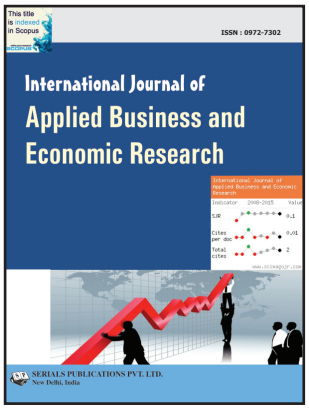

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A Study on the Intention of Business Collaboration Promotion by the Significance Recognition and Performance on Joint R&D

Focusing on Convergence Technology Development Business on SME

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ABSTRACT

This paper aims to identify the intention of business collaboration promotion by the significance recognition and performance on Joint research and development.

A Survey was carried out targeting SMEs from September 2015 to October 2015. We collected 225 cases of self-administrated survey via various methods including visiting, fax and e-mail. Finally, we selected 156 cases after removing those with significant missing or insincere responses and utilized SPSS22.0 and AMOS 22.0 to conduct exploratory factor analysis and measurement model analysis.

This research was conducted to identity the intention of business collaboration promotion by the significance recognition and performance on Joint R&D. After fully understanding the concept and dimension of each variable from past studies, we utilized the results of validity and reliability testing of all measurements in our final analysis. According to structural equation modeling analysis, we came up with following conclusion on our hypothesis. First, Joint R&D was found to have a positive effect on R&D significance recognition. Second, Joint R&D was found to have a positive effect on R&D performance. Third, R&D significance recognition was found to have a positive effect on R&D performance. Fourth, R&D significance recognition was found to have a positive effect on business collaboration promotion. Finally, R&D performance was found to have a positive effect on business collaboration promotion. These results emphasize an importance of R&D Performance on Joint R&D for business collaboration promotion and expected a reference of a practical aspect by an empirical analysis about a performance network, a performance technology and a performance business during R&D performance.

***Keywords*:** Joint R&D, R&D business, R&D significance recognition, R&D performance, Business collaboration.

1. INTRODUCTION

The small medium-sized enterprises (SME) has been done an important role for growth and development in the national economy and supported various R&D policy and program for SMEs. However, the outcome and effects of R&D has been resulted in an unsatisfactory condition. This paper aims to identify the intention of business collaboration promotion by the significance recognition and performance on Joint R&D. It performed in an empirical analysis for small and medium-sized businesses. The technology development business of small and medium-sized businesses has been progressing various titles including start-up growth technology development, convergence technology development, Technology innovation development, Market creative technology development, R&D planning capability, common used support of research equipment, technology development for product-process improvement, collaboration technology development for industry-academy-research and commercialization technology development. It needs an improvement for technology development business as the fair and objective evaluation and Joint research. This paper has been progressing for the implications deduction that government supported technology development business lead to business collaboration and Joint R&D.

2. LITERATURE REVIEW

2.1. Joint R&D, R&D Business and R&D Significance Recognition

R&D is an activity in connection with corporate or governmental innovation. R&D is a component of innovation and is situated at the front, end of the innovation life cycle. Innovation builds on R&D and includes commercialization phases. Seung-wook Choi defined the effect of government R&D subsidies program participation factor for SME's R&D Performances (Seung-wook Choi, 2014). Ju-hwan Oh argued the performance comparison between private and government-supported consulting and the determining performance factors on government-supported consulting for SMEs (Ju-hwan Oh, 2016). In-Cheol Kang argued the performance determinants of joint technology development - focusing on the moderating effects of the capability to absorb knowledge (In-Cheol Kang, 2015).

2.2. R&D Performance

Young-soo Rhu defined the relation analysis between national R&D business evaluation and R&D performance (Young-soo Rhu, 2009). Yeol Shin argued the performance analysis on SME supporting policies, focusing on the convergence technology development supported business and the performance analysis on SME supporting policies, focusing on the Industry-University-Research Institution cooperated technology development supported business (Yeol Shin, 2016). Seung-Il Choi argued the effect business performance of convergence capability on corporate (Seung-Il Choi, 2015). Ho Kim argued the critical success factors for new product development in korean SMEs (Ho Kim, 2015). In-Kon Koh defined as the empirical study on business planning of korean SMEs: focusing on new product development performance and firm size (In-Kon Koh, 2007).

2.3. Collaboration Business

Collaboration is explained as common work and teamwork of an industry and company. Various collaboration can be done as innovate designs, engineering, and manufacturing, collaborate across teams and create compelling presentations. Mi-yeon Park argued as the national R&D planning policies through Industry-University- Research Institution collaboration network analysis (Mi-yeon Park, 2016). Young-jae

Choi defined the development of information system and collaboration model via engineering collaboration (Young-jae Choi, 2007). Jin-Hwan Oh argued as joint research collaboration factors and performance - with a focus on mediation effects of collaborative efforts (Jin-Hwan Oh, 2015). Kyong-Hwan Kim defined as the impact of the Corporate performance on the Cross-divisional collaborations in the fuzzy front end). The effects of R&D's internal integration and cross-functional collaboration on new product innovativeness and development performance argued the evidence from korean innobiz enterprises (Kyong-Hwan Kim, 2014; Dae-sik Hur, 2015).

3. PROPOSED WORK

3.1. Research Model

In order to identify the intention of business collaboration promotion by the significance recognition and performance on Joint R&D, we suggested a research model as demonstrated in Figure 37.1.

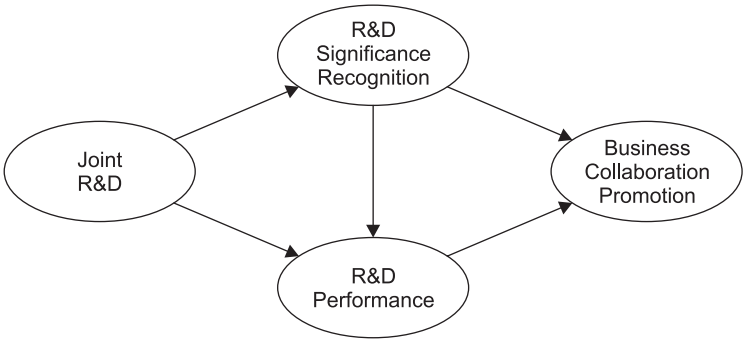

Figure 37.1: Research Model

3.2. Research Hypotheses

3.2.1. Relationship between Joint R&D and R&D Significance Recognition

Joint R&D perceived partner's characteristics with R&D capability (In-Cheol Kang, 2015).

Based on the past studies mentioned above, following hypothesis is formulated to identify the effects of Joint R&D on R&D significance recognition.

H1: Joint R&D will have positive effect on R&D significance recognition.

3.2.2. Relationship between Joint R&D and R&D Performance

The relationship between Domestic R&D business evaluation and R&D performance analyzed (Young-soo Rhu, 2009), R&D performance analysis of SME supported policies for convergence technology development-supported business and for the Industry-University-Research Institution cooperated technology development-supported business (Yeol Shin, 2016) and the establishment of business planning on new product development performance for korean SMEs (In-Kon Koh, 2007).

Based on the past studies mentioned above, following hypothesis is formulated to identify the effects of Joint R&D on R&D performance.

H2: Joint R&D will have positive effect on R&D performance.

3.2.3. Relationship between R&D Significance Recognition and R&D Performance

Government R&D subsidies program participation factor had an effect on SMEs R&D performances (Seung-wook Choi, 2014). Key success factor on korean SMEs argued for new product development performance (Ho Kim, 2015).

Based on the past studies mentioned above, following hypothesis is formulated to identify the effects of R&D significance recognition on R&D performance

H3: R&D significance recognition will have positive effect on R&D performance.

3.2.4. Relationship between R&D Significance Recognition and Biz Collaboration Promotion

The national R&D planning policies through Industry-University-Research Institution collaboration network analysis defined (Mi-yeon Park, 2016). R&D's internal integration and cross-functional collaboration had an effect on new product innovativeness and development performance (Dae-sik Hur, 2015)

Based on the past studies mentioned above, following hypothesis is formulated to identify the effects of R&D significance recognition on business collaboration promotion.

H4: R&D significance recognition will have positive effect on business collaboration promotion.

3.2.5. Relationship between R&D Performance and Business Collaboration Promotion

Joint research collaboration factors had an effect on performance and the corporate performance had impacted on the cross-divisional collaborations (Jin-Hwan Oh and Kyong-Hwan Kim, 2014).

Based on the past studies mentioned above, following hypothesis is formulated to identify the effects of R&D performance on business collaboration promotion.

H5: R&D performance will have positive effect on business collaboration promotion.

3.3. Research Methods

3.3.1. Population and Sample Characteristics

In order to identify mutual relationship among Joint R&D, R&D significance recognition, R&D performance and business collaboration promotion for convergence technology development business on SME, we selected domestic producers of multifunction office products as our subjects of study. Additionally, from September 2015 to October 2015, we collected 225 cases of self-administrated survey via various methods including visiting, fax, email and etc. Finally, we selected 156 cases after removing those with significant missing or insincere responses and utilized SPSS22.0 and AMOS 22.0 to conduct exploratory factor analysis and measurement model analysis.

3.3.2. Measurement and Operational Definition of Variables

By referring to what they suggested in their studies (Seung-wook Choi, 2014; Ju-hwan Oh, 2016; In-Cheol Kang, 2015), we included four questions about technology exchange, personal exchange, equipment exchange and the other in Joint R&D. By referring to what they suggested in their studies (Jin-hwan Oh, 2015; Kyong-Hwan Kim, 2014), we included eleven questions about researcher status, R&D investment costs, R&D organization, R&D manpower and others in R&D significance recognition. Then, by referring

to what they suggested in their studies (Young-soo Rhu, 2009; Yeol Shin, 2016; Seung-Il Choi, 2015; Ho Kim, 2015; In-Kon Koh, 2007), we included three questions about Joint R&D network, technical performance creation and business performance creation in R&D performance. Based on what they included two questions about the intention of collaboration promotion and accessibility of technical cooperation company in business collaboration promotion (Mi-yeon Park, 2016; Young-jae Choi, 2007; Jin-hwan Oh, 2015; Kyong-Hwan Kim, 2014; Dae-sik Hur, 2015). Survey comprises 20 questions. Survey score ranged from 1 point indicating 'very dissatisfied' to 5 points indicating 'very satisfied'. Table 37.1 summarizes the composition of survey.

Table 37.1
Composition of survey

Measurement variables	*No. of questions*	*Preceding studies*
1. Joint R&D	4	Seung-wook Choi [3], Ju-hwan Oh [4], In-Cheol Kang [5]
2. R&D significance recognition	11	Jin-hwan Oh [4], Kyong-Hwan Kim [15]
3. R&D performance	3	Young-soo Rhu [6], Yeol Shin [7][8], Seung-Il Choi [9], Ho Kim [10], In-Kon Koh [11]
4. Business collaboration promotion	2	Mi-yeon Park [12], Young-jae Choi [13], Jin-hwan Oh [14], Kyong-Hwan Kim [15], Dae-sik Hur [16]
Total	20	–

3.4. Empirical Analysis

3.4.1. Data Collection

Table 37.2 lists the characteristics of samples. The majority of the companies' locations was Seoul and Gyunggi-do by 54.5% and 62.8% of the companies had less than 20 employees. 71.8% of the companies experienced R&D business frequency of less than once per 3 months and 24.4% of the companies had less than 3 years of firm age.

Table 37.2
The Characteristics of Samples

	Categories	*Frequencies*	*%*
Business Area	Seoul ·Gyeonggi	85	54.5
	Chungcheong Province	35	22.4
	Gyeongsang Province	24	15.4
	Jeolla Province	12	7.7
	Total	156	100
No. of Employees	Less than 20	98	62.8
	20~299	43	27.6
	More than 300	15	9.6
	Total	156	100
R&D Business Frequencies	Less than 1 per 3 months	112	71.8
	1~3	34	21.8
	More than 4	10	6.4
	Total	156	100

	Categories	*Frequencies*	*%*
Firm Age	Less than 3 years	38	24.4
	Less than 5 years	45	28.8
	Less than 10 years	35	22.4
	Less than 20 years	26	16.7
	More than 20 years	12	7.7
	Total	156	100

3.4.2. Validity and Reliability Analysis

We performed exploratory factor analysis for testing the validity, principal component analysis for variable selection and orthogonal rotation for simplification process. Our analysis is based on those components with eigen values greater than 1.0 and loadings greater than 0.40. We initially chose Joint R&D, R&D significance recognition, R&D performance and business collaboration promotion as the key variables based on previous studies. Then, we decided to use all four variables in our analysis based on our reliability testing results for each variable where all four variables were identified to be reliable with Cronbach'α values falling within 0.788 and 0.875 (defining Cronbach'α > 0.8 as reliable and Cronbach'α > 0.7 as satisfiable) as shown in Table 37.3.

Table 37.3
Exploratory Factor Analysis and Reliability Test

MV	*JR*	*RP*	*SR*	*Cα*
E9	.125			.788
E8	.198			
E7	.196			
E3		.363		.833
E2		.381		
E1		.088		
E6			.017	.875
E5			.233	
E4			.150	
E11			.217	
OV	4.794	1.777	0.910	
V%	47.939	17.773	9.101	
AV%	47.939	65.712	74.814	

Ref. 1) PQ : Product Quality
Ref. 2) PQ : Service Quality
Ref. 3) BI : Brand Image
Ref. 4) Rec : Recommended
Ref. 5) Rep : Repurchase
Ref. 6) Cα : Cronbach' α
Ref. 7) OV : Original Value
Ref. 8) V% : Variance %
Ref. 9) AV% : Accumulation Variance %

3.4.3. Measurement Model Analysis

We performed measurement model analysis to test the goodness of fit for the selected measurement model and, validity and reliability of measurement metrics. We used CMIN/DF (<3.0, GFI·AGFI·CFI·NFI·TLI (>0.9), RMR·RMSEA (<0.05) to assess the fitness of data. As in Table 37.4, the values were shown to be standardized regression weights (SRW) value > 0.7, CR value > 0.7 and AVE value > 0.5. Our analysis showed *t* values greater than 1.965, and SMC values was 0.4 or higher, which signifies that our predictors explain most variance in response variables. According to CMIN/DF was 1.114, GFI .911, AGFI .854, CFI .989, NFI .902, IFI .989, TLI .984, RMR .040, and RMSEA .039.

Measurement model is proved to be appropriate as shown in Table 37.4.

Table 37.4
Goodness of Fit of Measurement Model

Measure		*SRW*	*SE*	*t-value*	*p*	*CR*	*AVE*
JR	E7	.718	–	–	–	.846	.647
	E8	.798	.147	5.961	***		
	E9	.757	.126	5.750	***		
RP	E1	.654	–	–	–	.906	.766
	E2	.913	.202	6.250	***		
	E3	.836	.201	6.051	***		
SR	E4	.860	–	–	–	.923	.750
	E5	.835	.108	8.481	***		
	E6	.711	.132	6.820	***		
	E11	.797	.123	7.983	***		
Goodness of fit – Measurement model		<Initial/Final model> Chi-Square = 44.558, df = 40, p = .286, CMIN/DF = 1.114 GFI = .911, AGF = .854, CFI = .989, NFI = .902, IFI = .989 TLI = .984, RMR = .040, RMSEA = .039					

Ref. 1) SRW : Standardized Regression Weights
Ref. 2) SE : Standard Error
Ref. 3) CR : Critical Ratio
Ref. 4) AVE : Average Variance Extracted

After confirming convergent validity of the measurement model, we performed distinction validity analysis. Table 37.5 shows the results of distinction validity analysis based on the assumption that AVE value being greater than the square of correlation coefficient confirms distinction validity (Fornell and Larcker, 1981).

Table 37.5
Distinction validity analysis

	JR	*SR*	*RP*
JR	.647		
SR	.478	.766	
RP	.708	.099	.750

Ref.) Bolded numbers are AVE values

Distinction validity was confirmed as the AVE values of each latent variable were greater than the coefficient of determination of the relationship between brand image and customer buying behavior, which has the highest correlation.

3.4.4. Research Model Analysis

To evaluate our research model, we tested its goodness of fit as a structural equation model. Table 37.6 shows how all the Goodness of Fit measures for the research model satisfy their corresponding reference values.

Table 37.6
Goodness of Fit of Research Model

	Reference Value	*Measured Value*
Chi-Square	–	44.558
df	–	40
P	>.05	.286
CMIN/DF	< 3.0	1.114
GFI	>.90	.911
AGFI	>.80	.854
CFI	>.90	.989
NFI	>.90	.902
IFI	>.90	.989
TLI	>.90	.984
RMR	<.05	.040
RMSEA	<.05	.039

3.4.5. The Results of Hypothesis Testing

As the research model is found to be appropriate, we analyzed path coefficients for detailed hypothesis testing and results are shown in (Figure 37.2). It is showed that Joint R&D had a positive (+) effect on R&D significance recognition (standardized coefficient β = .478, P = .001), Joint R&D had a positive (+) effect on R&D performance (standardized coefficient β = .708, P = 000), and R&D performance had a positive (+) effect on Business collaboration promotion (standardized coefficient β = .589, P = .000).

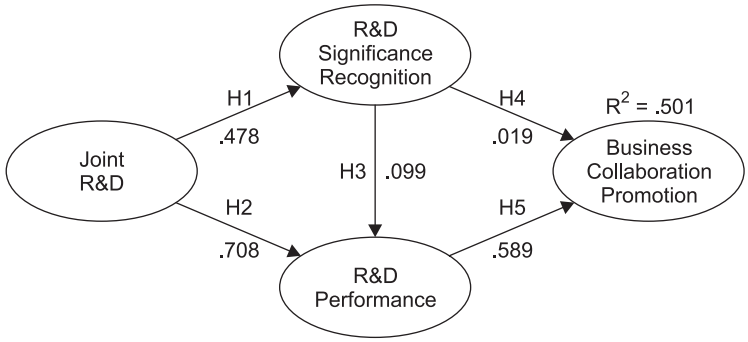

Figure 37.2: The Structural Path

Also, as Table 37.7 shows, the structural path coefficients of research model was found to be statistically significant.

Table 37.7
The Structural Path Coefficients of Research Model

Structure Path	β	*t*	*p*
JR → SR	.478	3.232	**
JR → RP	.708	3.914	***
SR → RP	.099	.807	.419
SR → CB	.019	.163	.871
RP → CB	.589	4.129	***

$^{**}p < .01$, $^{***}p < .001$

Finally, Table 37.8 shows the results of hypothesis testing on the intention of business collaboration promotion by the significance recognition and performance on Joint R&D

Table 37.8
The Results of Hypothesis Testing

Hypothesis	*Hypothesis To Be Tested*	*Result*
H1	Joint R&D will have a positive effect on R&D significance recognition	Accept
H2	Joint R&D will have a positive effect on R&D performance	Accept
H3	R&D significance recognition will have a negative effect on R&D performance	Reject
H4	R&D significance recognition will have a negative effect on Business Collaboration Promotion	Reject
H5	R&D performance will have a positive effect on Business Collaboration Promotion	Accept

4. CONCLUSION

4.1. Results and Suggestions

This research was conducted to identity the intention of business collaboration promotion by the significance recognition and performance on Joint R&D for convergence technology development business on SME. After fully understanding the concept and dimension of each variable from past studies, we utilized the results of validity and reliability testing of all measurements in our final analysis. According to structural equation modeling analysis, we came up with following conclusion on our hypothesis.

First, Joint R&D was found to have positive effect on R&D significance recognition. Second, Joint R&D was found to have a positive effect on R&D performance. Third, R&D significance recognition was found to have a negative effect on R&D performance. Fourth, R&D significance recognition was found to have a negative effect on business collaboration promotion. Fifth, R&D performance was found to have a positive effect on business collaboration promotion. These results suggest that R&D Performance on Joint R&D is a important variable for business collaboration promotion and expected a reference of a practical aspects by an empirical analysis about a performance network, a performance technology and a performance business during R&D performance.

4.2. Limitations and Future Research Directions

This study has following limitations and attempts to suggest directions for future research.

First, the company's segmentation analysis of convergence technology development business for domestic small and medium-sized businesses selected as parent population is desirable by business title of each technology development management agency. Second, the characteristics factor of effect on R&D significance recognition has reflected in characteristics of R&D environment and R&D effects, but it is necessary to reflect the characteristics factor as R&D infra establishment and a public image.

Acknowledgement

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