

The Effectiveness Analysis of a Supporting Program for SMEs' R&D Planning based on Innovative Capability Audit Tools

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Abstract

South Korea's Small and Medium sized Enterprises (SMEs) play a vital role in the national economy but there is a big gap between SMEs and large firms in terms of their revenues. In order to balance the national economy, it is required to narrow the gap between SMEs and large firms through the innovation promotion policy for SMEs. Since the end of 1990s, South Korea has practiced some policies, which are based on National Innovation System (NIS), to incubate technology-intensive SMEs. In this study, we analyzed the effectiveness of the South Korea government's supporting program for SMEs' R&D planning using the innovative capability audit tools. The innovative capability audit tools are useful to evaluate the policy for R&D planning support for SMEs. We found that the innovative capability has a strong relationship with the sales of SMEs. On the other hand, the capability has a negative relationship with the number of employees, the amount of R&D investment or the number of IP.

Keywords: Innovation, Innovativeness Audit, Policy Assessment, R&D Planning, SMEs

1. Introduction

SMEs in Korea play a pivotal role in the proportion of national economy. Despite the importance of SMEs in national economy, South Korea's SMEs are in charge of only 34.9% of total sales, but large corporations, accounting for less than 1% of total number of firms, are in charge of 65.1% of total sales. In order to balance the structural proportion of the national economy, it is required to overcome this gap between large firms and SMEs. Thus Korea government has supported various programstoreinforcethe technological competitiveness of its SMEs since the late 1990s. But the gap seldom narrowed.

In terms of the resource-based view, the performance differences of companies come from the differences of resources available for innovation. Therefore, most of the government programs were oriented to complement insufficient resources of SMEs through the direct funding

for R&D. The funding for R&D is important not only to conduct R&D but also to strengthen the innovative capability of the SMEs.

The SME's R&D capability is a significant asset. Especially, the SME's planning capability for R&D, a core capability, cannot be too emphasized for its sustainable growth and effectiveness of R&D¹.

These days the South Korea Government has a lot of R&D planning support programs in order to ensure the successful R&D. However, very few researches are found on the effectiveness of the governmental support programs.

In this study, we analyzed the effectiveness of governmental supporting programs for SMEs using innovative capability audit tools and showed a relationship between R&D planning support program and innovative capability of SMEs. Also, we found some interesting features of SME's innovative capability related to the firm size and employee number.

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2. Small and Medium-sized Enterprises (SMEs)

According to Organization for Economic Co-operation and Development (OECD), a Small and Medium-Sized Enterprise (SME) is a kind of business structure of non-affiliate, independent firm which occupies less than a given number of employees. SMEs stake over 95% of firms and 60%-70% of employment and supply a large share of new jobs in OECD economies. SMEs have distinctive strength and weakness that may call for unique policy responses.

As new technologies and globalization alleviate the significance of "the economy of scale" in many activities, the potential contribution from the smaller firms is getting more important. Small firms cannot escape from upgrading their management skills, their capability to take information and their base of technology. Governments need to get better SME access to financing, information infrastructures and international markets. Providing of frameworks in regulation, legislation and finance helpful to SMEs and small start-ups have to be a priority. Building up partnership for public-private linkage, networking of small-firms and industrial clusters can be shortcut to make a dynamic SME sector. Flexibility and responsibility to market needs from SMEs can often be better than large integrated firms. They can make resource pool and bear a part of the expense for training, research and marketing.

Clustering assists the exchange of personnel and diffusion of technology and leads out new possibilities of high efficiency in mutual business. The clustering and the support system can help SMEs be globalized. Government policy initiatives should take explanation of regional and local factors which influence entrepreneurship and be built on distinctiveness to promote small-firm partnerships. Policies should use local institutions, groups of industries and inter-firm connection to create and strengthen the micro-level bonds which can support the global competitiveness. With local strengths, SME policies are required to address the new dynamics of entrepreneurship and small-firm clusters to face the challenges posed by globalized economies. The significance of SMEs to longer-term economic stability derives from their size and structural status which, under sufficient conditions, i.e., well developed market; allow them the flexibility and ability to get through unfavorable economic conditions. Therefore, SMEs, more labor-intensive than larger firms, have lower capital costs for activities of job creation. As a result,

SMEs perform an important function in fostering income stability, growth, and employment.

In the modern economy, we meet complex networks of firms in which the competitive position of a firm depends, in part, on the efficiency of its suppliers. Therefore SMEs' competitiveness is concerned with the competitive position of the economy as a whole. Furthermore, SMEs foster the efficiency of domestic markets and make productive use of rare resources, such as capital, sustaining the long-range economic growth. SMEs is not free from limit in access to capital markets, both inside and outside of their region, in part, because of the recognition of higher risk, informational barriers.

Consequently, it is true that SMEs often cannot take the chance to get financing support in the form of long term debt. A lack of skilled workers can make the restrictiveness of the realization of the opportunities, make high costs, and reduce flexibility in the operation management. SMEs have problems in gaining access to suitable technologies and information on available techniques. This leads limits for innovation and SME competitiveness. Simultaneously, other constraints on capital and labor, as well as uncertainty associated with new technologies, restrict incentives to innovation. SMEs meet restriction in the accessibility of production inputs. For example, higher quality raw materials are sometimes exported or are introduced only to larger firms, and their suppliers have a tendency to be oligopolies. Inadequate infrastructure and weak social benefit of public services such as transportation, energy, urban planning and production sites represent particular barriers to SMEs².

3. Theoretical Background and Research Method

Tangible and intangible resources, which cannot be easily imitated by other companies, are necessary to build up competitiveness. The source of this competitiveness might come from innovative capability of the corresponding company. Therefore, if capabilities related to the innovation of SMEs are identified, we could make a SME-specific evaluation method. And SMEs could identify and strengthen their innovative capability for technology commercialization.

There are many previous researches relating to the degrees of difference of the innovation between companies. For example, Burgelman et al, Yam et al insisted that firms need specific capabilities for innovation such

as resources availability and allocation, understanding of competitor’s innovative strategy and market, understanding of technological development relating to firm, strategic management capability to deal with internal innovative activities^{3,4}.

Major preceding researches mainly focused on identifying the innovative capability of a typical enterprise and the relevance between the innovative capability and performance of the firm. In this study, we focused on the features of innovation of SMEs and their innovative capability.

There have been many researches trying to find out the difference and feature of innovation of between large firms and SMEs and measuring methods for performance⁵⁻⁷. For example, with the resource-based view, it is very important that firms must have resources that are difficult to be imitated by competitors in terms of building the competitiveness. One of these competitive resources is the innovativeness that makes one firm different from the others. On this theoretical background, we could make an effective tool for evaluating the degree of SME’s innovativeness that would apply to many other usages, such as the evaluation of SME supporting programs and the selection of competitive SMEs for further incubation.

In this paper, we suppose that the innovation capacity of SMEs is made up of two major factors, general capability and R&D capability. They are divided into four sub-categories that comprise thirteen items as shown in Table 1. We surveyed innovativeness capabilities of SMEs that were supported by “the R&D planning program” of the Government. We collected additional information about

Table 1. Description of innovativeness auditing tools

Category		Items
General Capability	Management Capability	entrepreneurship
		finance
		organization
		production
		marketing
	Innovative infra	employee
		innovation output
R&D Capability	Planning Capability	opportunity identification
		strategic planning
		Information supporting
	Execution Capability	R&D
		Commercialization

sales, the number of employees and IP, R&D investment of the firms surveyed, etc. and conducted a regression analysis on the relationship between innovativeness scores and resources of SMEs.

4. Results

The audit tools for innovation capability that we used can diagnose management capability, innovative infra, planning capability and execution capability of SMEs and consist of 40 objective indicators related to the firm’s innovation capability. With this audit tool, we conducted a survey on 60 companies and analyzed the difference of their innovation between before and after the support program.

Results of our survey show that the average of SME’s innovativeness score was 133.9, which increased to 145.6 after executing the government program for R&D planning support. It is shown in Table 2 and 3 that each innovativeness indicator with the support program is higher than without the program. The difference was compared in Table 4.

After executing programs, the scores of all innovativeness indicators increased. Especially, scores of R&D planning capability dramatically increased to 17.7%. However execution capability scores increased moderately. This means that the government program that supports SMEs at each stage of R&D planning can affect positively SMEs’ innovative capability and also our innovativeness audit can be used to evaluate the efficiency of SME support program.

We analyzed the relationship between innovativeness score and SME’s resource- performance. Table 5 shows the relationship of innovativeness score and SME’s sales, number of employee, R&D investment, number

Table 2. Descriptive statistics of SME’s innovativeness score (before supporting)

Innovativeness Indicator	Sample	Mean	Std. Dev.	Min	Max
Management capability	60	29.50	9.38	0	45
Innovative Infra	60	25.98	5.74	0	35
R&D planning capability	60	41.58	13.53	0	65
execution capability	60	34.60	11.02	0	53
Total Innovativeness score		133.90	33.04	76	194

Table 3. Descriptive statistics of SME's innovativeness score (after supporting)

Innovativeness Indicator	Sample	Mean	Std. Dev.	Min	Max
Management capability	60	30.87	9.20	0	45
Innovative Infra	60	26.52	5.72	0	35
R&D planning capability	60	48.93	12.47	0	65
execution capability	60	36.92	10.37	0	53
Total Innovativeness score	59	145.66	28.93	88	194

Table 4. Comparison of SME's innovativeness score between before and after supporting

Innovativeness Indicator	Before (N = 60)		After (N = 60)		diff (After-Before)	t-Test
	Mean	S.D	Mean	S.D		
Management capability	29.50	9.38	30.87	9.20	1.37	3.55**
Innovative Infra	25.98	5.74	26.52	5.72	0.53	3.19**
R&D planning capability	41.58	13.53	48.93	12.47	7.35	7.43**
execution capability	34.60	11.02	36.92	10.37	2.32	4.38**
Total Innovativeness score	133.90	33.04	145.66	28.93	11.76	6.38**

**P<0.01

Table 5. Regression analysis of resources, performance and innovativeness score

Regression Variables	Coef.	t	Beta
Sales	0.0068	4.03**	2.072
Employee	-0.9111	-2.28*	-1.233
R&D investment	-0.0007	-2.38*	-0.506
Researcher	0.9160	0.91	0.168
IP	-0.8969	-1.12	-0.262

F (5,20) = 5.84, R² = 0.593, **P<0.01, *P<0.05

of researchers, number of IP, etc. The relationship of innovativeness score and the amount of sales is positively correlated but the number of employees and R&D investment are negatively correlated with innovativeness scores. There is no statistical significance in relationship between innovativeness score and number of researcher, IP. Generally, the number of employees and R&D investment are known to be important factors for innovation. Our result shows that these factors affect negatively the innovativeness score. That is partly because our audit tool is designed for SMEs that are relatively short in operational period and small in R&D investment with fewer employees.

5. Discussion

In this study, we proposed that the audit tools for innovative capability can be a new method for measuring the effectiveness of SME supporting activities. Existing measurement methods could not sufficiently explain the effect of the innovation process that is highly complex.

We paid attention to a direct effect of inputs for innovation and found evidence that the government-supported program directly affects the innovative capability of SMEs. In addition, we could also identify that the specific innovative capability is closely associated with the R&D planning activity of SMEs. These findings can help improve the effectiveness of government-supported programs and identifying the innovative capability needed by SMEs.

But this study has some limitations. One of them is that the sample number of firms is very small, only 60. Another is that we could not analyze industry-specific features for SMEs. A future research will be planned to investigate changes of SMEs' innovative capability in accordance with the change of time.

6. References

1. Song M, Im S, Hans van der Bij H, Song LZ. Does strategic planning enhance or impede innovation and firm performance. *The Journal of Product Innovation Management*. 2011; 28(4):503–20.
2. Thakkar J, Kanda A, Deshmukh SG. Supply chain management for SMEs: A research introduction. *Management Research News*. 2009; 32(10):970–93.
3. Burgelman RA, Christensen CM, Wheelwright SC. *Strategic Management of Technology and Innovation*. 2004.

4. Yam RCM, Guan JC, Pun KF, Tang EPY. An audit of technological innovation capabilities in Chinese firms: some empirical findings in Beijing. *China Research Policy*. 2004; 33:1123–40.
5. Kerssens-van Dongelen IC, Cook A. Designing principles for the development of measurement systems for research and development processes. *R and D Management*. 1997; 27(4):345–57.
6. Keizer JA, Dijkstra A, Halman JJ. Explaining innovative efforts of SMEs: An exploratory survey among SMEs in the mechanical and electronic engineering sector in the Netherlands. *Technovation*. 2002; 22(1):1–13.
7. Lin BW, Lee Y, Hung SC. R and D intensity and commercialization orientation effects on financial performance. *Journal of Business Research*. 2006; 59(6):679–85.