How to facilitate different types of innovation in an organization through entrepreneurial orientation and knowledge management

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Abstract:

In dynamic and competitive environment, the importance of innovation is accepted as a necessary ingredients for firms to create value and sustain competitive advantage. However, very little empirical research has specifically addressed to what extent different kinds of innovation rely on specific knowledge management processes and entrepreneurial orientation. The objective of this study is to identify the different types of innovation that are predominant in companies, and how to facilitate different types of innovation activities. A questionnaire survey was conducted and 169 valid replies were received. This research analyzes the relationship among knowledge management processes, as well as entrepreneurial orientation and different types of innovation. The results from an empirical survey study reveal that organizations facilitate different types of innovation (i.e., administrative versus technical innovation, and product versus process innovation) through entrepreneurial orientation and knowledge management process (i.e., knowledge acquisition, knowledge sharing and knowledge application). The results also show that the partial mediating role of knowledge management processes in the relationship between entrepreneurial orientation and different types of innovation.

Keywords: Entrepreneurial Orientation, Knowledge Management Processes, Knowledge Acquisition, Knowledge Sharing, Knowledge Application, Administrative Innovation, Technical Innovation, Product Innovation, Process Innovation

1. Introduction

In the era of knowledge-based economy, innovative capability and continuous innovation are viewed as core to the competitiveness of organizations. However, innovation is a complex process and organizations are not innovative per se (Kör, 2016). Given this focus, to be innovative, organizations need to adopt different types of innovation activities pertaining to all aspects of the organization rather than a single innovation activity. However, prior research puts little emphasis on different types of innovation activities in an organization. So the following question may arise: How to facilitate different types of innovation activities in an organization? Thus investigating 'How to facilitate different types of innovation activities in an organization' remains important to both academics and practitioners. Responding to this gap in the literature, this study aims at achieving a more holistic understanding of different innovation types and to make several contributions in this area. It is important to find out which management practices and decision-making processes promote the successful adoption of different types of innovation activities in a firm. Herein, the purpose of this research is to understand the relationship between entrepreneurial orientation, knowledge management processes and different types of innovation.

In today's business environment, effective knowledge management is associated with survivability and competitiveness of organizations. In particular, the need to effectively manage knowledge is generally accepted as an antecedent of innovation (Carneiro, 2000; Darroch and McNaughton, 2002). Parlby and Taylor (2000) indicate that knowledge management is about supporting innovation, the generation of new ideas and the exploitation of the organization's thinking power. The role of knowledge management processes in innovation promotes competitive advantage through utilization of knowledge and collaboration practices (Cavusgil, Calantone and Zhao, 2003; Plessis, 2007). In addition, knowledge management's role in innovation has a significant impact on reducing complexity in the innovation process. Innovation is extremely depend on the availability of knowledge, however the explosion of richness of knowledge may increase complexity of developing innovation capability. In this regard, the complexity can be addressed by knowledge management through managing both new and existing

knowledge as a driver of several types of innovation (Cavusgil et al., 2003; Shani et al., 2003; Plessis, 2007). The need to effectively manage knowledge is generally accepted as an antecedent of innovation (Carneiro, 2000; Darroch and McNaughton, 2002), however the aspect as to what extent different kinds of innovation rely on specific knowledge sources is often neglected in the literature (Tödtling, Lehner and Kaufmann, 2009). The present study aims to empirically analyze whether knowledge management processes affect different types of innovation, including administrative versus technical and product versus process.

It is of vital importance for organizations to create an environment in which employees can gain and absorb the external knowledge in order to enhance the innovation capability (Massa and Testa, 2004). Entrepreneurial-oriented organization can create a work environment that maintains the organization's capabilities needed to develop innovation through converting and combining knowledge (Lee and Sukoco, 2007). In this vein, effectively combining the entrepreneurial orientation and knowledge management processes can facilitate the innovation capability (Wiklund and Shepherd, 2003; Lee and Sukoco, 2007). Entrepreneurial orientation is also identified as an antecedent of knowledge management in order to influence innovation (Lumpkin and Dess, 1996; Hult, 2003; Zhou et al., 2005). However, with the exception of Li et al. (2009), there is a lack of empirical evidence exploring the relationship between the entrepreneurial orientation, knowledge management processes and different innovation types. Accordingly, the aim of the current paper is to empirically analyze the relationship between entrepreneurial orientation, knowledge management and innovative performance, and thereby distinguishing between technical versus administrative, and product versus process innovations. The contribution of this study lies in the empirical analysis of the interaction effects of knowledge management processes among entrepreneurial orientation and different innovation types.

The rest of this article is organized as follows: "Literature review and hypotheses development" section focuses on the key constructs in the study, which are entrepreneurial orientation, knowledge management

and innovation, and develops the rationale for the conceptual model and hypotheses. Subsequently, the method and the results are presented. The last section reveals the conclusion and the limitations.

2. Literature Review and Hypotheses Development

2.1 Entrepreneurial Orientation and Innovation

Scholars, governments and international organizations have attempted to assess the changes that have occurred in innovative activities due to an increasingly globalized society, since innovation is an important factor for organizations in order to pursue long-term advantages (Archibugi and Iammarino, 2002). In a competitive environment, innovation is established as an increasingly critical component for organizations to create value and sustain competitive advantages (Huang and Li, 2009). However, innovation is complex, uncertain, somewhat disorderly, and subjects to changes of many sorts (Landau and Rosenberg, 1986). Landau and Rosenberg (1986) states that the process of innovation must be viewed as a series of changes in a complete system not only of hardware, but also of market environment, production facilities and knowledge, and the social contexts of the organization.

Over the past half-century, scholars around the world have produced a vast body of academic research and writing on innovation (Khandwalla, 2006; Birkinshaw, Hamel and Mol, 2008; Huang and Li, 2009). Several definitions of innovation exist in the literature. Herkema (2003) defines innovation as a knowledge process aimed at creating new knowledge geared towards the development of commercial and viable solutions. Herkema (2003) also states that innovation is the adoption of an idea or behavior that is new to the organization. Innovation is also defined as adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization (Zaltman, Duncan, and Holbek, 1973; Daft. 1978; Damanpour and Evan, 1984). The definition is sufficiently broad to include different types of innovations pertaining to all parts of organizations and all aspects of their operation (Damanpour, 1991). According to Damanpour (1991), distinguishing innovation is vital for identifying determinant of innovation. Among numerous types of innovation advanced in the

innovation literature, administrative versus technical innovation, and product versus process innovation have gained the most attention.

Damanpour et al. (1989, p. 588) define technical innovations as "those that occur in the operating component and affect the technical system of an organization". According to Daft (1978), an administrative innovation pertains to the policies of recruitment, allocation of resources, and the structuring of tasks, authority and reward. Damanpour (1996) states that "organizations face more difficult problems of control and coordination of differentiated units; thus they would adopt administrative innovations to solve such problems." In addition, administrative and technical innovations have different decision-making processes. In this respect, technical innovations is usually related to technology, and administrative innovations is related to the social structure of the organization (Evan, 1966; Daft, 1978).

Daft (1978) claims that the distinction between product and process relates to the different areas and activities that each of them affect within the firm. Product innovations are outputs or services that are introduced for the benefit of customers or clients. Process innovations are defined as tools, devices, and knowledge in throughput technology that mediate between inputs and outputs. Product innovations tend to occur with greater frequency earlier in a product's life cycle and are usually aligned with a differentiation strategy, while process innovations usually occur in later stages and aid in the effective implementation of a low-cost strategy (Daft, 1978; Gopalakrishnan and Damanpour, 1997; Gopalakrishnan and Bierly, 2001).

In today's dynamic environment, innovation and entrepreneurship are complementary, and the interaction of the two helps an organization to flourish (Zhao, 2005). Entrepreneurial orientation is the presence of organizational-level entrepreneurship (Wiklund and Shepherd, 2003; Kör, 2016). Entrepreneurial orientation is regarded as a critical organizational process that facilitate organization's ability to continually renew, take risks in its markets and areas of operation, and thus innovate (Miller, 1983; Naman and Slevin, 1993; Tajeddini, 2010). Entrepreneurial orientation reflects the extent to which an organization engages in risky ventures, receptive to innovations, and is the first to come up with proactive

innovations to prevail over competitors (Miller, 1983; Zhou, Yim and Tse, 2005). Entrepreneurial orientation also pertains to a firm's strategic orientation which captures specific entrepreneurial aspects of decision-making styles, such as taking calculated risks, being innovative and being proactive (Covin and Slevin, 1989; Lumpkin and Dess, 1996). Entrepreneurial orientation emphasizes the organizational process of creating new business out of ongoing practices and rejuvenating stagnant companies through stimulating innovations (Lumpkin and Dess 1996; Lu, Tzeng and Tang, 2013). In this regards, the work environment that supports innovativeness, risk taking and proactiveness, can promote different innovation outcomes (Amo and Kolvereid 2005; Amo 2006; Kör, 2016). Based on this analysis, the present study thus proposes that:

H1a: There is a positive relationship between entrepreneurial orientation and administrative innovation.
H1b: There is a positive relationship between entrepreneurial orientation and technical innovation.
H1c: There is a positive relationship between entrepreneurial orientation and product innovation.
H1d: There is a positive relationship between entrepreneurial orientation and process innovation.

2.2 Knowledge Management and Innovation

Modern organizations face matters such as an increasing complexity of products and processes, a growing reservoir of relevant knowledge (both technical and non-technical), and increasing competition in an economy with shorter product life-cycles (Beijerse, 1999). Within this environment, organizations gain many advantages by effectively managing knowledge. In an entrepreneurial economy, knowledge is assumed as the main source of intellectual assets which provides returns on investment and competitive advantage (Beijerse, 1999; Carneiro, 2000). According to the knowledge-based view, knowledge is also concerned as a valuable resource of the firm and a value creation in the firm (Nonaka and Takeuchi, 1995; Hansen, 1999; Huang and Li, 2009). Effectively managing knowledge assists organization to act as intelligently as possible in order to secure its viability and overall success; and to otherwise realize the best value of its knowledge assets (Wiig, 1997).

Knowledge management is defined in many different ways in the literature. Darroch and McNaughton (2002) describe knowledge management as a management function that creates or locates knowledge, manages the flow of knowledge and ensures that knowledge is used effectively and efficiently for the long-term benefit of the organization. Knowledge management is also described as an umbrella term for a variety of interlocking terms, such as knowledge acquisition, knowledge sharing and knowledge application (Gloet and Terziovski, 2004; Lin and Lee, 2005). According to Gloet and Terziovski (2004), knowledge management is the formalization of and access to experience, knowledge, and expertise that create new capabilities, enable superior performance, enhance customer value, and encourage innovation.

Changing customer needs, extensive competitive pressure and rapid technological change has forced organizations to use continuous innovation that fulfills the need for efficient provision of a constant stream of new products, services, and markets. However, being innovative continuously has become increasingly complex due to the growth in the amount of knowledge available to organizations as a basis for innovation (Cavusgil et al., 2003; Plessis, 2007). According to Plessis (2007), the availability of the knowledge has an important impact on innovation and therefore the explosion of richness of knowledge and acquisition of knowledge have to be managed to ensure successful innovation. Herkema (2003) indicates that innovation is a process that enable the adoption of an idea or behavior that is new to the organization through acquiring, sharing and application of knowledge. Therefore, organizations can promote different innovation through managing knowledge effectively. Nowadays, it is commonly accepted that innovations are brought forward in an interactive processes of knowledge management, such as knowledge acquisition process, knowledge sharing process and knowledge application process. However, it is still unclear, as to what extent different kinds of innovation rely on knowledge acquisition process, knowledge sharing process and knowledge application process (Darroch and McNaughton, 2002; Tödtling, Lehner and Kaufmann, 2009).

Lin and Lee (2005) define knowledge acquisition as the business processes that use existing knowledge and capture new knowledge. Acquisition-oriented knowledge management processes are related with

obtaining knowledge (Gold et al., 2001). Gold et al. (2001) state that many terms have been used to describe these processes, such as acquire, seek, generate, create, capture, and collaborate. According to Chen and Huang (2009), knowledge acquisition from outside and inside organizations provides opportunities for firms to recombine current knowledge and create new knowledge. In addition, linkage between newly acquired knowledge and existing knowledge can modify organizational knowledge stock and enhance the breadth and depth of knowledge available to the firm, thereby increasing the potential for new innovative outcomes (Chen and Huang, 2009; Pinar and Kör, 2010; Kör and Maden, 2013).

Knowledge sharing is the business processes that distribute knowledge among all individuals participating in business activities, and it refers to collective beliefs or behavioral routines related to the spread of learning among different individuals or units within an organization (Lin and Lee, 2005; Chen and Huang, 2009). According to Caloghirou et al. (2004), openness towards knowledge sharing is important for improving innovation performance. Chen and Huang (2009) state that knowledge sharing implies new combination of knowledge, which could result in process improvements or novel products, thereby promoting innovation activities within organizations.

Knowledge management application process is related with the actual use of the knowledge and it is the central elements of the knowledge management process (Grant, 1996; Gold et al., 2001). Lin and Lee (2005) define knowledge application as business process through which effective storage and retrieval mechanisms enable a firm to access knowledge easily. New product development and innovation require the application and combination of specialized knowledge inputs from many different areas (Chen and Huang, 2009).

In line with the previous discussions, it is possible to generate the following hypotheses to be examined in this study.

H2a: There is a positive relationship between knowledge acquisition process and administrative innovation.

H2b: There is a positive relationship between knowledge sharing process and administrative innovation.

H2c: There is a positive relationship between knowledge application process and administrative innovation.

H2d: There is a positive relationship between knowledge acquisition process and technical innovation.

H2e: There is a positive relationship between knowledge sharing process and technical innovation.

H2f: There is a positive relationship between knowledge application process and technical innovation.

H2g: There is a positive relationship between knowledge acquisition process and product innovation.

H2h: There is a positive relationship between knowledge sharing process and product innovation.

H2i: There is a positive relationship between knowledge application process and product innovation.

H2j: There is a positive relationship between knowledge acquisition process and process innovation.

H2k: There is a positive relationship between knowledge sharing process and process innovation.

H2l: There is a positive relationship between knowledge application process and process innovation.

2.3 Entrepreneurial Orientation and Knowledge Management

As discussed above, highly entrepreneurial organizations are characterized by their willingness to engage in creativity and innovation activities, taking bold actions by venturing into the new and uncertain products, services, and markets, and a strong emphasis on being the pioneer in the marketplace (Wiklund and Shepherd, 2003; Rauch et al., 2009). Additionally, entrepreneurial orientation has a pivotal impact on discovering market opportunities and increasing the engagement in new product and process development through facilitating the utilization of new and existing knowledge (Wiklund and Shepherd, 2003; Madhoushi et al., 2011). In this vein, entrepreneurial orientation can strengthen the advantages of knowledge-based resources through supporting internal flows of knowledge and transferring individual knowledge into organizational knowledge (Wiklund and Shepherd, 2003; Li et al., 2009). The work environment that supports innovativeness, risk taking and proactiveness, can stimulate internal flows of knowledge that helps organizational members to adapt existing knowledge and absorb new knowledge. Accordingly, employees can be motivated to engage in reconfiguration of the existing knowledge-based resources into firm-level capabilities. Therefore, firms with strong entrepreneurial orientation have more

tendency to support knowledge management processes in terms of acquisition, sharing, and application. In such conditions, knowledge management processes are likely to occur. Within this scope, Madhoushi et al. (2011) asserted that the positive relationship between entrepreneurial orientation and knowledge management processes can be reasonably expected. Based on this analysis, it is proposed that:

H3a: There is a positive relationship between entrepreneurial orientation and knowledge acquisition process.

H3b: There is a positive relationship between entrepreneurial orientation and knowledge sharing process.

H3c: There is a positive relationship between entrepreneurial orientation and knowledge application process.

2.4 Knowledge Management Process as a Mediator

Innovation processes related with certain levels of uncertainty and complexity (Kör, 2016). Therefore, innovation requires not only a cooperation of individuals but also organization's ability to continually identify and exploit entrepreneurial opportunities in order to cope with the complexity of innovation processes. Additionally, under these conditions, entrepreneurial orientation creates an appropriate culture, climate, structure and/or strategy for leveraging knowledge management process and different innovation activities in order to respond quickly to emerging needs of market (Wiklund and Shepherd, 2003; Rauch et al. 2009; Wales et al. 2013; Kör, 2016). In this regards, organizations with strong entrepreneurial orientation can facilitate usage of existing knowledge, generation of new knowledge, distribution of knowledge among all individuals and application of knowledge (Lee and Sukoco, 2007). When knowledge conversion or creation process can be applied and disseminated throughout the organization, organization members are more inclined to transfer and utilize knowledge to develop new product, improve efficiency and further promote innovation (Lee and Sukoco, 2007; Huang and Li, 2009). Thus, entrepreneurial orientation can increase the capacity of organizations to transfer knowledge into innovation outcome. Accordingly, knowledge management processes play mediating role in the

relationship between entrepreneurial orientation and innovation types. Based on this analysis, the present study thus proposes that:

H4a: Knowledge management processes mediate the relationship between entrepreneurial orientation and administrative innovation.

H4b: Knowledge management processes mediate the relationship between entrepreneurial orientation and technical innovation.

H4c: Knowledge management processes mediate the relationship between entrepreneurial orientation and product innovation.

H4d: Knowledge management processes mediate the relationship between entrepreneurial orientation and process innovation.

3. Research Methodology

3.1 Data Collection and Sample

To investigate the hypotheses, this study uses a set of survey data from Fortune 500 Turkish companies in 2016. 160 valid replies were received. Variables in the questionnaire include entrepreneurial orientation, knowledge management processes and innovation types. The questionnaire consisted of 36 items divided among topics: entrepreneurial orientation, knowledge management processes and different innovation types including, administrative, technical, product and process innovation, and questions about participants' demographic characteristics. The participants of the study were engineers, specialists, managers and other employees, including consultants, assistants, researcher, inspector, technician, etc., who are familiar with the topics in the survey. Participants in this study answered the questionnaire in a voluntary manner and were informed of the aim of the survey. Participants were also assured of the anonymity and the confidentiality of their answers. The demographic characteristics of the respondents are represented in Table 1. The majority of the respondents had an undergraduate degree (52.7 %), followed by master degree (40.2 %) and PhD degree (7.1 %). Most of the respondents were male (65.7 %).

Table 1: Demographic characteristics of the participants

		Participants (n = 169) No.	%
Gender	Male	111	65.7
	Female	58	34.3
Age	20-30	76	45
	31-40	70	41.4
	>40	23	13.6
Education	Undergraduate	89	52.7
	Master	68	40.2
	PhD	12	7.1
Work Experience	0-4	31	18.34
	5-9	67	39.64
	≥10	71	42.01
Job Tenure	0-4	89	52.66
	5-9	48	28.40
	≥10	32	18.93
Position/ Title	Engineer	21	12.43
	Specialist	40	23.67
	Manager	68	40.24
	Other	40	23.67

3.2 Measures

All constructs were measured with multiple items. All items in the questionnaire were measured on a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. The items were taken from existing measures that are considered reliable and valid. All items in the survey were translated from their original language, which is English, to Turkish. This was done with the parallel back-translation procedure to ensure the adequacy of meaning (Bhalla and Lin, 1987). All correlational analyses, descriptive statistics,

factor analysis, tests of reliability, regression analyses and mediation analyses were performed by using the software programs SPSS (Version 24.0).

Entrepreneurial orientation was measured with eight items drawn from Covin and Slevin's (1989) entrepreneurial orientation scale. This scale is based on the works of Miller and Friesen (1982) and Khandwalla (1977). Knowledge management processes were measured with fifteen items adapted from the concept of Gold et al. (2001), Lin and Lee (2005), Chen and Huang (2009) and Huang and Li (2009). This scale is divided in three dimensions: knowledge acquisition process, knowledge sharing process, and knowledge application. Innovation types are measured as four constructs with a total of thirteen items: administrative innovation versus technical innovation were derived from those proposed by Huang and Li (2009) and Chen and Huang (2009), and process versus product innovation were drawn from Akgün, Keskin and Bryne (2009).

3.3 Analysis and Results

Data analysis was conducted in two stages. The first was a factor analysis of the data on knowledge management processes and different innovation types to identify the number and nature of the underlying variables, or dimensions, within those data. In the second stage, multiple regression analysis and mediation analysis were used to test the research hypotheses.

Knowledge management processes and innovation measure were subjected to principal component factor analysis with Varimax rotation. The KMO measure of sampling adequacy (.86) and Bartlett's test value ($p < .000$) indicated that the sample scores were suitable for factor analysis of knowledge management processes. According to Hair et al. (1998), values greater than ± 50 are necessary for practical significance. Nevertheless, sample size need to be considered when deciding on acceptable factor loadings. Using pattern matrix for interpretation, for the sample consisting of 169 observations, minimum acceptable factor loading is 0.45 (Hair et. al., 1998) and with no cross loading exceeding half the primary component loading (Finn and Kayande, 2004) or an item that loads at .32 or higher on two or more factors

(Costello and Osborne, 2005). The results support three factors of knowledge management processes with eigenvalues greater than 1 and explain 63.1% of the variance. The author retained all items with primary loadings greater than .45 but two items have cross loading exceeding half the primary component loading. This resulted in the deletion of one item from knowledge sharing process and one item from knowledge acquisition process. The factor eigenvalues of knowledge management processes and their information values obtained during factor analysis are presented in Table 2. Knowledge application process factor includes six items, knowledge sharing process factor includes three items and knowledge acquisition process factor includes four items.

Table 2: Results of factor analysis of knowledge management process items

	Components		
Questionnaire Items	1	2	3
KM Application1	.81		
KM Application2	.79		
KM Application3	.76		
KM Application4	.74		
KM Application5	.71		
KM Application6	.67		
KM Sharing1		.82	
KM Sharing2		.81	
KM Sharing3		.80	
KM Acquisition1			.78
KM Acquisition2			.73
KM Acquisition3			.61
KM Acquisition4			.56

Remarks: n=169

As shown Table 3, the results support two factors of different types of innovation: administrative versus technical with eigenvalues greater than 1 and explain 69.05% of the variance. The KMO measure of sampling adequacy (.86) and Bartlett's test value ($p < .000$) indicated that the sample scores were suitable for factor analysis of administrative versus technical innovation. The author retained all items with primary loadings greater than .45. The administrative innovation factor includes four items and the technical innovation factor consists of three items.

Table 3: Results of factor analysis of administrative versus technical innovation items

	Component	
Questionnaire Items	1	2
Administrative Inn1	.90	
Administrative Inn2	.80	
Administrative Inn3	.77	
Administrative Inn4	.51	
Technical Inn1		.85
Technical Inn2		.76
Technical Inn3		.71

Remarks: n=169

As shown Table 4, the results support two factors of different types of innovation, which are product versus process with eigenvalues greater than 1 and explain 76.07% of the variance. The KMO measure of sampling adequacy (.84) and Bartlett's test value ($p < .000$) indicated that the sample scores were suitable for factor analysis of product versus process innovation. The author retained all items with primary loadings greater than .45. The product innovation factor includes three items and the process innovation factor consists of three items.

Table 4: Results of factor analysis of product versus process innovation items

	Component	
Questionnaire Items	1	2
Product Inn1	.88	
Product Inn2	.87	
Product Inn3	.83	
Process Inn1		.79
Process Inn2		.78
Process Inn3		.74

Remarks: n=169

3.4 Measurements Reliability and Validity

In the present study, measurement quality of the constructs was assessed by examining the content validity, convergent validity, internal consistency of the items, and composite reliability (Barclay et al., 1995; Chin 1998; Gefen et al., 2000). After the translation process of the questionnaire, the content validity, clarity and accuracy of the questionnaires were checked and approved by one faculty member, two doctoral students and one manager. Table 5 provides information about the Cronbach's α, factor loadings and composite reliability. Internal consistency was assessed for each constructs using Cronbach's α. An analysis of reliability on the entrepreneurial orientation items resulted in a high corrected item-total

correlation of more than .3 was found for all the items except one (referring to: In dealing with its competition, my company typically initiates actions to which competition then respond). This item was excluded from further analysis. The internal reliability of the entrepreneurial orientation scale was moderately high. As can be seen Table 5, Cronbach's α ranges from .7 to .9 (Corrected Item-Total Correlation >.3), which indicates that all constructs have acceptable reliability. Factor loadings are above the recommended value of 0.45 (for sample size 150 or greater), and all factor loadings were significant (Hair et al., 2009). The average variance extracted (AVE), measuring the variance captured by the indicators in relation to the variance caused by measurement error of the indicators, need to exceed .50 (Fornell and Larcker, 1981). Since all values were acceptable, convergent validity was established. The composite reliability values ranged between 0.77 and 0.90, which exceeded the recommended 0.70 threshold value; therefore construct reliability can be assumed (Bagozzi and Yi, 1988).

Table 5: Factor loadings, AVE, composite reliability and Cronbach's α

Construct	Factor Loading	AVE	Comp. Reliability	Cronbach's Alpha
Knowledge Application	.67-.81	.56	.88	.9
Knowledge Sharing	.80-.82	.65	.85	.8
Knowledge Acquisition	.56-.78	.5	.77	.7
Administrative Innovation	.51-.90	.58	.84	.8
Technical Innovation	.71-.85	.60	.82	.8
Product Innovation	.83-.88	.74	.90	.9
Process Innovation	.74-.79	.59	.81	.8
Entrepreneurial Orientation	.45-.84	.56	.88	.8

3.5 Hypotheses Testing Procedure

Table 6 reports correlations and descriptive statistics for all variables. As indicated in Table 6, entrepreneurial orientation was positively associated with knowledge application process ($r=.46$, $p<.001$), knowledge sharing process ($r=.26$, $p<.001$), knowledge acquisition ($r=.27$, $p<.001$), administrative innovation ($r=.62$, $p<.001$), technical innovation ($r=.57$, $p<.001$), product innovation ($r=.65$, $p<.001$) and process innovation ($r=.43$, $p<.001$). Knowledge application process was positively correlated with administrative innovation ($r=.52$, $p<.001$), technical innovation ($r=.53$, $p<.001$), product innovation ($r=.29$, $p<.001$) and process innovation ($r=.39$, $p<.001$). Knowledge sharing process was positively correlated with administrative innovation ($r=.22$, $p<.001$), technical innovation ($r=.18$, $p<.001$), and process

innovation (r=.18, p<.001). Knowledge acquisition process was positively correlated with administrative innovation (r=.16, p<.05), technical innovation (r=.24, p<.001), and product innovation (r=.17, p<.001). These results provided initial support for the hypotheses of the study. Additionally, as Table 6 shows, the highest correlation among the principal constructs is .68, far less than the problematic level of CMV (e.g., .90) (Bagozzi et al. 1991). The result of the test suggests that CMV is likely not a serious concern in the present study.

Table 6: Means, standard deviations and correlations

	M	SD	1	2	3	4	5	6	7	8
Entreprenurial Orientation	3.4	.35	-							
K. Application	3.7	.16	,46**	-						
K.Sharing	3.8	.03	,26**	.00	-					
K. Acquisition	3.5	.25	,27**	.00	.00	-				
Administrative Inn.	3.5	.16	,62**	.52**	.22**	.16*	-			
Technical Inn.	3.8	.09	,57**	,53**	.18*	.24**	.68**	-		
Product Inn.	3.5	.06	,65**	,29**	.15	.17*	.45**	.44**	-	
Process Inn.	3.6	.08	,43**	,39**	.18*	.14	.55**	.00	.00	-

Remarks: n=169. *Correlation is significant at the 0.05 level (2-tailed); **correlation is significant at the 0.01 level (2-tailed).

Hypotheses were tested with regression analysis. Several tests were applied to test the regression assumptions. Multi-collinearity was evaluated for each regression model using the Variance Inflation Factor (VIF). Large VIF values denote multicollinearity problem (Hair, et al., 1995). A common cut-off threshold for VIF values is 10. In this study, all VIF scores were less than 1.5, which indicate a lack of multi-collinearity. The distributions of residuals were checked by making probability plots (Q-Q plots), which were normal. Therefore, these test results indicated that the assumptions of regression analysis were fulfilled.

Hypothesis 1a to 1d predicts that entrepreneurial orientation is positively related to innovation types. As presented in Table 7, results relevant to these hypotheses indicated that entrepreneurial orientation is significantly related to administrative innovation ($\beta = .615$, $p < .000$, Adj. R^2=.37), technical innovation ($\beta = .565$, $p < .000$, Adj. R^2=.32), product innovation ($\beta = .651$, $p < .000$, Adj. R^2=.42) and process innovation ($\beta = .433$, $p < .000$, Adj. R^2=.18). Thus, hypotheses 1a to 1d can be accepted.

Table 7: Results of regression analysis of the effects entrepreneurial orientation on the innovation types

	Administrative Inn.	Technical Inn.	Product Inn.	Process Inn.
Entrepreneurial Orientation	.615**	.565**	.651**	.433**
Adj. R^2	.37	.32	.42	.18

Remarks: n=169, β is significant at the 0.05 level (2-tailed); ** β is significant at the 0.01 level (2-tailed). Standardized coefficients are reported.

Table 8 shows results of regression analysis of the effects of knowledge management processes on innovation types. Knowledge acquisition, knowledge sharing, and knowledge application processes have positive and significant effects on administrative innovation ($p < .012$, $p < .001$, $p < .000$, respectively, Adj. R^2=.328). Likewise, knowledge acquisition, knowledge sharing, and knowledge application processes have also positive and significant effects on technical innovation ($p < .000$, $p < .003$, $p < .000$, respectively, Adj. R^2=.360). Additionally, knowledge acquisition, knowledge sharing, and knowledge application processes have positive and significant effects on product innovation ($p < .004$, $p < .003$, $p < .000$, respectively, Adj. R^2=.221). Knowledge acquisition, knowledge sharing, and knowledge application processes have also positive and significant effects on process innovation ($p < .007$, $p < .001$, $p < .000$, respectively, Adj. R^2=.293). Therefore, Hypotheses 2a and 2l are supported.

Table 8: Results of regression analysis of the effects knowledge management processes on the innovation types

	Administrative Inn.	Technical Inn.	Product Inn.	Process Inn.
Knowledge Acquisition	.16*	.236*	.202*	.179*
Knowledge Sharing	.221*	.184*	.208*	.217*
Knowledge Application	.516**	.531**	.389**	.477**
Adj. R^2	.328	.360	.221	.293

Remarks: n=169, β is significant at the 0.05 level (2-tailed); ** β is significant at the 0.01 level (2-tailed). Standardized coefficients are reported.

Hypothesis 3a to 3c predicts that entrepreneurial orientation is positively related to knowledge management processes. As presented in Table 9, results relevant to these hypotheses indicated that entrepreneurial orientation is significantly related to knowledge acquisition process ($p < .000$, Adj. R^2=.068), knowledge sharing process ($p = .001$, Adj. R^2=.061) and knowledge application process ($p < .000$, Adj. R^2=.068). Accordingly, results support Hypotheses 3a to 3c.

Table 9: Results of regression analysis of the effects entrepreneurial orientation on the knowledge management processes

	Knowledge Acquisition	Knowledge Sharing	Knowledge Application
Entrepreneurial Orientation	.271**	.259*	.271**
Adj. R^2	.068	.061	.068

Remarks: n=169, β is significant at the 0.05 level (2-tailed); ** β is significant at the 0.01 level (2-tailed). Standardized coefficients are reported.

Knowledge management processes are hypothesized to mediate entrepreneurial orientation and different innovation types. The mediation model was tested using Baron and Kenny's (1986) four-condition criteria: (1) the predictor variable should have a significant relationship to the outcome, (2) the predictor variable should have a significant relationship to the mediator, (3) the mediator should have a significant relationship to the outcome, and (4) when the mediator is specified in the full model, the relationship between the predictor variable and the outcome should become non-significant. Additionally, full or perfect mediation is supported when the independent variable has no significant effect when the mediator is controlled, while partial mediation is indicated if the effect of the independent variable is reduced in magnitude but still significant when the mediator is controlled (Baron and Kenny, 1986). Different innovation types were used as the dependent variables, entrepreneurial orientation was used as the independent variable, and knowledge management processes were used as the mediating variables. Following Baron and Kenny's (1986) indications, Table 10 shows the conditions to establish the mediation effects. The first step in the analysis was to examine the relationship between entrepreneurial orientation and different innovation types. Entrepreneurial orientation has positive and significant effect on all innovation types (see Table 7). The second step was to examine the entrepreneurial orientation effect on knowledge management processes. All knowledge management processes relate positively and significantly to entrepreneurial orientation (see Table 9). In the next step, the relationship between knowledge management processes and innovation types was examined. Three knowledge management processes have positive and significant effect on all innovation types (see Table 8). Finally, as shown in Table 10, all knowledge management processes significantly reduce the effects of entrepreneurial orientation on the dependent variables, except for the effect of entrepreneurial orientation to product

innovation. Thus, Hypothesis 4c, which states that knowledge management processes mediate the relationship between entrepreneurial orientation and product innovation, is not supported. In addition, Hypothesis 4a, 4b and 4d, which state that knowledge management processes mediates the relationship between entrepreneurial orientation and different innovation types (i.e., administrative, technical and process innovation), are partially supported.

Table 10: Results of regression analysis for mediating effect

	Administrative Inn.	Technical Inn.	Product Inn.	Process Inn.
Knowledge Acquisition	.061	.148*	-.009	.067
Knowledge Sharing	.111	.101	-.028	.111
Knowledge Application	.320**	.382**	-.020	.270
Entrepreneurial Orientation	.428**	.323**	.670**	.263*
Adj. R^2	.45	.43	.41	.24

Remarks: n=169, β is significant at the 0.05 level (2-tailed); ** β is significant at the 0.01 level (2-tailed). Standardized coefficients are reported.

4. Conclusion and Limitations

Innovative capability of organizations is argued to be essential for maintaining competitive advantage in the global market. Nevertheless, this requires a fast acquiring of critical knowledge of internal and external environment of organizations as well as a dynamic, a flexible, an innovative and a competitive organizational climate (Covin and Miles, 1999; Lee and Sukoco, 2007). Herein, it is crucial to determine how to facilitate innovation types in an organization. Therefore, the goal of the proposed study was to obtain a better understanding of the role of knowledge management processes (i.e., knowledge acquisition, knowledge sharing and knowledge application) in the relationship between entrepreneurial orientation and innovation types (i.e., administrative versus technical innovation, and product versus process innovation). This study also investigated the relationship between entrepreneurial orientation, knowledge management processes and innovation types. In doing so, the study contributes to the theoretical development of a conceptual model for explaining the relationships between entrepreneurial orientation, knowledge management processes and types of innovation. This study also intends to provide insights to a better

understanding of knowledge management in what concerns the possibility of influencing innovation by integrating and expanding previous research in the areas of knowledge management and innovation.

Based on the results of this study, several conclusions can be drawn. The first conclusion is that both entrepreneurial orientation and knowledge management processes (i.e., knowledge acquisition, knowledge sharing and knowledge application) influence innovation types, including administrative, technical, product and process innovations. The results that the knowledge management processes influence innovation types in organizations not only consistent with some researchers' (Darroch and McNaughton, 2002; Huang and Li, 2009; Li et al., 2009) view that knowledge management processes are positively related with innovation, but also the results extend current research by penetrating into distinguishing between types of innovation, and the impact of three knowledge management processes on these innovation types. In this light, knowledge management is the continuous processes including acquisition, sharing and application of knowledge in order to promote different innovation types through effectively utilization of knowledge. Additionally, based on the results of the positive relationship between entrepreneurial orientation and innovation types, the author indicates that it is necessary for firms to emphasize strong entrepreneurial orientation for creating a dynamic and a flexible environment where innovativeness, proactiveness and risk taking behaviors can stimulate different types of innovation. Additionally, at the practical level, firm managers should be aware of the importance of effectively managing knowledge and build organizational environments and/or strategies that can develop innovations in organizations through entrepreneurial orientation.

The second conclusion is that there is a positive relationship between entrepreneurial orientation and knowledge management processes, including knowledge acquisition, knowledge sharing and knowledge application. According to De Long and Fahey (2002), effectively managing knowledge faces the difficulties from an organizational climate or strategic orientation, which in turn hindering the achievement of maximum benefit from knowledge management. In agreement with the implication of De Long and Fahey (2002), the findings of the study reveal that entrepreneurial orientation, as a strategic

orientation, plays a critical role in strengthening knowledge management processes within organizations. Since, in order to implement the knowledge management effectively, organizations must create the thirst for knowledge and achievement among the individuals of the organization (Akram et al., 2011). The results of the study further indicate that entrepreneurial orientation is helpful to enhance to create a work environment that supports new knowledge acquisition, internal flows of knowledge and adaptation of both existing and new knowledge. Thereby managers may be able to build the knowledge culture within the organization in which knowledge acquisition, knowledge sharing and knowledge application are the integral part of the organization strategy.

The third conclusion is that knowledge management processes partially mediate the relationship between entrepreneurial orientation and innovation types (i.e., administrative, technical and process innovation). Entrepreneurial orientation would affect different innovation types within organizations through effectively managing knowledge processes. Just like a system, entrepreneurial orientation is an important input, knowledge management is a key process, and then innovation is a critical output for organizations. Furthermore, partial mediation occurs when the independent variable has a direct effect on the dependent variable as well as an indirect effect through the mediator (James and Brett, 1984). Partial mediation is also suggested when controlling for the mediator does not attenuate the significant relationship between the independent and dependent variables (Bates and Khasawneh, 2007). Rucker et al. (2011, p. 361) states that "in the case of partial mediation, there is a clear implication that other indirect effects could (and probably should) be examined and tested empirically." Based on this discussion, entrepreneurial orientation holds an important position by providing organizational strategic orientation and climate to develop different types of innovations in organization. However, entrepreneurial orientation is not enough to develop innovations, and it is essential to place consideration on not only effectively managing knowledge processes, but also other indirect effects because of partial mediation.

The results of the study should be considered in light of several limitations. First, self-reported data from a single source may pose potential problems such as CMV or may decrease the objectivity of the study. To

alleviate this limitation, samples have been chosen from executives and employees who are familiar with the topics in survey and as discussed in the method section, the results of the study did not provide any indications of CMV. Second, the study should be repeated with an increased sample size and in a wider range of sectors, as well as in different cultures to increase the generalizability of the findings. Third, only three types of knowledge management capabilities and four types of innovation were examined. In future studies, other types of knowledge management processes and innovation can be studied. Additionally, according to Preacher and Kelley (2011), full mediation result supports that the process by the relationship between independent and dependent variables has been completely explained and there is no need to test for further indirect effects. However, in the case of partial mediation effect of knowledge management processes (i.e., knowledge acquisition, knowledge sharing and knowledge application) between entrepreneurial orientation and different innovation types (i.e., administrative, technical and process innovation), other indirect effects should be examined and tested empirically. Accordingly, future research might benefit from including other mediator variables into research model. Additionally for future research, other facilitating mechanism should be included to study in order to achieve a more holistic understanding of product innovation.

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