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The Effectiveness of Absorptive Capacity Formation Mechanism on Innovation Performance by Industry

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Abstract

Technical innovation is becoming more and more important in order to create competitive advantage in this management environment that the speed of technical changes is getting faster and the lifecycle of product is being reduced. To improve the performance of technical innovation, companies need to have absorption ability to utilize external knowledge and skills effectively. Such absorption ability is formed through interaction with internal and external resources of an organization and the characteristics of environment and so has important association with the results of corporate technical innovation. Accordingly, this study divides the factors of absorption ability into exploratory learning, transformative learning, and exploitative learning and made an empirical analysis of the impact of these three factors on organizational commitment and organizational innovation outcome. According to the 2-step approach of higher-order latent variable, path analysis and total effectiveness analysis were conducted directly. As a result of analysis, exploratory learning had a significant impact on organizational commitment and organizational performance and organizational commitment had a significant impact on performance. Transformative learning and exploitative learning had a significant impact on organizational commitment, but did not have an impact on performance.

Keywords: Absorptive Capacity, Exploitative Learning, Exploratory Learning, Organization Flow, Performance, Transformative Learning

1. Introduction

With uncertainty of the corporate management environment and acceleration of knowledge-based economy, companies heavily depend on securing and utilizing knowledge, and as the uncertainty of the environment increases, the importance of technological innovation is emphasized as a new growth engine to improve competitiveness. In the management environment in which the speed of technological change accelerates and product life span decreases, technological innovation becomes increasingly more important to create competitive advantage. Accordingly, companies need the absorptive capacity to use external knowledge and technology effectively as well as R&D efforts by themselves to improve their performance of technological innovation, and this absorptive capacity is formed through companies' interactions with internal and external resources or environmental characteristics and has an important relationship with the results of their technological innovation. To respond to environmental changes flexibly by constantly evolving this existing capacity, companies need the absorptive capacity to perceive, digest and apply new external knowledge and develop new knowledge, and when a high level of absorptive capacity has been accumulated, organizations can strengthen their dynamics by changing and recreating their existing capacity properly for environmental changes[1]. Absorptive capacity allows a certain knowledge sector to understand and utilize new development. It allows more accurate forecast of technological advancement and commercial potential in the future and evaluation of how important the current technology is important regarding that[2]. Thus, an organization with a high absorptive capacity predicts the urgency of a valuable

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opportunity well and actively pursues the opportunity while one with a low absorptive capacity acts passively in exploring the opportunity[3].

As the world economy becomes globalized and the competitions among companies get fierce, management resources essential for securing and maintaining competitive advantage of companies, the entities are achieved by their continuous efforts and investments, rather than things that are easily purchased in the market. Moreover, as compared to tangible resources, intangible resources are difficult to be replicated and imitated, so they can be a valid solution for the creation of companies' competitive advantage, and of the intangible resources, it is much more difficult to imitate and replicate as compared to other intangible assets, so it plays a key role in creating their growth and profit[4]. However, in a rapidly changing technological environment, the development of technologies and new products cannot be covered only by in-company ideas and knowledge. It depends on the extent, but companies sometimes depend on external technologies or supports for the investments of innovation processes[2]. And yet, external knowledge does not naturally flow into companies and becomes internal knowledge. For ripple effects of knowledge to be made effectively, adopters' absorptive capacity is crucial. Absorptive capacity can be defined as "abilities to recognize a new value of information, assimilate and apply it for commercial purposes[2]." Since the absorptive capacity to accept knowledge from an outside company differs depending on the organization, there may be a difference in the performance accordingly[2,5].

Therefore, to utilize the knowledge obtained and created from outside, organizations must understand the knowledge[6], and to increase the efficiency of the organizations and reduce their expenses, the knowledge should effectively be applied. In other words, it is necessary to transfer the generated knowledge to the organizations and make all the organization members understand it so as to transform the knowledge as clearly innovative products. Various previous studies were examined in this study. As a result, it was inferred that absorption ability would have an impact on innovation outcome and such absorption ability would have an impact on other innovation outcomes due to other characteristics of technology system. Based on this, this study aims to analyze the effectiveness of absorption ability on organizational commitment and innovation outcome.

2. Theoretical Background

2.1 Absorptive Capacity

There have been a lot of studies on the role of absorptive capacity, centering around the fields of strategies and organizations; recently, studies of absorptive capacity have actively been conducted regarding innovation, business outcome and inter-organizational learning; and in South Korea, most of them have inquired into the role of absorptive capacity regarding the accumulation of technological ability. Concerning the formation of absorptive capacity, Kim and Kim[7] studied the impacts between users and companies to investigate and reveal the external mechanism related to the promotion of absorptive capacity of manufacturing companies[7] while Park analyzed the process of government-contributed research institutes' organizational changes and presented changes in absorptive capacity and related factors[8]. In a recent study, Mun analyzed what have actually impacts on the uses of external knowledge of Korean manufacturing companies among the factors determining the uses of external knowledge suggested in the preceding studies, such as companies' innovation performance appropriability strategy, absorptive capacity, technology entrepreneurship, companies scale and opportunity of technological advancement by industry, using Korean Manufacturing Innovation Survey (KMIS)[9]. However, despite there is an increasing interest in the role of absorptive capacity and many studies are in progress, there are not yet sufficient studies on the factors affecting the formation of absorptive capacity[1–3,8,10]. Zahra and George concretized the existing concept that saw absorption ability as innovative process of an organization who creates values by absorbing knowledge[1]. And they divided absorption ability into retainability and utilization and expanded them into the assets to create corporate competitive advantage. They also described the process that an organization creates and changes new knowledge in the stage of knowledge acquisition, assimilation, conversion, and utilization as ordinary and strategic one. By doing so, they highlighted that absorption ability is a continuous developmental route that is multi-dimensional and not regularized and also acts as managerial role in acquiring, converting, and utilizing an organization's knowledge.

2.2 Organizational Commitment

There is no agreed definition on organizational commitment yet and it is defined in various ways depending on

the research purposes and characteristics of researchers. Sheldon[11] defined organizational commitment as voluntary willingness to work by making the psychological bonding of an organization that associates an individual's identity with an organization's identity or encourages unusual attachment to an organization consistent with positive evaluation of an organization or organizational goals[11]. Buchanan II[12] defined loyalty as identification of organizational goals and values with an individual's ones, absorption or immersion of one's role and activity from psychological perspective, attachment to an organization, and positive attitude toward an organization[12]. Scholl[13] defined organizational commitment as potential power that an individual performs an organization's role as member of the organization and does innovative and voluntary behaviors[13]. Organizational commitment is a very important concept to organization managers who have to improve organizational performance in that it is a positive involvement that an individuals tries to do something for an organization to help the organization be successful and prosperous. Kim[7] stated in his study on the relationship between leadership and absorption ability and organizational effectiveness that absorption ability in organizational members had a positive impact on creativity, job performance, job commitment, organizational commitment, and organizational citizenship behavior[14].

2.3 Performance

Innovation outcome is influenced by internal and external factors. Currently, many companies are recognizing the importance of cooperation with other companies, universities, and research institutes and networking. By making good use of these, they are making a lot of efforts to maximize innovation outcome. Quite recently, open innovation, which diversifies sources of innovation, accelerates internal innovation, improves values of technology, and maximizes innovation outcome by making good use of external ideas and technologies, appeared. Through this, companies could improve their success probability of new products, reduce cost in R&D, create additional revenues, and reinforce market dominating power. They also could reduce the time from idea to research and development to commercialization and use it as complementary asset for reinforcing the internal R&D activities. However, to create innovation outcome well, the premise is that there should be a smooth communication between members and between departments. It is necessary to manage conflicts that might occur between departments and communication between members should be made freely[15]. By performing such activities, they can develop new products and new processes, improve the existing products and processes, and innovate products and processes in order to improve quality and reduce lead time[16,17].

3. The Hypothesis and Proposed Model

3.1 Research Model

This study identifies causal relationship depending on the research purpose based on the SEM (Structural Equating Model) model. Accordingly, this study aims to verify the impact of absorption ability on organizational commitment and innovation outcome based on service and manufacturing industries.

Absorptive capacity is a firm's ability to utilize external knowledge through the sequential processes of exploratory, transformative, exploitative learning[18,19]. Exploratory learning represents acquiring external knowledge and it coincides with the notion of potential absorptive capacity. Transformative learning link between the two processes, and it represents maintaining knowledge over time. Exploitative learning relates to applying acquired knowledge, and it reflects the concept of realized absorptive capacity[19]. From absorption capacity process perspective, exploratory learning specifically refers to acquisition of knowledge[18]. From the moment that they recognize the necessity of knowledge, many companies (organizations) begin to look for a way to acquire external knowledge. Exploratory learning is an acquisition of external knowledge for improving strategic flexibility and competitiveness through acquisition of

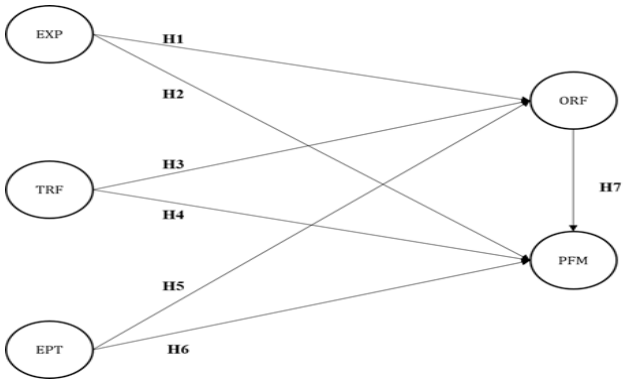

Figure 1. Research model.

a high level of external knowledge. It is also an activity to acquire new knowledge and reconstruct it appropriately for our organization by engaging in activities to analyze, evaluate, and interpret the knowledge acquired from the existing knowledge and from outside. In particular, the knowledge imported from outside is often difficult to be understood or copied in the outside because it is basically premised on the previous knowledge of the applicable knowledge context[20,21]. It is revealed that absorption ability has a positive impact on organization and corporate performance[22,23]. Such absorption ability is shown to have a positive impact on the innovation outcome of company (organization) and organizational commitment directly. Considering such aspects, the following hypotheses are set.

H1: Exploratory learning will have a positive impact on organizational commitment.

H2: Exploratory learning will have a positive impact on innovation outcome.

Transformative learning link between to exploratory and exploitative learning, and it represents retaining knowledge over time[18,20]. Exploratory and exploitative learning are insufficient for sustaining superior performance when cumulative knowledge is entailed, entry timing is important, or an environment is highly dynamic[19,22,24]. Transformative learning accelerates assimilation of knowledge in an organization through the activities to analyze, evaluate, and interpret knowledge. Therefore, assimilation of knowledge (exploratory learning) is an essential process for an organization to internalize the knowledge acquired from the outside. Transformation refers to the activity that combines the existing knowledge of an organization with its newly acquired knowledge. Therefore, transformative learning causes new insight and recognizes opportunities and at the same time allows an organization to see itself and change its perspective to have an outlook on the future competition[1,19].

H3: Transformative learning will have a positive impact on organizational commitment.

H4: Transformative learning will have a positive impact on innovation outcome.

According to absorptive capacity, exploitative learning concentrates on knowledge in the context of a product or service, and it exceeds assimilating external knowledge[18]. Especially, exploitative learning is linked to matching knowledge and markets[25,26]. After determining potential applications, a firm applies the knowledge, and the actual exploitation step consists of this[19,27]. Exploitation is associated with creation of new knowledge by refining, expanding, adjusting, and applying the existing competitiveness of a company (organization) or combining acquired and transformed knowledge. The existence of structural, systematic, and procedural mechanism that accelerates the utilization of knowledge causes the continuous improvement of new product, system, process, knowledge, and organizational structure[1].

H5: Exploitative learning will have a positive impact on organizational commitment.

H6: Exploitative learning will have a positive impact on innovation outcome.

Even if official compensation is not given to the performance of an organizational member, the behavioral directivity of the organizational member who absorbed himself/herself to the organization is maintained[13]. Moreover, the organizational member who is highly immersed in the organization strongly tends to identify himself/herself with the organization and so is likely to contribute to the improvement of performance of the organization by exerting his/her ability to the best under given situations believing that the survival and competitiveness of the organization is his/her own survival and competitiveness[28,29].

H7: Organizational commitment will have a positive impact on innovation outcome.

3.2 Operational Definition

The major purpose of this study is to verify the causal relationship on the impact of absorption ability – exploratory learning, transformative learning, and exploitative learning – on organizational commitment and innovation outcome. Each measurement item is selected by considering the items used in the previous studies and modified appropriately for this study[11–21,24–27].

4. Research of Study

4.1 Data Collection

PLS is used because requirements for sample size and residual distribution are relatively strict[30] and the relationship between measurement item and construct can analyze model, formative indicator and so PLS is thought to be appropriate. This study verifies measurement model and structural model as reflective high-dimensional PLS

model according to 2-step approach. This approach is a method to estimate the latent variable score initially without 2nd composition and use this in the 2nd structural model as measurement variable for analysis[31]. This approach has an advantage in that it can be used for both reflective and formative measurement models[32,33]. The subject of this study is office workers who are working for service and manufacturing industry. For this study, 150 sets of questionnaire were distributed from Nov. 1 to 30, 2014 and a total of 123 questionnaires were selected for our final analysis after removing some questionnaires that are problematic among the questionnaires collected.

4.2 Reliability and Validity

The PLS analysis requires testing internal consistency, convergent validity, and discriminant validity of question items and constructs. To test the internal consistency, speed, cost, security, perceived ease of use, perceived usefulness, perceived enjoyment, intention to use, personal innovativeness, social influence, and self-efficacy were analyzed in terms of Fornell and Larcker composite reliability and internal consistency[34,35]. In addition, in the 1st measurement model, the measurement items with low reliability and measurement variables whose validity is not obtained were removed and then the non-standardized latent variable scores drawn by the execution of PLS algorithm were used as measurement variables for the 2nd latent variables to evaluate reliability and validity. As a result of verification, composite reliability appeared at 0.6 or higher and Cronbach's alpha widely used for reliability verification at 0.6 or higher. .

Table 1. Descriiptive statistics of respondents.

		Frequency	Distribution (%)
Job Experience	First-year	25	20.3
	Second-years	29	23.6
	Third-years	27	22.0
	Fourth-years	42	34.1
Gender	Male	114	92.7
	Female	9	7.3
Age	20s	56	45.5
	30s	62	50.4
	40s	5	4.1
Education	High school diploma	83	67.5
	Associate degree	15	12.2
	Bachelor's degree	23	18.7
	Master or Doctoral degree	2	1.6

Table 2. Testing of internal consistency.

Construct	Composite reliability	Cronbach's α
EPT (Exploitative learning)	0.873	0.854
EXP (Exploratory learning)	0.699	0.602
ORF (Organizational flow)	0.648	0.890
PFM (Performance)	0.753	0.836
TRF (Transformative learning)	0.735	0.646

The convergent validity was tested with AVE and factor loadings of constructs. As in Table 7, the AVE proved to be higher than 0.5, the reference standard suggested by Fornell and Larcker and Chin[34]. All factor loadings of constructs proved to be 0.7, the reference standard suggested by Fornell and Larcker.

As in Table 8 the discriminant validity was tested based on whether the square root of every AVE marked on the diagonal axis of correlation coefficients was bigger than the coefficients of the other constructs. As a result, the smallest square root of AVE (0.805) was bigger than the largest coefficient (0.773), indicating the discriminant validity was good[34].

Table 3. Testing of convergent validity.

Construct	AVE	Item	Factor loading	t-value
EPT	0.873	EPT1	0.930	53.726
		EPT2	0.938	58.273
EXP	0.699	EXP1	0.934	43.366
		EXP2	0.726	7.633
ORF	0.648	ORF1	0.833	21.604
		ORF2	0.710	8.689
		ORF3	0.883	39.845
		ORF4	0.860	30.803
		ORF5	0.766	14.204
		ORF6	0.766	14.497
PFM	0.753	PFM1	0.800	17.040
		PFM2	0.898	43.677
		PFM3	0.901	35.107
TRF	0.735	TRF1	0.901	35.429
		TRF2	0.811	14.559

Table 4. Correlation between latent variables.

Construct	EPT	EXP	ORF	PFM	TRF
EPT	0.934				
EXP	0.640	0.836			
ORF	0.612	0.565	0.805		
PFM	0.432	0.476	0.501	0.868	
TRF	0.773	0.664	0.643	0.429	0.857

The present study performed the confirmatory factor analysis as in Table 9. In the confirmatory factor analysis, the factor loading of a construct should be higher than those of the other constructs. As a result, every question item met the requirement Table 5. As abovementioned, the constructs and question items used here were found to be fit for the structural model analysis as their internal consistency, convergent validity and discriminant validity met the reference requirements.

4.3 Hypothesis Verification Result

The PLS analysis result of this research model is shown in Figure 2.

In PLS analysis, the explanatory power of path model is expressed as explained variance R^2[30]. As a result of

Table 5. Confirmatory factor analysis.

Construct	EPT	EXP	ORF	PFM	TRF
EPT1	**0.930**	0.630	0.544	0.407	0.701
EPT2	**0.938**	0.568	0.598	0.400	0.742
EXP1	0.551	**0.934**	0.597	0.475	0.604
EXP2	0.555	**0.726**	0.278	0.286	0.511
ORF1	0.486	0.483	**0.833**	0.380	0.540
ORF2	0.545	0.527	**0.710**	0.282	0.474
ORF3	0.586	0.501	**0.883**	0.401	0.584
ORF4	0.479	0.452	**0.860**	0.520	0.582
ORF5	0.347	0.339	**0.766**	0.423	0.370
ORF6	0.498	0.420	**0.766**	0.399	0.524
PFM1	0.339	0.275	0.437	**0.800**	0.358
PFM2	0.329	0.408	0.428	**0.898**	0.351
PFM3	0.445	0.526	0.443	**0.901**	0.405
TRF1	0.649	0.641	0.624	0.416	**0.901**
TRF2	0.691	0.481	0.462	0.308	**0.811**

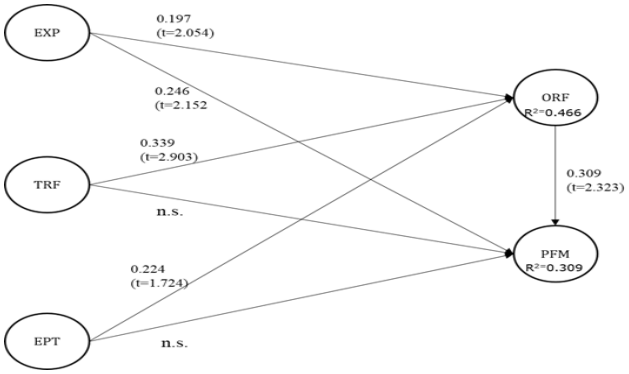

Figure 2. Testing results of the structural model.

R^2analysis of PLS, the effectiveness of organizational commitment was explained at 46.6% and that of innovation outcome at 30.9%, which exceeded Falk and Miller's[36] power (10%).

With the PLS analysis, path coefficients and their significance were tested. For this, the full sample was used to find out the path coefficients of the structural model. The bootstrapping provided in PLS was used to calculate the t-value for the path coefficient. Table 6 summarizes the analysis results.

Hypothesis 1 that exploratory learning will have a positive impact on organizational commitment, Hypothesis 2 that exploratory learning will have a positive impact on innovation outcome, Hypothesis 3 that transformative learning will have a positive impact on organizational commitment, Hypothesis 5 that exploitative learning will have a positive impact on organizational commitment, and Hypothesis 7 that organizational commitment will have a positive impact on innovation outcome were accepted. However, Hypothesis 4 that transformative learning will have a positive impact on innovation outcome and Hypothesis 6 that exploitative learning will have a positive impact on innovation outcome were rejected.

Table 6. Hypothesis Testing.

Hypothesis		Path coefficient	t-value	Result
H1	EXP → ORF	0.197	2.054	Supported
H2	EXP → PFM	0.246	2.152	Supported
H3	TRF → ORF	0.339	2.903	Supported
H4	TRF → PFM	0.003	0.019	Not supported
H5	EPT → ORF	0.224	1.724	Supported
H6	EPT → PFM	0.082	0.413	Not supported
H7	ORF → PFM	0.309	2.323	Supported

5. Conclusions

To maintain and develop the competitive advantage that a company acquired continuously, methods to maximize the effectiveness of resources should be explored and adaptability to the environment to cope with the environmental changes in the future should be improved. Cohen & Levinthal[2] conceptualized such an ability as absorption ability. They defined absorption ability as ability of an organization to evaluate and use external knowledge by utilizing its prior knowledge and experience and based on this, reinterpret, combine, and commercialize the values of information. This study divides the factors of absorption ability into exploratory learning, transformative learning, and exploitative learning and made an empirical analysis of the impact of these three factors on organizational commitment and organizational innovation outcome.

The findings of this study are as follows: First, exploratory learning appeared to have a positive impact on organizational commitment and innovation outcome. In general, if acquiring new and a high level of knowledge, it should be reconstructed appropriately for our company. In that case, competitors cannot catch our company easily. In the end, if making good use of exploratory learning, it may have a positive impact on organizational commitment and innovation outcome. Second, transformative learning appeared to have a positive impact on organizational commitment. In general, companies are making a lot of efforts to internalize the knowledge that they acquired from the outside through the activities to analyze, evaluate, and interpret it systematically. By doing so, they can get a new insight and so if they utilize this appropriately, they can have positive emotion such as attachment to the organization and immersion in it. Third, exploitative learning appeared to have a positive impact on organizational commitment. The existing core capabilities that a company held can be expanded and applied or newly acquired knowledge can be combined with the existing capabilities. By doing so, they can have attachment to the organization and make voluntary efforts for the success of the organization through the process of creating new knowledge. Fourth, organizational commitment appeared to have a positive impact on innovation outcome. In general, the higher the positive emotion for organization, the higher the positive effects on performance. This is consistent with the previous studies. Fifth, transformative learning and exploitative learning appeared not to have an impact on innovation outcome. In general, transformative learning and exploitative learning had a positive impact on innovation outcome, but both are rejected in this study. The reason why such a result is drawn seems to be attributable to the characteristics of organization. An organization accepts new knowledge from the outside, but does not analyze and interpret it systematically and apply and expand it appropriately to its won. This is why such a result seems to be drawn.

The practical significance of this study is that the variables related to the absorption ability formation process provide useful guidelines practically in establishing core capabilities of an organization. The analysis of the relationship between absorption ability and organizational commitment and innovation outcome proposed in this study will be helpful for an organization to plan and establish its management strategies. In particular, the companies who did not recognize absorption ability importantly are expected to recognize the absorption ability formation mechanism and take considerable interests in management strategies through absorption ability in the future and this will play an important role in securing sustainable competitive advantage and coping with this rapidly changing corporate environment.

Despite such implications, however, there are still limitations. First, subject of study and samples are limited to particular companies and so it is difficult to generalize it. Second, various factors that may have an impact on absorption ability, organizational commitment, and innovation outcome could not be taken into account. So further studies need to make a systematic analysis of various variables such as absorption ability formation mechanism, organizational commitment, and innovation outcome, and of the causal relationship between these factors as well.

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