

- PICMET 2016 Conference -

The Relationship between Open Innovation and Innovation Performance:
Focused on the Firms in South Korea

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ABSTRACT

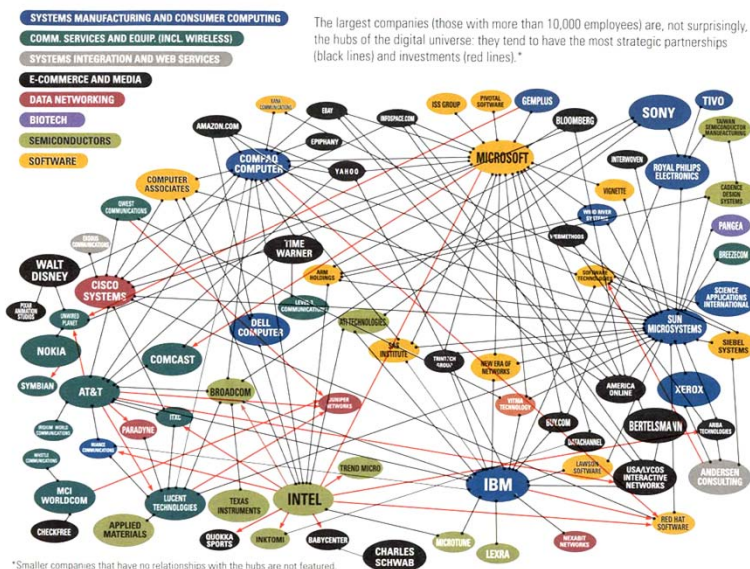
- Recently, because the environment is changing very rapidly and becomes complex, it is difficult for a firm to survive and maintain a sustainable competitive advantage through internal R&D. Accordingly, the importance of open innovation is emphasized, and the ratio of external R&D in various industries has been increasing steadily.
- Therefore, this study analyzed open innovation through Korea Innovation Survey (KIS) data that conducted by Science and Technology Policy Institute (STEP). We confirmed the extent of open innovation of the firms (by separating manufacturing and service) in South Korea, and examined the relationship between open innovation and innovation performance based on the performance of the manufacturing industry in 2013.
- This study suggests that open innovation is not a new activity and open innovation doesn't always influence innovation performance due to the difficulties associated with managing open innovation. The results of this study will be used to establish the strategic direction and support the decision making when firms conduct innovation activities in the future.

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- 3 Hypotheses
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1. Introduction



1. Introduction

- **Recently, open innovation is highlighted an important mechanism used by a firm to internalize the knowledge and capabilities of other firms.**
 - In a variety of industries, the number of R&D collaborations has steadily increased for last decades as a paradigm shift toward open innovation (Chesbrough, 2003; Chesbrough et al., 2006; Hagedoorn, 2002).
 - Significant technological breakthroughs are exogenous to firms, because no single firm can keep abreast of all technological developments through internal R&D (Rothaermel and Hess, 2007).



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1. Introduction

- **In recent decades, firms across industries have increasingly acquired external technologies to complement their internal knowledge (Beamish and Lupton, 2009; Lichtenthaler, 2011; von Hippel, 1988).**
 - Many firms are required to implement open innovation, and the basic premise of open innovation is opening up the innovation process (Huizingh, 2011).
 - Firms that open their boundaries through open innovation can acquire new knowledge, reduce costs, shorten time to market, and achieve innovation (Cruz-Cazares et al., 2013).
 - Accordingly, the boundaries between firms' internal knowledge and external knowledge are gradually blurred (Teece, 1998).

<Open Innovation>

Firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology (Chesbrough, 2003).

- **Although the era of open innovation has begun, we still lack a clear understanding of the mechanisms.**
 - It has been criticized whether firms achieved internal R&D only in the past, that we can see as open innovation when firms used a certain extent of external R&D, and so forth.
 - Therefore, this study analyzed open innovation through Korea Innovation Survey (KIS) data that conducted by Science and Technology Policy Institute (STEPI).

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2. Backgrounds

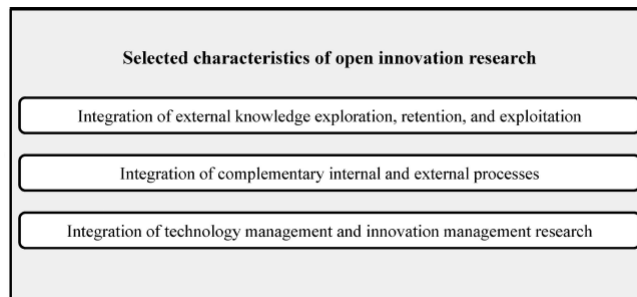
- **Due to the complexity and dynamism of technological developments, it is challenging for firms to generate an appropriate knowledge base about the technological trends (Lichtenthaler, 2003).**
 - Traditionally, most firms pursued relatively “closed” innovation strategies, which developed new technologies internally.
 - The innovating firm’s ways of accessing knowledge from external channels were termed ‘open search strategies’ (Laursen and Salter, 2006).
 - Accordingly, open innovation has become one of the hottest topics in innovation management.
- **The most interesting issue is what aspects of open innovation activities make effective.**
 - Prior studies explain that open innovation activities positively influence innovation outcomes in large firms (Parida et al., 2012).
 - Tomlinson (2010) suggests that vertical cooperation has a positive impact on innovative performance.
 - On the other hand, Laursen and Salter (2006) suggest a curve-linear relationship between open innovation and firm performance because too much open innovation hurts firm performance.

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2. Backgrounds

- **Prior Research into Open Innovation (Lichtenthaler, 2011)**
 - First, the open innovation literature advances prior research by explicitly integrating inward and outward knowledge transfer (Chesbrough, 2006).
 - Second, open innovation research points to the simultaneous internal and external organization of critical knowledge-management processes (Chesbrough, 2003).
 - Third, the open innovation framework helps integrate technology management research with innovation management literature (Chesbrough et al., 2006; Tsai and Wang, 2008).

<Illustrative Overview of Open Innovation>



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3. Hypotheses

● External R&D and Innovation Performance

- Recent studies in the innovation and technology management have proposed several potential benefits of opening up the innovation process.
- Most scholars would agree that open innovation activities could be beneficial for SMEs and large firms alike (Lichtenthaler, 2008; Parida et al., 2012).
- Therefore, we also propose that the use of external R&D is important for firms to achieve innovation performance in South Korea.

H1. The use of external R&D will be positively associated with the firm's innovation performance.

● Government Support Program and Innovation Performance

- The acquisition of external information (ex. new knowledge, government support program) is a major challenge and opportunity for firms from outside their boundaries.
- Choi (2015) suggests that internal R&D investment and taking advantage of government support programs are needed in order to achieve technological innovation.
- Therefore, we propose the use of a variety of government support programs is required for innovation performance, as one of open innovation activities.

H2. The use of government support programs will be positively associated with the firm's innovation performance.

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4. Research Method

● Frequency Analysis

- Database : Korea Innovation Survey (KIS) data (conducted by Science and Technology Policy Institute (STEPI))
- Sample
 - * The period 2000~2013 in manufacturing industry (KIS 2002, 2005, 2008, 2010, 2012, 2014)
 - * The period 2011~2013 in service industry (KIS 2014)

● Logistic Regression

- Database : Korea Innovation Survey (KIS) 2014 data
- The unit of analysis : Firm-level (Manufacturing firms that performed product innovation in 2011~2013)
- Measures
 - * Dependent variable : Innovation performance (New product development)
 - * Independent variables
 - ① Use of external R&D
 - ② Use of government support programs
 - * Control variables : Firm type, Firm age, Innovation cost, Employee, Process innovation, Location dummy, Industry dummy

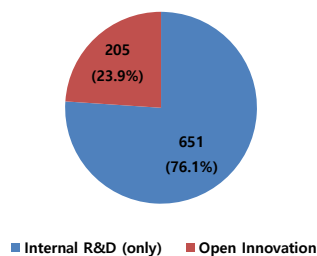
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5. Results

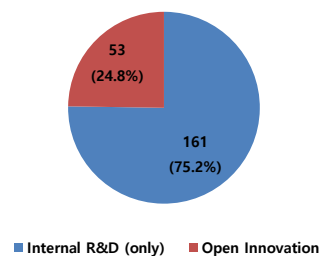
● Frequency Analysis of Open Innovation in South Korea

- Manufacturing industry : 23.9% (205 of 856 population)
- Service industry : 24.8% (53 of 214 population)
- There is no significant difference with regard to open innovation between manufacturing industry and service industry.

<Manufacturing Industry in 2011~2013>



<Service Industry in 2011~2013>



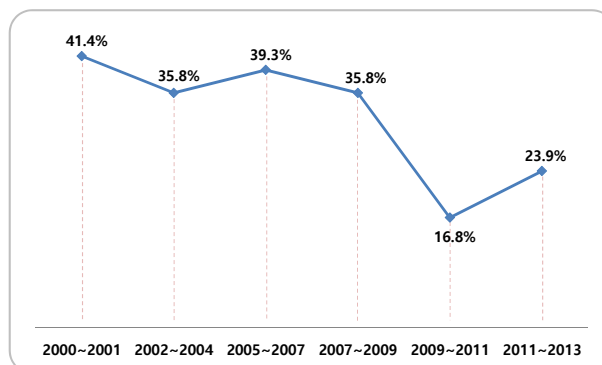
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5. Results

● The Transition of Open Innovation in the Manufacturing Industry

- The ratio of open innovation
 - * 2000~2001 : 41.4%
 - * 2011~2013 : 23.9%
- The ratio of open innovation is not related to the recent paradigm shift in the manufacturing industry.

<The Ratio of Open Innovation in the Manufacturing Industry>



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5. Results

Descriptive Statistics and Correlation Matrix

Variables	Mean	S.D.	1	2	3	4	5	6	7	8
1. New Product Development	0.467	0.499	1							
2. Firm Type	0.134	0.341	0.033	1						
3. Firm Age	19.912	13.509	-0.009	0.367	1					
4. Innovation Cost	5.991	1.962	0.154	0.417	0.328	1				
5. Employee	4.283	1.329	0.038	0.631	0.501	0.635	1			
6. Process Innovation	0.307	0.461	0.123	0.092	0.002	0.064	0.110	1		
7. Use of External R&D	0.230	0.421	0.066	0.067	-0.024	0.095	0.057	0.066	1	
8. Use of Government Support programs	1.683	2.026	0.099	0.051	0.010	0.171	0.102	0.145	0.146	1

Notes: Location and industry dummy variables are included, but not reported here.

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5. Results

Logistic Regression

- Dependent variable : New product development (1/0)

Variables	Model 1	Model 2	Model 3	Model 4
Firm Type	0.291 (0.269)	0.267 (0.303)	0.345 (0.271)	0.293 (0.303)
Firm Age	-0.008 (0.006)	-0.012 [†] (0.007)	-0.009 (0.007)	-0.013 [†] (0.007)
Innovation Cost	0.236 ^{***} (0.049)	0.228 ^{***} (0.057)	0.212 ^{***} (0.050)	0.214 ^{***} (0.058)
Employee	-0.174 [†] (0.086)	-0.210 [†] (0.099)	-0.179 [†] (0.086)	-0.210 [†] (0.099)
Process Innovation	0.520 ^{***} (0.154)	0.518 ^{***} (0.179)	0.474 ^{***} (0.155)	0.486 ^{***} (0.180)
Use of External R&D		0.269 (0.196)		0.233 (0.197)
Use of Government Support Programs			0.132 ^{***} (0.037)	0.075 [†] (0.042)
(Constant)	-0.870 [†] (0.408)	-0.171 (0.460)	-0.745 [†] (0.412)	-0.122 (0.461)
N	1143	785	1143	785
Log likelihood	-648.02087	-485.89263	-641.73042	-484.29774
LR Chi-square	143.30 ^{***}	113.64 ^{***}	155.88 ^{***}	116.83 ^{***}
Pseudo R ²	0.0996	0.1047	0.1083	0.1076

Notes: Standard errors are in parentheses. Location and industry dummy variables are included, but not reported here.
[†] p<0.1, * p<0.05, ** p<0.01, *** p<0.001

H1 : not supported

H2 : supported

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5. Results

● Explanations of the Results

- When changing the number of patent application as a dependent variable (negative binomial regression), the results are similar.
- The results of this study suggest that open innovation doesn't always influence innovation performance in South Korea.
- Especially, unlike only acquiring information (use of government support programs), there may be difficulties in the inter-firm relationship (use of external R&D).

● Limitations and Future Research

- Despite the importance of open innovation, many firms experience severe challenges in actively managing the process of open innovation between firms (Lichtenthaler, 2011; van de Vrande et al., 2009).
- Therefore, future research is needed to consider additional variables in relation to specializing in South Korea and managing open innovation activities between firms.

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6. Conclusion

- 1 The concept of open innovation has recently gained widespread attention, and then many firms are required to conduct open innovation.
- 2 Through Korea Innovation Survey (KIS) data, we identified that open innovation is not a new activity in the manufacturing industry.
- 3 In South Korea, the use of external R&D doesn't influence innovation performance in the inter-firm relationship.
- 4 Future research is needed to consider additional variables because there are major inter-firm differences in how open innovation is successfully managed.

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