

S&T Policy for SMEs: Lessons Learned and Implications from Korea

Young Il Park*

Abstracts This article puts forward the opinion of a policy expert, who had been involved in Korea's science and technology policy for 30 years, about technology policy for SMEs. This article first explains why technology policies for SMEs are needed, and from what point of view. The next section looks at the current problems facing Korean SMEs, followed by the introduction of past and current policies to support SMEs. The comparison between current issues facing SMEs and past and current policies leads to lessons that can be learned. There are four lessons for the policy itself and three for the implementation of these policies. As for policy, the first four are about stages of development, concentration, R&D and diffusion, and policy mix. The latter three are policymakers, institutional building, and cooperation between ministries. This article makes four suggestions for future policy: the importance of startups' culture, cooperation with others, infrastructure to reduce uncertainty, and policy monitoring and evaluation.

Keywords SME policy, SME technology policy, Korean SME policy, SME policy by technology policy expert

I. Introduction

The issues surrounding SMEs are some of the most important policy issues for any country, regardless of the level of development. The reason being that the number of SMEs and the number of people employed at SMEs is considerable, influencing the vitality of the economy as a whole, and is a matter of survival for those who work in it. Thus, developing policies affecting SMEs should be a priority at all levels of national interest. Although Korea is considered a country with strong economic growth, their growth in SMEs is relatively modest, and the proportion of SMEs that have successfully entered the global market is still low. The SME problem is still unresolved in Korea.

This article puts forward the opinion of a policy expert, who had been active in Korea's science and technology policy for 30 years, for technology policy for

Submitted, December 6, 2019; Accepted, December 24, 2019

* Former Vice Minister of Science and Technology of Korea, Professor, Department of Content Convergence, Ewha Womans University, Korea; yipark@ewha.ac.kr.



This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

SMEs. The arguments in this article may differ from those articulated by SME policy experts.

However, as an expert with a long experience in actual technology policy and also research science and technology policy at university, this article offers suggestions for technology policy for SMEs from the perspective of technology policy expertise. Unlike general academic papers, this article is based on experience and vision because it is more meaningful to convey experience and vision than doing so in a purely academic format.

This article first explains why technology policies for SMEs are needed, and from what point of view. In the next section, we look at the problems of SMEs, especially in Korea, from the perspective of the technical policy expert. Chapter 4 draws on Korea's science and technology policy, what are the current efforts to support SMEs, and what lessons can be learned from these attempts. Based on these discussions, Chapter 5 presents a direction for technology policy for SMEs.

II. Approaches to SME Technology Policy

1. Argument for Government Intervention

Romijn (2001), Ko, Bae, and Seol (2017) point out that there are three main theoretical considerations for SME policy: market failure theory, system failure theory, and socio-political perspective. The market failure theory summarizes the logic for government intervention on the basis that SMEs cannot compete fairly in the market. The system failure theory explains the reason for government to intervene because it lacks the elements or functions that social systems or systems related to SMEs have. The socio-political view is that SMEs should be protected because they are not socially competitive, but are socially disadvantaged. The OECD's SME policy also had a strong socio-political view.

Technical policy experts, including myself, find evidence of government involvement in SMEs in all market failure theory, system failure theory, and socio-political approaches. An example of a market failure approach is the issue of fair competition with large corporations. SMEs may adopt government procurement support policies to overcome the problem of not being able to compete with large firms in the market, and there may be fair trade perspectives on unfair trade of large firms. It also carries out policies, such as encouraging technology development with large corporations.

There are many policies related to system failure theory. We will reinforce the funding system, including technology development funding to strengthen technological shortages, tax reforms to promote technology development, and

military service exemption system for SME technology workforce reinforcement. Sociopolitical approaches are a consideration for relatively underdeveloped areas and policies for areas or groups temporarily experiencing special difficulties. On the other hand, policies for specific industries or SMEs all appear in the political process.

Although various technical policies to enhance the technology of SMEs have a system failure point of view, policy designers and executors must consider the government in the context of the rationale for government intervention depending on the situation or target. This attitude is different from the scholars' view on SME policy.

2. Evaluation of Policy Performance

When implementing a policy for SMEs, the question that policymakers should always ask is whether the outcome of the policy or a specific policy instrument are expected. The perception of performance also always brings the time element when the result is realized.

1) Performance recognition

Let's start with the performance problem. Specific policy measures do not drive policy outcomes. They relate to the willingness and capacity of the beneficiaries, and there are problems of the social system in which policy instruments can work. This fact is no exception for technology policy. OECD (1998) also shows that one country's performance is the result of the total systematic activities and networks between various players' activities and context factors. In this sense, the system approach works.

Whatever the policy, it is important to evaluate whether the policy instruments have achieved their initial goals. Every specific technology development program is evaluated when the program is completed after several years. Evaluation is whether the initial goals set during that period were successful enough or not. However, if the performance evaluation is microscopic, there may be because the problems related to the specific issues of a given sector or SMEs are not solved at all, even though the performance of the program exists. Thus, performance evaluation of policies needs to be assessed not only at the project or program level, but also at higher levels of specific functions or sectors.

2) Time issue of policy effects

Let's look at the problem of time when the effects takes place. The effects of certain policy instruments may emerge at the desired time, but that of policies

supporting technology development will generally be late. In Korea, for a very successful technology development, it takes at least 10 years for new technology to become a commodity, and the commodity to be in full bloom in the market and become the flagship industry. It is a very substantial policy to refer to a specific industry as a whole, but time issues are always present at small levels. When discussing technology policy, the parallax problem of policy effect should always be questioned. The time issue is where policymakers differ from scholars, and that's why they choose policies that sometimes seem ineffective.

III. Problems and Technology Policies of SMEs in Korea

1. Evaluation of SMEs' R&D

The overall status of R&D investment in SMEs of Korea are as follows (Noh, 2018). Small and medium-sized research institutes maintained a modest growth of 38,644 in November 2018. However, fewer than 10 researchers accounted for 96% of the total in 2018. The problems of R&D investment in SMEs are as follows. In summary, the R&D institutes of SMEs are increasing in number, but the R&D of each company or SME is deteriorating in relative term. 86.9% took the form of self-development rather than cooperation. The proportion of SMEs in national corporate R&D expenditures is declining from 26.6% in 2007 to 21.9%. The percentage of masters and doctors in research institute is 23.2% for SMEs, against 49.5% for large companies.

In particular, in the high-tech sector, new product development and exploration of new areas are the main targets, and in the mid- to low-tech sectors, there is a tendency to focus on product technology and process technology.

2. Technology Problems with SMEs

Korean SMEs are estimated to account for 98% of all companies, 90% of employment, and 80% of economic power (Korea Small Business Institute, 2019). Nevertheless, the gap between large firms and SMEs is growing, and there is no report that SMEs have become more competitive. We also recognize the importance of innovative SMEs and continue to strengthen their competitiveness, but reports that their competitiveness has been strengthened are not easy to find. Although the results of very small projects or programs are reported, good technology policy has not yet been evaluated as a fundamental problem-solving instrument for SMEs.

Let's review issues facing SMEs again. We can divide the problems of SMEs into external and internal problems. External problems are product

competitiveness and market environment, while internal problems consist of management, funding, and organizational problems. Product competitiveness eventually is a technical problem. And technology development power is directly related to the continuous growth of companies.

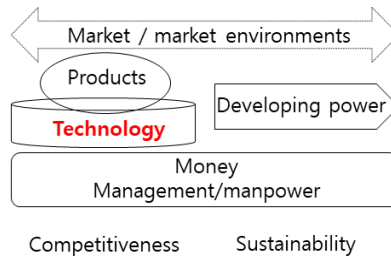


Figure 1 Technology among issues of SMEs

STEPI (2018), however, states that the success factors of SME technology development relate to the CEO's commitment to innovation, technology development experience, and human resources. On the other hand, failures include lack of funding, lack of manpower, and failures in technology and market forecasting. As such, immediate policies for SMEs include technology development funding, technology development expert support, and technology and market information support.

IV. Evaluation of Past Technology Policy

1. Policy Development

Korea's science and technology policy is divided in four stages from the perspective of SMEs' position and policy measures. The first stage is from the Korean War in the 1950s to the early 1980s. At this stage, SMEs entered into contract-based cooperation with large firms, which could not concentrate on long-term activities such as R&D. In a strict value chain structure, SMEs struggled and tried to optimize the value chain. In this process, SMEs could receive large companies' purchase guarantees and quality assurance programs and export support from the government.

The second stage is from the mid-80s to the early 90s. At this stage, the government emphasized fostering technology-intensive SMEs (OECD, 1996). In this process, government-funded research institutes played a role, and selective SME nurturing policies became popular and important. Besides, with the issue of new technology SME nurturing policies, special attention was paid

to new technology-based companies. As a result of this particular interest, special policy tools such as procurement incentives, military exemption systems, and R&D tax credits were introduced and were very effective.

In the third phase, from the mid-1990s to early 2000, incubations of technology-based startups grew rapidly. At this stage, the mutual growth of large corporations and SMEs was unfolding in the desirable direction, and the venture start-up policy was strengthened and expanded.

The fourth stage, from the mid-2000s up to now, is the transition from the old economic system to the new creative and innovative economic system. SMEs are therefore treated as major players in this new economy. Therefore, new policies are being designed.

2. Current Policies

The government R&D support program for SME's technology development focuses on promoting the technology associated with future growth areas and global strategic issues (Seong and Popper, 2005). The government and public institutions allocate a share of more than 30 billion US dollars for the R&D budget to SMEs.

Figure 2 shows that the production process-related automation system technology accounted for the highest portion with 7%, of the budget, followed by control/security of 7% and embedded SW related technologies of 6%. Metal-related technologies were divided into forming and source technology with 9%. These high portion technologies are production-related. Other areas include gas equipment and waste disposal researches, optic and lights related to laser and imaging technology, advanced material, semiconductor, fiber/textile, automobile power system, robotic transportation safety system, shipbuilding, and marine technology, new drug development through genetic research, eco-friendly agricultural technology, functional foods, and educational and game platform-based digital contents.

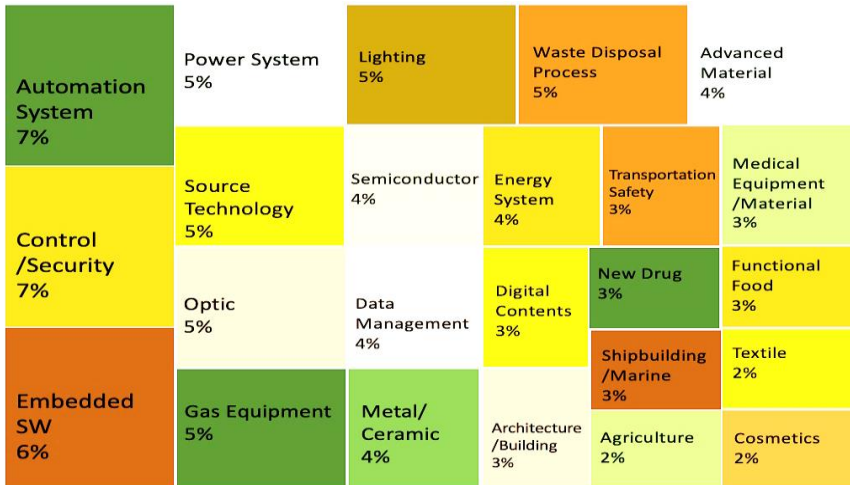


Figure 2 SME R&D by sector

Source: Kim et al. (2018)

The share of SMEs in national science and technology policies increased from 13.0% in 2013 to 16.3% in 2017 (Noh, 2018, p.1). Although the government is working on SMEs, major R&D supports still goes to big companies.

From this statistics, small and medium-sized enterprises' technical development does not appear to be deeply impacted by human resources compared to large enterprises, and that their relative market competitiveness does not seem to be strengthened. Technological development efforts are still lacking, and even other parts are offsetting technical efforts. In particular, internal problems, market problems, and even non-market issues are offsetting the effects of technical policy measures.

Nevertheless, there is a reason to support the technology development of SMEs and various programs for strengthening technology. The government should pursue long-term effects, even if not all policy measures require a long-term perspective, and it needs to proceed on the basis of the requirements and changes of the times. Second, it is important to note that a few successful SMEs can be Unicorn, a billion-dollar company, and that one or two Unicorns can save the industry or the region.

The ultimate goal of SME policy is to ensure the sustainability of internal investment and smooth use of external resources for independent technological innovation. From this point of view, a comprehensive, optimal, and harmonious policy is needed. This policy, of course, is necessary for the strengthening of SMEs' technological capabilities and should be a direction to strengthen national competitiveness.

3. Lessons

Lessons for the technology policies of Korea for SMEs are as follows. First, any policy cannot disregard the stage of development of each country. The policy should be targeted to the SME problems. Therefore, SME policy should be designed according to the nation's development stage.

Second, we need a strategic approach due to limited resources. Selectivity and concentration policy is very important, especially when large-scale investments are needed. The priority keywords are urgent, future prospective, trend, and the contribution to the whole economy as the policy effects.

Third, innovation policy regarding technology diffusion, commercialization, and entrepreneurship are very important apart from R&D policy. That is the appropriate policy mix between R&D and application, and between acquisition and diffusion because not all technologies are developed in-house or in a nation.

Let's add an issue of policy mix. Policies are classified into several types: short-term, medium-term and long-term policies; science and technology policies; policies by technological fields; policies by stage, such as idea generation, research, development, commercialization, and diffusion; policies by social purpose, such as commercialization; policies by groups or regions; priority setting for future growth, etc. The World Bank (2010) claims the optimum policy mix among the above issues is the most important issue. Figure 3 shows the overall picture of total S&T policy instruments related to industrial technology development. The figure is old, but the scheme has been maintained until now.

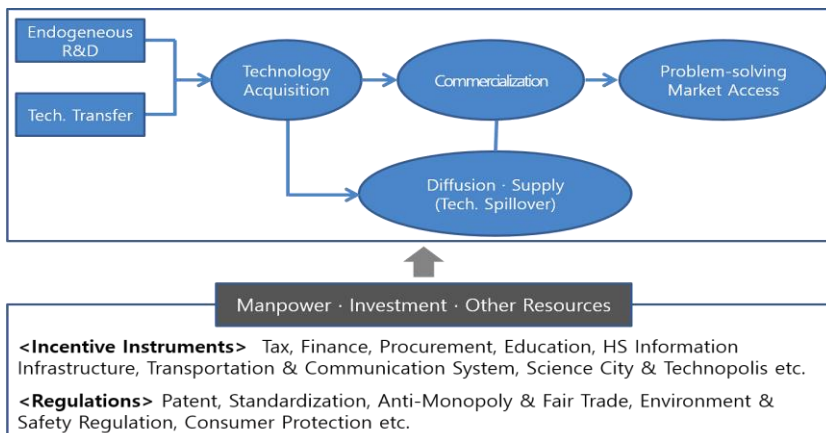


Figure 3 Overall structure of S&T policy instruments

Source: Korean Ministry of Science and Technology (1986).

Lessons for the implementation of policies are as follows. First, the competence of technocrats, S&T policy-makers, and professionals can be one of the key success factors in the early stage of industrial technology development. However, according to the development stage of the nation, more emphasis should be given to the professionals' role.

Second, proper institution building, such as legislative works, regulation systems, should be a critical factor. The representative institutions are the exemption of 3-year military service for the young scientists and engineers who work in an SME, government procurement system, certification of new technology by government, the tax exemption of expenditure of R&D organization of SMEs.

Third, cooperation among ministries, among government agencies and support from them are one of the success engines. Many ministries have policies for SMEs. The direction of these policies is not concentrated to get selectivity and overcome the limit of scarce resources, and even obstacles of different policies.

V. Implications and Conclusion

1. Implications for Future Policy

The following are technology policymaker's suggestions for future SME policies of Korea. First, it is very important to nurture a technology startup company culture to foster future market players. It is also important to build a market ecosystem so that new innovative startups can grow into medium and large corporations.

Second, SMEs should focus more on in-house technological innovation investments and technical cooperation. Small and medium-sized businesses find it difficult to establish their technology innovation capabilities only based on internal investments. Because of the high level of uncertainty and complexity of technology development, small investments and workforce are not very helpful. Therefore, facilitating external technical cooperation can be an alternative solution to internal investment. Of course, only 10-15% of companies cooperate externally. This low ratio is the product of SMEs prioritizing short-term objectives, while universities and research institutes focus on mid- and long-term objectives. However, this ratio should be increased in the policy.

Third, the policy should focus on building a future-oriented infrastructure. For example, it is important to explore uncertainties and build a global R&D network thoroughly. In response to uncertainty, the technology roadmap helps to understand the direction for innovation and enhance investment efficiency.

From a national perspective, the technology roadmap allows us to respond to rapid technological changes gradually and is a useful tool to select and focus on future industries. Building a global R&D network is not an easy task in Korea, which is distinct from neighboring countries. It is also difficult for small and medium-size businesses to conduct such cooperative activities. However, a platform should be established to support SMEs' cooperation through intergovernmental and private cooperation platform.

Fourth, the monitoring and analysis of SME technology innovation policy itself should be strengthened. There are two problems with government policy to promote the technological innovation of SMEs. One is the issue of direct government funding of SME technology innovation. Some studies are showing the correlation between government funding and technological innovation, but other studies indicate that the funding do not contribute to innovation. The relationship between technological innovation processes or inputs other than funding and technological innovation requires further analysis. The other problem is to design effective policies by comparing the effects of different fostering programs. In addition to financial assistance, there are various forms of support for R&D activities such as tax benefits, technical information provision, technical training, and educational provision. To define which practice works, we need to compare the effectiveness of each program.

2. The Takeaways from the Korean Experience

National Innovation System (NIS) requires multidimensional efforts and cooperation between innovative players to get the desired outcomes. In NIS, SMEs should play a major role in the future in close relationships with other parties. The national level of science technology competency will get closer to that of advanced countries when SMEs build sufficient technology capability to survive in the global market. This article can, thus, be summarized as follows.

SMEs' willingness to innovate and their entrepreneurship are very important. National monitoring capability and infrastructures for the SME activities should be enhanced to foster effective SMEs' innovative activities. Regulation, legal framework, and institution building are given special attention due to their vast influential effects. The national public-private cooperation program is also important. Cultivating human resources and basic research are very important not only for the future, but for overcoming current resource problems.

Strong support for international technological cooperation can provide SMEs' global competence. The mechanism for coordination and cooperation should be provided and should function properly.

References

- Kim et al. (2018) SMEs Technology Innovation Competency and Global Policy Trend Analysis (IX), STEPI.
- Ko, C.R., Bae, S.J. and Seol, S.S. (2017) Suitability analysis of SMEs support means by customized information Analysis, *Journal of Korea Technology Innovation Society*, 20-1, 81-102.
- Korea Small Business Institute (2019) KOSBI SME Trend.
- Korean Association for Policy Studies (2012) The 50th Anniversary of SME Policies and Futures of SME Policy.
- Korean Ministry of Science and Technology (1986) Korean Science and Technology Development Plan Towards 2000.
- Noh, M.S. (2019) SME R&D investment status and prospect, *SME focus* 19-02, Korea Small Business Institute, 1.14.
- OECD (1996) *Reviews of National Science and Technology Policy: Republic of Korea*.
- OECD (1998) *Secretariat, Technology, Productivity and Job Creation - Best Policy Practices*.
- Romijn, H. (2001) Technology support for small-scale industry in developing countries: a review of concepts and project practices, *Oxford Development Studies*, 29-1, 57-76.
- Seong, S. and Popper, S.W. (2005) *Strategic choice of science and technology strategies*, RAND Corporation.
- STEPI (2018) SMEs Technology Innovation Competency and Global Policy Trend Analysis (IX).
- The World Bank (2010) *Innovation Policy: A Guide for Developing Countries*.