Knowledge Acquisition, Absorptive Capacity, and Innovation Capability: An Empirical Study of Taiwan's Knowledge-Intensive Industries

Shu-Hsien. Liao, Chi-Chuan. Wu, Da-Chian. Hu, and Guang An. Tsuei

Abstract—This study investigates the roles of knowledge acquisition, absorptive capacity, and innovation capability in finance and manufacturing industries. With 362 valid questionnaires from manufactures and financial industries in Taiwan, we examine the relationships between absorptive capacity, knowledge acquisition and innovation capability using a structural equation model. The results indicate that absorptive capacity is the mediator between knowledge acquisition and innovation capability, and that knowledge acquisition has a positive effect on absorptive capacity.

Keywords—Absorptive capacity, knowledge acquisition, innovation capability.

I. INTRODUCTION

IN 1965, Drucker proposed that knowledge would replace equipment, capital, materials, and labor, to become the key element in production. Two decades later, in 1997, he maintained that competitive advantage in the future will be determined by knowledge resources, or what is known as knowledge workers [1]. Rapid changes in business environment have shortened the cycle of core competitiveness and there is essentially no longer any long-term competitiveness. Therefore, businesses should maintain their competitive advantage by understanding the market conditions, innovating knowledge, and promoting innovation.

However, innovation must rely on a base of common knowledge. Moreover, knowledge in an organization comes from both inside and outside the organization. Therefore, an organization's ability to absorb external knowledge, its absorptive capacity, is very closely related to knowledge acquisition. There have also been some studies showing that the more organizations absorb new knowledge and acquire

Shu-Hsien. Liao is with the Graduate Institute of Management Science, Tamkang University, 151, Ying-Juan Rd, Danshuei Jen, Taipei 251, Taiwan ROC (e-mail: Michael@mail.tku.edu.tw).

Chi-Chuan. Wu is with the Graduate Institute of Management Science, Tamkang University, 151, Ying-Juan Rd, Danshuei Jen, Taipei 251, Taiwan ROC (e-mail: ccwu@ttu.edu.tw).

Da-Chian Hu is with the Graduate Institute of Management Science, Tamkang University, 151, Ying-Juan Rd, Danshuei Jen, Taipei 251, Taiwan ROC (phone: 886-2-26215656*2185; e-mail: 894560241@s94.tku.edu.tw).

Guang An. Tsuei is with the Graduate Institute of Management Science, Tamkang University, 151, Ying-Juan Rd, Danshuei Jen, Taipei 251, Taiwan ROC.

knowledge, the more innovation and competitive advantages they will obtain in the process [2]. The main purpose in this study as follows. First; to find out if knowledge acquisition will be an antecedent factor for absorptive capacity in organizations, second; to determine if absorptive capacity will mediate the relationship between knowledge acquisition and innovation capability and finally; to understand the correlation between knowledge acquisition, absorptive capacity, and innovation capability in organizations.

II. THEORETICAL BACKGROUND AND HYPOTHESIS

A. Relationship between Knowledge Acquisition and Absorptive Capacity

Researchers have identified many key aspects to the knowledge management process: capture, transfer and use [3]; acquire, collaborate, integrate and experiment [4]. Knowledge acquisition and creation are the first steps in the process of developing knowledge [5]. However, acquiring knowledge is the first activity in the boarder activity of accepting knowledge from the external environment and transforming it into a representation that can be internalized, and/or used within an organization. Sub-activities include extracting knowledge from external sources, interpreting the extracted knowledge, and transferring the interpreted knowledge. Hence, knowledge, once acquired, must be quickly and effectively disseminated to all parts of the firm [5].

Improved use of existing knowledge and more effective acquisition of new knowledge is also a key aspect of acquisition [6]. It includes the mechanisms and procedures for collecting information inside and outside the organization or creating knowledge [7]. Of course, the procedure of acquiring and identifying knowledge through the experience and reconciliation in an organization will assist administrative and technological innovation [1].

Reference [8] highlight four distinct but complementary capabilities that compose a firm's absorptive capacity: knowledge acquisition, knowledge assimilation, knowledge transformation, and knowledge exploitation. Therefore, organizations with better knowledge acquisition will have a positive level of absorptive capacity.

Thus, this research proposes the first hypothesis as follows:

World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:3, No:5, 2009

Hypothesis 1: Knowledge acquisition is positively related to absorptive capability.

B.   Relationship between Absorptive Capacity and Innovation Capability

Reference [9] defined absorptive capacity as: the ability to recognize the value of new information, to assimilate it, and apply it to commercial ends. It is also a key factor to innovation capability. Absorptive capacity is the ability to evaluate and utilize knowledge outside the organization in order to identify the organizational environment. This means that high absorptive capacity (higher education, employee development, and innovation tendency) will lead to high performance [10].

In recent years, studies related to absorptive capacity can be divided into the following areas.

1. Absorptive capacity is related to an organization's existing knowledge and internal knowledge including human capital and technology. [11-13]

2. Absorptive capacity is related to the external environment, such as government policies and rules, industrial interactions and risk. [2, 14-16].

3. R&D expenditure will increase the absorptive capacity of an organization. [17]

4. Intensity of learning will influence absorptive capacity. [2]

5. Absorptive capacity is related to organizational strategies.[13]

6. Absorptive capacity will increase the innovation and competitive advantage.[10,13,14]

Most studies have taken the numbers of patents and publications, or the usages of patents as the measure of absorptive capacity [15,18,19]. On the other hand, other studies have taken the ratio of R&D expenditure and sales volume as the measure [20]. However, absorptive capacity is a tacit and complex construct, and thus very difficult to measure. Therefore, we took the four dimensions used by [14]. They are (1) the links between the firm and the surrounding environment, (2) the level of knowledge and experience of the organization, (3) the diversity and overlapping of knowledge structure, and (4) the strategic posture for measuring absorptive capacity. This will avoid using a single index-such as R&D or R&D expenditure to evaluate absorptive capacity.

Maintaining or increasing the absorptive capacity of an organization would incur R&D expenditure, and it influence innovation capability positively. Therefore, once an organization can sustain absorptive capacity, this will link its research and practice together[18]. Innovation capability is related not only to product/process, but also to technology and management [21].

Reference [7] found that most studies in the innovation literature stressed the importance of capacity in using external knowledge, that is, absorptive capacity influenced innovation capability. Moreover, interacting with external new knowledge will promote absorptive capacity. Therefore, this research proposes the second hypothesis as follows:

Hypothesis 2: Absorptive capacity is positively related to a firm's innovation capability.

C.   Relationship between Knowledge Acquisition and Innovation Capability

Different studies have defined innovation in different ways, most of which focus on the improvement or upgrading of technology, or the reform or development of products. This research considers innovation capability as the performance of the enterprise going through various types of innovation to achieve an overall improvement of its innovation capability [22]. Reference [23] suggests that innovation should use production and marketing technology to produce new products, or services to customers, or new attributes of products to customers. However, the new attributes are related to uncertainty of competitors' behaviors. This uncertainty will influence the organizational decisions and will, in turn, affect innovation [24].

Reference [25] also defined innovation as: (1) the ability to develop products to meet the needs of market, (2) the ability to use existing technology to develop products, (3) the ability to develop new products or update existing products to meet the needs of markets, and (4) the ability to acquire new technology to create new opportunities. Therefore, some authors took innovation capability as an asset in an organization. In our previous study, we extended the scope of innovation from technology to management. Reference [22] measured innovation capability using three important dimensions: product innovation, process innovation, and management innovation. Thus, this research proposes the third hypothesis as follows:

Hypothesis 3: Knowledge acquisition is positively related to a firm's innovation capability.

D. Relationship between Absorptive Capacity, Innovation Capability, and Knowledge Acquisition

Reference [26] evidenced that the organization's absorptive capacity was a significant intermediary factor in taking advantage of weak ties networks [26]. Reference [27] concluded that absorptive capacity played a mediation role in creating new knowledge [27]. Reference [28] also found that knowledge acquisition had more indirect than direct influence on innovation. Therefore, we propose that absorptive capacity is a mediator between knowledge acquisition and innovation capability.

Hypothesis 4: Absorptive capacity is a mediator between knowledge acquisition and innovation capability.

According to the abovementioned studies, we developed a research map for our research, as shown in Fig. 1. There are many complex relationships between knowledge acquisition, absorptive capacity, and innovation capability. The heavy black line in the figure indicates the main influence. In addition, we have identified some other factors affecting knowledge acquisition, absorptive capacity, and innovation capability. This presents a more comprehensive view of directions for future research.
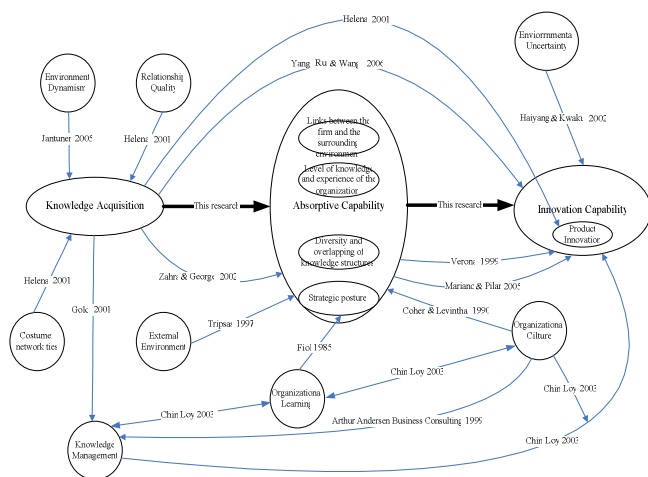
World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:3, No:5, 2009

Fig. 1 Research Map

III. RESEARCH METHODOLOGY

A. Research Framework

This study investigates the relationship between knowledge acquisition, absorptive capacity, and innovation capability. According to the literature review, the research framework and hypotheses were developed are depicted in Fig. 2.
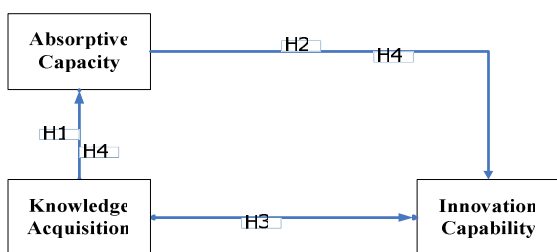

Fig. 2 Research framework

B. Sampling

TABLE I
PERCENTAGE OF SAMPLES

Demographic variable	Classification	Samples	Percentage
Industry	Manufacturing	227	62.7%
	Financial	135	37.3%
Gender	Male	194	53.6%
	Female	168	46.4%
Total		362	100%

This study used the cross-industry data collection method. 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 2006. Therefore, there are two samples (industries) in our survey. A total of 1,300 questionnaires were mailed between Dec. 2006 and Mar. 2007, with 362 valid and complete responses used for subsequent quantitative analysis. The useable response rate was 27.8%. Our sample distribution according to industry and gender is listed in Table I. As can be seen, the manufacturing sector accounts for 62.7% of our sample, with the remaining 37.3% being the financial sector.

C. Measurement

A 5-point Likert scale (1 = totally disagree, 5 = totally agree) was used to measure these constructs. The questionnaire was further refined after a pilot study was conducted with managers in the area of knowledge management and innovation.

(1) Knowledge acquisition

Knowledge acquisition can be treated as a process of using and acquiring knowledge from existed knowledge. It requires concerted effort and a high degree of experience in recognizing and capturing new knowledge. This study modified the constructs of [5-7]. Thus, this research uses seven items. Two primary means for knowledge acquisition are (1) to see and acquire entirely new knowledge, or (2) create new knowledge out of existing knowledge through collaboration among individuals and business partners.

(2) Absorptive capacity

On the other hand, many previous studies have measured absorptive capacity in organizations. A first approximation of the selection of factors that may be considered relevant for measuring absorptive capacity was made by [9]. They pointed out that in order to grasp what the sources of a firm's absorptive capacity were, one should concentrate on 'how the communications between the firm and the external environment are organized', and also on the 'nature of the know-how and experience within the organization.' This current study employs the constructs developed by [14], which included groups of factors as follows: (1) communication with the external environment (4 items), (2) level of know-how and experience within the organization (3 items), (3) diversity and overlaps in the knowledge structure (3 items), and (4) strategic positioning (4 items).

(3) Innovation capability

Our framework was developed according to the concepts of [22], which defined innovation capability as the performance of the enterprise going through various types of innovation to achieve an overall improvement of its innovation capability. This construct has three dimensions: (1) product innovation (6 items); (2) process innovation (4 items); and (3) management innovation (6 items).

(4) Moderate effect

It has previously been indicated that moderate effects have a significant influence on cross-sectional variations of some constructs. In this research, we also test the influence of industry type in H5.

IV. DESCRIPTIVE STATISTICS AND EMPIRICAL RESULTS

A. Descriptive Statistics

Means, standard deviations, and reliability estimates of the study variables are presented in Table II, which reveals that the

World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:3, No:5, 2009

TABLE II
DESCRIPTIVE STATISTICS AND CORRELATION COEFFICIENTS

Variables	Mean	S.D.	1	2	3	4	5	6	7	8
1. LFE	3.68	0.52	(0.60)							
2. LKE	3.69	0.56	.54**	(0.68)						
3. DOK	3.62	0.58	.34**	.43**	(0.64)					
4. STP	4.28	0.47	.37**	.39**	.29**	(0.45)				
5. KAC	3.83	0.45	.42**	.55**	.30**	.40**	(0.75)			
6. PRI	3.74	0.49	.61**	.64**	.37**	.48**	.56**	(0.76)		
7. POI	3.64	0.54	.57**	.57**	.39**	.40**	.46**	.64**	(0.70)	
8. MAI	3.58	0.51	.55**	.59**	.43**	.41**	.58**	.67**	.68**	(0.77)

Note: 1. Values in parentheses along the diagonal are alpha coefficients.
2. *p < 0.05, **p < 0.01

measures exhibited appropriate internal consistency reliability. As seen in the table, all α are almost above 0.8, with some being 0.7. Reference [29] concluded that an α above 0.7 indicates high reliability; 0.35-0.7, medium reliability; and below 0.35, low reliability; thus our reliability is quite high. Correlations reflecting several of the direct paths predicted by the hypotheses were significant.

B. Empirical Results

(1) Measurement model

Next, we conducted a confirmatory factor analysis (CFA) to test the fitness of factors and items in variables, as listed in Table III. CFI performed well with both small and large samples, with the GFI value equal to or exceeding 0.9. The SRMR value should be below 0.05, and the RMSEA value should be below 0.08. The CFI value was equal to or exceeded 0.9. All indexes matched the benchmarks of [30].

TABLE III
MODEL FIT OF MEASUREMENT MODEL

Variables Index	Absorptive capacity	Knowledge Acquisition	Innovation Capability
GFI	0.96	0.99	0.94
AGFI	0.94	0.98	0.92
SRMR	0.042	0.025	0.04
RMSEA	0.038	0.015	0.045
NNFI	0.97	1	0.98
CFI	0.98	1	0.98
PNFI	0.73	0.59	0.81
CN	337.67	810.22	285.68
Normed chi-square	1.52	1.08	1.72

(2) Convergent validity

Convergent validity can be assessed from the measurement model by determining whether each indicator's estimated pattern coefficient on its posted underlying construct factor is significant (greater than twice its standard error) [31].

In factor analysis, the T-value of all items in this research were between 5.62 and 14.77, so they all exceeded 1.96, which indicates that all observation items are significant in representing latent variables.

(3) Discriminant Validity

Following [31], we tested the discriminant validity, which can be assessed for two estimated constructs by constraining the estimated correlation parameter between 0 to 1.0 and then performing a chi-square difference test on the values obtained for the constrained and unconstrained models [32]. Reference [33] that, "A significantly lower χ2 value for the model in which the trait correlations are not constrained to unity would indicate that the traits are not perfectly correlated and that discriminant validity is achieved." (p. 476.). In our study, the values of Δχ2 is between 10.67 to 82.3. All values are exceeded 3.84, indicating that our study achieved discriminant validity.

(4) Path Analysis

Next, we conducted a path analysis using the maximum likelihood (ML) estimation procedures to formally test the hypothesized relationship between the observed variables. Path analysis with maximum likelihood (ML) estimation provides accurate estimates of parameter with samples between 100-150 [34]. Table IV shows some important values of path analysis.

TABLE IV (A)
PATH ANALYSIS

Path	Relation	Standard Solution	Result
KAC→LFE(γ_{11})	+	0.42***	Supported
KAC→LKE(γ_{12})	+	0.55***	Supported
KAC→DOK(γ_{13})	+	0.30***	Supported
KAC→STP(γ_{14})	+	0.41***	Supported
	Supporting H1		
LFE→PRI(β_{15})	+	0.31***	Supported
LFE→POI(β_{16})	+	0.32***	Supported
LFE→MAI(β_{17})	+	0.25***	Supported
LFE→PRI (β_{25})	+	0.30***	Supported

World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:3, No:5, 2009

LFE→POI (β_{26})	+	0.26***	Supported
LFE→MAI (β_{27})	+	0.22***	Supported
DOK→PRI (β_{35})	-	0.04	---
DOK→POI (β_{36})	+	0.12**	Supported
DOK→MAI (β_{37})	+	0.15***	Supported
STP→PRI (β_{45})	+	0.17***	Supported
STP→POI (β_{46})	+	0.12**	Supported
STP→MAI (β_{47})	-	0.08	---

Partially supporting H2

TABLE IV (B)
PATH ANALYSIS

Path	Relation	Standard Solution	Result
KAC→PRI(γ_{15})	+	0.21***	Supported
KAC→POI(γ_{16})	+	0.12**	Supported
KAC→MAI(γ_{17})	+	0.30***	Supported

Supporting H3

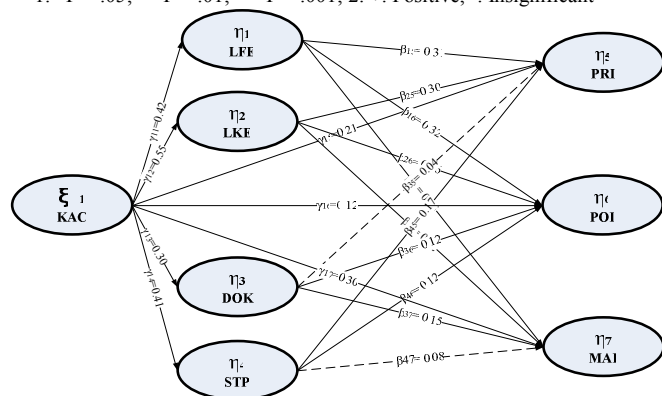1. *P < .05; ** P < .01; ***P < .001; 2. +: Positive; -: Insignificant

Fig. 3 Optimal Path Diagram

1) Knowledge Acquisition and Innovation Capability

According to Table IV, $\gamma 11 = 0.42$ (p < .05), $\gamma 12 = 0.55$ (p < .05), $\gamma 13 = 0.30$ (p < .05), $\gamma 14 = 0.41$ (p < .05), $\gamma 15 = 0.21$ (p < .05), $\gamma 16 = 0.12$ (p < .05), and $\gamma 17 = 0.30$ (p < .05). These values were all significant, indicating that with more knowledge, organizations have greater absorptive capacity, thus supporting Hypothesis 1.

As seen in Table IV and Fig. 3, $\beta 15 = 0.31$ (p < .05), $\beta 16 = 0.32$ (p < .05), $\beta 17 = 0.25$ (p < .05), $\beta 25 = 0.30$ (p < .05), $\beta 26 = 0.26$ (p < .05), $\beta 27 = 0.22$ (p < .05), $\beta 35 = 0.04$ (p > .05), $\beta 36 = 0.12$ (p < .05), $\beta 37 = 0.15$ (p < .05), $\beta 45 = 0.17$ (p < .05), $\beta 46 = 0.12$ (p < .05), and $\beta 47 = 0.08$ (p > .05). These values were all significant, except $\beta 35 = 0.04$ (p > .05) and $\beta 47 = 0.08$ (p > .05), indicating that with greater absorptive capacity, organizations will have greater innovation capability, with the exception of some paths ($\beta 35$, $\beta 47$), thus giving partial support to Hypothesis 2.

2) Knowledge Acquisition and Innovation Capability

According to Table IV, the relationship between knowledge acquisition, product innovation, process innovation, and management innovation were statistically significant ($\gamma 15 = 0.21$ (p < .05), $\gamma 16 = 0.12$ (p < .05), $\gamma 17 = 0.30$ (p < .05)). Therefore, knowledge acquisition is positively related to a firm's innovation capability, as predicted in Hypothesis 3.

3) Mediation Effect

In this section, we performed competition model to demonstrated our full mediation model is the best one in our hypothesis model. The model fit of our fully mediated model indicated that $\chi 2$ (33, N=362)=55.36, p<.01; GFI=.97; CFI=.99; and RMSEA=.043. Both of the estimated structural paths are significant. The partially mediated model fits the data: $\chi 2$(32, N=362)=55.35, p<.01; GFI=.97; CFI=.99; and RMSEA=.045, although the path between knowledge acquisition and innovation capability is not significant. A direct model for the data is: $\chi 2$(33, N=362)=95.38, p<.01; GFI=.95; CFI=.98; and RMSEA=.072. In comparing the fit of the three models, using GFI, CFI, and RMSEA, the results suggest the partially mediated model and fully mediated model provide substantially better fit to the data than the direct model. Furthermore, the results of a chi square difference test demonstrated that the partially mediated model and fully mediated model were non-significant ($\chi 2$ diff (1, N=362)=.01, p>.05). Therefore, the fully mediated model is the best model in our study. Secondly, we use three steps to show our model is a full-mediated model. First, we examine the relationship between knowledge acquisition and innovation capability, and the results are significant (β=.78, p<.01). Second, we consider the relation of absorptive capacity and innovation capability, and the results are also significant (β=.98, p<.01). Third, we add absorptive capacity to the first model to test if absorptive capacity is a mediator. The results of the partially mediated model indicate that once we add absorptive capacity to our model as a mediator, the relationship between knowledge acquisition and innovation capability was changed to non-significant (β=.02 , p>.05). Originally, the total effect between knowledge acquisition and innovation capability was .78, but now it mostly equal to the direct effect of .02 plus the indirect effect of .776 (0.8*.97) between knowledge acquisition and innovation capability. This means that the total effect between knowledge acquisition and innovation capability is totally partial out by absorptive capacity after it is added to our model. These results demonstrate that absorptive capacity is a mediator in our model and full mediated is the best one. Absorptive capacity therefore fully mediated the relationship between knowledge acquisition and innovation capability, supporting Hypothesis 4.

V. CONCLUSION

This study investigates the roles of knowledge absorptive capacity, knowledge acquisition and innovation capability in finance and manufacturing. We found that absorptive capacity is a mediator between knowledge acquisition and innovation

World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:3, No:5, 2009

capability.

A. Research Findings

Our statistical analyses yield the following findings. First, Knowledge acquisition is positively related to absorptive capabilities. Hence, H1 is supported. According to this, organizations can acquire knowledge and information to increase their absorptive capacity. Second, Absorptive capacity is positively related to a firm's innovation capability. Among the four dimensions of absorptive capacity, only the level of knowledge and experience of the organization have no positive influence on product innovation. Therefore, H2 is partially supported. Third, Knowledge acquisition is positively related to a firm's innovation capability. Thus, H3 is supported. Fourth, Absorptive capacity indeed plays a mediator role between knowledge acquisition and innovation capability. Thus, H4 is supported. Finally, Models in financial and manufacturing sectors yield different results, showing that industry structure moderates the relationship between knowledge acquisition, absorptive capacity, and innovation capability. Hence, H5 is supported.

B. Discussion

In this research, we implemented four constructs [9] that are used to measure absorptive capacity. Combining the absorptive capacity, internal operation, employee behaviors, and organization policy is more complete. Therefore, absorptive capacity is not only related to employee behaviors but also to the organization overall. This is more comprehensive than the findings of [8] that absorptive capacity influences only employee behaviors. Our research demonstrates the influence on knowledge acquisition and innovation capability. Reference [5] found knowledge acquisition to be positively related with innovation capability, but [28] argued that knowledge acquisition is indirectly influenced by innovation capability. Thus, how knowledge acquisition can affect innovation capability is the key issue of this work. Reference [26] proved that absorptive capacity and network are mediators to innovation capability, and this study supports the results [26], that absorptive capacity is an intermediary. In addition, we found knowledge acquisition affects innovation by absorptive capacity. According to [5], managers should set up knowledge management processes that are appropriate for acquiring knowledge by organizational learning. Moreover, they should build an environment appropriate for sharing employees' tacit knowledge in the organization. Briefly speaking, an organization should build up its absorptive capacity mechanism. In particular, [22] used innovation capability, including management innovation, and found the relationship between absorptive capacity and innovation capability is related not only to employees but also management of the organization.

C. Implications

This research shows that knowledge acquisition could affect innovation capability indirectly. This does not mean that knowledge is unimportant, but the relationship of knowledge

acquisition, absorptive capacity, and innovation capability is more critical for managers. In other words, with a powerful absorptive capacity, knowledge acquisition could successfully increase innovation capability beyond that of a firm's competitors. Reference [22] argued that knowledge sharing and absorptive capacity would more connected by absorptive capacity. Thus, knowledge acquisition or absorptive capacity will be more meaningful to employees when supported absorptive capacity. Because the knowledge of an organization is developed progressively, absorptive capacity must be related to existing knowledge, including the experience and the structure of knowledge. Therefore, different existing knowledge will also have different distortions of the absorption of new knowledge. Reference [14] found that different outside environments or industry sectors have different impacts on absorptive capacity. In Asia, because of financial crises, governments have asked banks which to take some measures to stop these crises. These measures would increase bank risk, add guarantees, and reduce the value of real estate holdings, leading banks to face stronger competitive challenges. Also, two different industry sectors have different knowledge structure. The absorption of knowledge in an organization is promoted because of diversification of knowledge [14]. The same background of knowledge increase the flows of knowledge, and the difference of knowledge help identify individuals. Christensen classified innovation into two ways: sustaining innovation and disruptive innovation. What we call sustaining innovation is producing better products or service for customers in order to create more profits, whereas disruptive innovation tries to produce products that are more convenient and easy for customers to use in order to save cost. Therefore, most innovation is related with products. No doubt most research about innovation is involved with marketing issues (including leaders and challengers in markets.) But for organizations, they also put more concerns not only on general value-added activities (logistics, R&D, manufacturing, and customer service) but also on technology analysis such as reconfirming decision support and operations. In other words, organizations use marketing research, analysis markets reports, and predictious of market needs and financial conditions. These are not directly related with products or technology. Thus, based on existing knowledge in organization, organizations can increase innovation. Innovation capability not only focuses on products or technology, but also on process and management. Based on resource-based theory, an organization should build core competitiveness to maintain it's competitive advantage. For a sustainable run of enterprises, any organization should create innovation capability. If we consider organization as a system, knowledge is its input, absorptive capacity is its processing, and innovation capability is its output. By acquiring knowledge, organizations absorb knowledge and translate it to innovation so they can obtain competitive advantage.

D. Limitation and Future Work

First, in this research, we consider industry as a moderator. But we do not know whether or not organizational culture

World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:3, No:5, 2009

influences innovation capability. This is another moderator in organizations which would be a topic for further research in the future. Second, [9] found that there is a relationship between absorptive capacity and the learning capability. Therefore, organizational culture may play an important role as a moderator. Organizational culture is not only a set of values, but also an attitude/behavior of members in organization. For this reason, organizational culture can be treated as an antecedent of absorptive capacity in future works. Third, absorptive capacity does influence knowledge acquisition. Knowledge acquisition is a full mediator between absorptive capacity and performance. In addition, we found absorptive capacity is a mediator for another two variables. This infers that knowledge acquisition is a key issue for innovation in future work. Finally, [35] found organizational learning could promote knowledge management, which means that we can acquire knowledge by organizational learning in order to develop absorptive capacity. Therefore, organizational learning is another important issue for knowledge management and innovation capability.

REFERENCES

[1] P. Drucker, and P. Ferdinand, Post-capitalist society: Butterworth-Heinemann Oxford, 1993.
[2] L. Kim, "Crisis construction and organizational learning," ORGANIZATION SCIENCE, vol. 9, no. 4, pp. 506–521, 1998.
[3] D. De Long, "Building the Knowledge-Based Organization: How Culture Drives Knowledge Behaviors," Center for Business Innovation, Ernst & Young, May, 1997.
[4] D. Leonard-Barton, Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation: Harvard Business School Press, 1995.
[5] J. Yang, M. Rui, and J. Wang, "Enhancing the firm's innovation capability through knowledge management: A study of high technology firms in China," International Journal of Technology Management, vol. 36, no. 4, pp. 305-317, 2006.
[6] A. Gold, "Knowledge Management: An Organizational Capabilities Perspective," Journal of Management Information Systems, vol. 18, no. 1, pp. 185-214, 2001.
[7] A. Jantunen, "Knowledge-processing capabilities and innovative performance: an empirical study," European Journal of Innovation Management, vol. 8, no. 3, pp. 336, 2005.
[8] S. Zahra, and G. George, "Absorptive Capacity: A Review, Reconceptualization, and Extension," Academy of Management Review, vol. 27, no. 2, pp. 185-203, 2002.
[9] D. Levinthal, "Absorptive Capacity: A New Perspective on Learning and Innovation Wesley M. Cohen," Administrative Science Quarterly, vol. 35, pp. 128-152, 1990.
[10] G. Colin, "Absorptive capacity, knowledge management and innovation in entrepreneurial small firms," International Journal of Entrepreneurial Behaviour & Research, vol. 12, no. 6, pp. 345-360, 2006.
[11] A. Boynton, R. Zmud, and G. Jacobs, "The Influence of IT Management Practice on IT Use in Large Organizations," Management Information Systems Quarterly, vol. 18, no. 1, pp. 14, 1994.
[12] W. Keller, S. S. R. Institute, and U. o. Wisconsin--Madison, Absorptive Capacity: On the Creation and Acquisition of Technology in Development: Social Systems Research Institute, University of Wisconsin, 1996.
[13] M. Lenox, and A. King, "Prospects for developing absorptive capacity through internal information provision," Strategic Management Journal, vol. 25, no. 4, pp. 331-345, 2004.
[14] M. Nieto, and P. Quevedo, "Absorptive capacity, technological opportunity, knowledge spillovers, and innovative effort," Technovation, vol. 25, no. 10, pp. 1141-1157, 2005.
[15] D. Mowery, J. Oxley, and B. Silverman, "Strategic alliances and interfirm knowledge transfer," Strategic Management Journal, vol. 17, no. WINTER, pp. 77-91, 1996.
[16] R. Veugelers, "Internal R & D expenditures and external technology sourcing," Research Policy, vol. 26, no. 3, pp. 303-315, 1997.
[17] X. Liu, and R. White, "The relative contributions of foreign technology and domestic inputs to innovation in Chinese manufacturing industries," Technovation, vol. 17, no. 3, pp. 119-125, 1997.
[18] I. Cockburn, and R. Henderson, "Absorptive Capacity, Coauthoring Behavior, and the Organization of Research in Drug Discovery," Journal of Industrial Economics, vol. 46, no. 2, pp. 157-182, 1998.
[19] C. Nicholls-Nixon, "Absorptive capacity and technological sourcing: implications for the responsiveness of established firms," Unpublished Ph. D. dissertation, Purdue University, 1993.
[20] G. Stock, N. Greis, and W. Fischer, "Absorptive capacity and new product development," Journal of High Technology Management Research, vol. 12, no. 1, pp. 77-91, 2001.
[21] A. Petroni, and B. Panciroli, "Innovation as a determinant of suppliers' roles and performances: an empirical study in the food machinery industry," European Journal of Purchasing and Supply Management, vol. 8, no. 3, pp. 135-149, 2002.
[22] S.-h. Liao, W.-C. Fei, and C.-C. Chen, "Knowledge sharing, absorptive capacity, and innovation capability: an empirical study of Taiwan's knowledge-intensive industries," Journal of Information Science, vol. 33, no. 3, pp. 340-359, June 1, 2007, 2007.
[23] A. Afuah, Innovation Management: Strategies, Implementation, and Profits: Oxford University Press, 1998.
[24] H. Li, and K. Atuahene-Gima, "The adoption of agency business activity, product innovation, and performance in Chinese technology ventures," Strategic Management Journal, vol. 23, no. 6, pp. 469-490, 2002.
[25] P. Adler, and A. Shenhar, "Adapting your technological base: The organizational challenge," Sloan Management Review, vol. 32, no. 1, pp. 25-37, 1990.
[26] P.-A. Julien, E. Andriambeloson, and C. Ramangalahy, "Networks, weak signals and technological innovations among SMEs in the land-based transportation equipment sector," Entrepreneurship & Regional Development, vol. 16, no. 4, pp. 251 - 269, 2004.
[27] F. Van Den Bosch, H. Volberda, and M. de Boer, "Coevolution of Firm Absorptive Capactiy and Knowledge Environment: Organizational Forms and Combinative Capabilities," Organization Science, vol. 10, no. 5, pp. 551-568, 1999.
[28] J. Darroch, and R. McNaughton, "Beyond market orientation," European Journal of Marketing, vol. 37, no. 3/4, pp. 572-593, 2003.
[29] L. Cronbach, "Coefficient alpha and the internal structure of tests," Psychometrika, vol. 16, no. 3, pp. 297-334, 1951.
[30] R. Bagozzi, and Y. Yi, "On the evaluation of structural equation models," Journal of the Academy of Marketing Science, vol. 16, no. 1, pp. 74-94, 1988.
[31] J. Anderson, and D. Gerbing, "Structural equation modeling in practice: A review and recommended two-step approach," Psychological Bulletin, vol. 103, no. 3, pp. 411-423, 1988.
[32] K. Joreskog, "Simultaneous factor analysis in several populations," Psychometrika, vol. 36, no. 4, pp. 409-426, 1971.
[33] R. Bagozzi, and L. Phillips, "Representing and Testing Organizational Theories: A Holistic Construal," Administrative Science Quarterly, vol. 27, no. 3, pp. 459-89, 1982.
[34] L. Ding, W. Velicer, and L. Harlow, "Effects of estimation methods, number of indicators per factor, and improper solutions on structural equation modeling fit indices," Structural Equation Modeling, vol. 2, no. 2, pp. 119-143, 1995.
[35] C. Chin-Loy, "Assessing the influence of organizational culture on knowledge management success," Nova Southeastern University United States, 2003.

Shu-Hsien Liao is a professor in the Department of Management Sciences & Decision Making, Tamkang University, Taiwan. He received the Ph.D. degree in Operational Research/System Group of Business School, University of Warwick, UK, in 1996. His publications have appeared in the European Journal of Operational Research, Journal of the Operational Research Society,

Journal of Information Science, Soft Computing, Expert Systems With Applications, Government Information Quarterly, Technovation, and Space Policy. His current research interests are in decision theory, information management, decision support systems, knowledge management, electronic commerce, database management, Data mining, Technology management, and Supply (Demand) Chain Management.

Chi-Chuan. Wu is a PhD student at Department of Management Science, Tamkang University, Taiwan. She received her Master degree in Business Management from Tatung University, Taiwan. Her research interests are in knowledge management, management of technology innovation.

Da-Chian Hu is a PhD student at Department of Management Science, Tamkang University, Taiwan. He received his Master degree in Management Science from Tamkang University, Taiwan. His research interests are in knowledge management, management of technology innovation and organizational behavior.

Guang An. Tsuei received his Master degree in Management Science from Tamkang University, Taiwan. His research interests are in knowledge management, management of technology innovation.