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세계선도 중소기업의 혁신 성공요인 분석

Analysis of Success Factors for Innovation of Global Leading SMEs

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목 차

국 문 요 약

중소기업의 성장은 국가혁신체제(National Innovation System: NIS)에서 핵심적인 요소로서 그 중요성이 지속적으로 강조되고 있다. 최근, 작지만 강한 기업인 히든챔피언에 대한 관심이 증대되고, 이에 대한 성공모델을 제시함으로써 중소기업의 성공을 도모하려는 연구들이 확산되고 있다. 그러나 히든챔피언에 대한 정성적인 연구는 많은 반면, 정량적으로 분석한 연구는 미흡하기 때문에, 본 연구에서는 그와 유사한 세계선도 중소기업을 선정하여 기술혁신활동조사 자료를 통해 정량적인 방법으로 다른 유형의 중소기업과의 차이점을 분석하고, 혁신 성공요인을 도출하고자 한다. 이를 위해 첫째, 선행연구들을 통해 세계선도 중소기업의 혁신 성공요인 변수를 도출하고, 둘째, t검정, 카이스퀘어검정, 그리고 로지스틱회귀분석을 통해 정량적인 성공요인을 도출한다. 결과적으로, 중소기업은 정부기관과 박람회 같은 외부정보를 활용하여 시장추세와 비즈니스 기회를 파악하고, 정부에서는 중소기업 지원을 활발히 하여 세계선도 중소기업을 육성할 수 있을 것이다.

핵심어 : 세계선도 중소기업, 기술혁신, 성공 요인, 기술혁신조사

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ABSTRACT

For many small and medium-sized enterprises (SMEs), innovation activities to lead a market with technology development and a globalization strategy tend to be a haphazard process due to a lack of capabilities. Thus, this paper aims to explore success factors of the global leading SMEs in Korea that are not only the first mover through technology innovation but also outstanding in export. The analysis utilizes data from Korean Innovation Survey (KIS) and statistical analyses such as t-test and chi-square are performed to compare global leading SMEs and normal SMEs, concentrating on various factors such as information sources, collaboration and non-technology innovation activities. The results indicate that critical success factors involve information from outside companies (information from conferences and government institutes) and government supports through logistic regression analysis. This research suggests a strategic direction for policy makers to promote innovation and growth in SMEs.

Key Words : Global leading SMEs, technology innovation, success factors, innovation survey

I. Introduction

Developing countries, such as China and India, show a rapid economic growth rate, and knowledge-based economy has considerably progressed in the global economy. Recently, Korean economy is hanging in the balance in the whole world crisis like the failing real economy and a lack of energy resources after the global financial crisis. While large domestic companies can overcome this terrible situation through globalization, small and medium companies(SMEs) might lose competitiveness due to their traditional business strategy. That means that the Korean economy might fail in the world markets because SMEs account for about 99.8% of all Korean companies, 87% of total employment, and 50.6% of outputs in Korea, playing a critical role in the growth of the domestic economy (Hong, 2005). Moreover, while it forms the nucleus of regional innovation systems as a decisive element of regional economy and industry, large companies normally concentrate on a capital city (Hong, 2004).

In particular, global leading enterprises (GLSMEs) that are first movers in the world marketplace like hidden champions contribute to national economies and are also crucial objects of economic and industrial policies in industrialized economies. This has happened through technology innovation that is the most crucial aspect of corporate growth (Hay & Kamshad,1994; Carden, 2005). SMEs need technological innovation than imitation because SMEs should pursuit potential growth for competitive advantage rather than profitability now (Teece, 1986; Levin et al, 1987). However, for many SMEs, the innovation activity to lead markets with technology development tends to be a haphazard process due to a lack of capabilities or funds. Thus, SMEs in manufacturing industries need to focus on success factors of GLSMEs to draw up a strategic innovation plan.

Many empirical and theoretical studies on the global leading enterprises in general can be found in the literature. Hidden champions, defined by Herman Simon(1996), are small but strong SMEs, and have shown sustained growth by gaining competitive advantages in a niche market. Yoon (2010) examined the effects of corporate strategy, business ethics, and knowledge management on the organizational performances of leading companies in Busan. Kim (2010) analyzed critical factors in the success of

global hidden champions which attain revenues comparable with large companies despite small and medium sizes through case analysis. Besides, Lee (2009) investigated how the collaborations of firms and government affect international SME performances.

Although several researchers investigated the characteristics of global and innovative companies, they have three kinds of limitations. First, although the existing literature proposes a variety of success factors of innovation, little research analyzes whether the innovation of a company is the first to a market or the company as a success factor. Second, while prior research considers a lot of factors as success factors for innovation, it has a limitation to examine detailed characteristic of factors. Third, even though hidden champions are actively studied, they mainly focused on case studies because of ambiguity of criteria of hidden champions.

To overcome these limitations, this paper aims to explore success factors of the global leading SMEs (GLSMEs) as excellent SMEs in innovation to lead global markets in manufacturing industries of Korea through an empirical analysis. For this, first, we identify GLSMEs according to selected criteria in the light of prior research and extract GLSMEs using 'Korea Innovation Survey' data. Second, any differences are analyzed by comparing GLSMEs and other types of SMEs to derive characteristics of GLSMEs. Finally, this research investigates how GLSMEs successfully use technological innovation for continuous growth.

This paper is structured as follows. In Section 2, the literature review behind GLSMEs and success factors for GLSMEs is performed. Section 3 explains methodological aspects of this study for empirical analysis. In Section 4, the results and implications of the statistical analysis are discussed. Section 5 provides the summary and concluding remarks.

II. Theoretical background

1. Global leading company

The form of competitive advantages that a company earns by being the first to enter

a specific market of industry is called different names in the literature: 'first mover company', 'leading company', 'dominant firms', and more. The first-to-market strategy allows a company to acquire a superior brand recognition and customer loyalty, and the company also has more time to perfect its product or service (Investopedia, 2011). IBM is a representative example of a dominant firm or leader in its industry (Varian, 2006). A new product announced by IBM may be recognized as the output of the first-mover by followers. Thus, they contemplate production strategy with given IBM's leadership (Kim, 2010). Leaders in various industries are determined by information advantages, legal factors, and historical, institutional factors (Carlton and Perloff, 2005).

Although various studies define a global leading company, any literature did not define common classification of global leading companies. First, 'Hidden champion', suggested by Herman Simon (1996) refers to a group of SMEs that have low profiles and are highly profitable, and are often a leader in a narrow or niche market sector. Another possible category is the 'born global venture corporation' spotlighted in an internationalization study of technology-intensive venture companies (Min and Kim, 2009). It rapidly grows and gets a high market performance and absorptive capacity, knowledge competence and international experience (Kim & Jung, 2007). In addition, INNO-BIZ companies are SMEs that have technological competitiveness, and regarded as a key company for future growth of a country through technological innovation to overcome the limitations of large companies-oriented growth by producing core technology. These types of SMEs are selected by criteria based on 'Oslo manual' to get government supports.

2. Success factors for innovation

Previous research studied successful cases of excellent SMEs to investigate methods of their success. Many researchers and field managers realize that innovation of technology is important to continuous growth of a company. However, since SMEs have a lack of capability and funding to innovate, they need critical factors for innovation to get quick growth. Thus, there are several studies on success factors for innovation of SMEs.

First, a lot of literature tackle how SMEs succeed in innovation. In prior research, success factors of innovation mainly include support of CEO, culture, communication, collaboration, reward for innovation, and so on (Langrish et al, 1972; Kanter, 1988; Damanpour, 1991; Stewart, 1994). In particular, success factors of technology innovation in SMEs encompass CEO's experience and expertise, organizational structure, external networks, external resources, intellectual property, investment in education, and so on.

Second, the relationship between success factors of innovation and innovation performance is conducted. Existing studies divide innovation success factors into internal factors, external factor, and capabilities of companies. In addition, they often suggest different performances, depending on the ability of companies. Critical factors for innovation performance include firm size, market concentration, internal resource capabilities, R&D intensity, networks, CEO's career and experience.

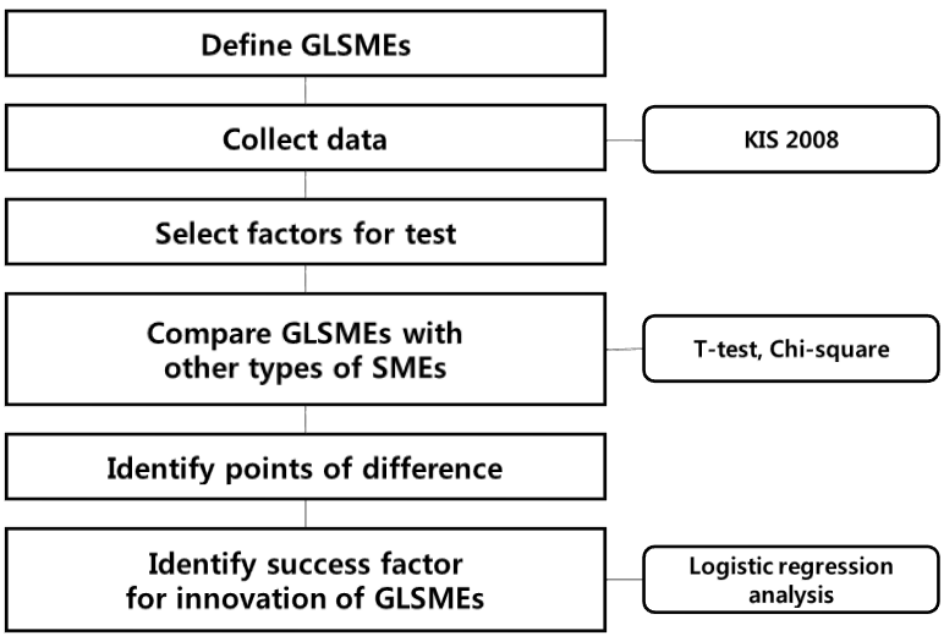
Third, the idiosyncrasies of innovation success factors are analyzed according to industries and companies. The researchers found that sources of technology, input and output of innovation, interaction with research institutes, character of customer, degree of technological diversification, and environment are different by characteristics of industries (Pavitt, 1984; Malerba 2005). From these results, the effects on innovation performance by source of innovation information, cooperation partners, and investment in technology innovation can be dependant on types of SMEs.

III. Research Framework

1. Research process

The research process of this paper consists of four steps. First, the proper criteria to identify GLSMEs are derived. Second, GLSMEs are listed by considering cut-off values about each criterion. Third, several factors to investigate differences between GLSMEs and other types of SMEs are suggested, concentrating on six factors: (1) sources of information about innovation activities; (2) collaboration; (3) non-technology innovation activity; (4) government supports; (5) innovation protection methods; (6)

R&D activity. Fourth, this paper analyzes differences in the factors, using statistical analysis techniques such as t-test and chi-square test between GLSMEs and other types of SMEs: (1) domestic non-leading SMEs (DSMEs); (2) domestic leading SMEs (DLSMEs); (3) global non-leading SMEs (GSMEs). Fifth, success factors are derived by logistic regression analysis. Finally, from interpretation of these results, the main success factors for innovation of GLSMEs are examined, and useful implications for understanding the success factors of GLSMEs will be discussed to support promising GLSMEs in technological and economic perspectives. (Figure 1) depicts the overall procedure of this research.



(Figure 1) Procedure of research

2. Hypothesis

In this paper, three types of success factors are applied to formulate possible hypotheses. Factors that affect innovation results consists of three factors (internal environment, external environment, and ability of companies). Differences between

GLSMEs and other SMEs are analyzed by detailed factors, considering three types of factors.

First, the internal environment can be understood as an internal strategy, and the focus of strategy would differ according to each type of enterprises. In this paper, the internal strategies about innovation are regarded as *a way to protect innovations*, *cooperation partners*, and *non-technical innovation activities*. Ways to increase the level of innovation protection methods consist of patents, trademarks, copyrights, trade secrets, a complex design, and the ownership of marketing and manufacturing assets (Arundel and Kabla, 1998). Competition among companies has intensified, and the international environment has rapidly changed. Thus, companies focus on their core competencies rather than holding all the necessary competencies. Therefore, the links among strategic alliances in a variety of ways have been raised (Choi, 2005). The impact of cooperation on innovation is valid in collaboration with universities, research institution, and businesses to develop and spread new technologies (Cooke, 2002; Freel, 2003). Innovation can be considered a complex phenomenon including technical and non-technology aspects (Anderson and King, 1993). In addition, non-technology innovation activities are commonly classed as organizational innovation and marketing innovation. Organizational innovation changes the structure of an organization, and marketing innovation explores new ways of marketing to potential or existing customers (Slater and Narver, 1995). Recent technological innovation in services is becoming critical and thus, non-technical innovation in manufacturing has received attentions as an important factor (Howells, 2001).

External environment is typically considered supports of government. Since most of the SMEs have limited resources of research, it is difficult to operate an R&D organization autonomously. Accordingly, governments promote installation of such institutes through a variety of policy supports (Park, 2008) and support innovation by R&D cooperation, finance, and education.

Innovation capacity of companies are also different by types of SMEs, and those factors are R&D capabilities and learning ability. SMEs need to collect professional employees to gain and sustain competitive advantage (Bedrock and Watson, 1993). Therefore, the R&D capabilities can vary according to companies, and thus, the ratio

of R&D staff and investment and the number of patents are the factors of R&D capabilities. It is extremely difficult and dangerous to rely on internal R&D to innovate in rapidly changing technology environment. Therefore, even though the use of external technology and information is different across companies, most of companies actively use them (Cohen and Levinthal, 1990). Since sources of knowledge are expected to vary in various types of companies, the learning ability can be regarded as a source of information. Therefore, the first group of hypotheses is derived to examine the characteristics of technological innovation in GLSMEs by considering aforementioned three types of factors.

Hypothesis 1 GLSMEs and other types of SMEs have differences in conducting technological innovation.

1-1 GLSMEs and other types of SMEs have differences in utilizing important source of information.

1-2 GLSMEs and other types of SMEs have differences in a way to protect innovation results.

1-3 GLSMEs and other types of SMEs have differences in using supports of government.

1-4 GLSMEs and other types of SMEs have differences in collaborating with cooperation partners.

1-5 GLSMEs and other types of SMEs have differences in performing non-technology innovation.

1-6 GLSMEs and other types of SMEs have differences in possessing R&D ability.

Besides, success factors of innovation in GLSMEs are analyzed. Internal environment is not used to determine success factors for innovation because the internal strategies can depend on the nature of business and industry. Thus, this study selects innovation capacity and government supports to provide implications on technology policy.

In terms of external environment, effects of government supports are examined. According to recent research on the effectiveness of government supports in the

process of R&D, the higher government financial supports result in a lower percentage of technology commercialization (Svensson, 2007). However, according to the research of Audretsch (2002), the government supports on private enterprise investment in R&D and commercialization efforts was presented to be highly effective.

When it comes to innovation capacity, R&D intensity, a number of patents, and utilization of information are analyzed. First, in the R&D intensity, Dewar and Dutton (1996) asserted that professionals within the organization who have a lot of diversity and depths of knowledge have increased the rate of adopting radical innovation. Investments in innovation have been identified as an important source of competitive advantages for firms. Numerous studies have found that the supports for R&D investment promote performance and economic growth (Pakes, 1985; Zachariadis, 2003). However, a few scholars have reported a negative relationship or no relationship at all between the constructs (Souitaris, 1999). Second, in a number of patent the relationship between patents and innovation has two opposing results that its relationship is positive or negative (Lemely and Shapiro, 2007). Finally, in the utilization of information, it is indispensible to acquire sources of information on technological opportunities to obtain useful knowledge (Chang and Hong, 2011). Thus, utilization of internal and external information are considered as factors that affect technology innovation. Based on these previous studies, several hypotheses about the relationship between innovation and success factors for innovation are formulated.

Hypothesis 2 Sucess factors for innovation positively affect the innovation of GLMEs.

- 2-1 Active utilization of inside information has a positive impact on the innovation of GLMEs.
- 2-2 Active utilization of outside information has a positive impact on the innovation of GLMEs.
- 2-3 The number of existing patents has a positive impact on the innovation of GLMEs.
- 2-4 Government supports have a positive impact on the innovation of GLMEs.

2-5 R&D intensity has a positive impact on the innovation of GLMEs.

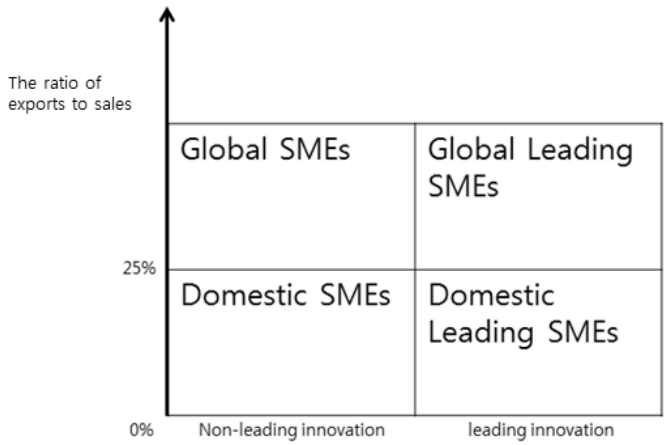
3. Data analysis

1) Data

For this empirical analysis, the "Korea Innovation Survey in Manufacturing Sectors" which was conducted by the sciences and technology policy institutes (STEPI) in 2008 with reference to the community innovation survey (CIS) by the OECD is utilized. It provides useful information about the innovation of 3,104 firms in the manufacturing industry. The results of prior research are reflected to choose relevant data in order to test the hypotheses. If the ratio of exports divided by sales is more than 25%, it seems to be a global company (Knight and Cavusgil, 1996; McKinsey and Co, 1993). In order to select SMEs which have innovation capability, according to the Organization for Economic Co-operation and Development (OECD), companies should have more than the 1.1% of R&D intensity which would identify them as medium-low-technology companies (Tomas, 1997).

Thus, GLSMEs are defined as small and medium companies that drive technology innovation. They have 'a ratio of more than 25% of exports to sales' in a global criterion, 'more than 1.1% of R&D intensity' in an innovation capability criterion, and 'the launching new innovative product to market' in a leading criterion.

The sizes of samples are respectively 70 of GLSMEs, 266 of DLSMEs, 152 of GSMEs, and 853 of DSMEs. DLSMEs are leading technology SMEs by innovation but have a ratio of lower than 25% of exports. On the other hand, GSMEs are global companie but do not launch new innovative products. The criteria of DSEMs are totally opposite to the criteria of GLSMEs; a ratio of lower than 25% of exports and non-launching new innovative product to market.



(Figure 2) Global leading SMEs and other types of SMEs

2) Variables

(1) Variables for analyzing differences among the types of SMEs

Variables for comparison are identified in 〈Table 1〉: utilized sources of information(I1~I12); innovation protection methods(PM1~PM7); collaboration(P1~P7), non-technology innovation activity, government supports(G1~G8), and R&D activities. I1~I12, PM1~PM7, P1~P7, and G1~G8 measure the extent (1 = not at all to 5 = very important) of Liker-type scales. Factors of non-technology innovation(OR1~OR4, MA1~MA4) are measured by binary values (1 = yes, 0 = no).

(2) Variables for determining success factors for innovation

〈Table 2〉 shows independent variables for identifying success factors for GLSMEs and dependent variables is a binary variable (1 = GLSMEs, 0 = GSMEs). Independent variables can be defined with the importance of inside information(info-in), importance of outside information(info-out), the number of patents(PAT), importance of government support(GOV), the ratio of R&D employees(RD_E), and R&D intensity(RD_I). In addition, info-out, info-in and GOV were defined by results of factor analysis that test each variable, I1~I12 and G1~G8. To know how GLSMEs success innovation activities, the dependent variable is set to be 1 as GLSMEs and 0 as GSMEs.

〈Table 1〉 Key factors for the first hypothesis: variables and definition

Factors	*Variables*	*Operational Definition*	
Sources of information	I1~I12	Information sources: within enterprise(I1), group subsidiaries (I2), suppliers of equipment, materials, components, or software(I3), clients or customers(I4), competitors or other enterprises in own sector(I5), External meetings such as association and sodality .(I6), new hires staff(I7), consultants, commercial labs, or private R&D institutes(I8), universities or other higher education institutions(I9), government or public research institutes(I10), conferences, trade fairs, exhibitions(I11), Professional journals and books(I12)	
Protection methods	PM1 ~PM7	Protection methods of innovation: a patent(PM1), an utility model patents(PM2), an industrial design (PM3), a trademark(PM4), company confidential(PM5), a complex design(PM6), time-to-market (PM7)	
Collaboration	P1 ~P7	Partners: group subsidiaries(P1), suppliers of equipment, materials, components, or software(P2), clients or customers(P3), competitors or other enterprises in own sector(P4), consultants, commercial labs, or private R&D(P5), universities or other higher education institutions(P6), government or public research institutes(P7)	
Non-technology innovation activity	O1	Organizational innovations	New or significantly changes in your business, such as Supply Chain Management, Six Sigma, lean manufacturing methods, quality management, education and training institutions, etc.
	O2		New or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within your enterprise
	O3		A major change to the organization of work within your enterprise, such as changes in the management structure or integrating different departments or activities
	O4		New or significant changes in your relations with other firms or public institutions, such as changes in the management structure or integrating different departments or activities
	M1	Marketing innovations	Significant changes to the design or packaging of a good or service (Exclude routine/seasonal changes such as clothing fashions)
	M2		Launching the new brand to promote product and utilizing a new concept of advertising media and promotion strategy
	M3		New or significantly changed sales or distribution methods, such as internet sales, franchising, direct sales or distribution licenses
	M4		Taking new pricing methods such as price discounts and differentiation
Government supports	G1~G8	Government supports: Tax incentives for technology development(G1), technology development and commercialization support by funding(G2), Participation in government R&D(G3), government technology support and guidance(G4), Offer technical nformation(G5), Technical staff and support education and research(G6), government and public sector buying(G7), Marketing support, such as exhibitions and promote exports (G8)	
R&D activity	RD_E	R&D personnel divided by total employees on 2005~2007	
	RD_I	The ratio of total R&D expenditures to total sales on 2005~2007	
	PAT	Number of patents	

〈Table 2〉 Key factors for the second hypothesis: variables and definition

Factors	*Variables*	*Operational Definition*
Sources of information	Info-in	Importance of inside information
	Info-out	Importance of outside information
Government supports	GOV	Importance of government support
R&D activity	PAT	Number of patents
	RD_E	R&D personnel divided by total employees in 2005~2007
	RD_I	The ratio of total R&D expenditures to total sales in 2005~2007

3) Methodology

This paper implements different methodology about two analyses. First, gap analysis is conducted to investigate details of features in terms of differences for innovation between GLSMEs and other types of SMEs. Second, logistic regression is applied to examine success factors for innovation of GLSMEs in terms of innovation capacity and external environment.

(1) Methodology for analyzing differences among the types of SMEs

To find difference factors between GLSMEs and other types of SMEs, t-test and chi-square statistics were applied. T-test is used to test ratio scales such as the number of patents(PAT) and R&D activities(RD_E, RD_I) and interval scales such as the importance of information(I1~I12), innovation protection methods(PM1~PM7), collaboration partnership(P1~P7), importance of government support(G1~G8). Besides, the chi-square test uses nominal scales like non-technology innovation. For binary variables, t-test has a limitation to compare mean value of them. Therefore, the chi-square test is proper to test some factors of binary values.

(2) Methodology for determining success factors for innovation

To find success factors for innovation of GLSMEs in comparison with GSMEs, logistic regression is adopted to examine the hypotheses. Since the dependent variable is binary variable (GLSMEs = 1, GSMEs = 0), logistic regression that is mainly used in predicting a percentage of incidents with bivariate data is proper. The results of this analysis are significant factors that influence positively or negatively on innovation of

excellent SMEs.

IV. Results and discussion

1. Results in difference of factors

1) Information source

〈Table 3〉 shows the results of t-test about the first hypothesis. In government research institutes(I10) and conferences(I11), GLSMEs have higher values than all other types of SMEs. Therefore, GLSMEs could take advantage of general media information more than other companies did. The differences between GLSMEs and GSMEs occurs in not only government research institutes (I10) and conferences (I11) but also universities(I9) and Journal(I12). Innovative SMEs focus on also media information more than non-innovative SMEs did. The differences between GLSMEs and DLSMEs are only two common differences, as mentioned above. There are some differences about all factors except internal information(I1) between GLSMEs and DSMEs. GLSMEs use more sources of information than DSMEs do. Although all SMEs actively collect internal information, SMEs that do not conduct innovation and have low exports, do not actively retrieve external information. It means that innovative and global SMEs gather information from a variety of media.

2) Innovation protection methods

While GLSMEs do not significantly register a higher number of patents than other types of SMEs, they show noticeable differences in the protection methods of innovation. Domestic SMEs focus on registering design rights(PM3) than GLSMEs did. Design right is one of the industrial property to protect industrial goods and unique products and decorative features by granted rights. Innovative SMEs that target at a domestic market innovator pay attentions to design for protection methods of innovation because it is important not only technology but a visual part to overcome

〈Table 3〉 Comparison of information sources by t-test

	Mean values				t-value		
	GLSMEs	GSMEs	DLSMEs	DSMEs	GSMEs	DLSMEs	DSMEs
Within enterprise(I1)	3.87	3.72	3.87	3.81	.882	-.005	.450
Group subsidiaries (I2)	1.16	.85	.74	.49	1.311	2.130	3.201*
Suppliers (I3)	2.21	1.86	2.36	1.78	1.489	-.675	2.085*
Clients or customers(I4)	2.86	2.53	2.86	2.31	1.341	-.033	2.687*
Competitors (I5)	2.30	1.95	2.25	1.75	1.412	.208	2.561*
External meetings (I6)	1.73	1.43	1.57	1.24	1.384	.780	2.555*
New hired staff(I7)	1.61	1.32	1.58	1.14	1.397	.173	2.574*
Consultants, commercial labs, or private R&D institutes(I8)	1.47	1.21	1.33	.90	1.216	.662	3.077*
Universities (I9)	1.74	1.10	1.39	.98	2.876*	1.657	3.835*
Government or public research institutes(I10)	1.89	1.07	1.40	.86	3.651*	2.236*	5.104*
Conferences (I11)	2.47	1.85	2.01	1.36	2.433*	1.973*	5.430*
Journals and books(I12)	2.19	1.57	2.04	1.45	2.595*	0.638	3.604*

* Significant at 5%

limitations of the marrow domestic markets. The differences between GLSMEs and GSMEs that did not innovate first in a market are the importance of time-to-market (PM7). The differences between GLSMEs and DSMEs are also important of time-to-market, too. While GSMEs and DSMEs focused on registering patents(PM1) and confidentiality(PM5) more than time-to-market, GLSMEs focused on time-to-market

〈Table 4〉 Comparison of innovation protection methods by t-test

	Mean values				t-value		
	GLSMEs	GSMEs	DLSMEs	DSMEs	GSMEs	DLSMEs	DSMEs
Patent(PM1)	3.10	2.74	3.17	2.76	1.154	-.257	1.423
Utility patents(PM2)	2.01	2.08	2.48	1.95	-.210	-1.778	.242
Industrial design (PM3)	1.24	1.53	1.77	1.23	-.996	-2.294*	.055
Trademark(PM4)	1.51	1.57	1.77	1.41	-.205	-1.064	.462
Confidentiality(PM5)	2.83	2.80	2.93	2.46	.086	-.408	1.626
Complex design(PM6)	1.14	1.21	1.34	1.06	-.279	-.971	.443
Time-to-Market(PM7)	2.96	2.15	2.86	2.16	2.895*	.410	3.528*

* Significant at 5%

more than confidentiality to protect innovation results. The reasons why they have differences in innovation protection methods are that SMEs which can not innovate first in a market do not have technological capability to penetrate a new market or will innovate first in a market.

3) Government support

In tax incentives for technology development(G1), participation in government project(G3), technical information(G5), and marketing support(G8), GLSMEs have higher values than other types of SMEs. The differences between GLSMEs and GSMEs are shown in all parts except technical staff(G6) and public sector purchasing(G7). The differences between GLSMEs and DLSMEs are same with the case of GLSMEs and GSMEs. The reasons of similarity in technical staffs and public sector purchasing are that GLSMEs did not get government supports. In addition, GLSMEs and other types of SMEs do not get much government supports. All parts of importance of government supports differ from GLSMEs to DSMEs. GLSMEs evaluate that the government supports are more important and gets government supports more than DSMEs get. It means that government supports do not help large growth of DSMEs.

〈Table 5〉 Comparison importance of government support by t-test

	Mean values				t-value		
	GLSMEs	GSMEs	DLSMEs	DSMEs	GSMEs	DLSMEs	DSMEs
Tax incentives (G1)	1.53	.84	.82	.53	2.727*	3.000*	4.538*
Funding(G2)	1.86	1.30	1.45	1.02	2.043*	1.600	3.486*
Government R&D(G3)	1.56	.87	.97	.62	2.744*	2.467*	4.247*
Technology support and guidance(G4)	1.10	.60	.73	.46	2.491*	2.044	3.566*
Technical information(G5)	1.20	.61	.75	.44	2.949*	2.311*	4.238*
Technical staff and education (G6)	.94	.63	.77	.44	1.594	.933	2.824*
Public sector purchasing(G7)	.71	.38	.65	.35	1.964	.349	2.386*
Marketing support (G8)	1.60	.86	.97	.55	3.092*	2.716*	4.899*

* Significant at 5%

4) Collaboration

While GSMEs and DSMEs that innovate only in own firms relatively have low scores in the importance of cooperation partners, GLSMEs more highly rated the importance of cooperation partners. Main type of collaboration partners for GLSMEs is universities or other higher education institutions(P6). GLSMEs have high value of importance in this factor more than other type of SMEs. DSMEs and DLSMEs that focus on a domestic market have low importance in cooperation with group subsidiaries (P1). In addition, GSMEs and DSMEs that did not innovate first in a market have lower importance in cooperation with suppliers(P2), clients(P3), research institutions(P7) than GLSMEs and DLSMEs. All types of SMEs think cooperation with competitors is of little importance.

5) Non-technology innovation activities

Both GLSMEs and other types of SMEs do not have common difference factors in non-technical innovations. In particular, DLSMEs show no differences in the distribution of non-technical innovation. The difference factors between GLSMEs and GSMEs include changes in design(M1), launching a new brand(M2), and new pricing methods(M4). While about 30% of GLSMEs carry out marketing innovation, 10% of GSMEs perform marketing innovation. It means that innovative SMEs focus on

〈Table 6〉 Comparison collaboration by t-test

	Mean values or percentage(%)				t-value		
	GLSMEs	GSMEs	DLSMEs	DSMEs	GSMEs	DLSMEs	DSMEs
Group subsidiaries(P1),	.39	.17	.07	.04	1.590	2.297*	2.551*
Suppliers (P2)	.64	.18	.59	.31	3.233*	.294	2.016*
Clients or customers(P3)	.71	.26	.68	.36	2.703*	.150	1.927*
Competitors (P4)	.37	.16	.36	.21	1.663	.102	1.298
Consultants, commercial labs, or private R&D(P5)	.43	.08	.29	.15	3.146*	.906	1.954*
University(P6)	1.04	.28	.55	.35	4.153*	2.167*	3.208*
Government or public research institutes(P7)	.70	.22	.41	.21	2.982*	1.493	2.612*

* Significant at 5%

marketing innovation more than non-innovative SMEs. GLSMEs and domestic SMEs differ in all of aspects in non-technology innovation without changing distribution methods(M3). It has shown that while innovative SMEs perform non-innovation activities regardless of activities, non-innovative SMEs do not much any innovation activities. Changing the organization (O3) are the best activity in non-innovation activities of GLSMEs because over 50% of GLSMEs conduct the innovation work.

〈Table 7〉 Comparison non-technology innovation activities by chi-square analysis

	Percentage				chi-square		
	GLSMEs	GSMEs	DLSMEs	DSMEs	GSMEs	DLSMEs	DSMEs
Changes in business(O1)	40%	40%	40%	30%	.427	.107	6.582*
Improvement in KMS(O2)	30%	30%	30%	20%	.818	.011	7.557*
Changes in organization(O3)	50%	40%	50%	30%	.769	.018	8.893*
Changes in relations with other firms(O4)	30%	20%	20%	20%	3.584	2.033	13.475*
Changes in designs(M1)	30%	10%	30%	20%	17.853*	.583	13.989*
Launching a new brand(M2)	30%	10%	30%	20%	13.463*	1.263	15.188*
New sales methods(M3)	20%	10%	20%	13%	3.100	.426	2.590
New pricing methods(M4)	27%	10%	30%	14%	7.243*	.088	8.045*

* Significant at 5%

6) Research and development activities

Although DLSMEs and GLSMEs have R&D intensity higher than DSMEs and GSMEs, GLSMEs do not significantly spend more on R&D employees(RD_E) and R&D intensity(RD_I) than other types of SMEs. The proportion of the research staffs in GLSMEs is 10%, and R&D intensity is 3.78%. This score indicates no significant difference between GLSMEs and other types of SMEs. R&D activities of DLSMEs are the highest value in all types of SME, indicating that new technology development groups that develop a technology in the country before exporting a product really exist (Lee, 2009). On the other hand, non-innovative SMEs, GSMEs and DSMEs have a similar level of R&D activities regardless of the ratio of export.

〈Table 8〉 Comparison R&D activities by t-test

	Mean values				t-value		
	GLSMEs	GSMEs	DLSMEs	DSMEs	GSMEs	DLSMEs	DSMEs
Number of patents(PAT)	9.94	11.19	10.85	5.63	-.256	-.267	1.651
R&D personnels(RD_E)	10%	8%	11%	8%	1.375	-.379	1.471
R&D intensity(RD_I)	3.78%	3.13%	4.33%	3.24%	0.857	-.660	0.655

* Significant at 5%

7) Results of comparison

〈Table 9〉 summarizes the results of the aforementioned comparative analyses. GLSMEs and DLSMEs have many similar elements such as non-technology innovation, whereas GSMEs and DSMEs show a lot of differences from GLSMEs about their importances for elements and generally answered lower value than GLSMEs did. It shows the difference between innovative SMEs and non-innovative SMEs. In addition, GLSMEs are analogous to innovative companies like DLSMEs more than global companies like GSMEs.

2. Results in success factors for innovation of GLSMEs

In order to analyze the factors that affect innovation of GLSMEs, the dependent variable is the binary value of GLSMEs or GSMEs. While GLSMEs are SMEs that succeed in innovation first to market and are excellent in export performance, GSMEs are excellent in the performance of export but can not succeed in innovation. Success factors for innovation in a global environment can be derived by identifying unique factors that GLSMEs only have.

〈Table 10〉 shows the results of the logistic regression analysis. Importance of outside information(Info-out) and government support(GOV) have positive coefficient values in 5% level of significance. On the other hands, the other factors do not have statistical significance. 'Hosmer and Lerneshow test' is used as a test of goodness of fit. As a result, this regression model is suitable for study because the p-value are bigger than 0.05.

〈Table 9〉 Results of hypothesis 1

H	*Contents of hypothesis*	*Results*	*Explanation of differences*
1-1	Differences from GSMEs in information source	Partially adopted	Using more information of universities, journals, and conference
	Differences from DLSMEs in information source	Partially adopted	Using more information of universities and conference
	Differences from DSMEs in information source	Partially adopted	Using more all of external information except internal information
1-2	Differences from GSMEs in a way to protect innovation	Partially adopted	Higher importance of early market entry
	Differences from DLSMEs in way to protect innovation	Partially adopted	Lower importance of industry design
	Differences from DSMEs in way to protect innovation	Partially adopted	Higher importance of early market entry
1-3	Differences from GSMEs in government supports	Partially adopted	Higher importance of financial support, R&D cooperation, supporting technology information, etc
	Differences from DLSMEs in government supports	Partially adopted	Higher importance of supporting tax, marketing and technology information, R&D cooperation
	Differences from DSMEs in government supports	Adopted	Higher importance of all aspect of government support
1-4	Differences from GSMEs in cooperation partners	Partially adoption	Cooperating more with supplier, customer, and research institution
	Differences from DLSMEs in cooperation partners	Partially adopted	Cooperating more with own companies and university
	Differences from DSMEs in cooperation partners	Partially adopted	Cooperating all partners except competitor
1-5	Differences from GSMEs in non-technology innovation	Partially adopted	Doing more marketing innovation
	Differences from DLSMEs in non-technology innovation	Rejected	No difference
	Differences from DSMEs in non-technology innovation	Partially adopted	Doing more marketing innovation and organization innovation except distribution innovation
1-6	Differences from GSMEs in R&D ability	Rejected	No difference
	Differences from DLSMEs in R&D ability	Rejected	No difference
	Differences from DSMEs in R&D ability	Rejected	No difference

〈Table 10〉 The results of logistic regression

Variables	*B*	*S.E.*	*Sig*	*Exp(B)*
Importance of inside information(Info-out)	.321	0.135	0.018*	1.379
Importance of outside information(Info-in)	.081	0.135	0.546	1.085
number of patents(PAT)	-.001	0.004	0.821	0.999
Importance of government support(Gov)	.260	0.066	0.003*	1.297
R&D personnel(RD_E)	.287	1.211	0.813	1.332
R&D intensity(RD_I)	-.360	2.091	0.863	0.698
Constant	-2.999	0.179	0.000	0.050

* Significant at 5%

3. Discussion & Implications

1) Implications of hypothesis 1

In terms of sources of information, GLSMEs mainly use external information from conferences more than other types of SMEs that have low export ratio or did not use innovation. This study finds that general SMEs are vulnerable to collect useful information, using diverse sources of information. It supports that diversity and depth of knowledge have increased the rate of innovation (Dewar and Dutton,1996) and knowledge is important to acquire sources of information on technological opportunities (Chang and Hong, 2011).

On a way to protect innovation results, GLSMEs have lower importance value in industrial designs than DLSMEs. In addition, the results of comparison between GLSMEs and non-innovative SMEs indicate that GLSMEs are willing to protect innovation by dominating the markets in advance. It supports that successful innovation of GLSMEs is sensitive to market information.

In terms of government support, the differences between GLSMEs and DSMEs are shown in all aspects of government support elements. GLSMEs utilize all of government supports except public sector purchasing and educational supports. By the results of logistic regression analysis, the positive attitudes toward government supports influence success for innovation of GLSMEs. Moreover, government supports help innovative SMEs along with a prior study that government supports in R&D

sponsors were highly effective (Audretsch, 2002).

In cooperation partners, GLSMEs give considerable thoughts to collaborate in innovation with group subsidiaries and universities. However, GLSMEs do not actively register an industrial design.

In non-technology innovation, it is reasonable that non-technology innovation activities are as important as technology innovation activities in the manufacturing industry (Howell, 2001). Thus, the marketing support of governments affects the marketing innovation of GLSMEs. It is unclear what impacts of marketing innovation have on innovative companies. However, it is certain that it affects the innovation of global leading companies.

Finally, R&D activities are not a success factor for GLSMEs and they have no significance in differences between GLSMEs and others. Effects of R&D activities on firm growth might vary over time. According to Dosi(1988), these statistics about the R&D intensity have a tendancy to underestimate the importance of R&D activities because GLSMEs and DLSMEs perform R&D by collaboration with other institutes more than internal experiment. As a result, while the R&D intensity is a proper factor, it has limitations in reliability.

2) Implication of hypothesis 2

It is difficult that internal information particularly affects the innovation of GLSMEs because most of SMEs mainly use internal information. However, utilization of external information positively affects the success for innovation of GLSMEs. External information in conferences helps them to understand mega-trends of relevant fields and contribute to learning new skills in order to create innovative products in markets. Innovation success of SMEs is promoted by exploiting an innovation strategy that explores new technologies and then expand into a new market.

Government supports also positively affect the innovation of GLSMEs. Since the insufficient ability of SMEs in terms of financial, personnel, and training areas is improved by government supports, a force to innovate occurs in SMEs. In addition, SMEs can reduce R&D costs and get better quality of technology information through government supports. They continuously need to effort in getting information about

government supports to acquire assistances of government.

The number of patents as well as R&D intensity do not affect the success of innovation. Most of SMEs just invest R&D budget without considering factors such as culture of companies (O'Regan et al, 2006; Kim, 2010). In addition, since the number of patents is outcomes of innovative activities, the number of patents is irrelevant to explain a success factor of innovation (Kim and Hong, 2011). However, since data of R&D intensity and innovation outcomes in this paper are collected at the same time, the relationship between two factors can be hardly analyzed due to a time lag problem.

V. Conclusion

This paper explores success factors of Korean GLSMEs in manufacturing industries and investigates key differences among various factors by analysing other three types of SMEs such as DLSMEs, DSMEs, and GSMEs. Consequently, the results of analysis support and extend previous international business and innovation research by applying t-test, chi-square test, and logistic regression analysis. This study has three kinds of differences from prior research. First, detailed success factors that are not considered in prior research are analyzed. For example, various sources of information are additionally considered in this research. Second, global leading SMEs are quantitatively defined and analyzed by using the concept of hidden champions. Third, the range of innovation is elaborated as first to market and first to companies.

The empirical findings can be summarized as follows. First, government supports positively affected the success of GLSMEs. This is consistent with arguments that the government's effort to promote SMEs plays an important role in increasing the innovation performance of firms. Second, information from outside a company positively affects the success of GLSMEs. In particular, information from conferences and government research institutes assists in developing innovative products and increasing exports for SMEs. Third, it is unclear that R&D activities can support SMEs because of a lack of longitudinal data sets. Thus, if researchers want relations between

R&D and companies, they should collect longer data.

Several limitations of this study need more detailed discussions. First, this study used subjective judgments of researchers to define GLSMEs. This is a common problem because new concept of SME such a hidden champion should be defined from previous research. Second, in terms of selecting variables, this research reflects the variables of previous studies. Thus, the range of variables is too narrow to cover broad spectrum of related variables. Future research needs to overcome the limitations of this study.

The results of this study offer some ample information and valuable insights for policy makers who work in supporting SMEs and for corporate officers of SMEs who establish tactics in innovation. They indicate that a success factor such as first-to-market by technology innovation should not be neglected, and various factors could help conduct an assessment of the status quo and show future directions regarding the innovation features and management in SMEs.

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