

IT competency, Intellectual Capital and Innovation Performance for Knowledge-intensive Manufacture industry in Taiwan

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ABSTRACT

Many companies have developed strategies that include investing heavily in information technology (IT) and strengthening intellectual capital(IC) in order to enhance innovation. Drawing from knowledge-based theory and related literature, this study used structural equation modeling with data collected from managers in 119 high-tech manufacturing firms. The key result showed that IC played a significant role in mediating the effect of IT on innovation performance.

Keywords: Information Technology Competency, Intellectual Capital, Innovation Performance

INTRODUCTION AND RESEARCH FRAMEWORK

Many managers and management scholars would agree that the introduction of information technology (IT) and the competency to effectively manage and apply IT has become critically important, because it may promote innovation and provide a foundation for gaining a competitive advantage. In addition, in a rapidly changing operating environment with ever-evolving technology, organizations need to pay more attention to what they know (intellectual capital) instead of what they have (visible assets) in order to facilitate organizational innovation (Stewart, 1998).

Consequently, academic discussions of IC, based on the Resource Based View (RBV) and Knowledge Based View (KBV) (Bontis, 1998) have become increasingly common. As Harrison and Sullivan (2000) noted, in the age of the knowledge economy, if organizations are able to utilize intellectual assets well they will be able to costs, and thus new business models are being developed that have the aim of using knowledge to increase firm value. However, to date there is no complete theoretical framework of IC, and even its definition is uncertain in the literature, which is a clear defect in the related research.

Scholars have generally viewed human capital, relational capital (or social capital) and structural capital as dimensions of IC, important knowledge assets able to build competitive advantage. However, one unclear issue is whether relational capital refers to internal relations or those external to the organization question. Therefore, we feel that these two kinds of relational capital need to be considered separately. Therefore, we will discuss both internal relation capital (hereafter referred to as social capital) and external relation capital (referred to as network capital) in this study.

Following knowledge-based theory, the main purpose of this study was to verify the causal relationships between IT, IC and innovation performance. From the literature review, we developed four hypotheses to be tested, as described below, and the relationships between IT competency, intellectual capital and innovation performance are shown in Figure 1.

H1 : IT competency will be positively related to IC.

H2 : IT competency will be positively related to innovation performance.

H3 : IC will be positively related to innovation performance.

H4 : The relationship between IT and innovation performance will be partially mediated by IC.

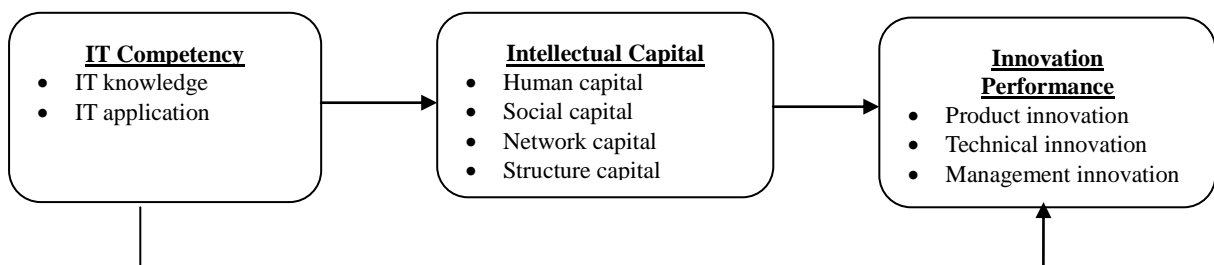


Figure 1 : Hypothesized relationships between IT competency, intellectual capital and innovation performance

METHODS

In order to investigate the casual relationships between IT, IC and innovation performance for Taiwanese knowledge-intensive manufacturing companies, we selected high-tech firms in Hsin-chu Science Park and Southern Taiwan Science Park in Taiwan as research target, and 119 valid samples were gathered, with the majority of them relatively young and medium-small sized firms.

In measures, overall, all constructs in the model were measured with multiple-item scales. In general,

well-validated measures reported in previous research were used. Each of these variables was measured by a five-point Likert-type scale, ranging from 1(*strongly disagree*) to 5(*strongly agree*). IT competency (cronbach's $\alpha=0.842$) was measured using five items form Tippins and Sohi (2003), including two dimensions, namely, IT knowledge and IT application. Intellectual capital (cronbach's $\alpha=0.873$) was measured using fourteen items scale from Subramaniam and Youndt(2005) and Yli-Renko et al., (2001), including four dimensions, namely, human capital, social capital, network capital and structural capital in this study. Innovation performance (cronbach's $\alpha=0.842$) was measured using ten items mainly form Projogo and Sohal(2003), including three dimensions, namely, product innovation, manufacture innovation and management innovation. Besides, entire set of items was subjected to confirmatory factor analysis (CFA), using structural equation model to verify validity of each scale. Results showed that measurement scales in this study possessed content validity, convergent validity, discriminate validity and reliability.

ANALYSIS AND DISCUSSIONS

After analysis by structural equation modeling, three important results were derived. First, IT had a direct and significant effect on IC ($\beta = 0.555$, t-value = 5.452), but the direct effect on innovation performance was not significant ($\beta = 0.122$, t-value = 1.467); Second, IC had a significant direct effect on innovation performance ($\beta = 0.665$, t-value = 7.754); Third, IC had mediating effect between IT and innovation performance (indirect effect = 0.369). Consequently, H1, H3, H4 were accepted, but H2 was not accepted. The path coefficients of the final model were as shown in Figure 2.

Generalizing the analysis results, we considered that young high-tech SMEs in Taiwan could utilize IT knowledge in embedded employees even in the organization and apply it to organizationally related matters, such as routines, standard operating processes (SOP), communication tools, meeting tools and so on. In addition, IC was found to mediate the relationship between IT competency and innovation performance, showing that intellectual capital not only influences the latter, but also play a mediating role leading to IT competency and in turn promoting innovation performance.

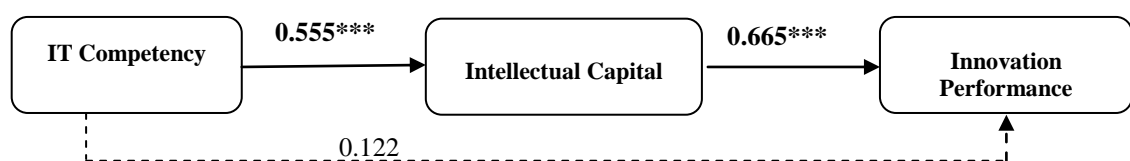


Figure 2: Path coefficients of the final model

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

This study made a contribution to the literature on KBV by supporting the perspective that organizations' competitive advantage and performance are a function of complex invisible resources that are embedded within organizations. In addition, it also provided new evidence that even though IT does not have a direct effect on innovation performance, intellectual capital plays the most important mediating role in terms of product, technology and management innovation.

Therefore, managers should focus on introducing effective IT knowledge, and endeavor to make it root

deeply so that it can be applied to related organizational functions. Moreover, managers should also pay more attention to accumulating competitive intellectual capital in order to strengthen innovative activities. The results of this study not only expand the original statement of KBT, but add to the literature by adopting a macro-view in discussing intellectual capital. The results of the study show that intra-organizational social capital and inter-organizational network capital were simultaneously important.

Management Implications

Some specific management implications of this work are as follows. (1) In order to ensure the workforce is of an appropriate size and has the right skills to meet organizational demands, firms should conduct an audit of the quantity and quality of organizational human resourced by using their IT information systems. Moreover, in order to enhance staff competence, the IT information system should be applied to activities related to recruitment, selection, training, and career development undertaken by the department of human resources. (2) Trust plays an important role in developing internal and external network capital. Based on the aim of building trust among individuals, interaction and the quality of relations and cooperation should be maintained. Therefore, IT should be used to raise communication efficiency and aid formal contractual relationships such as collective R&D, technology transformation, collective marketing and so on. Furthermore, informal relations should not be ignored, such as political and interpersonal relations. (3) Although structural capital referred to organizational institutions, such as culture, structure, system, SOP or routines, we considered organizational culture and basic values as factor that affect organizational strategy and organizational policy. Therefore, organizations should try to become learning organizations (LO) and keep an open mind to adopt a learning orientation within the organization, and make greater efforts toward knowledge acquisition efficiency by utilizing IT systems to develop and promote innovation.

Limitations

Finally, there were two limitations with this study. First, it mainly focused on high-tech firms in Taiwan and used a cross-sectional research method. However, the effects of R&D on innovation performance occur after a considerable time lag, and the different times and environments would cause different IC outcomes. Therefore, longitudinal research, such as a time series study, should be undertaken to verify the results of this work in the future. Second, other industries, such as the knowledge-intensive service industry, could be adopted to test the relationships between IT, IC and innovation performance.

REFERENCES

- Bontis, N., (1998). Intellectual Capital: An Exploratory Study that Develops Measures and Models, *Management Decision*, 36(2), 63-76.
- Fornell, C., and Larcker, D. F., (1981). Evaluating Structural Equation Models with Unobservables and Measurement Error, *Journal of Marketing Research*, 18, 39-50.
- Harrison, S., and Sullivan, Sr P. H., (2000). Profiting from intellectual capital: learning from leading companies, *Journal of Intellectual Capital*, 1(1), 33-46.
- Prajogo, D. I., and Sohal, A. S., (2003). The relationship between TQM practices, quality performance, and innovation performance: an empirical examination, *The International Journal of Quality and Reliability Management*, 20(8/9), 901-918.

Stewart, T. A., (1997). *Intellectual Capital: The New Wealth of Organizations*, New York : Bantam Doubleday Dell Publishing Group, Inc.

Subramaniam, M., and Youndt, M. A., (2005). The influence of intellectual capital on the types of innovative capabilities, *Academy of Management Journal*, 48(3), 450-463.

Tippins, M. J. and Sohi, R. S. (2003). IT competency and firm performance: is organizational learning a missing link?, *Strategic Management Journal*, 24, 745-761.

Yli-REnko, H., Autio, E., and Sapienza, H. J., (2001). Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms, *Strategic Management Journal*, 22, 587-613.