Absorptive Capacity: Empirical Exploration on Trait of Organizational Structure and Absorptive Capacity Practices

Hyun-Joo Song

Technology Management Program

Graduate School of UNIST

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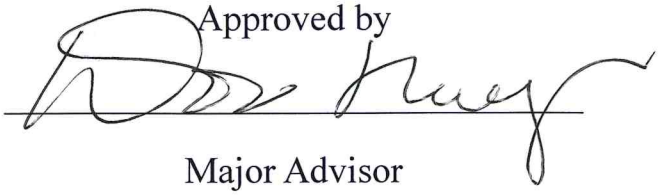

Major Advisor

Han-Gyun Woo

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Hyun-Joo Song

This certifies that the thesis of Hyun-Joo Song is approved

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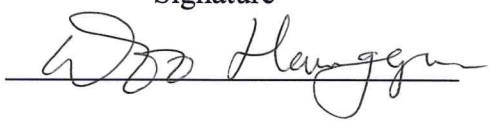

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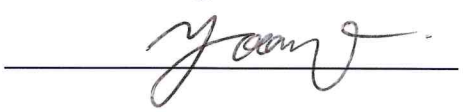

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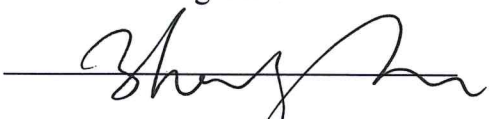


Thesis Supervisor: Lu Zhang

ABSTRACT

Open innovation literature argues that firms need to identify new knowledge and collaborate it through the innovation process. In line with the issue, absorptive capacity has been highlighted in the various fields such as technology management, strategic management, international business and organizational economics. But the component, outcomes, antecedents and definition of absorptive capacity is diverse and somewhat ambiguous. Relevant to this issue, many studies attempted to conceptualize absorptive capacity with different definitions and dimensions. However, few undertake dealing with other antecedents such as characteristics of organizational structure. In this paper, we aim to empirically explore the antecedents of absorptive capacity, namely formalization, decentralization, and coordination capability, those which possibly affect the potential absorptive capacity and realized absorptive capacity. Further, we try to find effect of absorptive capacity practices on absorptive capacity. By doing so, findings are expected to allow firms to better understand how absorptive capacities can be developed.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

In an increasingly competitive global market, many firms have decided to open their innovation process in order to survive. According to the open innovation literature, firms need to identify new knowledge and collaborate it through the innovation process (Lichtenthaler and Lichtenthaler, 2010). In line with the issue, absorptive capacity which is regarded as the important capability for effective knowledge management by affecting the creation, acquisition and transfer knowledge(Nonaka et al., 2000, Gupta and Govindarajan, 2000)has been highly highlighted in the various fields such as technology management, strategic management, international business and organizational economics (Jansen et al., 2005). But the component, outcomes, antecedents and definition of absorptive capacity is diverse and ambiguous, it poses a certain level of challenges in studying absorptive capacity (Zahra and George, 2002).

Various studies conceptualized absorptive capacity with different definitions and dimensions. In terms of dimensions, Van den Bosch et al. (1999) suggested that organizational forms and combinative capacities need to be considered as a determinant of absorptive capacity. And Zahra and George (2002) proposed that absorptive capacity contains two subsets of potential and realized absorptive capacity. They argued that realized capacity comprises knowledge transformation and exploitation and potential capacity centers on knowledge acquisition and assimilation capabilities. Despite the needs of potential absorptive capacity, it has received less attention than realized absorptive capacity.

Recent research conducts empirical studies that treat combinative capabilities as determinants of both potential and realized absorptive capacity (Jansen et al., 2005). However, few undertake dealing with other antecedents of potential and realized absorptive capacity, such as characteristics of organizational structure.

In this paper, we aim to empirically explore the antecedents of absorptive capacity, namely formalization, decentralization, and coordination capability, those which possibly affect the potential absorptive capacity and realized absorptive capacity.Further, we try to find effect of absorptive capacity practices on absorptive capacity. By doing so, findings are expected to allow firms to better understand how absorptive capacities can be developed.

2. THEORETICAL BACKGROUND

2.1 Absorptive Capacity in General

With the growth of technology, success of business is more likely up to knowledge(Drucker, 1993)and thus firms that wish to obtain competitive advantages need to manage their knowledge

properly.Recently, knowledge management has been emphasized in business field and became fundamental task.(Pertusa-Ortega et al., 2010)In the knowledge management context, absorptive capacity is regarded as the important capability for effective knowledge management by affecting the creation, acquisition and transfer knowledge. (Nonaka et al., 2000, Gupta and Govindarajan, 2000)(Von Krogh et al., 2000)The definition of knowledge management by Pertusa-Ortega(2010) is "the set of business actions undertaken to aid the creation and/or acquisition of knowledge, its transfer to all members of the company and its subsequent application with the aim of achieving distinctive competencies that provide the company with a long term competitive advantage."(Pertusa-Ortega et al., 2010) p.311

The definitions, dimensions and operationalizationsof absorptive capacity in prior works arerather diverse (Boynton et al., 1994, Cockburn and Henderson, 1998, Keller, 1996, Liu and White, 1997, Lane and Lubatkin, 1998, Mowery and Oxley, 1995, Veugelers, 1997).Among them, the definition by Cohen and Levinthal (1990) is most widely cited: "the firm's ability to value, assimilate and apply new knowledge." Other study extend the definition of absorptive capacity as a broad set of skills needed to deal with the tacit components of transferred knowledge and to modify this imported knowledge.(Mowery and Oxley, 1995)

More recently Zahra and George (2002) re-conceptualize the absorptive capacity as a dynamic capability embedded in a firm's routines and processes, making it possible to analyze the stocks and flows of a firm's knowledge. They highlight four distinct capabilities that compose absorptive capacity including acquisition, assimilation, transformation and exploitation. Further, those capabilities are categorized into potential absorptive capacity with acquisition, assimilation and realized absorptive capacity containing transformation and exploitation.Those two potential and realized capacity simultaneously or sequentially carry tasks necessary but insufficient for better, improved organizational performance.

The distinction of the two dimensions is important to evaluate each of the capabilities impact to competitive advantage. Absorptive capacity is not naturally given but likely to be developed and maintained as a result of firms' activities (Jansen et al., 2005). It is regarded as byproduct that is closely related to current knowledge base and routine activities. Therefore, if a firm wishes to obtain new knowledge that are unrelated to their existing knowledge base, the firm needs to make a greater effort to build absorptive capacity. (Liao et al., 2007)

2.2Organizational antecedents

Prior research has emphasized the importance of organizational antecedents and investigated.(Volberda, 1999)(Jansen et al., 2005)(Van Den Bosch et al., 1999)For example, Van den Bosch et al. (1999) argue that not only the prior knowledge but also organizations forms and combinative capabilities need to be considered as organizational determinants of absorptive capacity.They offered framework that explain how knowledge environments coevolve with the emergence of organization forms and combinative capabilities

Another research stream on organizational antecedents of absorptive capacity can be found in Jasen and Van den Bosch's work (2005) that investigated the effects of combinative capabilities on absorptive capacity. They cite the research of Verona(1999) that suggest managerial structure, system and social relations as capabilities for absorbing new knowledge and follow the three types of combinative capabilities distinguished by Van den Bosch(1999):systems capabilities, coordination capabilities and socialization capabilities (Volberda, 1999).This study reveals coordination capabilities enhance potential absorptive capacity while socialization capabilities enhance realized absorptive capacity. It provides evidence that different absorptive capacities are created from different organizational antecedents. Similarly, they conduct other research that examines the impact of organizational and environmental antecedents on organizational ambidexterity. This study distinguishes the three types of coordination mechanisms including decentralization, formalization and connectedness as the organizational antecedents.(Jansen et al., 2005).The results indicate that decentralized and densely connected relations build more ambidextrous organization.

Among antecedents of organization, organizational structure is regarded as key issue in management field, because it facilitates the coordination of elements in the organization by developing, transferring and using knowledge.(Lam, 2000)(Nonaka and Takeuchi, 1995)(Mintzberg, 1979)Mintzburg(1979:2) defined organizational structure as: “the structure of an organization structure can be defined simply as the sum total of the ways in which it divides its labour into distinct tasks and then achieves coordination among them.”. Thus, firms need to design proper structure that enables better flow of knowledge.(Nonaka and Takeuchi, 1995)(Nonaka, 1988) In this study, we conceptualize three dimensions for explaining the organizational structure from existing literature: formalization, decentralization, coordination. Those three are regarded as key dimensions for organization structure in knowledge management fields, but they have not empirically tested as determinants of potential and realized absorptive capacity.

Table 1 Prior research of organizational antecedents

Study	Dependent variable	Independent variable
Van den Bosch &Volberda (1999)	Knowledge absorption - Efficiency - Scope - Flexibility Knowledge environment - Stable - Turbulent Organization Form - functional - division - matrix Combinative Capabilities - Systems - Coordination - Socialization	Absorptive capacity
Jansen & Van den Bosch (2005)	Formalization Decentralization Connectedness	Ambidexterity
Jansen & Van den Bosch(2005)	Coordination Capabilities - Cross functional interfaces - Participation - Job rotation System Capabilities - Formalization - Routinization Socialization Capabilities - Connectedness - Socialization tactics	Potential and Realized absorptive capacity
Annick Willem & Marc Buelens(2009)	Coordination Centralization Formalization Specialization	Knowledge sharing
Pertusa-Ortega (2010)	Formalization Complexity Centralization	Knowledge performance

Formalization

Formalization is the degree to which rules, procedures, instructions, and communications are formalized or written down (Feldman and Pentland, 2003).In the studies related to formalization, some researchers argue that formalization is a main mechanism of knowledge transformation and exploitation(Realized absorptive capacity).They suggest that formalization routines provide the patterns and procedures of behavior,action and interaction that consequently foster knowledge creation based on the dynamic systems rather than static. The formalized way supports exploitation of internalized knowledge and helps the members to understanding of sets of tasks in organization (Becker et al., 2005).

However, others said that routines in an organization are a form of tacit knowledgewhile formalization is codified and it can be the obstacle of organizational flexibility (Reynaud, 2005) because routines make the organization to keep their patterns of action unchangeably. Likewise, other studies consider that rules in organization restrict knowledge creation because it limits the chances of interaction and communication between the organization members(Daft and Macintosh, 1981). Furthermore, the strict formal rules in an organization seem to restrict the range of new ideas (Von Krogh, 1998)(Lopez et al., 2006).

Decentralization

A high level of decentralization in decision-making process is expected to enhance the knowledge flow in an organization. Decentralization is refers to as the delegate of political-administrative power to lower levels of an organizational hierarchy in organizational decision-making process (Robbins, 1990). Decentralization makes individuals to involve in the organizational levels and fosters them into the process of strategic reflection In this way, individuals can get more chances to involve in decision-making processesand be exposed to a variety of opinions and information (Ouchi, 2006). Moreover, freedom of action encourages employees' creativity that creates and applies new knowledge in a more flexible way (Nonaka et al., 2000). However, it arises difficulty of gaining consensus and negative effects on the speed of decision-making process (Jansen et al., 2005). As a result, decentralization may decrease efficiency and slow down transformation and exploitation of new external knowledge(Atuahene-Gima, 2003).

Coordination

Coordination is defined as the process of informing the individual planned behaviors to the others. (Simon and Barnard, 1976)And other defines it as "integrating or linking together different parts of an organization".(Van den Bosch et al,1976) The impact of coordination of knowledge inside and outside

organization is likely to affected by other structural dimensions.(Willem and Buelens, 2009)Enhanced interactions by coordinating different units are expected to increase knowledge exchange across boundaries (Tsai, 2002). And it can also facilitate the formation of common interests, gain more chances to share ideas which increase knowledge flows within the organization (Coleman, 1994)

2.3 Absorptive capacity practices

The interrelationship between potential and realized absorptive capacity can be hinted from ambidexterity literature. Ambidexterity provides an analysis framework that can take into account the dual structure of innovation: knowledge exploration and knowledge exploitation (Duncan, 1971). In a number of research in knowledge management field, they have investigated exploration and exploitation issues with distinct stages that are similar to absorptive capacity - such as searching for acquiring new knowledge, transfer it's knowledge to the firm and combination of new knowledge with existing knowledge.(Almeida et al., 2003)

Related to the exploitation and exploration, tension between the two has been highlighted in diverse management literatures. Some researchers argue that firms need to simultaneously act both exploitation and explorationto achieve superior performance than firms emphasizing one of them (March, 1991, Gibson and Birkinshaw, 2004, He and Wong, 2004). On the other hand, others suggest that the exploration and exploitation have fundamentally different logics that require different structure and strategies(Tushman and O'Reilly III, 1996). Moshe Farjoun(2010) point out the issue by explaining it with duality mechanism that apparent stability and change. (Farjoun, 2010)They are largely seen as incompatible and mutually exclusive. Related to the stability, exploitation is seen as the notion of static efficiency and stability (Schumpeter, 1942), low variance(March, 1994), repetition and consistency.(March, 1994)(Levinthal and March, 1993) Exploration is seen as related to change(March, 1995), variability, long-term efficiency(Schumpeter, 1942) and ambiguous settings. In the dualistic view, the two must be balanced in order to secure its future through exploration and current viability through the exploitation.

In this view, the tradeoffs between the two are seen as unavoidable, so management needs to emphasize between the two by pursuing it sequentially(Lavie and Rosenkopf, 2006, Ghemawat and Ricart Costa, 1993). Simsek (2009) refers it as temporal dimension that captures the extent to which exploitation and exploration pursued sequentially or simultaneously. Additionally, they posit structural dimension following the Thompson's(1967) distinction. It is about whether or not exploitation and exploration are undertaken within one unit (independent) or across two or more units(interdependent).(Simsek et al., 2009) The intensity of tradeoffs between the exploration and exploitation for independent units are seen as more severe and restrictive than that for interdependent

units. So, independent units more tend to pursuit the notion of bi-polarity. On the other hand, when it occurs interdependently, pursuing and attaining are regarded as different issues and required to proper coordination of resource or efforts.(Simsek et al., 2009)

Similar to this issue, the tension between potential absorptive capacity and realized absorptive capacity can arise. Two absorptive capacities are separated but play complementary role. Both subsets are necessary and facilitate to get better performance. Prior research reveals that these two absorptive capacities affects differently on building competitive advantage and insist the needs of leveraging organizations' potential and realized absorptive capacity for the efficiency.(Zahra and George, 2002)This paper regards the tension between two as the source of enhancing organizations' efficiency and adopts the concept of structural and temporal dimensions, which had been suggested in ambidexterity research. Prior research suggests that the exploration and exploitation may yields different payoffs depending on the stage of technology life cycle (TLC). They indicate that in the early stage of TLC, exploration may be an effective way to make better payoff and that exploitation may yield greater payoff in the later stage of TLC (He and Wong, 2004). This study captured the concept of TLC for stage focused absorptive capacity practice that is same context of temporal dimension of ambidexteritywith assumption that potential absorptive capacity may have benefit in early stage of TLC and realized absorptive capacity may be more vitalized in later stage of TLC. Structural focused practice in this paper followed the study by Simsek et al.,(2009). It is about whether or not exploration for new knowledgeis undertaken within one unit (independent) or across two or more units(interdependent).(Simsek et al., 2009) This paper assumes that organization which has sub-unit for new knowledge may pay more attention to acquire and assimilate new knowledge.And they may more open to adapt new knowledge. However, theefforts and resources spending for managing subgroups may decrease organizational efficiency and complex system due to the subgroup likely to hinder the knowledge exchange.

3. HYPOTHESES

Many previous studies on formalization of organizational form viewed a firm as being highly formalized with characteristics of rules, procedures, instructions, and written-down communications. The routines generated by formalization enable employees to understand tasks that has patterns and the identified patterns of behavior help better understanding of task relations, so the time and efforts spent on implementation can be reduced (Cohen and Bacdayan, 1994). And further, formalization makes an organization to be more efficient when they transform or share new knowledge with sets of tasks. However in the communication aspect, this routine process is an obstacle to organizational

flexibility and limits chances to communicate with other units that hold different knowledge background. Accordingly, two following hypotheses are proposed:

H1. Formalized organizational structure gives more positive effect on building realized absorptive capacity than potential absorptive capacity.

Decentralization gives employee more chances to participate in decision-making process, and this experience are expected to increase their creativity with freedom (Leenders et al., 2003, Lee and Choi, 2003, Bucic and Gudergan, 2004). It allows constant knowledge flow by generating and changing knowledge from rapid decision-making (Drucker, 1992). However, decentralization increases the initiatives which are needed to be taken between units for knowledge exchange (Tsai, 2002). Thus it may be an obstacle to create realized absorptive capacity by decreasing efficiency of implementation.

H2. Decentralized organizational structure gives more positive effect on building potential absorptive capacity than realized absorptive capacity.

Enhanced interactions by coordinating different units are expected to increase knowledge exchange across boundaries (Tsai, 2002). And it can also facilitate the formation of common interests, gain more chances to share ideas which increase knowledge flows within the organization (Coleman, 1994). However, this coordinating process may hinder implementation because the coordinating process is complex andneeds times and efforts to meet consensus.

H3. Coordinated organizational structure gives more positive effect on building potential absorptive capacity than realized absorptive capacity.

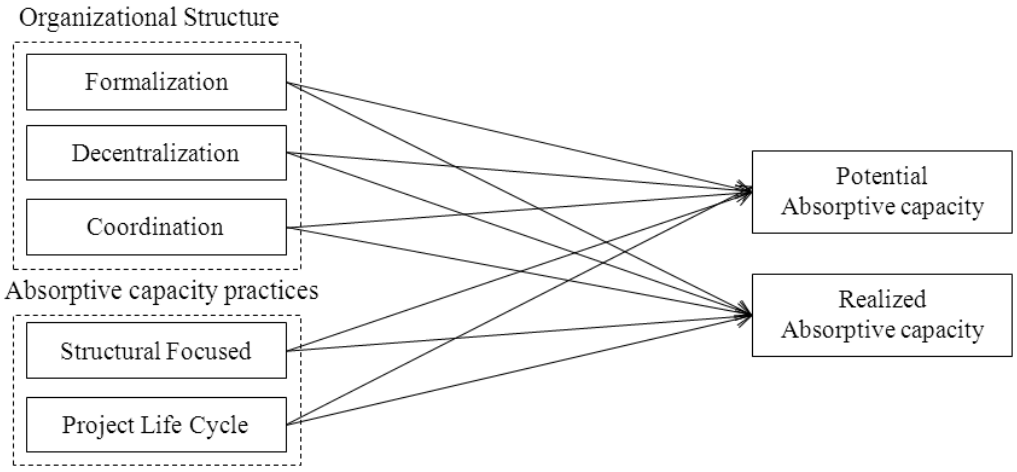
The organizations that have independent sub-unit for exploring new knowledge are expected to less restrictive to adopt new knowledge with great support.However, those may perform less efficiency due to the time, resource and effort for implementing sub-unit. In the meantime, the organizations that have inter-dependent subunit regarding exploring new knowledge may have difficulties to approach new knowledge from outside with limited resources. But those have benefit of implementation because of united team system with high efficiency.

H4. Independent-knowledge exploitation unit in organization gives more positive effect on building potential absorptive capacity than realized absorptive capacity.

Regarding the nature of technology life cycle, this paper expects that different absorptive capacity will be needed depending on the stage of technology life cycle. As He and Wong(2004) mentioned, potential absorptive capacity which is related to acquisition and assimilation would be needed in the early stage of TLC. On the other hand, realized absorptive capacity which reflects transformation and exploitation would be more vitalized in later stage of TLC. Thus, we proposed hypothesis5. .

H5. The higher stage of technology life cycle gives more positive effect on realized absorptive capacity than potential absorptive capacity.

Figure 1. Research model of hypothese



4. DATA AND METHODS

4.1 Study design and Data collection

The data for this study was gathered with survey list from a research company in August 2012. This survey was designed to target sample organizations that have research and development department located in Korea. To conduct team level analysis, we grouped employees and managers who work in same department with constraint that the group must have more than two members and contain different level. We received a total of 248 survey responses that include 57 teams within 21 organizations. Responses with doubtful as well as only numbers or missing data were eliminated from sample. In order to confirm agreement among team members who work in the same team, we

checked intra-class correlation coefficientsusing SPSS and removed teams that have intra-class correlation coefficient below 0.7. Finally, we get 197 response includes 42teams within 20organizations. 82.7% were male and 17.3% were female. Among them 41.6% were working in the large company, 25.4% were in middle and small company, 19.3% were belonged to public institution and rest of 13.7% were in research laboratory. Detailed information of demographic profile is listed in table2.

4.2 Measures

Potential and Realized Absorptive Capacity

To measure the two types of absorptive capacity, we adopted 16 items which specifically indicate detailed activities including acquisition, assimilation, transformation and exploitation features byJaworski&Kohli, (1993) and Szulanski (1996).Those items were translated into Korean for survey and re-translated into English to recheck the translations. All questionnaires used a 7-point Likert scale where 1= completely disagree to 7=completely agree. We performed exploratory factor analysis through SPSS. Total 12 items are adopted among 16 items from Jaworski&Kohli, (1993) and Szulanski (1996) after delete items with low loading.The results yield two factors which reflect as potential and realized absorptive capacity. All factors have eigenvalues greater than one and reliability of those items were checked by Cronbach's alpha.(0.879, 0.886)

Organization Structures

The items of organization structure in this study consist of formalization, decentralization and coordination. The instruments for measuring organization structure adopted from various studies and each instrument has different number of items. Formalization contains 5 items including "Formal procedures determine how we work together with the other unit" and "Information is mainly held in and exchanged through a large number of reports and formal documents" adopted from Willem and Buelens(2009). 7-items for decentralization are adopted from study by Dewar, Whetten and Boje(1980) including 'If I wished to make my own decisions, I would be quickly discouraged' and 'I had to ask my boss before I did almost anything'.We performed exploratory factor analysis through SPSS. Total 13 items are adopted after delete items with low loading.The results yield three factors which reflect formalization, decentralization and coordination well. Further, Cronbach's alpha coefficient was calculated to examine the reliability of adjusted instruments. All of the measured coefficients show reliable values and all factors have eigenvalues greater than one. (Table5)

Table 2. Demographic profile and descriptive statistics of surveyed people

Measures	Items	Frequency	Percentage
gender	Male	163	82.7
	Female	34	17.3
Business Type	large company	82	41.6
	middle company	16	8.1
	small company	34	17.3
	Public institution	38	19.3
	Research laboratory	27	13.7
Job position	Executive	3	1.5
	General manager/Principal research engineer	19	9.6
	Deputy general manager/ Senior research engineer	16	8.1
	Manager/Research engineer	48	24.4
	Assistant manager/ Associate research engineer	72	36.5
	Staff/ Staff research engineer	39	19.8
	Nonresponse	0	0.0
Age	20-29years	54	27.4
	30-39years	81	41.1
	40-49years	48	24.4
	over 50years	11	5.6
	Nonresponse	3	1.5
Job tenure	under 5 year	78	39.6
	5-10year	52	26.4
	10-15year	25	12.7
	15-20year	20	10.2
	over 20year	19	9.6
	Nonresponse	3	1.5
Highest degree	Bachelor's degree	122	61.9
	Master's degree	52	26.4
	Doctor's degree	16	8.1
	Nonresponse	7	3.6

Table3. The result of factor analysis for absorptive capacity

	Factor1	Factor2	Factor3	Factor4	Factor5
A5	.665				
A6	.605				
A8	.754				
A9	.856				
A10	.827				
A11	.613				
A12		.610			
A14		.612			
A17		.610			
A18		.810			
A19		.767			
A20		.840			
A21				.812	
A22				.679	
A23				.842	
A24				.835	
A28					.770
A29					.836
A30					.789
A32			.845		
A33			.863		
A35			.784		
A36			.787		
A37			.640		
A38			.711		

Factor1:Potential absorptive capacity, Factor2:Realized absorptive capacity, Factor3:Coordination, Factor4: Formalization, Factor5: Decentralization

Confirmatory factor analysis (CFA) was carried out to check the validity of proposed factor model compared to plausible model through several fit indices using LISREL. Several indices should be checked to assess the adequacy of model. Firstly, the ratio of χ^2 over the degree of freedom needs to be smaller than3(Medsker et al., 1994). Acceptable model fit for Comparative Fit Index(CFI), Goodness-of-Fit Index(GFI), Adjusted Goodness-of-Fit Index(AGFI)is greater than 0.9(Bagozzi and Yi, 1988). And the value up to 0.08 of Root-Mean Square error of Approximation index (RMSEA) is regarded as acceptable(Browne et al., 1993).The results show that those items yield appropriate model fit.(χ^2/df=2.4 Comparative Fit Index (CFI)=0.97, Goodness-of-Fit Index(GFI)=0.8, Adjusted Goodness-of-Fit Index(AGFI)=0.78, Root-Mean-Square Effort of Approximation[RMSEA]=0.084) Several measures fall short of the required thresholds, but those results can be acceptable considering small number of sample.

We used Haman's single-factor test and Modern MTMM technique to test possible common method variance(Podsakoff and Organ, 1986)(Podsakoff et al., 2003). Common method variance can be problem when a single factor accounts for the majority of the covariance among variables according to Harman's test. The results of our exploratory factor analysis indicate 5 factors explaining 78.11 % of the variance. This result verifies that common method variance was not occurred in this study since one factor did not explain a majority of the variance. The other method to check common method variance by Mordern MTMM technique uses correlation coefficient of latent variables. We calculated the correlation and all correlation coefficient value reconfirmed that there was no common method bias.

Table4. Extraction Method: Principal Component Analysis

Component	Initial Eigen-values			Extraction Sums of Squared Loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	11.320	45.281	45.281	11.320	45.281	45.281
2	2.911	11.645	56.926	2.911	11.645	56.926
3	2.798	11.190	68.116	2.798	11.190	68.116
4	1.387	5.548	73.664	1.387	5.548	73.664
5	1.113	4.452	78.117	1.113	4.452	78.117

Structural focused and Stage focused practices

To measure the absorptive capacity practices, we made two questionnaries. First one for structural focused practices was measured using the item 'Our team/department have a dedicated

sub-team or team member to explore the new knowledge or market information with 7-scale Likert. And data for stage focused practices was asked through the concept of project life cycle which can divide into conceptualization, planning, execution and termination stage. The item was measured with question ‘At which one of the following stages would you place the current phase of the project that is performed? (1= Conceptualization, 2= Planning, 3=Execution, 4= Termination)’.

Control variables

To examine potential affects over the independent variables, we included a number of control variables. Control variable contains questions for personal information such as gender, job tenure, age, job position, education level so on.A dummy variable was used for measuring gender(0=male, 1=female), and five business types were included, namely large company, middle company, small company, public institution and research laboratory. Job positions also were asked to examine team and individual level analysis. Job positions were categorized as executive, and three different manager level, assistant and staff. The education item was measured as three, which are bachelor’s degree, master’s degree and doctoral degree group. Control variables are analyzed relationship between the organizational structure and potential and realized absorptive capacitythroughmultiple regression analysis.

Table 5.Cronbach's alpha values

Potential	Realized	FORM	DECEN	COOR
0.879	0.886	0.864	0.729	0.899

5. RESULTS

The hypotheses were targeted at the team level because the unit of analysis of this study was team level. Measures were collected at the individual level and it aggregated to team level. Individual responses from same team were averaged for creating team level variables. TABLE6 presents the means, standard deviations and correlations among adopted variables. We used the natural logarithm of the number of employees in whole organization and number of members within teams to contain the organization size and team size. The result shows that potential and realized absorptive capacity correlated with other variables except decentralization and tenure. Formalization variable has significant correlations with other variables except decentralization and tenure variable. And

ln_sizeand ln_teamsize also have significant correlations with other variables.

In this paper, we analyzed proposed hypotheses through multiple regression analysis using SPSS. Table7 shows the results of regression analysis forpotential and realized absorptive capacity. The model 1 contains control variable including Tenure, ln_size, and ln_teamsize. In addition to this, variables for organizational structure were added in model 2 with formalization, decentralization, coordination, structural focused practices and stage focused practices.

The $R^2$of the regression models increases when introduces variables for organizational structure compared to model 1. Table7 shows the organizational structure and structural focused absorptive capacity practices have positive and significant effect on potential and realized absorptive capacity. We found evidence for the hypotheses from this table. Formalization has positive but insignificant coefficient for potential absorptive capacity. (β=.137) Despite to this, parameter for realized absorptive capacity shows positive and significant results. (β=.309, p<0.05) It supports hypotheses 1. Decentralization parameter for potential absorptive capacity and realized absorptive capacity shows positive but insignificant value. Coordination parameter for potential absorptive capacity(β=.931, p<0.001) has higher value than parameter for realize absorptive capacity(β=.791, p<0.001). This evidence supports hypotheses 3. For the structural focused practices, we checked structural focused parameter in the table. In the both models, structuralfocused parameter shows positive and significant values. But the potential model (β=.429, p<0.01) has higher value than realized model (β=.133, p<0.05). This result supports hypothesis 4. However, we cannot find any evidence for supporting hypothesis 5. After analyzing proposed hypotheses, we additionally add interaction effect in the model. The result of interaction effects are listed in table 8. This table shows somewhat different result. The decentralization parameter change that originally insignificant in main regression analysis, shows significant output with interpretation that decentralization gives greater effect on building potential absorptive capacity than realized absorptive capacity. It supports hypothesis 2. In addition to this, we found interaction effect of decentralization and structural focused absorptive capacity practices.

Further analysis was needed to conduct for utilizing the variance, covariance of estimates and coefficient from different model. We checked the whether observed differences in parameter size are significantly different or not (Laursen and Salter, 2005). The results of this analysis also indicates variables for that team size and interaction effect of decentralization and structural focused give negative and significant effect on dependent variable, and variables for decentralization, coordination and structural focused practices have positive and significant effect on dependent variable.(See table9) Those results can be interpreted that outcomes are largely consistent with other two models (Models for potential absorptive capacity and realized absorptive capacity).

Table6. Result of means standard deviation and correlation of variables

Variable	Mean	S.D	1	2	3	4	5	6	7	8	9	10
1.POTEN	-.0339	.986	1.0									
2.REALI	-.0175	1.00	.731**	1.0								
3.FORM	.0156	1.02	.705**	.848**	1.0							
4.DECEN	-.0725	.941	-.012	-.046	.062	1.0						
5.COOR	-.0009	1.01	.803**	.932**	.711**	-.211	1.0					
6.STRUC	3.536	1.30	-.423**	-.623**	-.698**	-.248	-.583**	1.0				
7.TEMPO	2.666	.721	.149	.267	.353*	-.068	.243	-.243	1.0			
8.ln_size	5.989	2.42	-.387*	-.400**	-.609**	-.471**	-.198	.542**	.014	1.0		
9.ln_teamsize	2.824	1.50	-.401**	-.369*.	-.534**	-.470**	-.153	.504**	.039	.760**	1.0	
10.tenure	2.145	.786	-.015	-.038	-.193	.023	.038	.142	.235	.154	.156	1.0

T-value: **p<0.01; *p<0.05 (two-tailed test)

Table7.Multiple Regression Results of Absorptive Capacity

Variable	Model1	Mode2
Potential Absorptive Capacity		
Tenure	.025	-.025
Ln_size	-.244	-.087
Ln_teamsize	-.220	-.287*
FORM		.137
DECEN		.096
COOR		.931***
STRUC		.429**
TLC		.016
Adjusted R^2	.187	.794
F	2.831	15.438**
Change R^2	.121	.743
Reazied Absorptive Capacity		
Tenure	.004	-.013
Ln_size	-.319	-.007
Ln_teamzie	-.128	-.108
FORM		.309*
DECEN		.076
COOR		.791***
STRUC		.133*
TLC		.014
Adjusted R^2	.179	.954
F	2.695	82.741**
Change R^2	.113	.942

T-value: ***p<0.001; ** p<0.01;* p<0.05 (two-tailed test)

Table8. The result of multiple regression for interaction effect

Variable	Potential	Realized
Tenure	.133	.061
Ln_size	.039	.043
Ln_teamsize	-.352*	-.157*
FORM	.386	.398***
DECEN	.282*	.161**
COOR	.818***	.764***
STRUC	.464**	.165*
TLC	-.168	-.071
FORM*STRUC	-.007	-.067
DECEN*STRUC	-.301*	-.137*
COOR*STRUC	.029	.101
FORM*TLC	-.256	-.119
DECEN*TLC	-.007	-.014
COOR*TLC	.127	.080
Adjusted R^2	.858	.968
F	11.258**	55.927**
Change R^2	.782	.951

T-value: ***p<0.001; ** p<0.01;* p<0.05 (two-tailed test)

Table9. Multiple Regression Results of Absorptive Capacity Differences

Variable	Model1	Mode2	Model3
Realized- Potential Absorptive Capacity			
Tenure	.237	-.023	.110
Ln_size	.356	-.013	.077
Ln_teamsize	-.004	-.194	-.283*
FORM		-1.259***	-1.097***
DECEN		.136	.290**
COOR		1.425***	1.377***
STRUC		.240*	.298*
TLC		.025	-.129
FORM*STRUC			-.120
DECEN*STRUC			-.246
COOR*STRUC			.182
FORM*TLC			-.214
DECEN*TLC			-.026
COOR*TLC			.144
Adjusted R^2	.202	.850	.869
F	3.122	22.714	17.939
Change R^2	.137	.813	.839

T-value: ***p<0.001; ** p<0.01;* p<0.05 (two-tailed test)

Table10. Results of hypotheses test

	Hypothese	Supported?
H1	Formalized organizational structure gives more positive effect on building realized absorptive capacity than potential absorptive capacity	YES
H2	Decentralized organizational structure gives more positive effect on building potential absorptive capacity than realized absorptive capacity.	YES
H3	Coordinated organizational structure gives more positive effect on building potential absorptive capacity than realized absorptive capacity..	YES
H4	Independent-knowledge exploitation unit in organization gives more positive effect on building potential absorptive capacity than realized absorptive capacity.	YES
H5	The higher stage of technology life cycle gives more positive effect on realized absorptive capacity than potential absorptive capacity.	NO

6. DISCUSSION

Recently, open innovation as a business strategy has gained attention as the market changes such as rapid technological development and globalization become more intense. R&D activities which were often confined only to large corporations have been extended to small and medium enterprises. Also many companies have been adopting new channels which share and gather knowledge from outside of companies. Absorptive capacity which regarded as the important capability for effective knowledge management by affecting the creation, acquisition and transfer knowledge has been highlighted.

The objective of this study has been to explore the antecedents of absorptive capacity, namely formalization, decentralization, and coordination capability, those which possibly affect the potential absorptive capacity and realized absorptive capacity.Also it examined the effect of structural focused absorptive capacitypractices on absorptive capacity as well as that of stage focused absorptive capacity practices. The important insight from this study can help the understanding of the antecedents of two different absorptive capacities and the effect of absorptive capacity practices. We found that coordination gives the highest effect on potential absorptive capacity and decentralization has the lowest effect. The realized absorptive shows same results with the potential absorptive capacity. This result implies that organizations should treat coordination mechanism as the most important factor when they design organizational structural. In addition to this, by comparing the

parameter of two absorptive capacities, we found the competitive advantage of organizational structural strategy for two different absorptive capacities that should keep in mind when organizations build structure. Also we found negative and significant interaction effect from the results. Despite the results that decentralization factor have positive and significant effect on two absorptive capacities, the interaction with structural focused absorptive capacity practices appears negative and significant result. We can interpret it as to achieve successful implementing knowledge acquisition, assimilation, transformation and exploitation, decentralized structure can be an accelerator, and so does structural focused practice (running sub-units for new knowledge). However, adopting both of decentralized structure and structural focused practice may yield side effect by decreasing efficiency in implementation or complex communication systems.

Our contribution with this paper is that we empirically explored and show how the organizational structure influences on the potential and realized absorptive capacity which could have sequential relations. In this paper we investigated the effects of organization structure as antecedents on developing two kinds of absorptive capacities.We find that formalized organizational structure is more effective way to design organization when it needs to foster realized absorptive capacity. Further we found that decentralization and coordination gives more effect on building potential absorptive capacity than realized absorptive capacity. From a strategic management perspective, the results provide evidence that building different organization structure and development path yields competitive capacities in terms of knowledge management. Further, from strategy process aspects, it also deliver a contribution since exchanging of knowledge between units plays an important role in developing competitive capabilities, the communication process through building appropriate structure would be of particular value for manager.

Several limitationsof this study need to be considered. First limitation of this study is the nature of the sample. Samples were taken only in South-Korea, thus it can be an obstacle to generalize the result to other countries. Secondly, this study is cross-sectional rather than longitudinal. The results of this study can not cover the causality relations. In particular, two different absorptive capacity practices are expected to yield meaningful contribution through the longitudinal research.Future research should be designed with considering those limitations. Future research may incorporate other antecedents of absorptive capacity. Investigating the interplay between the potential and realized absorptive capacity over time also can be one of the issues for future research.

APPENDIX: INSTRUMENT

	Questionnaire items	Sources
Acquisition	Our unit has frequent interactions with corporate headquarters to acquire new knowledge Employees of our unit regularly visit other branches We collect industry information through informal means(e.g. lunch with industry friends, talks with trade partners) Our unit periodically organizes special meetings with customers or third parties to acquire new knowledge	(Jaworski and Kohli, 1993)(Szulanski, 1996)
Assimilation	We are fast to recognize shifts in our market(e.g. competition, regulation, demography) New opportunities to serve our clients are quickly understood We quickly analyze and interpret changing market demands	
Transformation	Employees record and store newly acquired knowledge for future reference Our unit quickly recognizes the usefulness of new external knowledge to existing knowledge Employees usually share practical experiences We laboriously grasp the opportunities for our unit for new external knowledge Our unit periodically meets to discuss consequences of market trends and new product development	(Jaworski and Kohli, 1993)(Szulanski, 1996)
Exploitation	Client complaints fall on deaf ears in our unit Our unit has a clear division of roles and responsibilities We constantly consider how to better exploit knowledge Employees have a common language regarding our products and services.	
Formalization	Formal procedures determine how we work together with the other unit. Information is mainly held in and exchanged through a large number of reports and formal documents. We have clear goals for our daily work performance. In general, our work is subject to a large number of rules.	(Willem and Buelens, 2009)

	The information that is required to do my job is laid down in procedures, goals and rules.	
Decentralization	How frequently did you usually participate in decisions on the adoption of new products? How frequently did you usually participate in decisions on the modification of existent products? How frequently did you usually participate in decisions to delete existent products? There could be little action taken on this project until a superior approved a decision. If I wished to make my own decisions, I would be quickly discouraged. I had to ask my boss before I did almost anything. Any decision I made had to have my boss' approval.	(Dewar et al., 1980)
Coordination	How often do you communicate with people in groups? Do the people in groups communicate with you in a timely way? If there's a problem with a flight, do people in groups work with you to solve the problem or do they try to avoid getting blamed? How much respect do you get from people in groups? How much help do you get from people in groups? How much do people in groups know about your job? Do the people in groups have the same work goals as you?	(Gittell, 2001)

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