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Entrepreneurship, knowledge integration capability, and firm performance: An empirical study

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Abstract From the knowledge-based view, an organization is considered an entity that integrates and distributes knowledge to produce products and services. Knowledge is acknowledged as a sustainable basis of competitive advantage that many organizations possess. Entrepreneurial activity also has been viewed as an essential feature for organizations to survive and prosper in today's turbulent environment. In this study, we explore the effect of entrepreneurship on organizational performance through knowledge integration capability. Our research model depicts the firm as a knowledge integration institution that produces its offerings through specialized knowledge integration capability that consists of learning culture, knowledge management process, and information technology capability. The results show a strong support for the relationship between entrepreneurship and knowledge integration capability. We also found that the effect of entrepreneurial activities on firm performance was mediated by knowledge integration capability.

Keywords Corporate entrepreneurship · Knowledge-based view · Knowledge management · Organizational performance

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1 Introduction

From the perspective of resource-based view, the firm is regarded as a unit of resources and capabilities so that a firm's competitive advantage is determined by its ability to obtain and defend resources and capabilities (Wernerfelt 1984). In this view, knowledge is considered to be one of key resources to obtain and transform other resources. Researchers from knowledge-based view have criticized the weakness of resource-based view in explaining how knowledge is treated and the distinction between resources and knowledge-based capabilities (Grant 1996b; Nelson and Winter 1982). Knowledge-based view considers the firm an entity that integrates and distributes knowledge to produce products and services (Grant 1996b). However, the traditional knowledge-based view is essentially static in nature, because it doesn't fully explicate why a firm's knowledge structure or configuration differs from that of other firms and how the different structure of knowledge affects firm performance (Hoskisson et al. 1999).

Previous studies on strategic management and entrepreneurship, on the other hand, have examined the relationship

between firm-level entrepreneurship and firm performance (Covin and Slevin 1991; Dess et al. 1997; Miller 1983; Naman and Slevin 1993; Zahra 1993). Researchers have examined the various aspects of firm-level entrepreneurship, such as diversification (Burgelman 1991), strategic renewal (Singh 1990), and product, process, and administrative innovations (Covin and Miles 1999). While much attention has been given to the relationship between firm-level entrepreneurship and its antecedents and outcomes, few studies have paid a systematic attention to investigate the relationship via knowledge-based perspectives (Zahra et al. 1999; Dess et al. 2003). Further, many prior knowledge management (KM) studies have addressed the various aspects of firm-level knowledge integration, including the influence of different types of knowledge (Brown and Duguid 2001; Spender 1996), the configuration of knowledge functions through combinative capabilities (Kogut and Zander 1992), and the organizational process characteristics (Grant 1996a). In particular, Tanriverdi (2005) well studied the relationship between information technology (IT) relatedness and knowledge management (KM) capability and their impact on firm performance. He treated IT relatedness as a separate construct from KM capability which consists of product KM, customer KM, and managerial KM capability. Cepeda and Vera (2007) found that firm's intended strategy affects knowledge configuration, the source of dynamic capability, which in turn results in operational capability. Most research, however, has overlooked the prospect that the integration of organizational knowledge activities can play a mediating role in the relationship between firm-level entrepreneurship and firm performance (Lumpkin and Dess 1996).

This study proposes an integrative model for exploring the effect of firm-level entrepreneurship on performance through knowledge integration capabilities that encompass learning culture, knowledge management process, and information technology capability. Different from the previous studies, in this study, we view knowledge integration capability as the combination of three capabilities. This is primarily because KM process alone cannot explain knowledge integration capability. To make knowledge integration take place, learning culture and IT capability are necessary (Ryu et al. 2005). Learning culture makes knowledge management process effective and efficient by leading associates to the active participation in knowledge activities, while IT capability allows user to access knowledge and people pertinent to their problem at hand. Moreover, information systems incorporate knowledge processes to support knowledge user activities (Kim et al. 2008). The basic assumption underlying the proposed model is that firm-level entrepreneurship as a meta structuring activity affects strategic context, where all the resources are arranged and allocated toward the strategic direction, which in turn influences firm performance (Purvis et al. 2001). This assumption draws on the knowledge-based view that firms exist to produce products and services through knowledge integration and application (Grant 1996b), as well as on the perspective that combination and exchange are the generic processes to create all new resources including knowledge (Schumpeter 1934; Kogut and Zander 1992). Accordingly, the main purposes of this study are 1) to disclose the major components of knowledge integration capability within firms as knowledge integration entity, and 2) to investigate the effect of firm-level entrepreneurship (in this study, named as entrepreneurial intensity) on the knowledge integration capability, and 3) to examine the causal relationship between entrepreneurial intensity, knowledge integration capability, and firm performance in a nomological network.

This study contributes to the literature in three ways. First, this study provides a model that integrates the concepts of entrepreneurial intensity, knowledge integration mechanism, and firm performance. This model facilitates the understanding of the knowledge-based theory of the firm by suggesting the antecedent to knowledge structure and the outcome of it. Second, this study identifies the primary components of knowledge integration mechanism that is the catalyst of knowledge-based view of the firm and the key bridge between entrepreneurship and firm performance in this study. Third, this study provides a way in furthering the empirical test on knowledge-based view of the firm, by providing a set of measurement items for the constructs that have been separately studied.

2 Knowledge-based view and knowledge integration capability

According to Grant (1996a; b), the firm is a knowledge application institution that produces products and services through specialized knowledge integration mechanisms such as rules, directives, and routines. The integration mechanisms enable firms to take unique advantages for governing economic activities and make them different from the others (Ghoshal and Moran 1996). Thus, the integration of specialized knowledge residing in individuals and directorates within an organization allows firms to maximize their efficiency by reducing redundancy and enhancing consistent representation (Davenport and Klahr 1998; Grant and Baden-Fuller 1995; Grant 1996b). In this sense, well established knowledge integration mechanisms are embedded in an organization and constitute a core capability that helps firms conduct their business proac-

tively which is referred to as knowledge integration capability (KIC).

KIC refers to an organization's combinative capability (Kogut and Zander 1992) of analyzing and synthesizing knowledge that comes from outside or is accumulated within the organization by utilizing its experiences. The principle mechanisms of integrating knowledge, represented by direction and routine (Grant 1996a), involve organizational learning and selection process, which enables an organization to generate knowledge that is in turn accumulated, stored, and embedded in organizational practices and rules (Levitt and March 1988). Organizational learning is characterized by learning culture that promotes inquiry and dialogue, and encourages collaboration and team learning (Garvin 1993). Learning culture is the prevailing culture in a learning organization that is skilled at knowledge generation, acquisition, and transfer, and that modifies its behavior to reflect new knowledge and insights (Garvin 1993). KM process is required in conjunction with learning culture in order to boost up knowledge integration. KM process can be interpreted as an organizational selection process in the sense that it helps an organization to identify a set of knowledge valuable to the organization. Finally, while learning culture and KM process contribute to knowledge integration activities, IT capability for proper IT support is necessary to maximize the effect of the rules and directives as the integration mechanism (Kim et al. 2002; Ray et al. 2004).

In our perspective, to be effective, KM process as a part of knowledge integration capability needs to come along with learning culture that facilitates the embeddedness of knowledge within an organization, as well as with technological capability that supports and incorporates KM process into the system. The harmonious combination of three components represents the effective configuration of firm resources and knowledge to enhance firm performance (Burgelman 1994).

2.1 Learning culture

Culture as the outcome of social interactions and thus embedded in organizations is argued to be a major source of competitive advantage (Gold et al. 2001; Lee and Choi 2003; Starbuck 1992). Culture defines the value of knowledge, the types of knowledge maintained in organizations, and knowledge activities acceptable in organizations (Gold et al. 2001; Lee and Choi 2003). In particular, learning culture is defined as a set of norms and values about individual and organizational behaviors in the process of the development of new knowledge (Škerlavaj et al. 2007). It bears openness, trust, and cooperation and helps improve organizational efficiency and effectiveness in the ways that; 1) it promotes the development of social capital through which it can reduces the probability of individual opportunism and thus needs for monitoring (Starbuck 1992), and 2) it facilitates work process through embedded actions (Granovetter 1985). Learning culture that encourages cooperation and teamwork also can construct innovative organizations (Putnam 1993; Fukuyama 1995; Zucker et al. 1996).

2.2 Knowledge management process capability

As discussed in the earlier section, the primary mechanisms for knowledge integration consist of direction and routine (Grant 1996a). Direction refers to an integration mechanism through which each specialist establishes rules, guidelines, and directives for other organizational members when there is lack of structured work procedures. Organizational routines refer to setting up interaction patterns among employees and achieving the integration of knowledge using the patterns of signals and responses, even without directives (Ryu et al. 2005). The directions and routines as shared knowledge become social tacit knowledge that is embedded in organizations in the form of social and institutional practice (Nelson and Winter 1982; Berger and Luckmann 1989). The shared knowledge, departing from individual employees, is accessible and sustained through social interaction (Brown and Duguid 2001). Much of valuable organizational knowledge may exist in the form of directives and routines (Nahapiet and Ghoshal 1998), because collectively shared tacit knowledge is the most secure and critical organizational knowledge (Spender 1996). In this sense, KM process including creation, codification, transfer, and sharing of organizational knowledge is the selection process through which knowledge valuable to an organization is identified, developed, and accumulated to enhance organization performance (Burgelman 1994). Thus, KM process capability, a firm's ability to create, share, transfer, and apply knowledge *explicit or tacit* is significantly related to organizational effectiveness (Gold et al. 2001; Lee and Choi 2003).

2.3 Information technology capability

Previous studies on KM have found the significant influence of IT infrastructure and infrastructure capability on organizational effectiveness (Gold et al. 2001; Sabherwal and Chan 2001; Tanriverdi, 2005). IT capability refers to the capability to effectively manage hardware and software that possess different types and levels of knowledge (Armour 2001) and skills and knowledge about a variety of business processes and organization routines (Nicholson and Sahay 2004). IT capability facilitates the process of

transforming knowledge into action and thus allows the effective exploitation of the rules and directives (Armour 2000; Armour 2001). Hence, it enhances organizational effectiveness through machine-invoked and worker-initiating interactions, which enable people to get the filtered information that is focused on their interest and tasks.

3 Entrepreneurial intensity

Entrepreneurship has been recognized as a major determinant of organizational performance (Kuratko et al. 1990; Lumpkin and Dess 1996; Zahra et al. 1998). Researchers (Burgelman 1983; Covin and Slevin 1991; Jones and Butler 1992; Stopford and Baden-Fuller 1994; Zahra 1993) have identified many perspectives of entrepreneurship, such as corporate entrepreneurship, intrapreneurship, international entrepreneurship, and new ventures. Despite the difference in the terms used, the most common properties of firm-level entrepreneurship may be summarized as proactiveness, risk-taking, and innovativeness (Covin and Slevin 1991; Miles and Arnold 1991; Miller 1983; Morris and Paul 1987). Researchers (Miller and Friesen 1982; Naman and Slevin 1993) confirm that entrepreneurial style represents the degree of the willingness of risk-taking, the proactiveness when competing with other firms, and the innovativeness. In this study, we follow Miller and Friesen (1982) and Naman and Slevin (1993)'s concept to define entrepreneurial intensity.

Entrepreneurial intensity is characterized by frequency and degree of entrepreneurship and makes the key to solving management problems through the strategic decision making process where entrepreneurs are willing to take risks, innovative, and proactive (Miller and Friesen 1982; Barringer and Bluedorn 1999; Lumpkin and Dess 1996). Some of previous studies regard entrepreneurial intensity as the antecedent to firm performance. We, however, argue that entrepreneurial intensity affects firm performance through KIC, because it facilitates the process of creative destruction through which new innovations are introduced to obtain competitive advantage (Schumpeter 1934).

4 Research model and hypotheses

Figure 1 illustrates the proposed research model. In the model, entrepreneurial intensity refers to the degree of strategic orientation that top management in a company holds to affect organizational principles and practice (Barringer and Bluedorn 1999). Knowledge integration capability is viewed as the combinative total of learning culture, KM process, and IT capability through which strategic orientation of top management is made feasible (Burgelman 1994; Gold et al. 2001; Sabherwal and Chan 2001).

The basic assumption underlying this model is that entrepreneurship is the major driving force to arrange and structure KIC, which in turn determines firm performance (Purvis et al. 2001). This assumption is similar to the mediating effects model proposed by Lumpkin and Dess (1996) where entrepreneurial orientation affects integration of activities which in turn influences firm performance. We tend to fill the gap between KM studies and the entrepreneurial literature by including the mediating role of KIC between entrepreneurship intensity and firm performance (Naman and Slevin 1993; Covin and Slevin 1988).

Based on the above argument of the mediation role of KIC, we in the remainder of this section elaborate on the relationships between entrepreneurial intensity, KIC, and firm performance to develop a set of testable hypotheses.

4.1 Research hypotheses

Knowledge integration capability is a combinative capability that is a heterogeneous and hard-to–imitate resource (Spender 1996). As discussed in the previous section, KIC is represented in the form of the combination of learning culture, KM process, and technological capability. KM process incorporates directives and rules in them (Ryu et al.

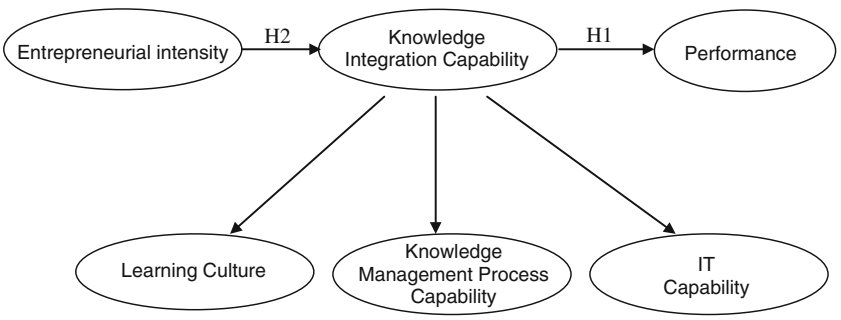


Fig. 1 The proposed research model

2005) and is embedded in organization culture and technological infrastructure in the form of social and institutional practice (Nelson and Winter 1982; Berger and Luckmann 1989). KM process capability makes shared knowledge is accessible and sustained through social interaction (Brown and Duguid 2001) and affects firm performance (Gold et al. 2001).

Learning culture facilitates work processes through embedded actions to improve effectiveness in work performance (Granovetter 1985). Cooperative and innovative learning culture within an organization provides incentives for constructive knowledge activities (Janz and Prasarnphanich 2003). Further, learning culture influences firm performance by determining what kind of knowledge should be kept, how the knowledge is used for organizational work, and how it comes along with business activities (Gold et al. 2001; Lee and Choi 2003). Learning culture as a KIC in turn affects firm performance by improving organizational abilities to innovate and to respond to the changes in market environments (Alavi et al. 2005–2006).

IT capability allows users to communicate each other, facilitate knowledge acquisition and integration, easily reach experts in specialized areas, and foster boundary spanning activities (Dewett and Jones 2001). These activities can be referred to as knowledge integration process. Thus, IT capability has been recognized as a major component of influencing organizational efficiency and effectiveness by reducing the bounded rationality of decision-making (Bakos and Treacy 1986; Kim and Sanders 2002).

In sum, KIC comprised of well interwoven learning culture, KM process, and technological capability influences firm performance by facilitating knowledge integration and application process that is built on cooperative and innovative culture. Therefore, we hypothesize,

H1: *Knowledge integration capability positively influences firm performance.*

Zahra et al. (1999) argued that entrepreneurship activities may enhance organizational performance by creating new knowledge, because knowledge is a critical resource for entrepreneurial firms seeking to establish competitive advantage (Ireland et al. 2003). Through effective entrepreneurship, firms are able to create a new knowledge and exploit it as a continuous source of innovation to outperform competitors (Dess et al. 2003; Kazanjian et al. 2001). Thus, entrepreneurial intensity affects knowledge integration process by facilitating the creation of mechanisms for exchanging new ideas and information (Kanter 1983; Purvis et al. 2001). Entrepreneurial intensity also promotes the use of structural integration devices including committees and task forces (Miller 1983) as well as the use of rules and directives (Lumpkin and Dess 1996). The active use of structural integration devices in turn help building shared tacit knowledge about social and institutional practice within organizations (Nelson and Winter 1982; Berger and Luckmann 1989).

In its relationship with learning culture, entrepreneurial intensity is regarded as an influential and proactive means of developing a learning culture (Hult et al. 2003). Entrepreneurial intensity creates the types of team environments in that collaboration, team learning, and thus innovative activities are encouraged (Lumpkin and Dess 1996). Through the team environments, the organizations can reduce conflicts and integrate the functional silos to reduce organizational isolations between departments (Kanter 1983). Therefore, proactive and innovative entrepreneurs boost up the learning culture where inquiry and dialogue are actively exchanged and collaboration and team learning are encouraged (Garvin 1993).

As per the relationship with knowledge management process capability, entrepreneurial intensity tends to facilitate the exchange of new ideas and information which results in the creation of new routines and mechanisms (Kanter 1983). The newly created routines and mechanisms for knowledge exchange by the work of entrepreneurial intensity are embedded in knowledge management processes to contribute to rebuilding operational capabilities (Cepeda and Vera 2007).

With regard to IT capability, entrepreneurial intensity as the shared belief across an organization may determine the deployment of technologies and their structure (Barringer and Bluedorn 1999). In particular, given the recent increasing role of IT, top management is more likely to

Table 1 Descriptive, CFRs, correlations, and AVE values

	CFR	AVE	1	2	3
1. Performance	0.856	0.669	**0.818**		
2. Knowledge Integration capability	0.806	0.583	0.556	**0.764**	
3. Entrepreneurial Intensity	0.798	0.570	0.350	0.673	**0.755**

CFR: Composite Factor Reliability
AVE: Average Variance Extracted

Boldface numbers on the diagonal are the square roots of the AVE values

Table 2 Goodness-of-fit measures for Alternative Models

Model	$\chi^2(df)$	χ^2/df	*p*	RMSEA	NFI	TLI	CFI
Null Model (M0)	1079.40(105)	10.28	0.00	0.253			0.00
One Factor Model (M1)	361.91(90)	4.02	0.00	0.144	0.67	0.67	0.72
Three First Order Factor Model (M2)	216.59(90)	2.41	0.00	0.098	0.80	0.85	0.87
Second Order Factor Model (M3)	116.03(87)	1.33	0.02	0.048	0.89	0.96	0.97

recognize the value of information technology in the strategic context, and the effective coordination between business strategy and IT strategy becomes a major responsibility of chief information executives (Applegate and Elam 1992; Chan et al. 1997; Sabherwal and Chan 2001). Accordingly, we can assume that entrepreneurial intensity shapes the information systems in ways of supporting strategic decision making activities, marketing initiatives, and knowledge sharing (Sabherwal and Chan 2001). The above discussion leads to the following hypothesis.

H2: *Entrepreneurial intensity positively affects knowledge integration capability.*

5 Method and data analysis

5.1 Data collection

The survey method was used to empirically test the hypotheses. The measurement items were developed by adapting items validated by previous studies. The sample frame consists of managers, senior managers, and CEOs. The questionnaire was developed in English and then translated into Korean. To reduce semantic discrepancy, the questionnaire was translated back into English and carefully revised. A pilot test was undertaken with 20 managers and senior managers who were taking Executive MBA program at a major research university in Korea, which resulted in some refinement to the questionnaire.

The company list of Korea Chamber of Commerce and Industry (KCCI) was used as the source of sampling for the field test. We randomly selected 600 companies and distributed the survey by mail and/or interview, and followed up with e-mail and telephone calls. A total of 163 responses were returned (27.1% response rate). Out of the 163 responses, 17 have incomplete data and were eliminated from further analysis. As a result, 146 responses were used for data analysis. The respondents were asked to indicate the name of the department he/she belonged to and also briefly described its activities. The questionnaire also asked for basic demographic information of the respondents. The age of the respondents ranges from 30 to 55, and the average is 39.84 (S.D. = 6.53). 88% of the sample is male and 12% female. About a half (53.3%) of the respondents classify themselves as senior managers or CEOs, and the remainders consist of project managers, team leaders, and other managers who are generally able to understand the characteristics of the overall organizations. About one third (34.9%) of firms are in the manufacturing industry. 86 firms have 1000 or more employees, and 55 firms have annual total sales revenues of US$ 1 billion or more.

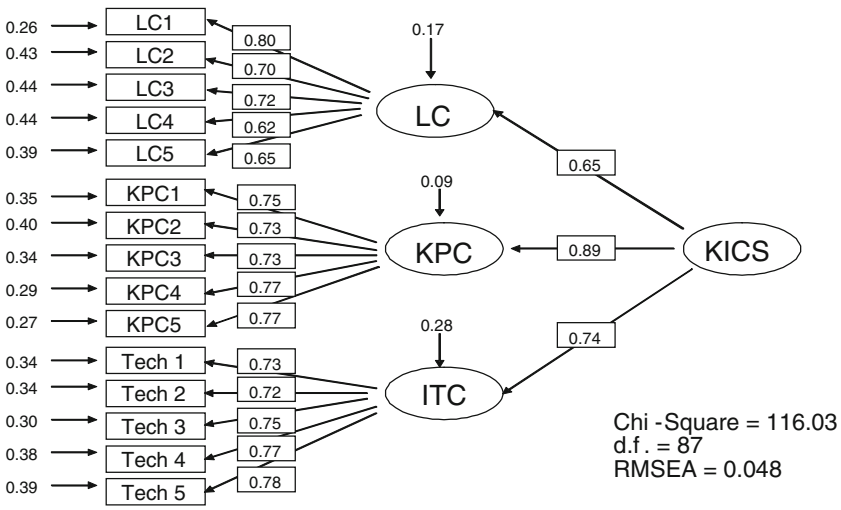


Fig. 2 Results of confirmatory factor analysis

Table 3 Goodness-of-fit indices for the measurement model

	Measurement Model	Desired Levels
χ^2	223.19	Smaller
d.f.	183	
χ^2/d.f.	1.220	< 3.0
P	0.023	
RMSEA	0.039	< 0.06
NFI	0.86	> 0.90
TLI	0.97	> 0.90
CFI	0.97	> 0.90

5.2 Measurement of research variables

The items for corporate performance were adapted from performance measures given by Deshpande et al. (1993). This encompasses sales and profit growth, and overall success compared with key competitors. To make sure that these measures well represent the objective performance, we collected the secondary data such as sales volume, asset size, and profit. We checked the correlation between the subjective and objective measures to find that they have a significant correlation with each other. The 5 point Likert scale was used, anchored by "strongly disagree" and "strongly agree" (for more details, see Table 7 in Appendix). Table 1 reports the descriptive statistics and correlations for independent and dependent variables. We also checked the cross-loading of measurement items based on the exploratory factor analysis to verify the internal and discriminant validity of the research variables (for more details, see Table 8 in Appendix).

5.3 Testing the second order structure

As discussed in the earlier section, we assume KIC is a second order factor consisting of KM process, learning culture, and technological capability. To verify the assumption, we performed a confirmatory factor analysis (CFA). Justification for our second order factor was made using an extension of Widaman's (1985) comparison models. Table 2 presents the results of comparing models with various fit indices. The results indicate that Model 3 (M3) was consistently better than any other comparing models.

Further, all item loadings for the first order factors and the second order factors are greater than the cut-off of 0.6 and normed Chi-square value is less than 2 (illustrated in Fig. 2). These results suggest the relative efficacy of using the second order factor.

5.4 Model assessment

Reliability for each construct was measured by using composite factor reliability (CFR). If CFR values are less than 0.70, the items may be unrelated or measuring more than one construct. The values of both reliability measures are above 0.70 (see Table 1; ranging from 0.87 to 0.91), and thus deemed acceptable (Bagozzi and Yi 1988; Fornell and Larcker 1981).

To ascertain convergent validity, we carried out an exploratory factor analysis. The results reveal that all the constructs were clearly delineated and that there was no cross loading above 0.40. We also examined the t-statistics for confirmatory factor loadings of the measurement items. All the t-values were well above 2.0, which indicate satisfactory convergent validity for all five constructs (Anderson and Gerbing 1988). To assess the fit of the measurement model to the data, we checked several fit indices (Bentler 1990; Hair et al. 1995; Tucker and Lewis 1973). As shown in Table 3, all fit indices of the SEM estimation (normed Chi-square, RMSEA, CFI, TLI, and NFI) are desirably at or well above the recommended threshold values except NFI value which is slightly lower than the desired level.

Discriminant validity was assessed in two different ways. First, we examined the average variance extracted (AVE) to exceed 0.50, or the square root of AVE to be greater than the correlation between a construct and any other construct (Fornell and Larcker 1981). As can be seen in Table 1, the square root of the AVEs (on the diagonal) is indeed greater than the corresponding correlations. In addition, we examined pair-wise discriminant validity with latent constructs (see Table 4). We constrained the correlation between each pair of constructs to be equal to 1 (Anderson and Gerbing 1988), and performed a χ^2 test. For all cases, the χ^2 difference was significant at $p<0.001$ level, which indicate discriminant validities.

Table 4 Pair-wise discriminant analysis paired constructs

Models	χ^2	χ^2 Difference
Measurement Model	223.19	–
Performance and KIC paired	286.70	63.51***
Performance and Entrepreneurial Intensity paired	339.25	116.06***
Entrepreneurial Intensity and KIC paired	260.73	35.74***

*** statistically significant at $p<0.001$

Table 5 Measurement model findings

Model	χ^2	*d.f.*	Delta
Null Model (MM0)	1609.95	210	
One Factor Model (MM1)	703.55	189	0.56
Measurment Model (MM2)	223.19	183	0.86

We investigated common method variance that may cause any potential inflation problem, since all data for five constructs in the hypothesized model were collected through the survey method. Common method variance refers to variance resulting from the use of a common method rather than from the construct itself (Podsakoff et al. 2003). For the test, we computed delta, the degree of the improvement in the Chi-square goodness of fit statistic between the null model and a superior model (Straub et al. 1995). The analysis begins with a series of measurement models: the null model (MM0) that has no underlying factor, a common-factor measurement model (MM1) in which all items have one underlying factor, and our measurement model (MM2). Further, delta was computed by using the following equation:

$$\text{Delta} = [\chi^2_{MM0} - \chi^2_{MMi}]/\chi^2_{MM0}, \text{ where } \chi^2_{MMi} \text{ is chi} - \text{square value of MMi(i} = 1 \text{ or } 2).$$

As shown in Table 5, the results indicated that our measurement model is the model which best fits the data and common method variance was not a major problem in this study (Scott and Bruce 1994; Sabherwal and Becerra-Fernandez 2003).

5.5 Testing research model

We used AMOS 5 (Arbuckle 2003) to examine the research model through structural equation modeling. To assess the fit of the hypothesized model and check the improvement of the hypothesized model compared to null model, used were several fit indices (Bentler 1990; Hair et al. 1995; Tucker and Lewis 1973).

As shown in Table 6, all fit indices of the SEM estimation (normed Chi-square, RMSEA, CFI, TLI, and NFI) are desirably at or well above the recommended threshold values except NFI value. The estimation results of the research model are shown in Fig. 3 below. Hypothesis 1 in Fig. 1 posited that knowledge integration capability significantly affects firm performance. The estimation results support H1 (b=0.551, t=4.15, p<0.001).

Table 6 Goodness-of-fit indices for the research model

	Research Model	Desired Levels
χ^2	223.29	Smaller
d.f.	184	
χ^2/d.f.	1.214	< 3.0
P	0.025	
RMSEA	0.038	< 0.06
NFI	0.86	> 0.90
TLI	0.97	> 0.90
CFI	0.97	> 0.90

Hypotheses 2 posited that entrepreneurial intensity positively influences KIC that consists of learning culture, KM process, and technological capability. The estimation results lend support for H2 (b=0.668, t=4.50, p<0.001). In sum, the results indicate that entrepreneurial intensity has significant effects on KIC which in turn influences firm performance.

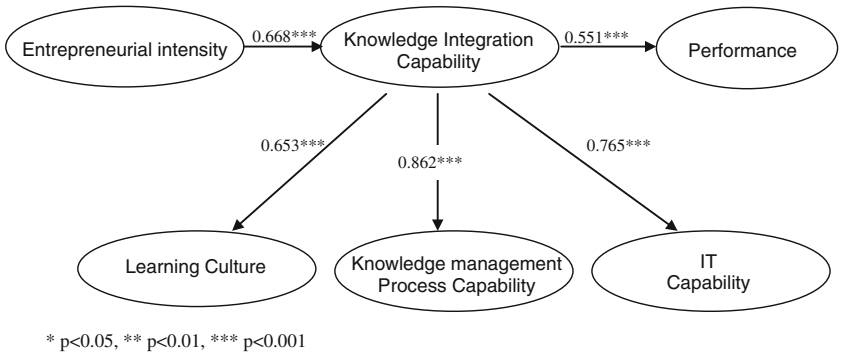
There is an argument in that knowledge integration capability may affect entrepreneurial intensity which in turn influences performance. This argument is based on the knowledge management literature where knowledge management capability positively influences innovativeness. We examined this argument with the same data and found that the original research model is better than the alternative model in every aspect of the fit (χ^2, p value, RMSEA, CFI, NFI, and TLI). In fact, it is reasonable to assume that capability influences performance (Agarwal and Selen 2009). Chen and Huang (2009) found that knowledge management capability positively affected innovation performance. Therefore, we conclude that the proposed model is better in explaining the firm performance from a knowledge integration perspective.

5.6 Test of the mediating effect of knowledge integration capability

In the research model and hypothesis section, we argued that the proposed model is similar to the mediating effects model of Lumpkin and Dess (1996) where KIC mediates the effect of entrepreneurial intensity to firm performance. To verify this argument, we conducted a mediation test. Figures 4 and 5 show the results of the test.

Figure 4 illustrates that entrepreneurial intensity directly affects firm performance. This result is congruent with that of the previous studies. However, when we include KIC as a mediating variable between entrepreneurial intensity and firm performance, the direct effect of entrepreneurial intensity on performance fades away. Figure 5 shows this effect clearly.

Fig. 3 The estimated model



The test result of the mediating effect of KIC between entrepreneurial intensity and firm performance clearly indicates that entrepreneurship determines the structural property, i.e., KIC, to influence firm performance.

6 Discussion and implications

In this study, we set out to identify the components of KIC and to examine its impact on firm performance. The proposed model provides an integrated view of entrepreneurship, knowledge-based view, and firm performance which has not been investigated by previous studies. Our results show a strong support for the relationship between entrepreneurial intensity and knowledge integration mechanism. Our findings also indicate that firm performance is primarily determined by KIC which is affected by entrepreneurial intensity and that the effect of entrepreneurial activities on firm performance was mediated by KIC (illustrated in Figs. 3 and 5).

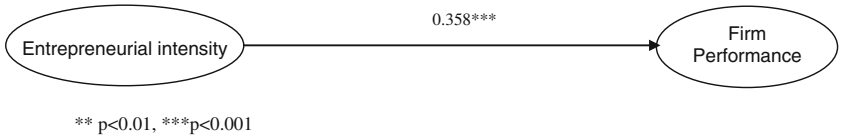
Thus, the proposed model can give rise to a precise logic about how the firm works as a knowledge integration institution and to the configuration of knowledge integration capability. This study also clearly shows that successful companies put a lot of efforts on building KIC to improve firm performance and enhance the possibility of successfully execution of top management agenda. These include learning culture, IT capability, and KM process capability as the integrated whole.

In addition, entrepreneurial intensity is found to shape KIC in three ways. Firstly, it can create collaborative, team-learning oriented, and innovative team environments (Lumpkin and Dess 1996) that represent the learning culture where knowledge exchange, collaboration, and team learning are encouraged (Garvin 1993). Secondly, entrepreneurial intensity affects KIC by facilitating the use of structural integration devices such as committees and task forces (Miller 1983) as well as the use of rules and directives (Lumpkin and Dess 1996). Finally, it is clear that the deployment of technologies and organizational structure within a firm is determined by entrepreneurial intensity as the shared belief about desired outcomes given by top management (Barringer and Bluedorn 1999). Accordingly, it may be concluded that the organizations with high entrepreneurial intensity pursue open and collaborative learning culture, active knowledge sharing and transfer, and extensive use of information systems that support strategic decision making, marketing initiatives, interorganizational activities (Sabherwal and Chan 2001) and the acquisition, integration and organization, and sharing of organizational knowledge (Alavi and Leidner 1999; Sensiper 1997).

This study confirms the 'firm as a knowledge integration institution' hypothesis (Grant 1996b) and the mediation effect model of integration capability (Lumpkin and Dess 1996). In addition, the study lays a foundation to further investigate other potential mediating variables such as the investment in research and development as well as moderating variables such as structure, size, and technology. Future studies are desired to check the impacts of various control variables on the relationship between knowledge integration capability and firm performance.

Our study has important implications for KM at the organization level. The managers may improve the scope and effectiveness of KM practices within an organization by promoting learning culture and exploiting its technological capability. The understanding of the three component structure of KIC gives some sort of practical tools to build and manage KIC to enhance firm performance. Further, system managers and developers may gain valuable insights regarding the ways to enhance KM and its systems effectiveness. The manifest variables used in this study to measure the research constructs may give detailed ideas about what kind of activities need to be done to make the system effective. For example, to improve firm performance, technological capability needs to be built to

Fig. 4 The direct effect model



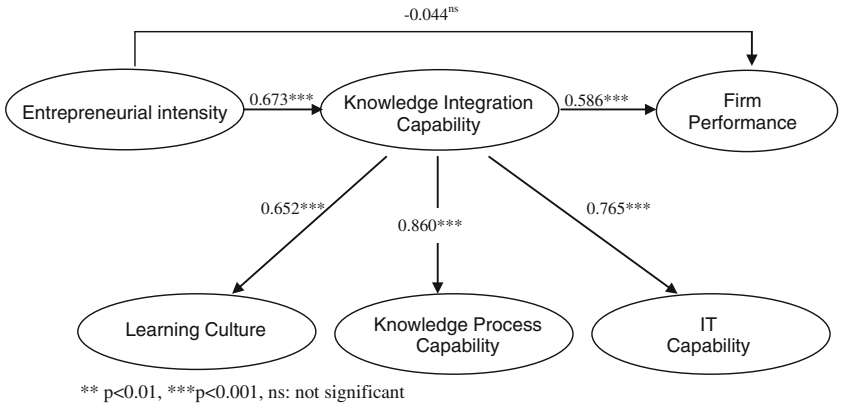


Fig. 5 The mediating effect model

facilitate strategic business planning, help monitor changes in the market, and enhance the ability to negotiate with customers, while KM needs to allow acquiring knowledge about best practices within the industry, absorbing knowledge from business partners into the organization, and transferring organizational knowledge to individuals. In addition, top management need to motivate employees to build trust with each other, work as team/groups, share their lessons learned with all employees.

6.1 Limitations

We have obtained interesting and insightful results. Our analysis, however, is based on cross sectional survey design and we need to exercise caution in making causal inferences. First, we made use of perception measures for firm performance. This is reasonable when it is very hard to collect data about the performance in the major market and overall performance. In addition, we checked the correlation between subjective versus objective measures to find out their correlations are statistically significant. However, the direct use of objective measures of firm performance may reduce method variance and allow more generalizability. For this reason, future research may utilize objective measures for firm performance. Second, data was collected in the survey/questionnaire form. The standard limitations of self-report data including self-selecting bias and low response rate may apply to this research. The results of this study do not, however, seem to be contaminated by the single source bias, as indicated in the earlier results of the common method bias test. Third, in this exploratory study, we draw a single subject from each organization. Our results are limited by the extent that each respondent can accurately assess his/her organization. Future studies may incorporate measures taken from multiple members of an organization and convert them to organization level measures. Finally, the measurement items of this study are drawn from previous studies. Although the items turn out to be reliable and valid based on the statistical test, they are not exhaustive and may lack some face validity. Future studies are desired to develop more items to reflect each construct better.

6.2 Summary and conclusions

We explored the relationship between KIC and firm performance. The results show that entrepreneurial intensity may be a strong indicator of developing KIC within an organization which in turn becomes the key determinant for firm performance. This study contributes to the literature in several ways. This study provides an integrative research model based on entrepreneurship and knowledge-based view literature. The proposed model facilitates the understanding of how the firm as a knowledge integration institution functions to affect firm performance. This concept of the knowledge integration institution is the key foundation of knowledge-based theory of the firm. Therefore, the understanding of the nomological network from the very force of shaping knowledge integration structure to firm performance provides the starting point to further research of knowledge-based theory of the firm. Future studies are desired to develop other antecedents to KIC such as social capital and social network structure in a firm. Further, our results suggest the three component structure well represents KIC. The structure explicates the major understanding of the knowledge structure from the previous studies. Future studies need to develop additional constructs that may capture other aspects of knowledge integration.

This study is just one of the many steps necessary for understanding the firm as a knowledge integration institution and its working mechanism. The long range goal of researchers in this area is to identify a portfolio of the variables of antecedents to, the components of, and the outcome of KIC that can be used as diagnostic tools for the firm performance and the role of information systems and as valid and reliable measures for conducting academic research.

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Appendix

Table 7 Research instruments

Constructs	Items
Corporate Performance (PFM) (Deshpande et al. 1993)	Comparing with major competitors, my organization performed better last year in …..
	PFM1: Sales growth in our primary market
	PFM2: Net profit growth
	PFM3: Overall performance
KM Process Capability (KMP) (Gold et al. 2001)	My organization has processes for …..
	KMP1: Acquiring knowledge about best practices within the industry
	KMP2: Absorbing knowledge from business partners into the organization
	KMP3: Transferring organizational knowledge to individuals
	KMP4: Using knowledge in development of new products/services
	KMP5: Using knowledge to improve efficiency
Information Technology Capability (ITC) (Chan et al. 1997)	In my organization, Information Systems (IS) ….
	ITC1: Enhance our ability to negotiate with our suppliers.
	ITC2: Enhance our ability to negotiate with our customers.
	ITC3: Assist us in setting our prices relative to the competition.
	ITC4: Help us monitor changes in our market share.
	ITC5: Facilitate strategic business planning.
Learning Culture (LC) (Watkins and Marsick 1997).	LC1: In my organization, employees spend time building trust with each other.
	LC2: In my organization, team/groups revise their thinking as a result of groupdiscussion or information collected.
	LC3: My organization makes its lessons learned available to all employees.
	LC4: My organization recognizes employees for taking initiatives.
	LC5: My organization works together with the outside community to meet mutualneeds.
Entrepreneurial Intensity (CE) (Covin and Slevin 1988; Barringer and Bluedorn 1999)	Please indicate which response ***most closely matches*** the management style of your business key managers.
	How many new lines of products or services has your firm marketed in the past 5 years?
	CE1: No new lines of products or services. 1 2 3 4 5 Many new lines of products or services.
	CE2: Changes in product or service lines have been mostly of a minor nature. 1 2 3 4 5 Changes in product or service lines have usually been quite dramatic.
	In dealing with its competitors, my organization ….
	CE3: Is very seldom the first firm to introduce new products/services, operating technologies, etc. 1 2 3 4 5 Is very often the first firm to introduce new products/services operating technologies, etc.

Questionnaire items on a 5-point Likert scale, varying from *Strongly disagree* to *Strongly agree*

Table 8 Cross-loading table

	Factors				
	Performance	CE	LC	ITC	KMP
PFM1	.803	.177	−.049	.012	.203
PFM2	.841	.067	.157	.180	.130
PFM3	.838	.075	.132	.217	.265
CE1	.247	.787	.137	.121	.138
CE2	.031	.833	.004	.244	.133
CE3	.079	.695	.261	.257	.331
LC1	.066	.188	.722	.199	.265
LC2	−.014	−.069	.730	.140	.252
LC3	.070	.133	.584	.188	.388
LC4	−.021	.152	.775	−.032	.030
LC5	.214	.024	.760	.120	−.018
ITC1	.043	.215	.019	.722	.236
ITC2	.074	−.048	.184	.769	.201
ITC3	.070	.159	.120	.795	.180
ITC4	.179	.274	.146	.759	.098
ITC5	.158	.154	.093	.731	.270
KMP1	.136	.116	.121	.233	.723
KMP2	.165	.168	.216	.106	.754
KMP3	.156	.041	.068	.318	.739
KMP4	.249	.287	.154	.134	.699
KMP5	.129	.123	.235	.361	.641

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