

## How Innovation Capability Can Be a Mediate Between Knowledge Management and Innovation Performance?

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**Abstract:** Being innovative is one of the best and effective strategies to compete, penetrate a new market and expand the market share. Furthermore in the current situation where the competition is ever-increasing, organizations try to reinforce and enhance their innovation performance. Therefore, the present study seeks to investigate how establishing knowledge management within organization can affects positively on innovation performance. Although, the literature refers to relationship between knowledge management and innovation performance, this relationship still weak and need to investigate again by examining the effect of a third variable as mediating variable which hope to make this relationship more clear. Therefore, this study targets to examine the mediating role of innovation capability between knowledge management and innovation performance. The sample frame of this study was Hi-technology companies in Kulim Technology Park (KTP) in Malaysia. The output of PLS-SEM establishes innovation capability as full mediating variable in the relationship between knowledge management and innovation performance. Moreover based on the obtained result, several recommendations have been highlighted.

**Key words:** Knowledge management, innovation capability, innovation performance, mediating role, market share

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### INTRODUCTION

In the era of the knowledge economy, rapid technological change and ever-increasing competition, organizations face many challenges to survive, grow and develop. As a result of the global pressure of competition, many strategies have been developed and applied in the business field to achieve competitive advantage. However, several researchers considered innovation as the main source of competitive advantage (Bigliardi and Dormio, 2009; Rosenbusch *et al.*, 2010; Sandvik and Sandvik, 2003). Being innovative is one of the best and effective strategies to compete, penetrate a new market and expand the market share (Bigliardi and Dormio, 2009; Rosenbusch *et al.*, 2010). In addition, the ability to leverage on innovation has become the main engine and driver of economic growth (Rosenberg, 2004; Torun and Cicekci, 2007). According to Torun and Cicekci (2007), modern economies are built with ideas that are translated to creative output.

Thus, organizations in this competitive environment try to reinforce and enhance their innovation performance. In order to achieve high rate of innovation performance,

a bundle of capabilities related to innovation should be built well first (Yam *et al.*, 2011). However in order to have and develop the capabilities, organizations should have knowledge (Othman, 2007; Slater and Narver, 1995). Since knowledge is a prerequisite to build and develop capabilities, managing knowledge become a very critical issue for organization which aims and focus on having competitive advantage (Darroch, 2005). Although, the assumption of having a good knowledge management processes will enhance and develop the organizations' capabilities which in turn, impact and improve the organizational performance is logic and well supported by theory such as Resource Based View theory (RBV) and Absorptive Capacity theory (AC). Nevertheless, this relationship between knowledge management processes and innovation capability is still weak and need more investigation to be clearer (Cepeda and Vera, 2007; Chang and Chuang, 2011).

From other side, although the effect of knowledge management on performance exists in the literature, this effect is still weak and cannot be concluded yet (Hung *et al.*, 2010). Because of the nature of the knowledge management outcome which affects specific

aspects more clearly and which is considered as the antecedent of performance, studying the effect of knowledge management on performance should be mediated by a third variable (Hung *et al.*, 2010). Therefore, the relationship between knowledge management and innovation performance should be considered through the mediation of the third variable which is considered as an antecedent of innovation performance.

### **Conceptual framework and research hypotheses**

**Knowledge management and innovation capability:** The relationship between knowledge management processes and innovation capabilities can be clearer from the Absorptive Capacity (AC) theory perspective (Jantunen, 2005; Lin, 2007). AC theory is talking about the organizations' abilities to assess and employ outside knowledge in the best way that make the organization become creative compare to the competitors (Cohen and Levinthal, 1990). Therefore, enhancing the absorptive capacity could improve innovation capabilities which lead to better innovation performance (Lin, 2007). Knowledge management plays important role in enhancing capability and equipping people with necessary knowledge and skills to innovate where generated idea is dependent upon individual creativity, therefore organizations need to facilitate innovation by creating and maintaining an environment that supports innovation and building innovation capability is one of the main requirements to enhance the innovation performance (Amabile *et al.*, 1996).

Furthermore, this relationship can be justified by using RBV theory where the core of the RBV theory is the way in which resources and capabilities are combined to achieve the superior performance (Yang *et al.*, 2009). The relationship between resources and capabilities like this, resources are related to having while capabilities are related to making them more invisible (Olavarrieta and Ellinger, 1997). Accordingly, resources are independent from capabilities and are the source of a firm's capabilities (Amit and Schoemaker, 1993; Grant, 1991). In this context, knowledge management has been considered as one of the organizational resources that generates capabilities in the organization (Despres and Chauvel, 1999; Drew, 1999; Mills and Smith, 2011). Accordingly, the following hypothesis formulated:

H<sub>1</sub>: Knowledge management processes are positively associated with innovation capability.

**Innovation capability and innovation performance:** Innovation capability basically refers to the firm's ability

to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the organization (Hurley and Hult, 1998; Lawson and Samson, 2001). Several researchers have asserted that innovation capability can positively enhance organizations' performance in areas such as financial, market share, innovation (Calantone *et al.*, 2002; Han *et al.*, 1998; Lau *et al.*, 2010; Tuominen and Hyvonen, 2004).

Furthermore, innovation capability has been regarded as an organizations' critical capability that deploys resources with a new capacity to create value (Yang *et al.*, 2009). Moreover, innovation capabilities has been known as the skills and knowledge needed to effectively absorb, master and improve existing technologies and to create new ones (Lall, 1992). Meanwhile, Cavusgil *et al.* (2003) consider innovation capability as critical antecedents to achieve superior innovation performance which provides the potential for effective innovation performance.

Return to the RBV theory which views the organization as a bundle of resources and capabilities (Wernerfelt, 1984) and the organization can achieve superior performance and competitive advantage through developing and deploying unique and distinguished organizational resources and capabilities (Barney, 1991; Wernerfelt, 1984), in other words, the more distinguished of the resources and capabilities, the more valuable to achieve and sustain the superior performance. Based on the earlier discussion the following hypothesis is introduced:

H<sub>2</sub>: Innovation capabilities are positively associated with innovation performance

**Knowledge management and innovation performance:** Knowledge management has been cited as an antecedent of innovation performance (Nonaka and Takeuchi, 1995). According to AC theory, the abilities of the organizations to identify, assimilate and apply the information from outside and inside the organization are the critical capabilities that enhance the innovation performance (Cohen and Levinthal, 1990). Therefore, knowledge management process which is represented by processes of acquiring the voluble information, disseminating this knowledge during the organization and make it available to the users on time and applying this knowledge in commercial way has been considered as the critical antecedents that contribute to provides a necessary foundation to improve the innovation performance of the organization (Becerra-Fernandez *et al.*, 2004; Carneiro, 2001; Darroch and McNaughton, 2002; Gold *et al.*, 2001; Liebowitz, 1999).

Moreover, RBV theory emphasizes on the role of the distinctive resources that the organization have in enhancing and improving the performance and competitive advantage (Grant, 1991). Furthermore, knowledge has been considered as one of the most distinctive resources that any organization may possess (Teece, 1998). Therefore, the processes of managing knowledge are critical in terms of providing a necessary knowledge for developing and enhancing the creative outcome. Consequently, the following hypothesis is proposed.

H<sub>3</sub>: Knowledge management processes are positively associated with innovation performance

**Mediating of innovation capability in the relationship between knowledge management and innovation performance:** Darroch (2005), Jantunen (2005) and Slater and Narver (1995) demonstrate that knowledge is a main foundation of capability and whenever the organization applied the current knowledge in order to solve its problems and activities, the capabilities will further enhanced. On the other hand, many scholars have been considered innovation capabilities as the main antecedents of innovation performance (Cavusgil *et al.*, 2003; Lall, 1992; Yang *et al.*, 2009; Zheng *et al.*, 2011). Thus, the earlier argument guides to propose that establishing knowledge management help to build innovation capabilities and then, innovation performance will increase. This argument is supported by absorptive capacity and RBV theory where absorptive capacity theory refers to the group of processes which is representative by knowledge management processes (i.e., acquisition, dissemination and applications) as antecedence processes that lead to enhance the organization with innovation capabilities which in turn, reflect positively on innovation performance (Cohen and Levinthal, 1990).

Beside AC perspective, this relationship can be justified from RBV perspective. According to RBV theory, knowledge is one of the distinctive resources that the organization can possess (Barney *et al.*, 2001; Barney, 1991) and capabilities are the result of combining the organizations' resources (Amit and Schoemaker, 1993). Additionally, Carneiro (2000), Darroch and McNaughton (2002) and Du Plessis (2007) have identified knowledge management processes as important concept has been cited as an antecedent of innovation performance. Accordingly, the following hypothesis has been formulated as follows:

H<sub>4</sub>: Innovation capability mediates the relationship between knowledge management processes and innovation performance

## MATERIALS AND METHODS

**Data collection and demographic distribution of the sample:** Online survey was the approach through which the necessary data collected form manufacturing companies working in Malaysia. Using this approach to collect the data, i.e., on line survey, provides an advantage which is eliminating the missing values that may cause many problems during analysis part. To achieve the main purpose of this study which is examining the hypothesized relationship on the level of business unit, the questionnaire as the tool of data collection was distributed to the senior managers or managers of R&D or operation managers. All the constructs included in the questionnaire were measured using 7-point likert scale (from strongly disagree = 1 to strongly agree = 7).

Referring to the World Bank report's (2010), one of the main requirements of innovation is the technological capabilities. Accordingly, the population of this study was represented by the manufacturing companies that use high level of technology. Therefore, the current study choses the companies listed in Kulim Hi-Tech park to be as sample frame of this research. Kulim Hi-Tech Park (KHTP) formally established in 1996 as the first Hi-Tech Park in Malaysia. The KHTP is located in the area of Kulim, in the state of Kedah, in the North-West of Peninsular Malaysia. Out of 200 questionnaires have been mailed to the manufacturing companies listed in KHTP, 46 valid questionnaires have been returned, representing response rate 23%.

Due to sample size constraint, Structural Equation Modeling (SEM) precisely Partial Least Square (PLS-SEM) path modeling algorithm techniques was used to test the formulated hypotheses in this study. PLS-SEM is a latent variable modeling technique that includes multiple dependent constructs and explicitly recognizes measurement error. PLS-SEM model includes 2 stages to analyze and interpret the model (Henseler *et al.*, 2009). The first stage is measurement model, followed by structural model. The measurement model relates to the relations between manifest variables and latent variables while the structural model is relates to the relations among the latent constructs (testing hypotheses) (Henseler *et al.*, 2009).

**The measurement model:** The measurement model is tested by assessing the validity and reliability of the items and constructs in the model. This ensures that only reliable and valid constructs' measures are used before assessing the nature of relationships in the overall model (Hair *et al.*, 2011). Therefore, the goodness of measurement, model has been established through the content validity and the construct validity.

Table 1: Cross loading of the measures

Items/ constructs	IC	IP	KAC	KAP	KD
IC1	0.799	0.697	0.463	0.697	0.818
IC2	0.805	0.609	0.481	0.436	0.530
IC3	0.882	0.682	0.402	0.473	0.513
IC4	0.749	0.644	0.492	0.421	0.529
IC5	0.860	0.625	0.472	0.541	0.561
IC6	0.764	0.579	0.426	0.620	0.473
IC7	0.831	0.758	0.490	0.611	0.615
IP1	0.773	0.876	0.499	0.630	0.642
IP2	0.696	0.914	0.433	0.554	0.584
IP3	0.817	0.875	0.414	0.579	0.662
IP4	0.578	0.820	0.286	0.471	0.434
IP5	0.660	0.888	0.380	0.561	0.445
IP6	0.770	0.892	0.507	0.727	0.650
IP7	0.538	0.701	0.423	0.433	0.417
IP8	0.597	0.794	0.461	0.402	0.383
KAC1	0.301	0.270	0.705	0.504	0.415
KAC2	0.560	0.525	0.917	0.701	0.734
KAC3	0.557	0.496	0.873	0.660	0.627
KAC4	0.268	0.199	0.794	0.519	0.453
KAC5	0.496	0.442	0.630	0.478	0.669
KAP1	0.509	0.473	0.629	0.847	0.672
KAP2	0.453	0.464	0.655	0.827	0.741
KAP3	0.693	0.695	0.713	0.889	0.744
KAP4	0.642	0.570	0.480	0.725	0.561
KAP5	0.557	0.549	0.592	0.911	0.602
KD1	0.437	0.534	0.630	0.579	0.781
KD2	0.593	0.450	0.649	0.650	0.890
KD3	0.556	0.498	0.628	0.685	0.850
KD4	0.638	0.535	0.485	0.652	0.801
KD5	0.766	0.639	0.711	0.737	0.842

**Content validity:** In PLS, individual item reliability is assessed by examining the loadings of respective items on their respective latent construct (Hulland, 1999). In other words, all the items destined to measure a particular construct should load highly on the construct they were designed to measure, otherwise, those items will be candidate for deletion (Chin, 1998; Hair *et al.*, 2011). Moreover, all the items of the construct should be significantly loaded on their respective construct. As shown in Table 1 and 2 after the entire items meet the standard condition thus, confidently researchers can say the content validity of the measurement model is confirmed.

**The convergent validity:** Hair and Anderson (2010) defined convergent validity as the extent to which the items used to measure a construct share a high proportion of common variance. There are several related methods to check the convergent validity among items of a construct such as testing Cronbach's alpha, examining the Composite Reliability (CR) and finally the Average Variance Extracted (AVE) (Hair and Anderson, 2010). Table 3 indicates that the value of Cronbach's alpha and composite reliability of all constructs exceeded the threshold value of 0.7, moreover the value of AVEs are

Table 2: The significance of the items loading

Constructs	Items	Loading	SE	t-value	p-value
Innovation capability	IC1	0.799	0.064	12.395	0.000
	IC2	0.805	0.044	18.122	0.000
	IC3	0.882	0.037	23.591	0.000
	IC4	0.749	0.067	11.254	0.000
	IC5	0.860	0.043	19.860	0.000
	IC6	0.764	0.072	10.565	0.000
	IC7	0.831	0.044	18.823	0.000
Innovation performance	IP1	0.876	0.027	32.488	0.000
	IP2	0.914	0.031	29.788	0.000
	IP3	0.875	0.029	30.632	0.000
	IP4	0.820	0.050	16.270	0.000
	IP5	0.888	0.034	26.149	0.000
	IP6	0.892	0.048	18.452	0.000
	IP7	0.701	0.132	5.312	0.000
	IP8	0.794	0.073	10.814	0.000
Knowledge acquisition	KAC1	0.705	0.106	6.619	0.000
	KAC2	0.917	0.026	34.801	0.000
	KAC3	0.873	0.051	17.064	0.000
	KAC4	0.794	0.083	9.566	0.000
	KAC5	0.630	0.104	6.045	0.000
Knowledge application	KAP1	0.847	0.070	12.189	0.000
	KAP2	0.827	0.062	13.398	0.000
	KAP3	0.889	0.046	19.271	0.000
	KAP4	0.725	0.076	9.545	0.000
	KAP5	0.911	0.052	17.423	0.000
Knowledge dissemination	KD1	0.781	0.078	10.024	0.000
	KD2	0.890	0.032	28.085	0.000
	KD3	0.858	0.045	19.280	0.000
	KD4	0.801	0.067	11.917	0.000
	KD5	0.842	0.043	19.447	0.000

Table 3: The output of convergent validity

Constructs	AVE	Composite reliability	Cronbach's alpha
Innovation capability	0.662	0.932	0.915
Innovation performance	0.718	0.953	0.943
Knowledge acquisition	0.625	0.891	0.844
Knowledge application	0.710	0.924	0.896
Knowledge dissemination	0.698	0.920	0.891

Table 4: The discriminant validity

Constructs	IC	IP	KAC	KAP	KD
IC	0.814				
IP	0.812	0.848			
KAC	0.568	0.505	0.791		
KAP	0.675	0.653	0.735	0.843	
KD	0.720	0.636	0.747	0.793	0.835

>0.5. Therefore, it can confirm that the measurement model meet adequately the level of convergent validity.

**The discriminant validity:** The one of the indicators that examine the constructs validity is discriminant validity. Discriminant validity is referring to the extent to which a group of items estimate only one construct and how this construct is distinctly estimated (Hair and Anderson, 2010). Fornell and Larcker (1981)'s criterion was used in this study to test the discriminant validity where the square root of AVE estimation go over the correlations between the factors making each pair. Table 4 after indicates that the discriminant validity of the present study confirmed.

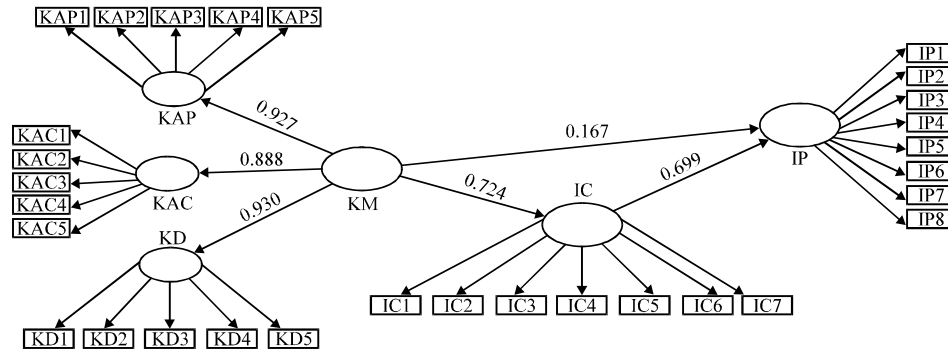


Fig. 1: The framework of the study

Table 5: The path coefficient

Constructs	Path coefficient	SE	t-value	p-value	Result
H <sub>1</sub> : IC->IP	0.699***	0.141	4.955	0.000	Accepted
H <sub>2</sub> : KM->IC	0.724***	0.101	7.146	0.000	Accepted
H <sub>3</sub> : KM->IP (direct effect)	0.691***	0.063	10.931	0.000	Accepted
H <sub>4</sub> : KM->IC->IP	0.506***	0.127	3.975	0.000	Accepted
KM->IP (affected by IC-mediating path)	0.15700	0.143	1.099	0.136	Rejected

\*\*\*p<0.001

**The structural model and hypotheses testing:** The second step after checking the validity and reliability of the measurement model is testing the formulated hypotheses. PLS algorithm and bootstrapping in Smart PLS was running to evaluate the hypotheses. Table 5 illustrates the accepted and rejected hypotheses.

As it is clear from Table 5, all introduced hypotheses have been accepted. Noticeable, the path coefficient of the relationship between knowledge management and innovation performance retract affected by mediating role of innovation capability in this path to be non-significant. Further, analysis shows that the Variance Account For (VAF) is 76% which meaning that 76% of the effect of knowledge management on innovation performance comes through the mediating of innovation capability. This result also points out the role of innovation capability as full mediator in the relationship between knowledge management and innovation performance (Fig. 1).

**RESULTS AND DISCUSSION**

By conducting this study several goals have been achieved. Besides reducing the existing gaps in the literature this study aims to introduce a framework that helps to improve the innovation performance. Furthermore, the present study tries to get some insight to explain how and why knowledge management affect innovation performance for that it has been introduced innovation capability as mediating variable. The output of PLS-SEM path coefficient indicates some results as

follows. It was found as expected that knowledge management processes as composite variable significantly affect innovation capability of the organization ( $\beta = 0.724, t = 7.146, p < 0.000$ ). This result supported by several previous researchers such as Darroch (2005), Drew (1999) and Esterhuizen *et al.* (2012). Additional, analysis has been done to get clearer picture regarding the nature of this relationship (i.e., knowledge management and innovation capability). The obtained results show that out of 3 processes of knowledge management (i.e., Knowledge Application (KAP), Knowledge Acquisition (KAC) and Knowledge Dissemination (KD)) only 2 processes were found to be significantly associated with innovation capability of the organization while no significant association between Knowledge Acquisition (KAC) and innovation capability.

On the other hand, Knowledge Application (KAP) has a significant association with innovation capability ( $\beta = 0.308, t = 1.969, p < 0.05$ ). This study, considered this result as logical finding by looking through innovation capability, it can find that it is a cumulative of experience and knowledge using these experiences and knowledge by the organization or individual to achieve superior performance make it become capabilities. Therefore, the ability of the organization to deal and apply the valuable knowledge gives the organization an advantage comparing to its competitors. Furthermore, this result in line with the study conducted by Olavarrieta and Ellinger (1997). Furthermore, Knowledge Dissemination (KD) was also found to be significantly associated with innovation capability ( $\beta = 0.508, t = 2.996, p < 0.001$ ). The logic justification of such result is that KD processes is concerned with making knowledge easy access by all employees who need it to do their work within the organization. Therefore, disseminating the knowledge help to used it or applies it which in turn, leads to build the organization's capabilities in general and innovation capability especially.

Investigating the relationship between innovation capability and innovation performance is another goal of this study. The outcome of the analysis shows that there is a positive significant relationship between innovation capability and innovation performance ( $\beta = 0.699$ ,  $t = 4.955$ ,  $p < 0.000$ ). This result is consistent with Cavusgil *et al.* (2003), Lau *et al.* (2010) and Yang *et al.* (2009) studies where innovation capability has been considered as critical antecedents of innovation performance. Further, this result is logic and came in line with Zheng *et al.* (2011)'s result where without capabilities cannot achieve the desired performance. Therefore, the organizations should be aware to different kinds of capabilities which need to be focused on to achieve its' goals like marketing capabilities, manufacturing capabilities, R&D capabilities, planning capabilities, innovation capabilities and like.

Moreover, the obtained results point out that there is no significant association between knowledge management processes and innovation performance ( $\beta = 0.157$ ,  $t = 1.099$ ,  $p < 0.136$ ). This result is compatible with Hung's *et al.* (2010) recommendation where the researchers stressed that knowledge management processes in organizations do not appear to affect the performance directly, organizations need to invest in the direct mediating processes to achieve superior performance rather than depending on direct relationship between knowledge management and innovation performance. This study, support this recommendation because the general output of the knowledge management is the knowledge and this outcome (i.e., knowledge) will not be able to achieve superior performance unless it came through another initiatives like capabilities. In other words, the ability to use or apply the knowledge is the critical factor in achieving target performance.

Further, analysis of mediating role of innovation capability in the relationship between knowledge management and innovation performance support the previous result (i.e., non-significant relationship between knowledge management and innovation performance). It was found that innovation capability is fully mediating the relationship between knowledge management and innovation performance where 76% of the effects of knowledge management on innovation performance comes through innovation capability. Moreover, the output of the study stresses on the critical role that knowledge management processes play to enhance and develop the companies' capabilities. Such result supported by several studies like Darroch (2005) where knowledge has been considered as a prerequisite to build and develop capabilities. In addition, Jantunen (2005) and Slater and Narver (1995) argue that knowledge is the main

driver of skills and capabilities. By applying knowledge management, several processes such as knowledge acquisition processes, knowledge dissemination processes and knowledge application processes, will be established within the organization. According to absorptive capacity theory, such processes are necessary to enhance the organization capabilities that help to improve the innovative output of the organizations. Examining the nature of these processes shows that the processes of knowledge acquisition support the organization with the necessary knowledge from outside and inside the organization. Getting knowledge can be done through several processes such as learning, observing, gathering knowledge and doing researches (Huber, 1991). By carrying out these processes, learning capability of the organization will be improved. The next step that helps to enhance the innovation capability for innovating is disseminating the acquired knowledge and making it accessible on time to the section that needs it which in turn leads to make the obtained knowledge applicable by making the right decision.

## CONCLUSION

As conclusion for this study, several recommendations have been drawn to the companies that have objective to be innovative company or to use innovation as main tool of competition. Based on the output of this study building innovation capability is a critical step to improve the innovation output. Accordingly, managers have to seek to build the companies' capabilities in different area, like marketing capabilities, manufacturing capabilities, R&D capabilities, planning capabilities, in order to achieve high rate of innovation performance. To do so it is highly recommended to establish an effective knowledge management processes within the organization where this study provides the logic justifications to spend time effort budget to build and launch knowledge management processes within the company.

Additionally, this study affirm the full mediating role of innovation capability in the relationship between knowledge management and innovation performance which provides extra evidence of important of investment on building the organizations' capabilities.

However, this study has some limitation the small simple size and focusing on Hi-technology companies are the main limitations that could affect the generality of the result. Therefore, it is highly recommended to re-examine this framework in different sector that include low-technology companies. Examining the effect of knowledge management on innovation performance

through another capability like marketing, R&D manufacturing capabilities also will help to get deep understanding regarding this issue.

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