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The Effect of Network Structure on Performance in South Korea SMEs: The Moderating Effects of Absorptive Capacity

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Abstract: This study has analyzed how the network structure (density, centrality) affects the performance (convergence, overall) in Small and Medium-Sized Enterprises (SMEs) with the different business exchange activities. In addition, we conducted a moderating effect of absorptive capacity (ability, motivation). Based on previous literature about the network and absorptive capacity, research hypotheses were developed and tested using a sample of 226 SMEs in South Korea. The results show that network density and centrality have a positive effect on perceived convergence and overall performance. These results are consistent with previous network studies relating to structural characteristics. To raise total performances in firms with different business exchange activities, they need to enhance density and centrality. For example, firms with different business exchange activities and high levels of density and centrality are able to easily obtain various types of information from other members of 7000 firms in Korea. Through this, they can improve performance. We also conducted the moderated regression analysis. The results show that employee ability has a positive moderating effect on the relationship between centrality and the overall performance while employee motivation has a negative moderating effect. The implications and directions for future study along with limitations are presented.

Keywords: network structure; absorptive capacity; convergence and overall performance

1. Introduction

The global economy has been stuck in a plateau of a low growth stage for several years [1] and South Korea's economy has also had a slowdown in growth [2]. Moreover, industrial trends are being changed very quickly under globalization [3]. Thus, it is very important for firms to find the opportunities for growth. Especially, the importance of Small and Medium-Sized Enterprises (SMEs) growth has become even more prominent, because SMEs not only are considered as the backbone of the economy but also are expected to play a vital role in helping nations rebuild their economies after the recession. However, due to the inherent nature of the resource poverty compared to the large conglomerate, SMEs seek to utilize networks to surmount limitations and secure the competitive advantages [4,5]. Especially, the network structure can be a crucial factor in the acquisition of resources [6] and its importance has been discussed [7].

Despite the importance of SMEs and network structure, the majority of the existing network literature lacks the multidimensional perspective of network structures [8] and mainly focuses on nascent or newly formed businesses, not the established ones [9]. Thus, this study explores the relationship between network structure and the performance of South Korean SMEs that joined the membership of Korea Small & Medium Business Convergence Association (KSCA). That relationship,

within the context of business convergence network, has neither been discussed nor the concept tested with robust methodology and data.

Network structure can give the SMEs a variety of useful resources which are what they need to improve performance, but it does not always guarantee success per se, as all firms cannot fully take advantage of the external resources that they acquired through the network. In other words, each firm has different abilities to recognize, understand, exploit, and integrate the acquired resources or absorptive capacity [10,11]. Absorptive capacity is one of the most important themes emerging in organizational research and strategy in decades [12–14]. It is widely accepted that absorptive capacity is the vital factor to enhance business performance [13,15], and many scholars have expressed the need for further investigation to clarify its role in the different contexts [16]. Accordingly, we assume that the relationship between network structure and performance becomes stronger when firms possess a high level of absorptive capacity. Specifically, by examining how each absorptive capacity component can interact with the network structure, we will be able to understand more regarding how both concepts enhance and relate to performance.

Thus, this study tries to consider both external and internal variables of the firm such as resources and capability simultaneously in order to explain SME performance within the context of the business convergence network. Based on the background above, this study attempts to empirically answer the two research questions which are as follows:

(i) What effects does network structure have on performance?
(ii) What effects does the absorptive capacity component have on the relationship between network structure and performance?

In the next section, we review the previous literature and propose hypotheses that link network structure and performance. We also assume that this relationship will be moderated by the firm's absorptive capacity. In the following section, we describe the sample, measurement, and statistical techniques to test the hypotheses. We then present the results of statistical analysis. Finally, we address the implications and limitations of our study and provide some suggestions for the next research direction.

2. Literature Review and Hypotheses

2.1. Network Structure and Performance

Social capital definition is "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit" [17]. According to the social capital theory, a firm's external networks can contribute significantly to firm performance [18]. Networks are vital to a firm, especially SMEs, which inherently have a shortage of internal resources. Due to their finite resources, they use a variety of sources and are connected to different networks to acquire the information to develop the business strategy [19]. Networks provide its actors with access to network resources such as information, management skills, equipment, technology, etc. [20]. This form of cooperation can allow SMEs to facilitate the achievement of economies of scale [9]. In addition, they can make it possible to discover opportunities, test new ideas [21,22], and attain their strategic goals. Therefore, utilizing networks can considerably impact a firm's ability to sustain and improve their competitive advantages within the context of SMEs [23], as well as potentially lower risk of failure and increase its chances of success [9]. The network structure, in particular, is considered a crucial factor in the acquisition of information, knowledge, resources, or competitive advantage [6,24].

In this study, the network structure consists of density and centrality. Network density refers to the degree of interconnection among actors in the network [20]. High level of density means that the exchange of information and resources among them will increase [25,26]. It can reduce the amount of time required to gather information for high quality and verify the accuracy of information across multiple sources [27].

Network centrality refers to an individual actor's position in the network [20]. It denotes the extent to which an actor occupies the central position of a network [24,28]. By occupying a high position, a firm can have a high degree of access to the control of valuable resources [24,29]. Furthermore, the firm can acquire nonredundant, diverse, and new information more quickly than less central actors [23]. This kind of information and resources can be transformed into fuel to discover the opportunities to develop and generate new ideas. Thus, it leads to an increase in the performance of the related organization and convergence.

Empirical evidence supports that network density and centrality can significantly influence the performance of the firm, including innovation [7,23,26,27,30,31]. Wang et al. [24], especially, reveal that network centrality positively influences both organizational innovation and performance using meta-analysis based on 40 samples. Hence, we propose the following hypotheses:

Hypothesis 1. *Network density has a significant positive effect on convergence performance.*

Hypothesis 2. *Network centrality has a significant positive effect on convergence performance.*

Hypothesis 3. *Network density has a significant positive effect on overall performance.*

Hypothesis 4. *Network centrality has a significant positive effect on overall performance.*

2.2. Moderating Effects of Absorptive Capacity

According to Cohen and Levinthal [10], the absorptive capacity definition is "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (p. 128). Based on Cohen and Levinthal's definition [10], Zahra and George [32] extended the notion and suggested four dimensions: acquisition, assimilation, transformation, and exploitation, which are distinct but interrelated. Moreover, Minbaeva, Pedersen, Björkman, Fey, and Park [33] suggested and identified that the firm's absorptive capacity consists of employees' ability and motivation, which are key aspects. These two elements are in line with not only Kim's [34] emphasis on prior knowledge and intensity of effort, but also Zahra and George's [32] potential (acquisition and assimilation) and realized (transformation and exploitation) absorptive capacity. It is an organizational level construct that is embedded in employees [33].

Some researchers reconceptualized the concept or developed the measurement items [13,35,36]. For example, Lane and Lubatkin [35] proposed that absorptive capacity is as a dyad-level construct—the relative absorptive capacity—which is more suitable for interorganizational learning.

To summarize, there are some arguments of absorptive capacity. However, the dominant theoretical viewpoint is that absorptive capacity is an organizational capability [13]. It depends on prior related knowledge [15] and also is considered to be crucial for firm success and long-term survival.

Although network density and centrality have positive effects on performance, their impact may depend on the absorptive capacity that firm has. In other words, firms differ in their ability to acquire, assimilate, transform, and exploit new knowledge gained from networks. Firms with high-level absorptive capacity are likely to identify new knowledge from the network and better understand it to help or enhance their performance. Moreover, these firms are able to exploit prior and new knowledge simultaneously for their products or processes to create more profits and sustainable competitive advantage.

By contrast, without such a sufficient capacity, firms would have fewer chances to recognize new knowledge from the network and could not transform and exploit it for their routines or processes for performance. In turn, this leads to lower network density and centrality effectiveness.

Empirical studies support this notion. For example, Tsai [31] identified that there was a strong positive relationship between network centrality and performance among business units with high-level absorptive capacity. Liu, Wang, and Ji [14] also supported this result. They found that absorptive capacity has a positive moderating effect on relationship between network scale,

centrality, and innovation performance. Similarly, studies related to absorptive capacity emphasized and identified the importance of the role of moderation effects [4,37,38]. Hence, we propose the following hypotheses:

Hypothesis 5. *Employees' ability positively moderates the relationship between density and convergence performance.*

Hypothesis 6. *Employees' motivation positively moderates the relationship between density and convergence performance.*

Hypothesis 7. *Employees' ability positively moderates the relationship between centrality and convergence performance.*

Hypothesis 8. *Employees' motivation positively moderates the relationship between centrality and convergence performance.*

Hypothesis 9. *Employees' ability positively moderates the relationship between density and overall performance.*

Hypothesis 10. *Employees' motivation positively moderates the relationship between density and overall performance.*

Hypothesis 11. *Employees' ability positively moderates the relationship between centrality and overall performance.*

Hypothesis 12. *Employees' motivation positively moderates the relationship between centrality and overall performance.*

Based on the prior studies above, this research proposes the research model shown in Figure 1, which includes the control variables (firm age, firm size).

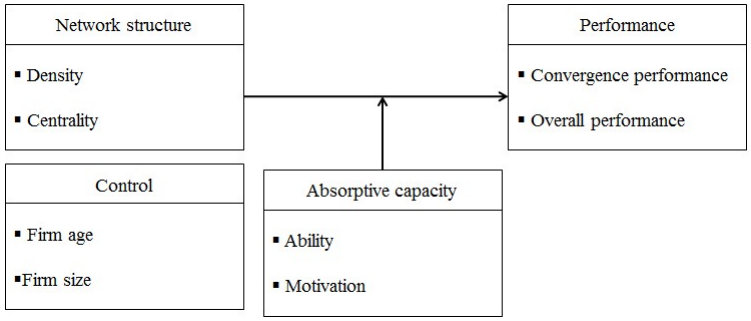

Figure 1. Research model.

3. Methodology

3.1. Sample and Data Collection

The South Korean SMEs have played an important role in the economy and employment. According to a recent KBIZ annual report, the total number of domestic SMEs was 3,542,350 (99.9%), and the number of employees was 14,027,638, which corresponds to 87.9% of employment in 2014. Especially, small and medium-sized manufacturing companies contributed significantly to overall output (50.6%) and value added (53.6%) for the last five years (2009–2014). These figures exceeded those of conglomerates (49.4%, 46.4%, respectively).

The population of this study was SMEs that joined the membership of Korea Small & Medium Business Convergence Association (KSCA) because the majority business exchange or convergence activities have been organized by KSCA members. As of December 2013, KSCA had 6996 SME members and 13 local branch offices. The data was collected from memberships belonging to 4 local branches (Daegu/Gyeongbuk, Seoul, Busan, Gyeonggi) which had relatively much more memberships and activity than others. We distributed a total of 940 questionnaires by hand to CEOs who participated in a formal gathering and regular meetings that were organized by KSCA local branches. We received 245 questionnaires (a response rate of 26%). Among the 245 responses, we excluded 19 as some data were missing or centralizing. Finally, 226 samples were used in the analysis. Table 1 shows a summary of the key characteristics of the sample.

Table 1. Sample Characteristics (n = 226).

Characteristic	Frequency	%
Year of establishment		
Under 5	25	11.1
5—under 10	33	14.6
10—under 15	77	34.1
15—under 20	36	15.9
20 and/or over	55	24.3
Number of employees		
Under 10	82	36.3
10—under 20	57	25.2
20—under 30	39	17.3
30—under 50	31	13.7
50 and/or over	17	7.5

3.2. Measures

The questionnaire we exploited in this study, except for convergence performance, was adopted from scales that were developed based on an English-language context. Thus, we first translated items into the Korean language and then we gave a bilingual pundit two versions of questionnaires (English, Korean) to assess the appropriateness and the semantic equivalence of the translation. Second, to secure the content validity of the measures, the review process was repeated several times until the bilingual pundit discovered no further inaccuracies in translation [39]. All of the indicators were measured using a five-point Likert-type scale (from 1 = totally disagree to 5 = totally agree). The related items are attached in Appendix A.

3.2.1. Network Structure

The network density and centrality were measured using Antia and Frazier's study [40] that we modified to our setting. Network density is concerned with the average strength of relationship in a network (5 items) and centrality refers to the strength of the firm's position in a network (4 items).

3.2.2. Absorptive Capacity

The firm's absorptive capacity was measured with R&D spending, the number of employees who work in R&D departments, etc., as a proxy [41]. However, it partially reflects the richness of the construct [32,33]. Especially, R&D spending explains only 4% of the variance in interorganizational learning compared to knowledge similarity variables [33,35]. Thus, in consideration of these circumstances, we adopted the Minbaeva et al. [33] concept of absorptive capacity and measured the absorptive capacity using 12 items taken from Liao, Fei, and Chen's study [42] which is related to overall employees' ability (5 items) and motivation (7 items), not on an individual level. Moreover, this measurement follows the Zahra and George [32] concept but is not the absolute absorptive capacity (e.g., R&D spending).

3.2.3. Performance

Performance can be measured in two ways: subjective or objective. Most of Korea SMEs respondents are reluctant to open the data or information related to financial and accounting. Moreover, some cases of secondary data are somewhat inaccurate. Given these circumstances, the subjective performance measure is more suitable and reliable. In addition, it has a high correlation with objective performance measures such as ROA or ROI [43–45]. Thus, in this study, performance is perceived performance by the respondents. We used Yang and Park's research report's [46] performance which consists of two dimensions (convergence, overall). The convergence performance is that discovery and development are related to convergence ideas, technology, and product development (3 items). It reflects the degree of its completion or process. The overall performance is related to sales (2 items), R&D efficiency (3 items), and cost reduction (3 items), which reflects the degree of increasing sales and market share or cost declining of R&D, production, and so on.

3.2.4. Control Variables

We controlled the firm age and size, variables which can influence firm performance as a confounding variable [9].

3.2.5. Common Method Bias

Collecting data from the same source based on a questionnaire may generate common method bias. To address this potential problem, we adopted Harman's one-factor test [47]. The unrotated factor analysis extracted 6 factors (with eigenvalue great than 1) which account for 72.19% of the total variance and the first factor explained 35.25% of the variance. In the unrotated factor structure, no single factor emerged, nor did general factor account for the majority of the variance. We also conducted a single-factor measurement model using AMOS 23. The results indicated that the model fit was very poor (χ^2 = 2650.522 (df = 324, p = 0.000), χ^2/df = 8.181, RMR = 0.104, GFI = 0.399, AGFI = 0.299, TLI = 0.383, CFI = 0.430, RMSEA = 0.179). Consequently, there was no evidence of threat regarding common method variance in our data.

4. Analysis and Results

4.1. Validity and Reliability

In order to investigate the validity and reliability of measurement, we used the confirmatory factor analysis (CFA). The result showed an acceptable fit (χ^2 = 546.340 (df = 309, p = 0.000), χ^2/df = 1.768, RMR = 0.032, GFI = 0.854, AGFI = 0.821, NFI = 0.877, TLI = 0.934, CFI = 0.942, RMSEA = 0.058). To assess convergent validity, we evaluated the standardized factor loading and composite reliability (CR), which should be greater than 0.5 [48] and 0.7 [49], respectively. Table 2 shows that all standardized factor loading and constructs of CR exceeded the threshold. To assess discriminant validity, we used the Fornell and Larcker [50] criterion, which calls for square root of AVE for each construct greater than the correlation coefficients with any construct. Table 3 diagonal values are square roots of AVE with values greater than the correlation coefficients between two constructs. Reliability was assessed by Cronbach's alpha using SPSS 23. The value ranged from 0.848 to 0.915 (see Table 2) which was above the suggested threshold level of 0.7 [51]. Hence, our measurement model secured the validity and reliability.

Table 2. Measurement Model Results (n = 226).

Variable	Abbr.	Standardized Factor Loading	SE	*t*-Value	CR	Cronbach's α
Density	D1	0.799	-	-	0.937	0.891
	D2	0.810	0.081	13.221		
	D3	0.755	0.089	12.106		
	D4	0.778	0.083	12.573		
	D5	0.813	0.093	13.278		
Centrality	C1	0.883	-	-	0.928	0.892
	C2	0.904	0.058	18.602		
	C3	0.816	0.059	15.711		
	C4	0.684	0.059	11.870		
Ability	A1	0.782	-	-	0.945	0.898
	A2	0.840	0.078	13.537		
	A3	0.783	0.075	12.441		
	A4	0.824	0.077	13.231		
	A5	0.764	0.075	12.084		
Motivation	M1	0.650	-	-	0.943	0.900
	M2	0.627	0.097	8.419		
	M3	0.695	0.116	9.185		
	M4	0.766	0.120	9.952		
	M5	0.804	0.117	10.340		
	M6	0.819	0.120	10.494		
	M7	0.889	0.124	11.153		
Convergence performance	D&D1	0.820	-	-	0.936	0.915
	D&D2	0.937	0.068	17.474		
	D&D3	0.905	0.069	16.819		
Overall performance	PER	0.729	-	-	0.922	0.855
	R&D	0.860	0.101	12.261		
	COST	0.868	0.097	12.345		

Model fit: χ^2 = 546.340 (df = 309, p = 0.000), χ^2/df = 1.768, RMR = 0.032, GFI = 0.854, AGFI = 0.821, NFI = 0.877, TLI = 0.934, CFI = 0.942, RMSEA = 0.058.

Table 3 shows the means, standard deviations, and correlation matrix of the independent variables and AVE. Overall, the correlation among the independent variables was relatively modest, ranging from 0.188 to 0.696. This showed that multicollinearity was not a serious issue.

Table 3. Correlations (n = 226).

Variable	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)
Density	3.844	0.627	0.865					
Centrality	3.403	0.721	0.625 *	0.875				
Ability	3.477	0.602	0.263 *	0.189 **	0.881			
Motivation	3.464	0.595	0.320 **	0.188 *	0.668 *	0.840		
Convergence	2.835	0.813	0.330 **	0.338 *	0.292 **	0.273 *	0.911	
Overall	3.087	0.641	0.427 **	0.397 **	0.480 *	0.463 *	0.696 **	0.893

Note: Diagonal values are square root of AVE, Significant at * $p < 0.05$, ** $p < 0.01$.

4.2. Hypotheses Testing

To test the hypotheses, linear regression analysis was applied. Following Aiken and West [50], we mean-centered the predictor variables before generating interaction terms. A variance inflation factors (VIF) test found that the highest VIF value was 1.838, far below the critical value of 10.

As shown in Table 4, M 1 and M 4 relate to H1–H4. Density and centrality have positive and significant effects on convergence and overall performance, respectively. These are supported for H1

(β = 0.195, $p < 0.05$), H2 (β = 0.200, $p < 0.05$), H3 (β = 0.275, $p < 0.01$), H4 (β = 0.245, $p < 0.01$). M 3 and M 6 relate to the moderating effects of H5–H12: the interaction between density and ACAP (ability, motivation) as well as that between centrality and ACAP (ability, motivation). The results show that the relationship between centrality and overall performance was moderated by ability and motivation, but the interaction between centrality and motivation was negative and significant. Therefore, H11 (β = 0.17, $p < 0.1$) is supported, whereas H12 (β = −0.166, $p < 0.1$) is not supported.

Table 4. Results of Regression (n = 226).

Variable	Convergence Performance			Overall Performance		
	M 1	M 2	M 3	M 4	M 5	M 6
Age	0.062	0.089	0.101	−0.013	0.034	0.048
Size	−0.033	−0.062	−0.060	−0.052	−0.090	−0.101 †
Density	0.195 *	0.136 †	0.134 †	0.275 **	0.176 *	0.180 *
Centrality	0.200 *	0.194 *	0.167 *	0.245 **	0.235 **	0.206 **
Ability		0.189 *	0.198 *		0.247 **	0.259 **
Motivation		0.066	0.070		0.162 *	0.163 *
D * A			0.002			0.002
D * M			0.014			0.013
C * A			0.181			0.176 †
C * M			−0.089			−0.166 †
R^2	0.129	0.179	0.198	0.209	0.333	0.349
ΔR^2	-	0.051	0.018	-	0.125	0.016
Adj R^2	0.113	0.157	0.160	0.194	0.315	0.319
F-value	8.152 **	7.963 **	5.292 **	14.572 **	18.258 **	11.541 **

Note: Standardized coefficients are reported, Significant at † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$ (two-tailed tests).

To better understand the interaction effect, we drew the interaction graph in Figure 2 following the recommendation of Aiken and West [52]. Figure 2 presents that a firm occupying central position can experience higher overall performance when its employee ability is high. However, if it is low, overall performance is not enhanced, even though the firm is occupying the central position. Thus, employee ability plays the moderating role in affecting the relationship between the network centrality and overall performance. Figure 3 shows the supported hypothesis results and H12 result.

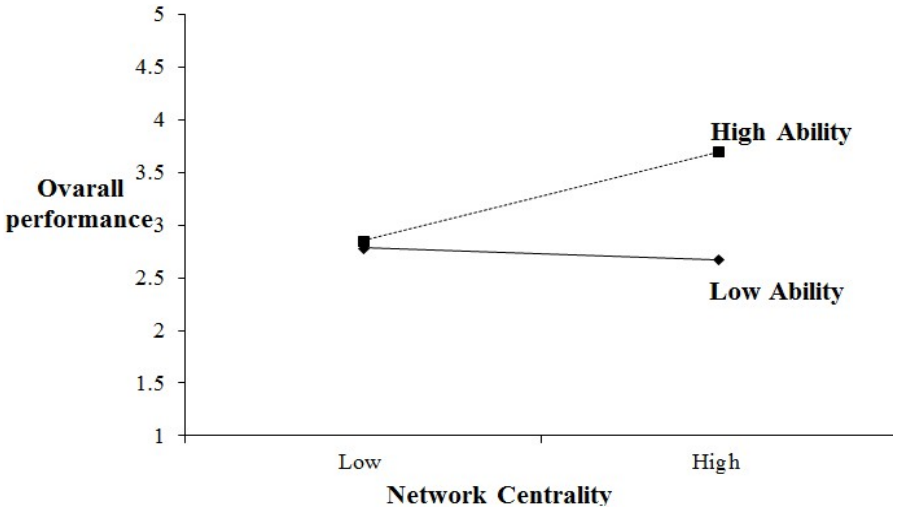

Figure 2. Interaction effects of ability.

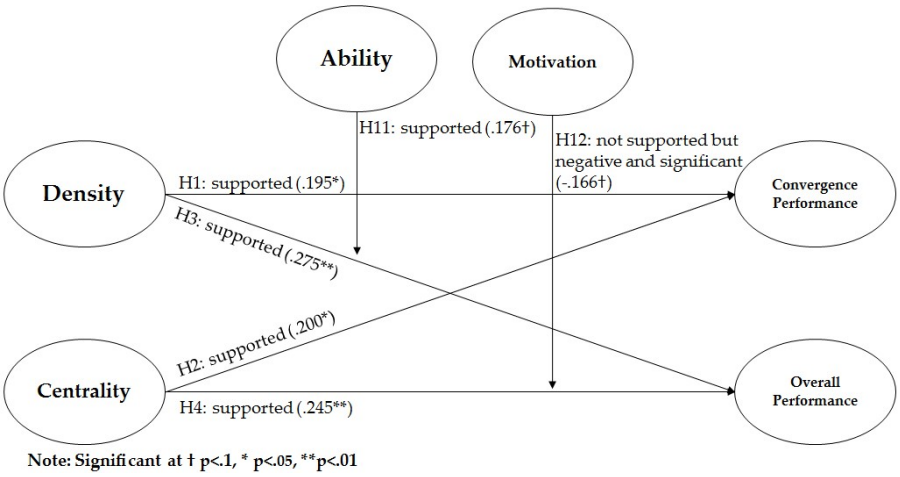

Figure 3. Supported hypothesis results and H12 result.

5. Conclusions

5.1. Summary and Implications

In this study, we incorporated both external and internal variables of the firm in order to explain SMEs performance. We considered network structure, which comprises network density and network centrality as the antecedent external variables. Also, we investigated the role of absorptive capacity as an internal variable of the firm by analyzing moderating effects. Based on the literature on the network and absorptive capacity, we developed hypotheses and tested using a sample of 226 SMEs in South Korea.

The result shows that network structure has a positive impact on SMEs convergence and overall performance, which means network density and centrality appear to be significantly positively associated with firm growth and survival. The finding is in line with previous studies in South Korea which show the positive relationship between network structure and performance, including innovation, corporate reputation, and loyalty at the firm level [53–57], as well as team-level performance [58–60]. This finding confirms the importance of social capital in providing SMEs with resources critical to the success of their firms. Some recent studies, however, reveal network negative and inverted U-shaped effects [27,61–65], because the network activities entail the costs related to time-consuming activities like establishing and maintaining relationship network members [27,66]. In consideration of current network study results, network structure can be viewed as a double-edged sword that enables either the improvement or worsening of a firm's performance [7,65]. Thus, SMEs with a low level of network structure have to keep pursuing network activities until the network density and centrality approach moderate levels.

According to the results, absorptive capacity has a moderating effect on the relationship between network centrality and overall performance only. But each absorptive capacity component has different moderating effects. Ability moderated positively the relationship between network centrality and overall performance, which indicates that the employees' ability can make the firm achieve better overall performance. Thus, firms need to invest in an employee's ability to improve the absorptive capacity. For instance, firms can enhance employees' competence through job-related training, workshops, programs, or a variety of other educational activities. This result is complementary with existing literature on absorptive capacity which mainly emphasizes that absorptive capacity has a direct effect on the firm performance. Also, this result supports Tsai's [31] study results and the suggestion that the impact of both network position and absorptive capacity should be studied simultaneously. On the other hand, motivation moderated negatively the relationship between network centrality and overall performance, which means that the employees' high motivation can make the

firm decrease the overall performance. This negative moderating effect is very interesting, as this result differed from previous studies which emphasize the absorptive capacity positive side. We see the type of motivation as one of the main reasons that this result occurred. According to another motivation, the self-determination theory, there are two types of motivation: autonomous and controlled [67,68]. Especially, when an individual has controlled motivation, it usually leads to putting in only the minimum required effort, focusing on short-term gains, and taking the easiest way to obtain the externally defined end [67,68]. Thus, controlled motivation might have acted in this study and we assume that the self-determination theory might be more suitable rather than the expectancy–valence theory of work motivation. The firm therefore needs to carefully approach when increasing their employee motivation.

In conclusion, this study result implies that firms, especially SMEs, should occupy the network centrality as well as improve employee abilities simultaneously. By doing so, the firm can enhance performance and create sustainable competitive advantages.

5.2. Limitations and Future Research Directions

This study has several limitations. First, we only focused on the network structure traits—density and centrality as independent variables. Hence, future studies need to investigate including the network relational traits such as trust, relational norm, strength, stability, or other antecedent variables. Few studies suggested personality traits, value, interpersonal citizenship behavior, championing behavior as an antecedent to centrality at the individual level [69–71]. Thus, based on these studies, future studies need to develop the antecedent variables at the organization level and investigate their effects. A comparative study is also needed either between the same and different industry or domestic and global marketplace networks in the model to obtain more precise results regarding networks traits effects.

Second, most of the hypotheses related to moderation of absorptive capacity were rejected. This is inconsistent with previous studies [14,31]. We assume that these results may relate to concept and measurement. In this our study, we adopted Minbaeva et al.'s [33] absorptive capacity concept which emphasizes prior knowledge (employee's ability) and intensity of effort (employee's motivation). They suggest that to accomplish outstanding performance at any level, not only ability but also motivation are needed coincidentally. Thus, future studies may re-examine using a three-way interaction. Also, intensity of effort can be reconceptualized as an autonomously motivated concept by adopting the self-determination theory. Thus, future studies may re-examine the motivation moderating effect using an autonomously motivated concept.

Third, our study focused only on the role of the moderating effect of absorptive capacity. A majority of previous studies have suggested that absorptive capacity contributes to the innovation and performance directly and indirectly [13,15,16,72]. Thus, examining the mediating role of absorptive capacity might help to better understand the process of the external network–performance relationship. In addition, future studies could examine potentially moderating variables that might play an important role in the relationship between network traits and performance (e.g., organizational culture, strategic orientation, environmental factors, leadership styles, bilateral contracts, or agreements between SMEs).

Fourth, it is difficult to extend the generalizability without any further studies. Accordingly, it is encouraged to conduct comparative studies, including in other countries, and longitudinal studies.

Lastly, some studies suggested and approached the dark side of network, or constraints, the potential liability [27,61–65]. For example, Lee's [27] study identified the network inverted U-shaped effects. She was emphasizing the network cost and suggested that network costs may exceed derived benefits from network resources and transform social capital into social liability. These negative results lead to cautions on the relationship between the external network and organizational performance [24,73] and are calling for revisiting research regarding network effect.

In spite of several limitations, this study provides a significant contribution towards increasing the understanding of the relationship between network structure and performance as well as absorptive capacity moderating effects.

Author Contributions: C.K. is an assistant professor at Yeungnam University, South Korea. He designed the research conceptual model and collected the survey data. J.L. is a researcher at Yeungnam University, South Korea. He analyzed the survey data and interpreted results. Both authors reviewed the previous literature and wrote paper together.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Variables		Items
Network	Density	**Relations** among KSCA members are very close.
		KSCA members frequently communicate with each other.
		KSCA members frequently discuss common problems.
		There is very much interaction among KSCA members through the various gatherings.
		KSCA members have extremely close ties.
	Centrality	**Our** company is a crucial cog in the KSCA network.
		Our company is very central to the KSCA network.
		Our company is very active in the KSCA network.
		Our company has closed relationship with KSCA members.
Absorptive Capacity	Ability	**Our** company employee is equipped with excellent professional knowledge.
		Our company employee can acquire quickly and thoroughly new knowledge required by the work.
		Our company employee has better working skills than the employee of competitors.
		Our company employee has higher educational qualifications than the employee of competitors.
		Our company employee has the ability to use and organize the acquired knowledge.
	Motivation	**Our** company employee makes an effort to obtain working skills and task licenses to get pay rise, promotions, and job offers.
		The knowledge acquisition behavior of our company employee has positive effect on the job efficiency.
		Our company determines pay rise, promotions, and job offer on the basis of the working skills and license possessed by our employee.
		Our company allocates further learning or training opportunities to the employee base on their possession of working skills and license.
		The rewards given by our company effectively encourage the employee to obtain working skills and licenses.
		Our company employee obtains fair rewards for their progress in learning compared with the employee of competitors.
		Our company reward system, which encourages the employee to obtain working skills and task licenses, is better than that of the competitors.
Convergence Performance (Discovery and Development)		**The** convergence ideas and projects were discovered successfully by the business exchange or convergence activities.
		The technology development was completed or is processing regarding the convergence projects.
		The convergence product development was completed or is processing.
Overall Performance	Sales	**Our** company's sales have an upward trend through the business exchange or convergence activities.
		Our company market share is increasing through the business exchange or convergence activities.
	R&D efficiency	**Our** company's R&D cost is declining through the business exchange or convergence activities.
		Our company's R&D period is declining through the business exchange or convergence activities.
		Our company's success rate of R&D is increasing through the business exchange or convergence activities.
	Cost reduction	**Our** company's transaction cost is declining through the business exchange or convergence activities.
		Our company's cost of purchasing is declining through the business exchange or convergence activities.
		Our company's cost of production is declining through the business exchange or convergence activities.

References

1. Park, H.S. Technology convergence, open innovation, and dynamic economy. *J. Open Innov. Technol. Mark. Complex.* **2017**, *3*, 24. [CrossRef]
2. Cooke, P. A ground-up "Quaternary" innovation strategy for South Korea using entrepreneurial ecosystem platforms. *J. Open Innov. Technol. Mark. Complex.* **2017**, *3*, 10. [CrossRef]
3. Park, J.H.; Lee, B.; Moon, Y.H.; Kim, G.; Kwon, L.N. Relation of R&D expense to turnover and number of listed companies in all industrial fields. *J. Open Innov. Technol. Mark. Complex.* **2018**, *4*, 9.
4. Park, T.; Rhee, J. Antecedents of knowledge competency and performance in born globals: The moderating effects of absorptive capacity. *Manag. Decis.* **2012**, *50*, 1361–1381. [CrossRef]
5. Yoon, J.; Kim, K.; Dedahanov, A.T. The Role of International Entrepreneurial Orientation in Successful Internationalization from the Network Capability Perspective. *Sustainability* **2018**, *10*, 1709. [CrossRef]
6. Waluszewski, A. Hoping for network effects or fearing network effects. *IMP J.* **2006**, *1*, 71–84.
7. Wang, M.C.; Fang, S.C. The moderating effect of environmental uncertainty on the relationship between network structures and the innovative performance of a new venture. *J. Bus. Ind. Mark.* **2012**, *27*, 311–323. [CrossRef]
8. Wang, M.C.; Chen, M.H. The more, the better? The impact of closure collaboration network and network structures on technology-based new ventures' performance. *R&D Manag.* **2016**, *46*, 174–192.
9. John, W. Modeling the relationship between networking and firm performance. *J. Bus. Ventur.* **2007**, *22*, 852–874.
10. Cohen, W.M.; Levinthal, D.A. Absorptive Capacity: A New Perspective on Learning and Innovation. *Adm. Sci. Q.* **1990**, *35*, 128. [CrossRef]
11. He, X.; Wei, Y. Export market location decision and performance: The role of external networks and absorptive capacity. *Int. Mark. Rev.* **2013**, *30*, 559–590. [CrossRef]
12. Jansen, J.J.; Van Den Bosch, F.A.; Volberda, H.W. Managing potential and realized absorptive capacity: How do organizational antecedents matter? *Acad. Manag. J.* **2005**, *48*, 999–1015. [CrossRef]
13. Lane, P.J.; Koka, B.R.; Pathak, S. The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Acad. Manag. Rev.* **2006**, *31*, 833–863. [CrossRef]
14. Liu, X.; Wang, J.; Ji, D. Network characteristics, absorptive capacity and technological innovation performance. *Int. J. Technol. Policy Manag.* **2011**, *11*, 97–116. [CrossRef]
15. Roberts, N.; Galluch, P.S.; Dinger, M.; Grover, V. Absorptive capacity and information systems research: Review, synthesis, and directions for future research. *MIS Q.* **2012**, *36*, 625–648.
16. Herath, H.M.; Mahmood, R. Strategic orientations and SME performance: Moderating effect of absorptive capacity of the firm. *Asian Soc. Sci.* **2014**, *10*, 95.
17. Nahapiet, J.; Ghoshal, S. Social capital, intellectual captial, and the organizaitonal advantage. *Acad. Manag. Rev.* **1998**, *23*, 242–266. [CrossRef]
18. Wu, L.Y.; Wang, C.J.; Chen, C.P.; Pan, L.Y. Internal resources, external network, and competitiveness during the growth stage: A study of Taiwanese high-tech ventures. *Enterp. Theory Pract.* **2008**, *32*, 529–549. [CrossRef]
19. Franco, M.; Haase, H.; Pereira, A. Empirical study about the role of social networks in SME performance. *J. Syst. Inf. Technol.* **2016**, *18*, 383–403. [CrossRef]
20. Gnyawali, D.R.; Madhavan, R. Cooperative networks and competitive dynamics: A structural embeddedness perspective. *Acad. Manag. Rev.* **2001**, *26*, 431–445. [CrossRef]
21. Aldrich, H.; Zimmer, C. Entrepreneurship through social networks. In *The Art and Science of Entrepreneurship*; Ballinger: Cambridge, MA, USA, 2006; pp. 3–23.
22. Lee, C.; Lee, K.; Pennings, J.M. Internal capabilities, external networks, and performance: A study on technology-based ventures. *Strat. Manag. J.* **2001**, *22*, 615–640. [CrossRef]
23. Naudé, P.; Zaefarian, G.Z.; Tavani, N.; Neghabi, S.; Zaefarian, R. The influence of network effects on SME performance. *Ind. Mark. Manag.* **2014**, *43*, 630–641. [CrossRef]
24. Wang, H.; Zhao, J.; Li, Y.; Li, C. Network centrality, organizational innovation, and performance: A meta-analysis. *Can. J. Adm. Sci./Rev. Can. Sci. l'Adm.* **2015**, *32*, 146–159. [CrossRef]
25. Coleman, J.S. *Foundations of Social Theory*; Harvard University Press: Cambridge, MA, USA, 1990.

26. Tseng, C.Y.; Lin, S.C.; Pai, D.C.; Tung, C.W. The relationship between innovation network and innovation capability: A social network perspective. *Technol. Anal. Strateg. Manag.* **2016**, *28*, 1029–1040. [CrossRef]
27. Lee, G.K. The significance of network resources in the race to enter emerging product markets: The convergence of telephony communications and computer networking, 1989–2001. *Strateg. Manag. J.* **2007**, *28*, 17–37. [CrossRef]
28. Freeman, L.C. Centrality in social networks: Comceptual classification. *Soc. Netw.* **1979**, *1*, 215–239. [CrossRef]
29. Ibarra, H. Network centrality, power, and innovation involvement: Determinants of technical and administrative roles. *Acad. Manag. J.* **1993**, *36*, 471–501.
30. Burt, R.S. *Structural Holes: The Social Structure of Competition Cambridge*; Harvard University Press: Cambridge, MA, USA, 1992.
31. Tsai, W. Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Acad. Manag. J.* **2001**, *44*, 996–1004.
32. Zahra, S.A.; George, G. Absorptive capacity: A review, reconceptualization, and extension. *Acad. Manag. Rev.* **2002**, *27*, 185–203. [CrossRef]
33. Minbaeva, D.; Pedersen, T.; Bjorkman, I.; Fey, C.F.; Park, H.J. MNC knowledge transfer, subsidiary absorptive capacity, and HRM. *J. Int. Bus. Stud.* **2003**, *34*, 586–599. [CrossRef]
34. Kim, L. Crisis construction and organizational learning: Capability building in catching-up at Hyundai Motor. *Organ. Sci.* **1998**, *9*, 506–521. [CrossRef]
35. Lane, P.J.; Lubatkin, M. Rlative Absorptive Capacity and Interorganizational Learning. *Strateg. Manag. J.* **1998**, *19*, 461–477. [CrossRef]
36. Todorova, G.; Durisin, B. Absorptive capacity: Valuing a reconceptualization. *Acad. Manag. Rev.* **2007**, *32*, 774–786. [CrossRef]
37. Flor, M.L.; Cooper, S.Y.; Oltra, M.J. External knowledge search, absorptive capacity and radical innovation in high-technology firms. *Eur. Manag. J.* **2018**, *36*, 183–194. [CrossRef]
38. Nieto, M.; Quevedo, P. Absorptive capacity, technological opportunity, knowledge spillovers, and innovative effort. *Technovation* **2005**, *25*, 1141–1157. [CrossRef]
39. Schwab, D.P. *Research Methods for Organizational Studies*, 2nd ed.; Erlbaum: Mahwah, NJ, USA, 2005.
40. Antia, K.D.; Frazier, G.L. The severity of Contract Enforcement in Interfirm Channel Relationships. *J. Mark.* **2001**, *65*, 67–81. [CrossRef]
41. Yun, J.J.; Zhao, X.; Hahm, S.D. Harnessing the value of open innovation: Change in the moderating role of absorptive capability. *Knowl. Manag. Res. Prac.* **2018**, 1–10. [CrossRef]
42. Liao, S.H.; Fei, W.C.; Chen, C.C. Knowledge sharing, absorptive capacity, and innovation capability: An empirical study of Taiwan's knowledge-intensive industries. *J. Inf. Sci.* **2007**, *33*, 340–359. [CrossRef]
43. Dess, G.G.; Robinson, R.B., Jr. Measuring organizational performance in the absence of objective measures: The case of the privately-held firm and conglomerate business unit. *Strateg. Manag. J.* **1984**, *5*, 265–273. [CrossRef]
44. Venkatraman, N.; Ramanujam, V. Measurement of business performance in strategy research: A comparison of approaches. *Acad. Manag. Rev.* **1986**, *11*, 801–814. [CrossRef]
45. Vij, S.; Bedi, H.S. Are subjective business performance measures justified? *Int. J. Prod. Perform. Manag.* **2016**, *65*, 603–621. [CrossRef]
46. Yang, H.B.; Park, J.B. *Facilitating a Convergence between Small-and-Medium Sized Enterprises in Different Business Sectors: Focusing on a Technological Aspect*; Korea Institute for Industrial Economics & Trade: Sejong, Korea, 2011.
47. Podsakoff, P.M.; Organ, D.W. Self-reports in organizational research: Problems and prospects. *J. Manag.* **1986**, *12*, 531–544. [CrossRef]
48. Anderson, J.C.; Gerbing, D.W. Structural equation modeling in practice: A review and recommended two-step approach. *Psychol. Bull.* **1988**, *103*, 411. [CrossRef]
49. Hair, J.F.; Anderson, R.E.; Tatham, R.L.; Black, W.C. *Multivariate Data Analysis: With Readings*, 4th ed.; Prentice Hall: Englewood Cliffs, NJ, USA, 1998.
50. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]
51. Nunnally, J.C. *Psychometric Theory*, 2nd ed.; McGraw-Hill: New York, NY, USA, 1978.

52. Aiken, L.S.; West, S.G. *Multiple Regression: Testing and Interpreting Interactions*; Sage Publications: Newbury Park, CA, USA, 1991.
53. Cha, H.W. A Study on the relationship between Network Structure of Corporate Communication and Corporate Reputation: Communication Network Analysis. *Korean J. Commun. Inf.* **2012**, *26*, 75–103.
54. Kim, Y.C.; Kwahk, K.Y. The effects of Alliance network characteristics on Firm performance in the golf ressorts industry Korea: A social network perspective. *J. Bus. Res.* **2011**, *26*, 23–50.
55. Kim, Y.C.; Lee, S.U.; Kang, J.A. Alliance Network Structure and Partner Firm Characteristics in Successful Knowledge Transfers. *Yonsei Bus. Rev.* **2016**, *53*, 303–341.
56. Lee, J.H.; Cho, S.M. Effects of Interorganizational Network Characteristics of social Enterprises on Organizational Performance: Forcusing on Network Centrality. *J. Korean Soc. Welf. Adm.* **2015**, *17*, 89–125.
57. Lee, J.C.; Park, B.J. The Effect of the Network Structure Changes and Network Characteristics in the High-Tech Industries on Firm Inonovation. *J. Strateg. Manag.* **2016**, *19*, 95–118.
58. Jo, I.H. A social Network Analysis Approach to the Effects of Diversity-Performance in R&D Team in Korea. *J. Corp. Educ. Talent Res.* **2010**, *12*, 25.
59. Lee, K.H. The effects of neetwork characteristics on project team performance: A social network inertia perspective. *Korean J. Manag.* **2016**, *24*, 9–32.
60. Yang, D.M.; Shim, D.S. The Effects of Leadership Network Characteristic in University Student Project Teams on Team Commitment and Team Performance: Team-Level Analysis. *Korean Corp. Manag. Rev.* **2016**, *23*, 175–194.
61. Adler, P.S.; Kwon, S.W. Social capital: Prospects for a new concept. *Acad. Manag. Rev.* **2002**, *27*, 17–40. [CrossRef]
62. Gilsing, V.; Nooteboom, B.; Vanhaverbeke, W.; Duysters, G.; van den Oord, A. Network embeddedness and the exploration of novel technologies: Technological distance, betweenness centrality and density. *Res. Policy* **2008**, *37*, 1717–1731. [CrossRef]
63. Gulati, R.; Nohria, N.; Zaheer, A. Strategic networks. *Strateg. Manag. J.* **2000**, *21*, 203–215. [CrossRef]
64. Koka, B.R.; Prescott, J.E. Designing alliance networks: The influence of network position, environmental change, and strategy on firm performance. *Strateg. Manag. J.* **2008**, *29*, 639–661. [CrossRef]
65. Swaminathan, V.; Moorman, C. Marketing alliances, firm networks, and firm value creation. *J. Mark.* **2009**, *73*, 52–69. [CrossRef]
66. Hansen, M.T.; Podolny, J.M.; Pfeffer, J. *So Many Ties, so Little Time: A Task Contingency Perspective on Corporate Social Capital in Organizations, Social Capital of Organization*; Emerald Group Publishing Limited: Bingley, UK, 2001; pp. 21–57.
67. Deci, E.; Ryan, R.M. *Intrinsic Motivation and Self-Determination in Human Behavior*; Plenum Press: New York, NY, USA, 1985.
68. Reinholt, M.I.A.; Pedersen, T.; Foss, N.J. Why a central network position isn't enough: The role of motivation and ability for knowledge sharing in employee networks. *Acad. Manag. J.* **2011**, *54*, 1277–1297. [CrossRef]
69. Klein, K.J.; Lim, B.C.; Saltz, J.L.; Mayer, D.M. How do they get there? An examination of the antecedents of centrality in team networks. *Acad. Manag. J.* **2004**, *47*, 952–963.
70. Liu, Y.; Ipe, M. How do they become nodes? Revisiting team member network centrality. *J. Psychol.* **2010**, *144*, 243–258. [CrossRef] [PubMed]
71. Wichmann, B.K.; Carter, C.R.; Kaufmann, L. How to become central in an informal social network: An investigation of the antecedents to network centrality in an environmental SCM initiative. *J. Bus. Logist.* **2015**, *36*, 102–119. [CrossRef]
72. Lichtenthaler, U. Absorptive Capacity, Environmental Turbulence, and the Complementarity of Organizational Learning Processes. *Acad. Manag. J.* **2009**, *52*, 822–846. [CrossRef]
73. Gibbons, D.E. Network structure and innovation ambiguity effects on diffusion in dynamic organizational fields. *Acad. Manag. J.* **2004**, *47*, 938–951.

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