THE RELATIVE CONTRIBUTION OF DIFFERENT KNOWLEDGE MANAGEMENT PROCESSES ON INNOVATION PERFORMANCE

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Abstract- This study seeks to investigate the relative contribution of different knowledge processes that are creation, transfer, integration and application on innovation performance of firms. In order to achieve this, a self-administrated questionnaire was conducted on a sample of 244 firms from different industries in Turkey and the data were analyzed through hierarchical regression method. The study found that knowledge transfer and knowledge application provided more contribution to innovation performance than that of knowledge creation and knowledge integration. The authors suggest that managers of the firms should pay attention to establish organizational structures and mechanisms that enhance sharing of knowledge throughout the organizations.

Index Terms- Knowledge processes, innovation, regression analysis, Turkey.

I. INTRODUCTION

Innovation has become essential for firms to retain their competitiveness and ensure long-term survival in dynamic global markets [1], [2], [3]. Grigoriou and Rothaermel [3] state that "innovation is a vehicle of economic growth and a potential source of firm-level performance heterogeneity" (p. 587). In parallel, over the past two decades, the antecedents of innovation performance have been an important subject of inquiry in organization literature. Scholars and practitioners in the field agreed that firm-level specific knowledge and management of knowledge were the most important determinants of superior innovation performance [4], [5], [6], [7]. Although specific knowledge stock of a firm has been accepted as the main driving force of innovation, the role of effective knowledge management on innovation performance is evident [8], [9]. The abilities which enable a firm to manage knowledge resources across its business units effectively through a series of processes including *creation*, *transfer*, *integration* and *application* were termed "knowledge management processes" [10], [9]. Previous research [11], [12], [13], [14] found that knowledge management processes were highly associated with innovation performance. Besides, the facilitating role of knowledge management processes on organizational innovativeness was meta-analytically confirmed [15]. Against a number of studies that measure the effects of knowledge management processes on innovation, research that explores the relative contribution of these processes on innovation performance is limited. Therefore, this study aims to measure the relative contribution of knowledge management processes on innovation performance individually.

II. THEORETICAL BACKGROUND

Innovation emerges as a result of the combination of knowledge elements in organizations [16], [17]. Similarly, Nonaka [18] and Amabile [19] consider knowledge as the key raw material for innovation. Many studies [20], [21], [22],[15], [14] in innovation research have consistently indicated that the knowledge resources of a firm were strongly associated with innovation success. However, Easterby-Smith and Prieto [23] state that "it is important to distinguish knowledge resources from the process of trying to manage it" (p. 238). Although knowledge assets can be treated as unique and valuable resources on the way of sustaining competitive advantage [24], knowledge itself is a static resource stock which needs to be transferred and spread throughout the organization in order to create value [25], [26], [27], [28], [29], [30]. Spender [27] focuses on the dynamic side of knowledge such as knowledge creating, processing and transferring rather than on knowledge per se as an economic asset. The author argues that competitive advantage is more likely to derive from firm-specific knowledge and stresses the importance of the conversion of static knowledge into a more dynamic nature (e.g., from declarative to procedural knowledge and; from tacit to explicit knowledge). With this premise, examination of the abilities of an organization in generating valuable knowledge through a series of activities has always created attention for the strategy scholars [27], [26], [29], [31], [9], [32].

The abilities of a firm to create valuable and strategic knowledge through a series of coordinated knowledge processes can be defined as knowledge management processes [8]. Although various knowledge process models were identified in the organization literature, the consensus among scholars [18] [8], [10],[9]in the area offered four common knowledge processes: creation, transfer, integration and application. Whilst knowledge creation includes acquisition of knowledge from internal and external sources (such as employees,

customers, suppliers and competitors), conversion of knowledge into applicable formats and storage in organization's knowledge repository [14], knowledge transfer refers to the distribution and sharing of knowledge throughout the organization at all levels from individuals to divisions [8], [31]. Knowledge integration is the organization, restructuring and interpretation of existing knowledge through "directives, organizational routines, and self-contained task teams" [8] (p. 122) to establish a base into new meaningful knowledge and maximize knowledge synergy [14]. Knowledge application is the actual use of valuable and strategic knowledge on the way of developing organizational competencies and realizing organizational outcomes such as "changes in the behavior of recipients, new product developments, improvement in innovation and operational excellence, enhancement in external relationships, adjustments in strategic direction and changes in competitive conditions" [14] (p. 1145) which may sustain competitive advantage. These four knowledge processes complement and mutually support each other and "they enable the firm to create and exploit the cross-unit knowledge synergies, and to renew them as they depreciate and become obsolete" [9] (p. 314). However, each knowledge process may offer different amount of contribution.

Knowledge can be managed via an appropriate combination of several human and technology initiatives [9], 23]. Whilst the technology side utilizes IT infrastructures, data warehouses, intranet, document management systems, collaborative platforms and virtual centers of expertise, call centers, enterprise databases (ERP), decision support systems and other technical and managerial procedures, "the human side focuses on the sense-making behaviors of individuals, on social relations and cultural factors when handling organizational knowledge" [23] (p. 239). Appropriate combination of knowledge processes enables firms to find existing embedded organizational knowledge and create new knowledge, facilitate the transfer, share and transformation of this knowledge at all organizational levels as well as helping firms to develop competencies through various organizational outcomes [33], [34]. Several researchers [33], [11], [9], [23], [12], [7] state that creativity and innovation related performance outcomes are highly associated with effective knowledge management. In her study, Darroch [11] empirically supports that firms which can use knowledge management processes efficiently are more innovative and perform better. The study of Palacios et al. [12] that was carried out in 222 from the Spanish biotechnology and telecommunications industries showed that effective knowledge management had a positive impact on innovation and entrepreneurship performance of the firms. Mitchell [35] suggests that creating and applying new knowledge or revealing and reconfiguring already existing knowledge results in new products or services which in turn culminate in innovation success. Although the role of effective knowledge management on innovation performance is evident, it is important to know the relative importance of each process on the way of creating innovation performance especially to inform managers for their best practices. Therefore, this study explores the relative contribution of each knowledge management process on innovation performance.

III. METHODOLOGY

A. Sample and Data Collection

Data for this research were obtained through a survey. The sample was selected from the database of Istanbul Chamber of Industry (ISO) that announced the largest 1,000 firms of Turkey (ISO-1000) from different sectors annually. This sample which was designed for multiple research purposes was the best available and relevant sample that could be obtained in Turkey. Since the original items of questionnaire were designed in English, based on several previous studies on innovation, knowledge, and environmental dynamism, it was translated into Turkish by a bilingual associate. Besides, a back translation was completed to check any discrepancy in addition to potential translation errors [36]. Because the unit of analysis in this study is at the firm level, a single informant was used and the questionnaire was mailed to only one executive from each firm. After the pilot study that was conducted with 35 senior level managers who had sufficient knowledge about the objectives of the research, the questionnaires were sent to the e-mail addresses of the managers as a web-link with a covering letter that assures the privacy and confidentiality of respondents. A total of 244 useable questionnaires were obtained yielding a response rate of 24.4%.

B. Measurement Instrument

A self-administrated survey questionnaire that consists of six construct categories that are knowledge creation, transfer, integration and application processes, innovation performance and an additional control variables category was used as the measurement instrument. To account for the effects of extraneous variables, firm age, firm size, stage of industry life cycle and industry structure were controlled. The questionnaire was consisted of a total number of 25 questions: 12 questions to measure the performance effects of all knowledge management processes, 4 questions for innovation performance, 5 questions to control the effects of industry structure factors, 1 question for stage of industry life cycle and 2 questions for the demographics (age and size).And the last question aimed to categorize the primary business activity of the firms.The items of the questionnaire and their theoretical sources were mentioned in Table 1. Responses to the items were recorded on a 5-point

Likert-type scale and reliability and validity issues were assessed.The constructs that had alpha values equal to and above 0.70 were accepted as reliable constructs [40].The reliability analyses show that all constructs possess satisfactory Cronbach's alpha values:knowledge creation (α=0.872), knowledge transfer (α=0.886), knowledge integration (α=0.843), knowledge application (α=0.879), innovation performance (α=0.864), and industry structure (α=0.855).

Table 1. Items of the questionnaire, factor loadings and Cronbach alpha coefficients

Variables	Items	Loadings	Alpha
Knowledge Creation [10], [9] [14]	Our firm has capability to develop knowledge from internal and external knowledge sources (via IT systems, call centers, CRM, ERP, supply chain, and logistics systems etc.).	0.905	
	Our firm has capability to store acquired knowledge into organizational knowledge repository.	0.867	0.872
	Our firm has capability to codify acquired knowledge into accessible and applicable formats.	0.859	
Knowledge Transfer [10], [9], [14]	Our firm has capability to distribute relevant knowledge throughout the organization (via collaborative platforms, social software, blogs, and wikis etc.).	0.912	
	Our firm has capability to share relevant knowledge among business units.	0.862	0.886
	Our firm has capability to transfer relevant knowledge to employees.	0.843	
Knowledge Integration [10], [9], [14]	Our firm has capability to integrate different sources and types of knowledge.	0.883	
	Our firm has capability to organize and manage knowledge.	0.865	0.843
	Our firm has capability to interpret new knowledge on the basis of prior knowledge.	0.782	
Knowledge Application [10], [9], [14]	Our firm has capability to apply knowledge to solve new problems.	0.908	
	Our firm has capability to apply knowledge to change competitive conditions.	0.871	0.879
	Our firm has capability to apply knowledge to develop new products/services.	0.866	
Innovation Performance [37], [38]	In the last three years, compared to our major competitors, our firm is more successful in terms of:		
	Success of new products launched.	0.929	
	Accelerated speed to market.	0.902	0.864
	Number of new product configurations.	0.873	
	Improved work methods and processes.	0.838	
Industry Structure Factors [39]	The number of competitors vying for customers in our industry is (Very low – Very high)	0.916	
	How easy is it for new firms to enter and compete in your industry (Very easy – Very difficult)	0.897	
	What level of bargaining power (i.e., ability to negotiate lower prices) do you have over your suppliers (Very weak – Very strong)	0.863	0.855
	What level of bargaining power (i.e., ability to negotiate lower prices) do customers have over your firm (Very weak – Very strong)	0.859	
	To what degree is your industry threatened by substitute products/services (No threat – Extreme threat)	0.815	

Besides, an exploratory factor analysis with VARIMAX rotation was employed in order to assess construct validity of the scale. The analysis which yields six factors resulted to thetheoretically expected factor solutions. Additionally, Hair, Black, Babin and Anderson [41] suggest that each item of a scale should also be loaded on their predicted construct with a loading level of 0.50 or higher to confirm construct validity. No item that was dropped from the scale and all items were loaded into their stipulated constructs at the 0.50 level or higher which constitute three factors: knowledge management processes,innovation performance and industry structure factors. Hence, no anomalies were observed in terms of reliability and construct validity in the study.

C. Analyses

Multiple regression analyses were used to analyze the data. A five-step hierarchical analysis was conducted. In hierarchical regression method, each set of independent variables is entered into separate blocks for analysis and the incremental changes of the R^2 statistic and the β coefficients are calculated. The control variables were first entered and then knowledge creation process variable was entered in the second step. Knowledge transfer and knowledge integration processes were entered in the third and fourth steps. Finally, knowledge application process was entered in the fifth step to predict innovation performance (Table 2).

IV. DISCUSSION AND CONCLUSION

Our research findings which confirm significant relationships between different knowledge processes and innovation performance highlight the importance of effective knowledge management to enhance innovation ability of firms once more. Although the results showed positive relations between all knowledge processes and innovation performance, knowledge transfer and application were observed as the most important determinants of innovation based

on their contribution to explain variation in innovation performance.In fact, these findings are consistent with suggestions of several researchers [42], [43], [14] who emphasize the vital role of knowledge sharing and application not only to enhance innovation performance but also to incorporate other firm-level resources in organizations through flat organizational structures and IT-based tools such as collaborative platforms, social software, blogs, wikis etc.

Table 2. The results of regression analyses

Predictors	*Innovation performance*				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
1. Firm age	.048	.043	.038	.047	.042
2. Firm size	.063	.059	.062	.054	.049
3. Industry structure forces	-.021	-.031	-.011	.012	-.007
4. Stage of industry life cycle	-.106*	-.082	-.059	-.038	-.043
5. Knowledge creation		.225***	.202***	.205**	.207**
6. Knowledge transfer			.316**	.311**	.308**
7. Knowledge integration				.237*	.229*
8. Knowledge application					.253***
R^2	.086	.169	.278	.351	.466
ΔR^2	-	.083	.109	.073	.115
F -value	1.123	1.945***	2.368***	2.539**	2.985***

N= 244

**p<0.05; **p<0.01; *** p<0.001 (two tailed)*

Effective and efficient knowledge transfer and application promotes the sharing of new information throughout the organization and enables firms to assimilate and use new information better, create more new product configurations and move readily to new markets [44], [45]. In order firms to achieve a high level of knowledge sharing and application, hierarchical structures which imply less flexibility and more rigidity [46] should be replaced with flatter organizational structures which include business units with self-organizing teams [45]. Considering our findings, firms should be aware that innovation performance is a function of multitude of factors and cannot be achieved through a single transaction of a resource or a capability.

Therefore, lack of a complementary resource or a capability may prevent firms from having a satisfactory innovation performance. In this sense, firms should analyze the limitations of their existing capabilities in product innovation thoroughly and take necessary actions. With respect to Turkish business environment, given the divergent and fast-changing consumer attitudes, wide geographical area, and difficult and harsh business conditions in the country, managers of the firms should pay attention to form flat organizational structures and establish rapid information and market intelligence sharing mechanisms through strengthening their IT infrastructures.

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