The business technology management competency of IT professionals: an empirical study

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ABSTRACT: In a rapidly changing business environment, IT professionals not only have to keep abreast of technological knowledge, but also take the responsibility for roles that are more entrepreneurial in nature and focus more on innovation through IT. This study proposed a new concept of business technology management (BTM) competency to explore the associated knowledge and skills, and examined the validity of the nomological framework. The empirical data in general supported the proposed competency model of BTM and revealed that business domain knowledge, IT-business integration, as well as management, interpersonal skills and knowledge contribute significantly to IT professionals' proficiencies on their BTM competency. The results of this study, therefore, can provide useful principles to help IT professionals review business technology management proficiencies and may serve as instrumental guidelines for the BTM competency training to strengthen IT-business relationship building.

INTRODUCTION

In the information era of the 21st Century, the rapid advancement of information and communication technology (ICT) has radically changed the business landscape. The trends in information technology (IT) applications in modern firms require IT professionals not only have to learn new skills/knowledge, but also adjust themselves in a timely manner to the changing business environment [1][2]. They are accountable for envisioning, guiding and implementing their firm's business and technology management practices [3]. Today's IT professionals are expected to effectively integrate IT functions to construct appropriate organisational structures, processes and enhance human skills to exploit various emerging technologies as a strategic differentiator [4].

Moreover, the complexity of IT/IS implementations in business integrated delivery systems requires the integration of diverse efforts including manpower, raw materials and relevant technical support [5]. With accelerated business competition and the popularity of ICT usage, there is an urgent need to understand the factors that drive IT professionals to develop and reinforce the competency to align, synchronise, and/or converge technology and business management to improve business operation, risk control and profitability [6]. It is these capabilities that can help them to shape and enable their business goals. As such, they are continuously required to possess sound business and technology management skills/knowledge to leverage firms' business and technology efforts.

Comprehending the essentials of what determines IT professionals' business technology management (BTM) related skills and knowledge can provide great management insight into effective strategies that will allow business enterprises to remain competitive and retain their customers. The need to communicate effectively with their business counterparts requires IT professionals to develop some commonality with business people of vocabulary and conceptual knowledge, and of working experience [7]. However, most IT/IS related research has focused on technology developments and business applications essential to its success [8]. Besides, reviews of technology education literature also imply that prior research has not yet addressed the critical issue of competency development in relation to the nature of business technology management for IT professionals. To fill the gap in the existing literature, this study has been initiated in order to investigate the skills and/or knowledge, which constitute the portfolios of BTM competency required by IT professionals. The psychological proprieties of BTM competency constructs are also tested for validity and reliability.

BASIC CONCEPTS AND THEORETICAL FOUNDATION

In today's business organisation, IT professionals might have to equip themselves with a fundamental business knowledge other than their own specialties to deal with the challenges of a changing environment. The BTM competency of IT professionals, for this study, was defined as the mix of skills and knowledge that IT professionals

should possess in order to leverage technology and business resources for business-IT alignment. Since IT professionals are often assigned to projects involving different functional areas of the organisations, it is important to develop a broad competency framework and not just one designed for a specific set of tasks. IT professionals with a better sense of BTM competency would be able to understand the business priorities, opportunities and the need for the strategic exploitation of IT. Nonetheless, the new concept of BTM competency and the relationships between the construct and the associated skills/knowledge were not clearly identified and discussed in previous research. This study seeks to identify the set of knowledge and skills that forms the BTM competency, which enables IT professionals to effectively align technology and business management for better business operation, risk control and improved profitability. Three broad dimensions of knowledge/skills emerge from the literature: 1) business domain knowledge; 2) IT-business integration; and 3) management and interpersonal knowledge and skills.

This category of business domain knowledge refers to the understanding, by IT professionals, of the holistic business organisational settings in which information technologies are deployed and of the connections between IT and the business organisation. This knowledge represents the competency for IT professionals' business understanding and enables them to see the *big picture* of IT in their organisations, as well as to make linkages between different organisational divisions and tasks. It also ensures benefits from the potential fit between IT and the specific business organisational setting [9]. Based on the literature e.g. [3][7][10], three areas of business domain knowledge were identified: business organisational overview, business organisational units and business organisational responsibility.

Today's IT professionals must support the executive management to establish the information policies and procedures to ensure integration of data transmission or interfacing among individual information systems. The knowledge/skills of IT-business integration refer to the ability of an IT professional to visualise the ways in which various kinds of IT/IS applications can enhance business processes and help to provide an integrated infrastructural platform to improve organisation performance. As argued by Curley, *IT has no intrinsic value, but when it is well coupled with organisations and business processes they can have great impact* [11]. Rai et al substantiated the importance of developing an integrated IT infrastructure and leveraging it to create higher-order IT-business process capabilities for the integration of resource flows between a firm and its business partners in a supply chain management context [12]. Therefore, IT-business integration knowledge and skills include the knowledge areas of integrating IT with business infrastructure and integrating IS applications with business processes.

Moreover, as the key figures for business information delivery and the change agents around the organisation, IT professionals should equip themselves with effective management and interpersonal skills/knowledge for effective negotiation. Management and interpersonal knowledge/skills represent the competency required by IT professionals to motivate their business partners, articulate visions and preferences and communicate them to others, handle negotiations with other people, and manage conflicts. In today's dynamic, distributed and complex workplace, successful IT professionals have to acquire a broader set of managerial or interpersonal skills in addition to technical knowledge and skills to enable strategic leveraging of IT [13]. Other studies e.g. [3][7][14-16], also argued the requirements for the managerial and interpersonal skills to achieve effective business technology administration practice. Therefore, in this study, management and interpersonal knowledge/skills include knowledge networking, interpersonal communication and leadership. Based upon the above discussions, a comprehensive model has been proposed in this study, as shown in Figure 1.

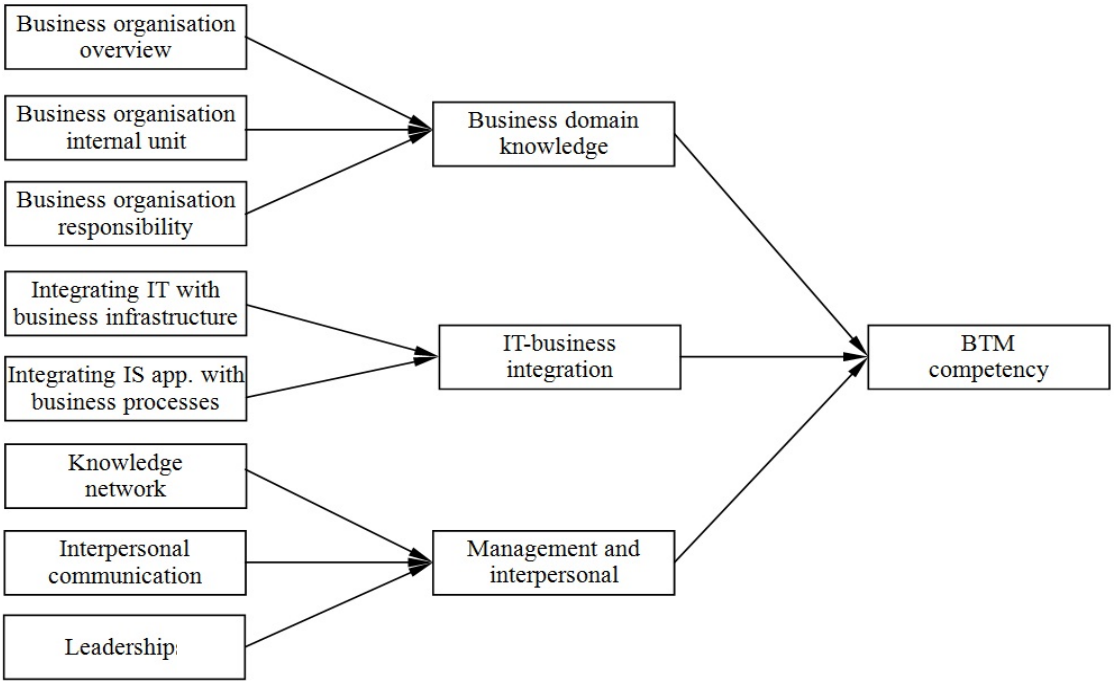

Figure 1: The conceptual framework of business technology management (BTM) competency.

RESEARCH DESIGN

The methodological approach adopted for examining the critical skills/knowledge in relation to IT professionals' BTM competency follows the literature e.g. [3][6][7][14-16]. First, the authors developed the BTM competency construct and its measures. A number of relevant studies were reviewed to ensure that a comprehensive list of measures was included. To construct a questionnaire to achieve the research goals, information was gathered by researchers in personal interviews with IS practitioners in business organisations, and academic experts in business departments of universities and colleges. This process was continued until no further modifications to the questionnaire were necessary. Feedback from several rounds of in-depth personal interviews served as the basis for refining the experimental scales items. The researchers tested and revised the questionnaire several times before starting to gather the data.

The instrument developed in this study contained two major parts including the respondent's basic data and the responses to the authors' research constructs. The basic data portion requested IT professionals to give the names of their organisations and main tasks; the needed demographic characteristics; and to fill out their current management position. The second part contained 31 questions, including 28 items of eight competency constructs in accordance with skills/knowledge classification.

The measurement items of skills/knowledge that were meticulously categorised to the predefined dimensions were tabulated as a list. Once the preliminary list of questions in the survey instrument was generated, an iterative process involving personal interviews with domain experts in business enterprises were conducted to refine the instrument. To make the results more general, several IT professionals at different types of industries were also interviewed. The in-depth interviews were recorded to improve the quality of data collection. Feedback from this pilot study served as the basis for correcting, refining and enhancing the instrument.

Data for this study were collected by using a large-scale questionnaire survey administered in Taiwan. Using a random sampling procedure, business organisations were selected to constitute a representative sample for this study. Each company received an initial phone call explaining the purpose of this research project and inquiring about the firm's willingness to participate. A contact person was identified at each company, asked to provide the number of IT professionals in the MIS department, and to distribute the self-administered questionnaires to IT professionals.

Participation in this study was voluntary and people were assured that their individual responses would be treated as confidential. A follow-up phone call was made to increase the response rate. Overall, 868 questionnaires were sent to IT professionals of the selected firms; 221 questionnaires were returned; 79 questionnaires were dropped because of invalid or incomplete answers. This left 142 for the statistical analysis, and a valid return rate of 16.4%.

DATA ANALYSIS AND RESULTS

Measurement Properties

The empirical data collected was analysed using the partial least squares (PLS) method, which is particularly suitable for the model with formative indicators to latent variables. This method places minimal demands on sample size and residual distributions. The anticipated results of this study were to verify the nomological and predictive validities by taking into account the tangible outcomes of BTM competency. The analysis strategy involved a two-stage approach: first, the psychometric properties of all scales were assessed through confirmatory factor analysis and, next, the structural relationships were examined. That is, the predicted relationships between skills/knowledge constructs and BTM competency were validated. The PLS method allows the validations of the psychometric properties of the scales used to measure a variable and the estimates of the structural model (the direction and potency of the casual relationships between the variables).

The measurement model relating the skills/knowledge items to their latent BTM competency construct was analysed by PLS-Graph 3.0. The assessment of item loadings, reliability and discriminant validity was performed for the reflective constructs through a confirmatory factor analysis (CFA). The psychometric properties of the scales were assessed in terms of item loadings, discriminant validity and internal consistency. Reflective items should be uni-dimensional in their representation of the latent variable and, therefore, correlated with each other. Item loadings should be above 0.707 to show that more than half of the variance is captured by the constructs [17]. As shown in Table 1, all items have loadings significantly higher than the recommended value of 0.707.

All constructs in the model exhibit good internal consistency, as evidenced by their composite reliability scores. The composite reliability coefficients of all constructs in the proposed conceptual framework are adequate. To assess discriminant validity: 1) indicators should load more strongly on their corresponding construct than on other constructs in the model and 2) the square root of the average variance extracted (AVE) should be larger than the inter-construct correlations [18].

To show discriminant validity, each construct's square root of the AVE has to be larger than its correlation with other factors. As the results show in Table 2, all constructs meet this requirement. Finally, the values for reliability

coefficients are all above the suggested minimum of 0.707 [19]. Thus, all constructs display adequate reliability and discriminant validity. All constructs share more variance with their indicators than with other constructs. Thus, the convergent and discriminant validity of all constructs in the research model can be assured.

Table 1: Results of descriptive analysis and confirmatory factor analysis.

Competency category	Skills/knowledge area	Item	Factor loading	Mean	Standard deviation
Business domain knowledge	Business organisation overview (BOO)	BOO1	0.86	4.48	0.94
		BOO2	0.86	4.64	1.02
		BOO3	0.90	4.48	1.08
		BOO4	0.86	4.41	1.02
	Business organisation internal unit (BOIU)	BOIU1	0.88	4.15	1.10
		BOIU2	0.89	4.08	1.11
		BOIU3	0.90	4.13	1.11
		BOIU4	0.89	4.21	1.04
	Business organisation responsibility (BOR)	BOR1	0.92	4.18	1.09
		BOR2	0.89	3.91	1.09
		BOR3	0.85	4.14	1.02
IT-business integration	Integrating IT with business infrastructure (IITBI)	IITB1	0.88	4.20	0.99
		IITB2	0.91	4.42	1.07
		IITB3	0.90	4.33	1.05
	Integrating IS app. with business processes (IISBP)	IISB1	0.88	4.54	0.94
		IISB2	0.87	4.43	0.94
		IISB3	0.84	4.70	0.85
		IISB4	0.90	4.57	0.99
Management and interpersonal	Knowledge network (KN)	KN1	0.86	4.73	1.15
		KN2	0.87	4.22	1.17
		KN3	0.82	4.65	1.08
	Interpersonal communication (IC)	IC1	0.92	4.74	0.91
		IC2	0.89	4.71	0.91
		IC3	0.86	4.59	0.98
	Leadership (LE)	LE1	0.87	4.37	0.98
		LE2	0.92	4.25	1.11
		LE3	0.90	4.24	1.10
		LE4	0.85	3.84	1.11

Table 2: Inter-correlations among factors and composite reliability.

Skills/Knowledge area	Skills/Knowledge area construct							
	BOO	BIOU	BOR	IITBI	IISBP	KN	IC	LE
Business organisation overview (BOO)	0.87							
Business organisation internal unit (BOIU)	0.60	0.89						
Business organisation responsibility (BOR)	0.67	0.75	0.89					
Integrating IT with business (IITBI)	0.62	0.62	0.67	0.90				
Integrating IS applications with business (IISBP)	0.71	0.69	0.71	0.78	0.87			
Knowledge network (KN)	0.66	0.58	0.65	0.64	0.73	0.85		
Interpersonal communication (IC)	0.69	0.48	0.57	0.60	0.69	0.73	0.89	
Leadership (LE)	0.58	0.72	0.70	0.68	0.71	0.68	0.62	0.88
Composite Reliability	0.93	0.94	0.92	0.92	0.93	0.88	0.94	0.93

*Diagonal elements are the square roots of AVE.

Test of the Structural Model

The bootstrapping procedure was further applied to generate *t*-statistics and standard errors. A test of the structural/inner model was used to assess the structure of BTM competency. As mentioned earlier, the higher-order factors in the model were estimated using the hierarchical component model. By applying the standard PLS algorithm, the relative path weights of the factors forming higher order constructs were calculated and presented in the depicted conceptual framework shown in Figure 2. The results for the structure of BTM competency indicate that the three dimensions forming BTM competency are significant. All of the first-order factors forming business domain knowledge, IT-business integration, and management and interpersonal skills/knowledge have significant paths. Taken together, all of the path coefficients support the proposed relationships among the three major constructs and related skills/knowledge sub-constructs of this competency framework. The results of the bootstrapping path analysis also provide strong support for the nomological network of the proposed three-order competency model.

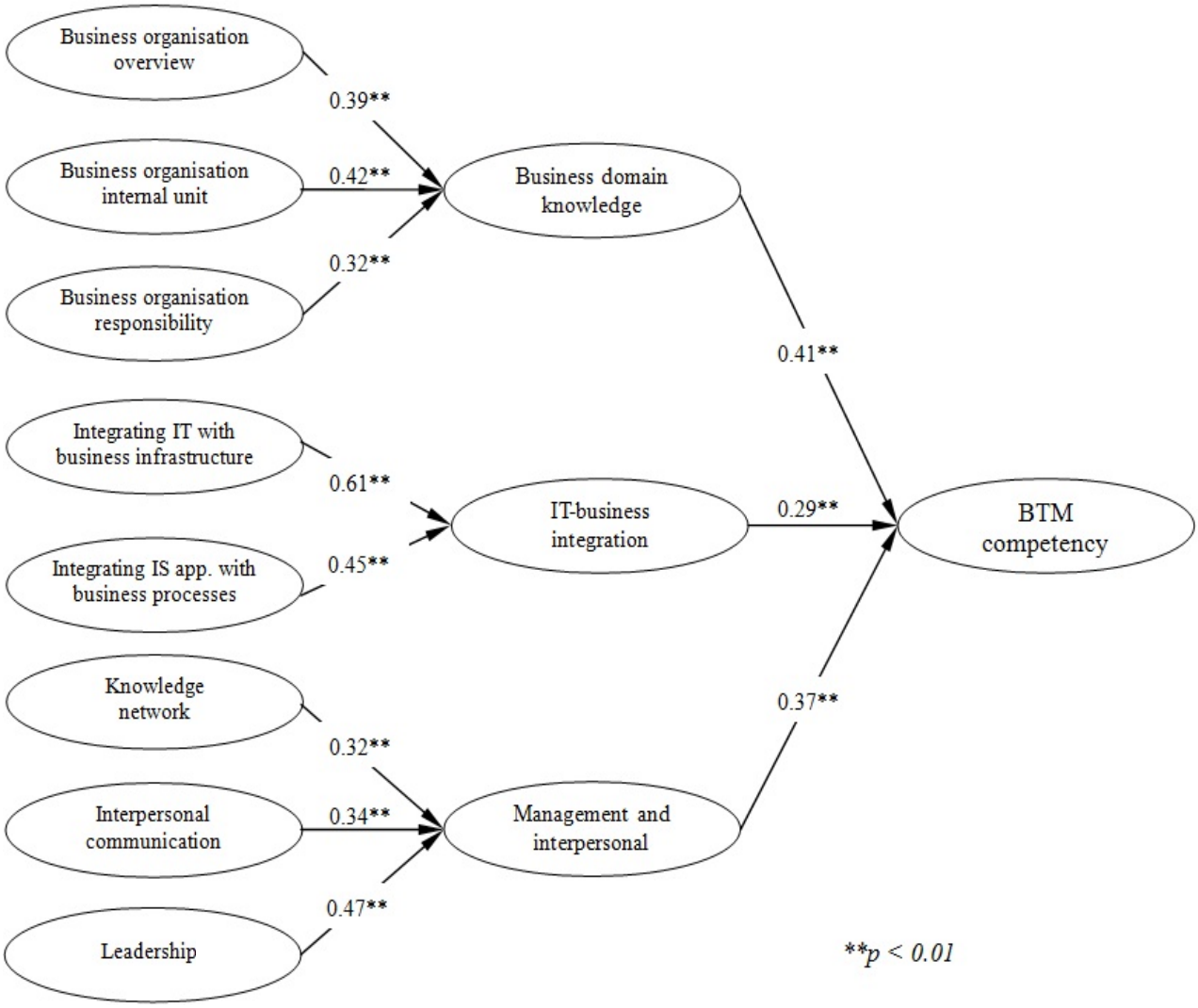

Figure 2: Partial least squares (PLS) analysis results.

DISCUSSIONS AND CONCLUSIONS

A competency model has been proposed in this study of the business technology management required by IT professionals. The study has defined its constructs, developed measures of these constructs and validated the model. Several implications follow for both theory development and practice. In regard to theoretical advancement for researchers interested in extending this line of work, the first critical issue relates to the psychometric properties of the BTM competency construct.

The authors' initial assessment of these properties in this empirical study is encouraging with the loadings for all of the control items at the desired level. Thus, others are encouraged to adapt the BTM competency construct and consider replacing the related scaled items in the measurement of the control dimension in order to develop a scale that exhibits greater convergence in other empirical settings. Secondly, the nomological structure for BTM competency is worthy of continued development and refinement.

Overall, the research findings from this study suggest the proposed conceptual framework to be an appropriate model for explaining the constituents of BTM competency. Judged by the path coefficients and relative explanatory results of analysis, the proposed BTM competency model might serve as a theoretical model for future studies. From the perspective of practice, the potentials of this competency assessment tool developed in the study can aid in five interrelated and complementary areas:

1. Help IT professionals to examine their proficiencies on BTM competency.
2. Facilitate broad communication and collaboration between IT professionals and their business partners in other functional areas of the business enterprises.
3. Provide instrumental guidelines for competency development programmes, training and career planning for business IT professionals.
4. Act as the preferred criteria for IT professionals' promotion and competency evaluation by executive management.

5. Create a seamless co-operative team between technology and business management staff throughout business enterprises.

In summary, the research findings support the proposed structure for BTM competency and indicate that BTM competency can align, synchronise, and/or converge technology and business management for better business operation, risk control and profitability creation.

The overarching objective in this article was to supplement the understanding of competency development of IT professionals and its influence on collaboration. The authors have described a three-order construct called BTM competency that was shown to play a significant role in the context of a nomological network, and which included important constructs from prior research.

Given the indisputable reality that IT is ubiquitous in today's business environment, the research findings have value for theory development, as well as for practice. Several avenues for future work remain and the authors hope this study will stimulate others to extend this line of research.

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