

Knowledge Management and Innovation: The Mediating Effects of Organizational Learning

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Abstract –The relationship between knowledge management and innovation is very critical now. However, without good capability of organizational learning, one organizational can't retain some important knowledge management practices and increase innovation. This study tries to set a model figuring out the moderating effects of organizational learning between knowledge management and innovation based on Common Wealth Magazine's Top 1000 manufacturers and Top 100 financial firms in Taiwan 2007. The result reveals that the relationship among knowledge management, as well as organizational learning and organizational innovation utilizing structural equation modeling. The results show that organizational learning is the mediating variable between knowledge management and organizational innovation. Therefore, knowledge management is an important input, and organizational learning is a key process, then organizational innovation is a critical output.

Keywords – Knowledge management, Organizational learning, Innovation, Mediating effects

I. INTRODUCTION

Facing this rapid change, enterprises should adapt and update its knowledge to maintain its competitive advantages [1]. However, past research showed the issues of knowledge management (KM) are complicated. Some research is related to the competitive advantages, and some are the e-business [2]; some are related to organizational learning, and some are organizational innovation [3]. We found that organizational learning is mixed with KM [4], and the relationship between knowledge management and organizational learning is not evident.

Reviewing past literatures, many scholars conducted the research to understand the relation among knowledge management, organizational learning, and organization innovation separately. We found few papers discussed the practical results and quantitative numbers [5]. Based on theory, knowledge management, organizational learning, and organization innovation should not discuss separately [6]. The immediate concern, in the relentless pursuit of innovation within a knowledge enterprise, appears to be more than just identifying and resolving issues on KM independently.

This study investigates the relationships among knowledge management, organizational learning, and organization innovation together in knowledge-intensive

business. We use LISREL to model the relationships among knowledge management, organizational learning, and organization innovation based on the data sampled from 27 Taiwanese firms. These firms include electronic, and financial insurance industries from which 327 valid samples were received.

II. LITERATURE REVIEW AND HYPOTHESE

A. Knowledge management

Gold, Malhotra, and Segars, (2001) examined the issue of effective knowledge management (KM) from the perspective of organizational capabilities [7]. Cui et al. (2005) also mentioned that KM capabilities consist of three interrelated processes: knowledge acquisition, knowledge conversion, and knowledge application [7], [8]. Knowledge is not only an important resource for a firm, but also it serves as a basic source of competitive advantage [7], [9], [10]. Therefore, KM capabilities refer to the knowledge management processes in an organization that develop and use knowledge within the firm [7]. From Gold et al. (2001) [7] and Cui et al. (2005) [8], we find the completely knowledge management activities from the perspective of organizational capabilities. They argue that there are three main processes: acquisition, conversion, and application. Although there are still many classifications of KM, this study prefer the viewpoints of organizational capabilities, and be in favor of these three dimensions in our study.

B. Innovation

The growth innovation literature provides many alternative conceptualizations and models for the interpretation of observed data. An innovation can be a new product or service, a new production process technology, a new structure or administrative system, or a new plan or program pertaining to organizational members. Therefore, organizational innovation, or innovativeness, is typically measured by the rate of the adoption of innovations, although a few studies have used other measures [11].

Very little empirical research has specifically addressed antecedents and consequences of effective knowledge management [5]. The management of knowledge is frequently identified as an important antecedent of innovation. Effective KM has been

presented in the literature as one method for improving innovation and performance. While many studies have reported that KM as antecedents of innovation, none has explicitly examined the relationship between the two constructs. In Darroch (2005), we got the result that KM process would positively affect innovation. Therefore, it is fair to conclude that the relationship between KM and innovation is close related [12]. Thus, this study propose,

H1: Knowledge management will affect organizational innovation positively

C. Organizational Learning

Facing the current uncertainty environment, business must keep learning to maintain its competitiveness. And, OL will develop well based on well structured knowledge in organizations. In other words, business could have OL capabilities underlying well individual learning [13]. Pilar et al. (2005) also argued that knowledge and, more specifically, its acquisition or creation, along with its dissemination and integration within the organization, become a key strategic resource to OL [14]. OL is seen as a dynamic process based on knowledge, which implies moving among the different levels of action, going from the individual to the group level, and then to the organizational level and back again[15], [16]. Ke and Wei (2006) have discussed and identified knowledge is the antecedent and base of OL [17]. Thus, this study propose,

H2: Knowledge management will affect organizational learning positively.

The firm's learning capabilities play a crucial role in generating innovations [18]. Innovation implies the generation, acceptance, and implementation of new ideas, processes, products, or services. Organizational innovation is defined as the application of ideas that are new to the firm, whether the newness is embodied in products, processes, and management or marketing systems [19]. What one may see as drivers of the innovation processes within firms is their learning. After empirical test, they indeed verified the relationship between learning and organizational innovation. In other words, learning will influence organizational innovation positively. Therefore, this study propose,

H3: Organizational learning will influence organizational innovation positively.

From literature review, knowledge management will affect organizational learning positively [20], [21]. And organizational learning will influence organizational innovation positively [22], [19]. Darroch and McNaughton (2003) also found that knowledge acquisition had more indirect than direct influence on innovation [23]. Therefore, this study propose,

H4: Organizational learning will be a mediator between knowledge management and organizational innovation.

According to the literatures, this study constructs the research framework which is shown in Fig. 1.

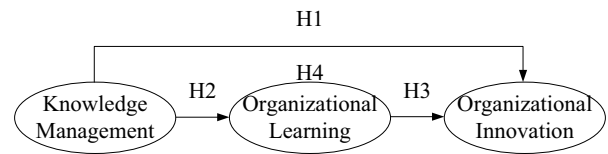


Fig. 1 Research Framework

III. METHODOLOGY

The firms selected for empirical study were chosen from the companies listed in Common Wealth Magazine's Top 1000 manufacturers and Top 100 financial firms in 2007 by mails. Therefore, a total of 600 questionnaires were mailed between Jun. 2007 and Sep. 2007, with 327 valid and complete responses used for subsequent quantitative analysis. The useable response rate was 54.5%.

In this study, 5-point Likert scale (1 totally disagree to 5 totally agree) was used. This study adopts three dimensions from Gold, Malhotra, and Segars (2001) [7]. They are knowledge acquisition, knowledge conversion, and knowledge application except knowledge protection because it will decrease knowledge transfer and integration. Organizational learning is defined as the activities which organizations do in transformation of learning capability including individuals and competitors [14]. It is considered to be four dimensions: management commitment, system perspective, openness and experimentation, and knowledge transfer and integration. Organizational innovation is defined as five dimensions: they are behavior, product, process, market, and strategic innovations [24].

IV. RESULTS

A. Correlation analysis

Table 1 displays the means, standard deviations of variables and their correlations. As can be seen, the following relationships exist between the research variables. Correlations can only reveal the degree of relationship between constructs. To further understand the direct and indirect effects, as well as mediating effects among the constructs, further analysis by structural equation model is required.

Table 1 Descriptive statistics of variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12
KAC	0.761											
KCO	.730**	0.700										
KAP	.689**	.760**	0.807									
MC	.576**	.532**	.577**	0.676								
SP	.553**	.507**	.575**	.675**	0.702							
EX	.599**	.569**	.639**	.732**	.605**	0.656						
TR	.561**	.500**	.610**	.670**	.596**	.675**	0.536					
BEN	.484**	.490**	.554**	.698**	.576**	.706**	.568**	0.734				
PDU	.472**	.431**	.537**	.457**	.465**	.470**	.448**	.544**	0.710			
PRO	.581**	.522**	.596**	.583**	.570**	.606**	.512**	.653**	.705**	0.697		
MAR	.374**	.358**	.440**	.436**	.415**	.403**	.347**	.522**	.765**	.658**	0.721	
STR	.489**	.447**	.555**	.520**	.486**	.532**	.518**	.590**	.638**	.598**	.599**	0.439
Mean	3.73	3.68	3.78	3.43	3.48	3.56	3.53	3.42	3.34	3.50	3.12	3.37
SD	.454	.450	.452	.565	.600	.542	.527	.582	.586	.513	.595	.492

**Significant at P<0.01.

B. Measurement Model

In terms of the quality of measurement model, the constructs display satisfactory levels of reliability, as indicated in table 2 and table 3 [25]. Table 2 and table 3 indicate the fitting index of measurement of each construct. Convergent validity can be judged by considering both the significance of the factor loading and t-values. All the multi-items constructs fit this criterion, and the loading is significantly related to its underlying factor (t-values greater than 1.96) in support of convergent validity. To assess discriminate validity, a series of difference tests on the factor correlations among all the constructs [26]. This was done for one pair of variables at a time by constraining the estimated correlation parameter between them to 1.0 and then performing a difference test on the values obtained for the constrained and unconstrained models [26]. The resulting significant difference in indicates that the two constructs are not perfectly correlated and that discriminate validity is achieved [27]. Therefore, after two-stage analysis, we got the results of convergent validity and discriminate validity. Based on table 3 and table 4, all t-values show well convergent validity, and the differences of chi-square are greater than 3.84, where this is a good evidence for the dimensions' discriminate validity.

Table 2 Index of Confirmatory Factor Analysis

Index	KM	OL	INN
GFI	0.86	0.92	0.84
SRMR	0.06	0.049	0.071
RMSEA	0.077	0.063	0.093
NNFI	0.94	0.97	0.94
CFI	0.95	0.97	0.95
χ^2	546.3	225.11	611.63
DF	186	98	160
Normed chi-square	2.94	2.3	3.82

Table 3 Reliability and Convergent validity

Variables	Reliability	λ	ϵ	T-value
KM	0.890	0.75	0.44	14.69***
		0.73	0.46	14.27***
		0.76	0.42	15.04***
OL	0.884	0.79	0.38	16.09***
		0.71	0.49	14.06***
		0.73	0.46	14.52***
		0.70	0.51	13.60***
INN	0.892	0.69	0.52	13.64***
		0.76	0.42	15.48***
		0.80	0.35	16.79***
		0.68	0.54	13.23***
		0.68	0.54	13.24***

Note: |T| ≥ 3.29 , at p 0.001 level ***

Table 4 Discriminate validity

Model	χ^2	DF	$\Delta\chi^2$
---	148.18	51	---
KM-OL	227.74	52	79.56*
KM-INN	258	52	109.82*
OL-INN	238.27	52	90.09*

Note: * significant $\Delta\chi^2 > 3.84$

C. Structural Model

Structural equation modeling of the LISREL 8.7 is implemented to assess the robustness of the results and the stability of the models. For the structural model, Table 5 illustrates the parameter estimates and GFI indicators. The results indicated that this structure fit the data well, $\chi^2(51, n=327) = 148.18, p < .01, CFI=0.98, NNFI= 0.97, RMSEA= 0.076$.

Table 5 shows the structural model with the standardized coefficients for the research sample. The result reported in table 5 provided sufficient support for H1. Knowledge management is significantly and positively related to organizational innovation, $\gamma_1 = 0.26, t(51) = 2.67, p < .05$. And the numbers in table 5 provided support for H2 and H3. Knowledge management is significantly and positively related to organizational learning, $\gamma_2 = 0.78, t(51) = 11.49, p < .05$. Organizational learning is significantly and positively related to organizational innovation, $\beta_1 = 0.62, t(51) = 5.88, p < .05$.

However, the result reported in table 6 provides path analysis showing the direct and indirect effect of each constructs. After analysis, we find the direct effect of knowledge management and organizational innovation, $\gamma_1 = 0.26$, $t(51) = 2.67$, $p < .01$, is significant, and indirect effect is 0.48 , $t(51) = 5.62$, $p < 0.001$ as shown in figure 3. Indirect effect is bigger than direct effect. Therefore, we find that organizational learning mediate the relationship between knowledge management and organizational innovation this is support for H4. The final optimal path model is listed in Fig. 2.

Table 5 Structural parameter estimates and goodness-of-fit indices

	Paths	Standardized coefficients	t-value	Note
H1	Knowledge management → Organizational innovation (γ_1)	0.26*	2.67	✓
H2	Knowledge management → Organizational learning (γ_2)	0.78*	11.94	✓
H3	Organizational learning → Organizational innovation (β_1)	0.62*	5.88	✓
	$\chi^2(32d.f.)=148.18$	GFI = 0.93	CFI=0.98	
	Standardized RMR = 0.047	NNFI=0.97	RMSEA=0.076	

*Significant at $P < 0.001$

Table 6 Direct and Indirect relationship

Variables	OL		INN	
	Effect	T value	Effect	T value
KM				
Direct	0.78***	11.94	0.26**	2.67
Indirect	--	--	0.48***	5.62
Total			0.74***	10.51
OL				
Direct			0.62***	5.88
Indirect			--	--
Total			0.61***	5.83

| T | ≥ 1.96 , at p0.05 level*; | T | ≥ 2.58 , at p 0.01 level** ; and | T | ≥ 3.29 , at p 0.001 level ***.

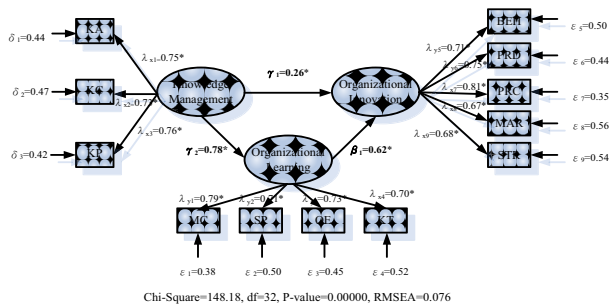


Fig. 2 Theoretical Model

After path analysis, knowledge management will affect organizational innovation by organizational learning. Therefore, organizational learning is an important mediator between knowledge management and organizational innovation. This model is totally new to the research formerly. Since knowledge management is

an important input, firms will exercise organizational learning well in order to increase organizational innovation. If firms can't learn from their individual and group knowledge, there will be no innovation in these firms.

V. DISCUSSION

This study proposes and tests a comprehensive model that explicitly articulates the role of various key variables that in past research received only partial and independent attention. The major findings and the implications are discussed as follows. Knowledge management practice has been taken for many years. But the efficiency of KM depends on many factors. This study tried to declare the importance between knowledge management and organizational learning. From empirical evidence, we found that business must implement knowledge management thoroughly, and accompany with organizational learning, then organizational innovation will spread out. If one organization ignores the organizational learning, knowledge management won't promote the organizational innovation directly. Therefore, organizational learning plays a bridge role to connect knowledge management and organizational innovation. More strictly speaking, organizational learning links the weakness between knowledge management and organizational innovation.

Also, using a cross-sectional data with questionnaires was another limitation of this study. In the future, this limitation should be overcome using longitudinal data. Aside from the limitation of self-report research, the generalizability of sampling is another limitation of this study. We conducted in a specific nation context, Taiwan firms. It is important to note that readers should be cautious when generalization the results to different cultural contexts. Furthermore, the sample size is relative small, requiring the increased sample size

This study demonstrates the importance of knowledge management and the relationship among organizational learning and organizational innovation. Based on 327 valid subjects, this paper implements a structure equation modeling to test the research framework and hypotheses. The results show that knowledge management is an important input to organizations, and organizational learning is a mediator. Knowledge management will significantly affect organizational innovation. But, through organizational learning, KM will have more impact to organizational innovation. Therefore, for managers, one organization should do organizational learning. By thoroughly doing organizational learning, KM implementation will lead to organizational innovation.

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