions   | Badr et al. (2006); Calof and Wright (2008); Saayman et al. (2008)                     |
| Setting strategic objective              | Strategic objectives are what enterprises want to achieve  | Badr et al. (2006); Calof and Wright (2008); Saayman et al. (2008)                     |
| Strategic analysis                       | Strategic analyst would consider related information   | Calof and Dishman (2002); Badr et al. (2006); Calof and Wright (2008)                  |
| Strategy formulation                     | Concerns the future position of products and markets   | Calof and Dishman (2002); Badr et al. (2006); Calof and Wright (2008)                  |
| Implementation and control               | A planned and thorough implementation plan is vital to the ultimate success of any strategy  | Calof and Dishman (2002); Badr et al. (2006); Calof and Wright (2008)                  |
| The product of competitive intelligence  | An actionable information about the external business environment that could affect a company's competitive position                               | Fair (1966); Gilad and Gilad (1988); Kahaner (1998); McGonagle and Vella (1998)        |
| Competitors' information                 | The gathering of new intelligence specifically for the project at hand   | Gilad and Gilad (1988); Gordon (1989); Teo and Choo (2001)                             |
| Environmental information                | The available intelligence, already gathered for some other purpose  | Gilad and Gilad (1988); Gordon (1989); Teo and Choo (2001)                             |
| Executive information system             | To support ad hoc decisions as well as certain routine analysis  | Simon (1957, 1997); Teo and Choo (2001); Walters et al. (2003); Sauter and Free (2005) |
| Rapidity of executive information system | The time between when a decision maker recognizes the need to make some decision to the time when he or she renders judgment                       | Walters et al. (2003); Sauter and Free (2005)  |
| Accuracy of executive information system | The decision is evaluated as being right or wrong in a situation   | Walters et al. (2003); Sauter and Free (2005)  |
| Organizational strategic benefits        | Applying CI on executive information system will give a company a competitive advantage, also improve the thorough performances of an organization | Porter (1980); Stanton et al. (1994); Teo and Choo (2001); Walters et al. (2003)       |
| Revenue prospect                         | CI gives a company a competitive advantage   | Stanton et al. (1994); Teo and Choo (2001);  |
| Cost evaluation                          | CI leads to cost estimation in business process  | Stanton et al. (1994); Teo and Choo (2001);  |
| Managerial effectiveness                 | Being enhanced through the use of CI which is positively related to firm performances  | Stanton et al. (1994); Teo and Choo (2001);  |

values of composite reliability of all factors range from 0.789 to 0.914 are greater than 0.7 which suffice the criterion suggested by Bagozzi and Yi (1988; 1991). As can also be seen, the values of Cronbach's  $\alpha$  of all factors range from 0.603 to 0.886 are also greater than 0.6 which perform the specification proposed by Fornell and Larcker (1981), which indicates high reliability of these questions (Fornell and Larcker 1981; Bagozzi and Yi 1988; Bagozzi et al. 1991; Teo and Choo 2001; Hair et al. 2006; Liao et al. 2008).

### Validity analysis

Validity analysis consists of two parts, scilicet convergent validity and discriminant validity. Fornell and Larcker (1981) suggest an acceptance level of average variance extracted is 0.5 on validity analysis. Table 4 reveals the values of average variance extracted of all factors range from 0.512 to 0.774 exceeded 0.5 which meet the standard (Fornell and Larcker 1981; Bagozzi and Yi 1988; Bagozzi et al. 1991;

**Table 2** Questions for measuring competitive intelligence and organizational impact

| Constructs/variables                           | Questions  |
|--|--|
| <i>The process of competitive intelligence</i> |  |
| Setting strategic objectives (SSO)             | <ol style="list-style-type: none"> <li>1. Understanding competitors' strategies and objectives</li> <li>2. Better understanding of the business environment</li> <li>3. Providing useful intelligence which helps to set achievable marketing objectives</li> <li>4. Providing information that can be a platform to develop marketing objectives</li> <li>5. Ensures that strategic objectives are developed within a reality perspective</li> <li>6. Helps managers to develop sensible and achievable strategic objectives</li> </ol> |
| Strategic analysis (SA)                        | <ol style="list-style-type: none"> <li>1. Helps in a better understanding of the business environment</li> <li>2. Provides intelligence on aspects of the competitive environment</li> <li>3. Helps to look at the big picture regarding business environments</li> <li>4. Helps managers to identify opportunities in the market and anticipate competitors' move</li> <li>5. Informs and supports marketing analysis</li> <li>6. Provides clear understanding of the market and adds value to the analysis</li> </ol>                  |
| Strategy formulation (SF)                      | <ol style="list-style-type: none"> <li>1. Up to date intelligence regarding business environment which helps managers to make their decisions</li> <li>2. Assesses and evaluates likely competitors' reaction</li> <li>3. Provides intelligence and suggestion to the senior managers</li> <li>4. Predicts the future position of products and markets</li> <li>5. Focuses on what to achieve in the market and how to go about it</li> </ol>  |
| Implementation and control (IC)                | <ol style="list-style-type: none"> <li>1. Indicators from competitive intelligence are used as an early warning system to assess success or failure</li> <li>2. Provides information about competitors' reaction to the strategy</li> <li>3. Checking the validity of the strategy</li> <li>4. Provides feedback to enable adjustments to be made</li> <li>5. Provides feedback about the strategy performances in the market</li> </ol>   |
| <i>The product of competitive intelligence</i> |  |
| Competitors' information (CPI)                 | <ol style="list-style-type: none"> <li>1. Patent research</li> <li>2. New products and services</li> <li>3. Discussion groups/newsgroups on competitors</li> <li>4. Customer feedback on competing entities' products/services</li> <li>5. Customer feedback on competitors' products/services</li> <li>6. Customer feedback on enhancements for future products/services</li> </ol>   |

Teo and Choo 2001; Hair et al. 2006; Liao et al. 2008). It indicates significant convergent validity of these questions.

Fornell and Larcker (1981) also propose the following procedure to test the discriminate validity of a variable: the values of all factors should exceed the threshold level (0.5).

Table 4 also displays all items of factor loading range from 0.636 to 0.912 are greater than 0.5 which fulfill the criterion advised by Bagozzi and Yi (1988; 1991). Confirmatory factor analysis is employed in this study to understand shared variance of measured variables that is believed to be attributable to a factor or latent construct. Confirmatory factor analysis

Table 2 continued

| Constructs/variables                                   | Questions   |
|--|---|
| Environmental information (ENI)                        | <ol style="list-style-type: none"> <li>1. Competitors' business process</li> <li>2. Competitors' Web sites</li> <li>3. Internet-based competitive intelligence sites</li> <li>4. Internet-based commercial databases</li> <li>5. Competitors' products/services price lists</li> <li>6. Competitors' products/services specification info</li> <li>7. Government information</li> <li>8. Articles in industry/trade Web sites</li> <li>9. Competitors' financial reports</li> <li>10. Competitors' advertising strategy, execution and targeting</li> </ol> |
| <i>Executive information system</i>                    |   |
| Rapidity of executives' decision-making support (REDS) | <ol style="list-style-type: none"> <li>1. Improve speed of executives' decision-making</li> <li>2. Improve speed of executives' decision-making process</li> <li>3. Improve speed of executives' decision-making for new business investment</li> </ol>   |
| Accuracy of executives' decision-making support (AEDS) | <ol style="list-style-type: none"> <li>1. Improve accuracy of executives' decision-making</li> <li>2. Improve accuracy of executives' business forecasting</li> <li>3. Improve accuracy of executives' decision-making for new business investment</li> </ol>   |
| <i>Organizational performances</i>                     |   |
| Revenue prospect (RP)                                  | <ol style="list-style-type: none"> <li>1. Facilitate new products/services generation</li> <li>2. Increase market share</li> <li>3. Increase profit margin</li> <li>4. Improve products/services differentiation</li> <li>5. Improve return on assets</li> <li>6. Improve return on investments</li> </ol>  |
| Cost evaluation (CE)                                   | <ol style="list-style-type: none"> <li>1. Reduce costs of advertising and promotion</li> <li>2. Reduce costs of customers' services and supports</li> <li>3. Reduce costs of goods production</li> <li>4. Reduce costs of materials procurement</li> <li>5. Reduce costs of new products/services development</li> <li>6. Reduce costs of products distribution</li> <li>7. Reduce overall manpower needs</li> </ol>  |
| Managerial effectiveness (ME)                          | <ol style="list-style-type: none"> <li>1. Focus research and development efforts</li> <li>2. Enhance organizational flexibility</li> <li>3. Enhance responsiveness to customer needs</li> <li>4. Enhance responsiveness to production operations</li> <li>5. Identify market trends</li> <li>6. Improve coordination with customers</li> <li>7. Improve coordination with suppliers</li> <li>8. Improve coordination with business partners</li> <li>9. Improve coordination between internal functions</li> </ol>  |



**Table 3** Respondents' demographics

| Category          | Basic information of respondents                  | N*** = 126 | %    |
|-------------------|---|------------|------|
| Gender            | Male  | 98         | 77.8 |
|                   | Female  | 28         | 22.2 |
|                   | Chairman, CEO, COO, President, GM, Vice President | 39         | 31.0 |
|                   | Associate Vice President, Senior Manager, Manager | 21         | 16.7 |
|                   | Assistant manager, supervisor, others             | 66         | 52.4 |
| Work seniority    | Below 5 years                                     | 23         | 18.3 |
|                   | 6–10 years  | 30         | 23.8 |
|                   | 11–15 years                                       | 20         | 15.9 |
|                   | 16–20 years                                       | 23         | 18.3 |
|                   | Above 20 years                                    | 30         | 23.8 |
| Education         | Under university                                  | 1          | 0.8  |
|                   | University  | 73         | 57.9 |
|                   | Master above                                      | 52         | 41.3 |
| Enterprise scope  | Under 50  | 25         | 19.8 |
|                   | 51–100  | 7          | 5.6  |
|                   | 101–500   | 19         | 15.1 |
|                   | 501–1000  | 14         | 11.1 |
|                   | 1000 above  | 61         | 48.4 |
| Industry sector   | Information technology                            | 58         | 46.0 |
|                   | Finance   | 14         | 11.1 |
|                   | Electrical and electronics                        | 19         | 15.1 |
|                   | Manufacture                                       | 9          | 7.1  |
|                   | Trade   | 10         | 7.9  |
| Age of enterprise | Others  | 16         | 12.7 |
|                   | Below 5 years                                     | 16         | 12.7 |
|                   | 6–10 years  | 10         | 7.9  |
|                   | 11–15 years                                       | 15         | 11.9 |
|                   | 16–20 years                                       | 11         | 8.7  |
|                   | 20 years above                                    | 74         | 58.7 |

N\* Number of survey = 200

N\*\* Number of collected = 128 (64%)

N\*\*\* Number of valid questionnaire = 126(63 %)

is used to test whether measures of a construct are consistent with a researcher's understanding of the nature of that construct. As such, the objective of confirmatory factor analysis is to test whether the data fit a hypothesized measurement model (Fornell and Larcker 1981; Bagozzi and Yi 1988; Bagozzi et al. 1991; Teo and Choo 2001; Hair et al. 2006; Liao et al. 2008). Table 5 indicates diagonal elements should be larger than off-diagonal elements. Therefore, the discriminant validities of these questions are also verified.

## Correlation analysis

Table 4 elaborates the means, standard deviations of constructs, and Table 5 displays their correlations. As summarized, the following relationships exist between the research variables.

- (1) Relationship between prior knowledge and executive information system: executives' prior knowledge is positively related to executive information system, meaning that executives with more prior knowledge express better performances in enhancing executive information system.
- (2) Relationship between the process of competitive intelligence and executive information system: the process of competitive intelligence is positively related to executive information system. Obviously, adopting a process of competitive intelligence will perform a greater efficiency in improving executive information system.
- (3) Relationship between the product of competitive intelligence and executive information system: the product of competitive intelligence is positively related to executive information system. This presents the product of competitive intelligence could cultivate executive information system.
- (4) Relationship between executive information system and organizational strategic benefits: executive information system is positively related to organizational strategic benefits. Applying executives' prior knowledge, the process of competitive intelligence and the product of competitive intelligence will increase capabilities of executive information system and subsequently affect strategic benefits expansion in organization.

Correlations can only provide the degree of relationship between constructs. It requires to investigate the structural equation model to get better understand the direct and the indirect influences among the constructs (Chin 1998a,b; Teo and Choo 2001; Liao et al. 2008).

## Structural equation model

Figure 2 portrays the actual path diagram of structural equation model by PLS analysis. Table 6 lists path analysis and hypothesis testing results, the path parameters are estimated by parametric method, which explained variance by structural equation model ( $R^2$ ), standardized path coefficients ( $\beta$ ), and t-values observation with the extent of significant were manipulated by bootstrap approach.

The results indicate the process of CI has a significant effect on executive information system ( $\beta = 0.438$ ,  $P < 0.001$ ), and the product of CI ( $\beta = 0.256$ ,  $P < 0.001$ ), which supported hypotheses H2 and H3. Execu-

**Table 4** Summary of construct loadings and reliability

| Factors | Items | Loading | Mean  | SD    | AVE <sup>1</sup> | Composite reliability <sup>2</sup> | Cronbach's $\alpha$ |
|---------|-------|---------|-------|-------|------------------|------------------------------------|---------------------|
| SSO     | SSO2  | 0.723   | 4.065 | 0.818 | 0.552            | 0.832                              | 0.730               |
|         | SSO4  | 0.734   |       |       |                  |                                    |                     |
|         | SSO5  | 0.765   |       |       |                  |                                    |                     |
|         | SSO6  | 0.750   |       |       |                  |                                    |                     |
| SA      | SA2   | 0.636   | 3.97  | 0.753 | 0.512            | 0.806                              | 0.677               |
|         | SA4   | 0.689   |       |       |                  |                                    |                     |
|         | SA5   | 0.811   |       |       |                  |                                    |                     |
|         | SA6   | 0.714   |       |       |                  |                                    |                     |
| SF      | SF2   | 0.712   | 3.890 | 0.793 | 0.555            | 0.789                              | 0.603               |
|         | SF3   | 0.742   |       |       |                  |                                    |                     |
|         | SF4   | 0.780   |       |       |                  |                                    |                     |
| IC      | IC1   | 0.755   | 3.873 | 0.836 | 0.517            | 0.811                              | 0.688               |
|         | IC2   | 0.719   |       |       |                  |                                    |                     |
|         | IC3   | 0.721   |       |       |                  |                                    |                     |
|         | IC5   | 0.679   |       |       |                  |                                    |                     |
| CPI     | CPI4  | 0.797   | 4.000 | 0.770 | 0.690            | 0.870                              | 0.775               |
|         | CPI5  | 0.828   |       |       |                  |                                    |                     |
|         | CPI6  | 0.866   |       |       |                  |                                    |                     |
| ENI     | ENI2  | 0.817   | 3.803 | 0.827 | 0.710            | 0.880                              | 0.796               |
|         | ENI6  | 0.866   |       |       |                  |                                    |                     |
|         | ENI7  | 0.845   |       |       |                  |                                    |                     |
| REDS    | REIS1 | 0.808   | 4.153 | 0.804 | 0.696            | 0.873                              | 0.781               |
|         | REIS2 | 0.883   |       |       |                  |                                    |                     |
|         | REIS3 | 0.810   |       |       |                  |                                    |                     |
| AEDS    | AEIS1 | 0.797   | 3.973 | 0.711 | 0.680            | 0.864                              | 0.783               |
|         | AEIS2 | 0.874   |       |       |                  |                                    |                     |
|         | AEIS3 | 0.800   |       |       |                  |                                    |                     |
| RP      | RP3   | 0.736   | 3.775 | 0.761 | 0.668            | 0.889                              | 0.832               |
|         | RP4   | 0.812   |       |       |                  |                                    |                     |
|         | RP6   | 0.894   |       |       |                  |                                    |                     |
|         | RP7   | 0.820   |       |       |                  |                                    |                     |
| CE      | CE2   | 0.762   | 3.775 | 0.773 | 0.638            | 0.914                              | 0.886               |
|         | CE3   | 0.806   |       |       |                  |                                    |                     |
|         | CE4   | 0.785   |       |       |                  |                                    |                     |
|         | CE5   | 0.779   |       |       |                  |                                    |                     |
|         | CE6   | 0.837   |       |       |                  |                                    |                     |
|         | CE7   | 0.824   |       |       |                  |                                    |                     |
| ME      | ME6   | 0.788   | 3.943 | 0.768 | 0.675            | 0.892                              | 0.839               |
|         | ME7   | 0.843   |       |       |                  |                                    |                     |
|         | ME8   | 0.870   |       |       |                  |                                    |                     |
|         | ME9   | 0.781   |       |       |                  |                                    |                     |

*SSO* Setting strategic objectives, *SA* Strategic analysis, *SF* Strategy formulation, *IC* Implementation and control, *CPI* Competitors' information, *ENI* Environmental information, *REIS* Rapidity of executive information system, *AEIS* Accuracy of executive information system, *RP* Revenue prospect, *CE* Cost evaluation, *ME* Managerial effectiveness

$$1 \text{ Avaraged variance extracted} = \frac{(\sum \text{factor loadings}^2)}{(\sum (\text{factor loadings}^2)) + (\sum \text{indicator measurement error})}$$

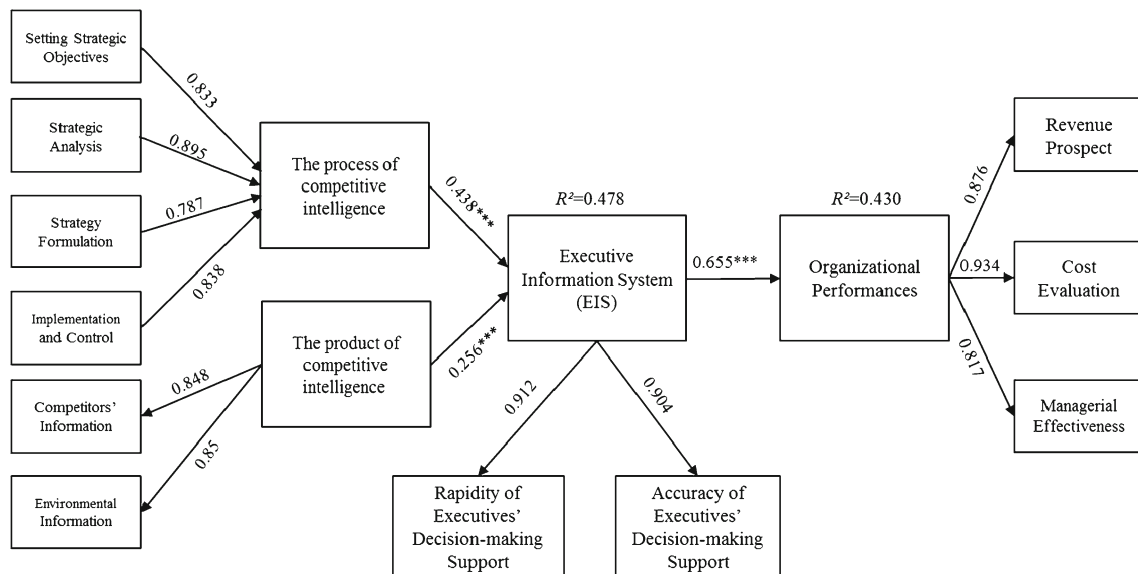
$$2 \text{ Composite reliability} = \frac{(\sum \text{factor loadings}^2)}{(\sum (\text{factor loadings}^2)) + (\sum \text{indicator measurement error})}$$

**Table 5** Descriptive statics and correlations among study variables

|      | SSO          | SA           | SF           | IC           | CPI          | ENI          | REDS         | AEDS         | RP           | CE           | ME           |
|------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| SSO  | <b>0.743</b> |              |              |              |              |              |              |              |              |              |              |
| SA   | 0.536        | <b>0.715</b> |              |              |              |              |              |              |              |              |              |
| SF   | 0.391        | 0.496        | <b>0.745</b> |              |              |              |              |              |              |              |              |
| IC   | 0.342        | 0.41         | 0.442        | <b>0.919</b> |              |              |              |              |              |              |              |
| CPI  | 0.206        | 0.282        | 0.195        | 0.268        | <b>0.831</b> |              |              |              |              |              |              |
| ENI  | 0.283        | 0.36         | 0.381        | 0.294        | 0.375        | <b>0.843</b> |              |              |              |              |              |
| REDS | 0.383        | 0.501        | 0.428        | 0.43         | 0.316        | 0.306        | <b>0.835</b> |              |              |              |              |
| AEDS | 0.469        | 0.493        | 0.504        | 0.382        | 0.22         | 0.417        | 0.649        | <b>0.825</b> |              |              |              |
| RP   | 0.398        | 0.572        | 0.362        | 0.446        | 0.198        | 0.291        | 0.462        | 0.521        | <b>0.817</b> |              |              |
| CE   | 0.346        | 0.578        | 0.412        | 0.456        | 0.263        | 0.28         | 0.564        | 0.446        | 0.755        | <b>0.799</b> |              |
| ME   | 0.419        | 0.493        | 0.429        | 0.541        | 0.273        | 0.313        | 0.601        | 0.571        | 0.576        | 0.638        | <b>0.822</b> |

SSO Setting strategic objectives, SA Strategic analysis, SF Strategy formulation, IC Implementation and control, CPI Competitors' information, ENI Environmental information, REDS Rapidity of executive information system, AEDS Accuracy of executive information system, RP Revenue prospect, CE Cost evaluation, ME Managerial effectiveness

Diagonal elements (in bold) are the square root of the average variance extracted (AVE). Off-diagonal elements are the correlations among constructs. For discriminate validity, diagonal elements should be larger than off-diagonal elements

**Fig. 2** Results of structural equation model analysis

tive information system has a significant direct influence on organizational strategic benefits ( $\beta = 0.655$ ,  $P < 0.001$ ), hypothesis H4 is also supported. Moreover, executives' prior knowledge had an influence ( $\beta = 0.123$ ,  $P < 0.01$ ) on executive information system, hence, H3 is also supported. The  $t$ -values of these estimates are all significant ( $>2$ ) (Chin 1998a, b).

This study has established two constructs of executive information system, namely the rapidity of executive information system and the accuracy of executive information system, which can support as the basis for future researches.

Although the questionnaire was pre-test, pilot-test and minor modified, elaborating good reliability and validity, it may not be applicable to all research domains and there is still a room for improvement. In addition, different businesses or industries could use this measurement tool in order to modify the construct.

The findings expose competitive intelligence activities exert the expansion of strategic performances through executive information system in organization. Hence, when assessing measurements for executive information system, enterprise executives should consider the information gath-

**Table 6** Path analysis and hypothesis testing results

| Hypotheses/Paths  | Standardized path coefficient | <i>t</i> -value | Hypothesized relationship | Results   |
|---|-------------------------------|-----------------|---------------------------|-----------|
| <b>H1.</b> The process of competitive intelligence → Executive information system | 0.438***                      | 6.331           | Positive                  | Supported |
| <b>H2.</b> The product of competitive intelligence → Executive information system | 0.256***                      | 3.346           | Positive                  | Supported |
| <b>H3.</b> Executive information system → Organizational strategic benefits       | 0.655***                      | 19.215          | Positive                  | Supported |
| Setting strategic objectives → The process of competitive intelligence            | 0.833                         | 46.335          | Positive                  | Supported |
| Strategic analysis → The process of competitive intelligence                      | 0.895                         | 76.603          | Positive                  | Supported |
| Strategy formulation → The process of competitive intelligence                    | 0.787                         | 30.71           | Positive                  | Supported |
| Implementation and control → The process of competitive intelligence              | 0.838                         | 36.923          | Positive                  | Supported |
| The product of competitive intelligence → Competitors' information                | 0.848                         | 38.759          | Positive                  | Supported |
| The product of competitive intelligence → Environmental information               | 0.85                          | 52.175          | Positive                  | Supported |
| Executive information system → Rapidity of executives' decision-making support    | 0.912                         | 89.095          | Positive                  | Supported |
| Executive information system → Accuracy of executives' Decision-making Support    | 0.904                         | 73.159          | Positive                  | Supported |
| Organizational performances → Revenue prospect                                    | 0.876                         | 49.871          | Positive                  | Supported |
| Organizational performances → Cost evaluation                                     | 0.934                         | 87.597          | Positive                  | Supported |
| Organizational performances → Managerial effectiveness                            | 0.817                         | 40.954          | Positive                  | Supported |

\*\*\* Significant path ( $P < 0.001$ ), \*\* Significant path ( $P < 0.01$ ), \* Significant path ( $P < 0.05$ )

ering from environmental scanning and all of competitor's information to avoid misjudgment and achieve better performances.

## Contribution

(1) The results reveal testimony that competitive intelligence is positively related to organizational performances, indicating that competitive intelligence does influence the behavior of decision-making both of enterprise executives and the entire organization. To enhance organizational performances should improve executive information system by encouraging top management to complete new concepts and methods in terms of competitors' information gathering and environmental scanning. In additions, enterprise executives in organization should support all members improve information collecting through a team formation of competitive intelligence. The knowledge sharing of accumulated

information can also upgrade the organizational capability both in strategically and tactically and also cultivate better strategic benefits in executive information system.

(2) The research findings demonstrate that the process of competitive intelligence is positively related to executive information system, meaning that the process of competitive intelligence is applied in executive information system show better ability in encouraging organizational strategic performances. [Saayman et al. \(2008\)](#) argue that the process of competitive intelligence is the primary key of competitive intelligence to enhance executive information system for enterprise executives. Four dimensions: (1) setting strategy objectives; (2) strategic analysis; (3) strategy formulation; and (4) implementation and control on this perspective were certified that being a part of executive information system. Therefore, to continue collecting message, compiling data, analyzing information, and communicating knowledge, disseminating competitive intelligence on executive

information system, organization may build a competitive repository in organization. On the other hand, [Teo and Choo \(2001\)](#) claim that the product of competitive intelligence encompasses two major constructs: (1) competitors' information; and (2) environmental scanning information were also certified in this study.

- (3) A literature review has illustrated that there have been few empirical studies by applying the competitive intelligence as a supporting actor for enterprise executives being a configuration on executive information system ([Tao and Prescott 2000](#); [Toit 2003](#); [Tanev and Balletti 2008](#); [Yap et al. 2012](#); [Vidigal 2013](#)). Yet the quantitative data do not provide evidence that executives apply competitive intelligence to recognize strategic performances in organization in Taiwan. This study outlines a structural equation model, and assesses organizational impact by using competitive intelligence on executive information system for enterprise executives. In other words, it suggests top management should plug the function of competitive intelligence into executive information system for long term strategic expansion in organization. In summary, this study attempts to provide a systematic and continuous focus on the information integration of competitors and environmental scanning, and also verified the feasibility of constructing a model of competitive intelligence process by [Badr et al. \(2006\)](#), [Dishman and Calof \(2008\)](#), and [Saayman et al. \(2008\)](#), and a model of competitive intelligence product by [Teo and Choo \(2001\)](#).

## Conclusions

Service science is an interdisciplinary approach to the design, study, and implementation of services system in which particular arrangements of people and technologies take actions that provide value for others. In this study, executive information system has been defined as the application of service system to demonstrate revenue prospect, cost evaluation and managerial effectiveness three constructs in the organization. **By integrating the property of competitive intelligence into executive information system, it could be affording more advantageous information through deeds, processes and capabilities for the benefit of another entity or the entity itself. These relationships and dependencies can be expected as a service system of interacting parts.**

Although this study illustrates the utilization of the process, and product of competitive intelligence as two primary constructs on executive information system; it would be of better application to any organization pursuing strategic or competitive on a formation of executive information system. Further, the innovative structure equation model provides enterprise executives accessing to the information earlier

than other forms of data gathering since the model encourages executives to approach information early, and certainly before rules of statistical significance would apply. This, in turn, allows the enterprise executives to act upon the information before competitors have access to it or before it could be damaging in the eyes of customers, employees, or constituents. **The study also examines the connections between competitive intelligence, executive information system and organizational performances and the impact of competitive intelligence on executive information system and organizational performances.** Furthermore, **the study shows executive information system with competitive intelligence activities will enhance the performances of organizational strategy.** The findings of this study disclose that **integrating competitive intelligence activities exert a complete function on executive information system for enterprise executives.** To summarize above, the major contribution in this study lie in affording new directions of exploration and broadening scope of competitive intelligence and executive information system studies.

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