HONG KONG JOURNAL OF SOCIAL SCIENCES

香港社會科學學報

第一的第 61 期 (2023 春/夏) Vol. 61 Spring/Summer 2023

Open Access Article https://doi.org/10.55463/hkjss.issn.1021-3619.61.33

An Empirical Analysis of the Effects of R&D Support Methods on SME Performance: Evidence from the Korean Government R&D Subsidies Provided to Overlap Beneficiaries

Seungku Ahn[1], Kwon-Sik Kim[2], Kwang-Hoon Lee[3]*

[1] *Korea Institute of S&T Evaluation and Planning, South Korea*

[2] *Korea SMEs & Startups Institute, South Korea*

[3] *Department of Public Administration & Integrated Energy and Infra System, Kangwon National University, South Korea*

Received: March 12, 2023 ▪ Reviewed: April 10, 2023

▪ Accepted: May 31, 2023 ▪ Published: June 30, 2023

Abstract:
The research goals of this paper are to examine the overlapping government R&D support provided to small- and medium-sized enterprises (SMEs) in Korea, analyze its effects on the financial and technological performance of beneficiary companies, and identify implications for optimizing the support system. The study aims to investigate the relationship between the number and status of government R&D benefits and the sales increase of SMEs, as well as the impact on their technological performance measured by the number of domestic and foreign patents. Additionally, the paper seeks to propose measures for preventing overlapping support and streamlining the R&D support systems for SMEs in Korea. The analysis results revealed that the number and status of government R&D benefits had a statistically significant positive (+) effect on the sales increase of a company, while the number of overlapping benefits and beneficiaries had a statistically significant positive (+) effect on the number of domestic and foreign patents of the company. The scientific novelty of this paper lies in its empirical analysis of the overlapping government R&D support provided to SMEs in Korea, shedding light on its effects on financial and technological performance. The study provides new insights into the positive relationship between the number and status of government R&D benefits and the sales increase in beneficiary companies. Additionally, it contributes to the literature by examining the impact of overlapping support on the technological performance of SMEs, measured by the number of domestic and foreign patents held by the companies.

Keywords: R&D subsidies, overlapping beneficiaries, small- and medium-sized enterprises.

Corresponding Author: Kwang-Hoon Lee, Department of Public Administration & Integrated Energy and Infra System, Kangwon National University, South Korea; email: swiss@kangwon.ac.kr

研发支持方式对中小企业绩效影响的实证分析：来自韩国政府向重叠受益人提供研发补贴的证据

摘要：
本文的研究目标是考察政府向韩国中小企业提供的重叠研发支持，分析其对受益公司财务和技术绩效的影响，并确定优化支持体系的影响。本研究旨在探讨政府研发福利的数量和状况与中小企业销售额增长之间的关系，以及以国内外专利数量衡量的对其技术绩效的影响。此外，本文还试图提出防止重复支持和简化韩国中小企业研发支持体系的措施。分析结果显示，政府研发福利的数量和状况对企业销售额增长具有统计显着的正(+)效应，而重叠福利的数量和受益人对企业的销售额增长具有统计显着的正(+)效应。公司拥有国内外专利。本文的科学新颖性在于对韩国政府向中小企业提供的重叠研发支持进行了实证分析，揭示了其对财务和技术绩效的影响。该研究为政府研发福利的数量和状况与受益公司的销售增长之间的正相关关系提供了新的见解。此外，它还通过研究重叠支持对中小企业技术绩效的影响（以公司持有的国内外专利数量来衡量）为文献做出了贡献。

关键词：研发补贴、重叠受益人、中小企业。

1. Introduction

Small and medium-sized enterprises (SMEs) account for 99% of the total number of businesses and 88% of the total employment in South Korea. They play a pivotal role in creating employment and propelling the economic growth of the country. Meanwhile, the Korean government has continuously expanded R&D investment to strengthen the competitiveness of SMEs, and the share and scale of R&D support provided to SMEs in national R&D have been steadily increasing.

However, questions are being raised whether the government's R&D investment effectively induces SMEs' innovative activities and contributes to the creation of results. Along with the problem of overlapping support, the benefits of R&D support provided to SMEs are concentrated on a few companies. Thus, it is necessary to analyze the problems of the R&D support method for SMEs raised in response to the criticisms of such overlapping support. Therefore, this study aims to review the status and effects of support provided to overlapping beneficiaries to enhance the effect of the Korean government's R&D support provided to SMEs and to propose alternatives to improve them. The main steps of the research process for this paper are summarized in Figure 1.

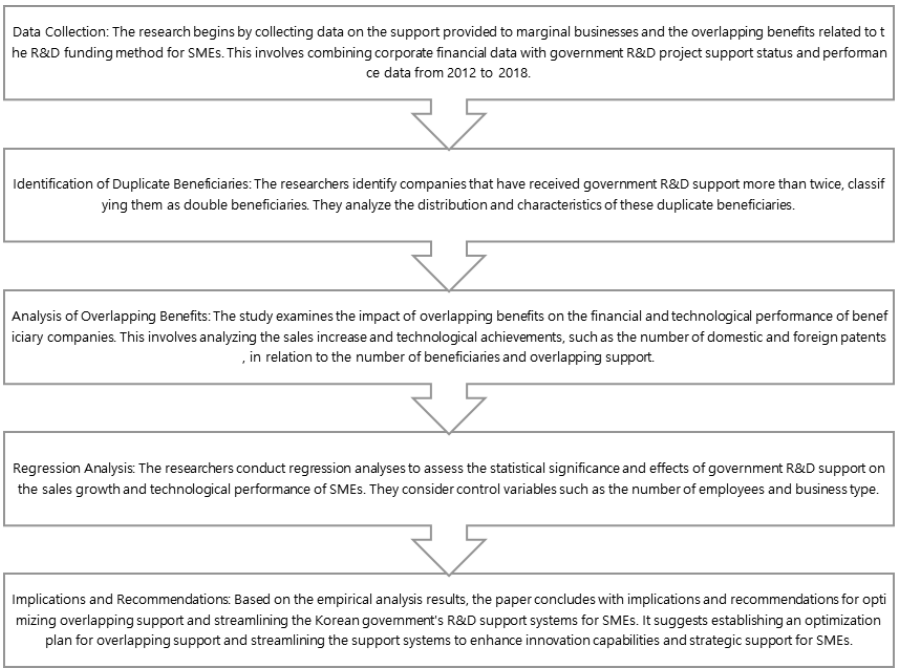

Figure 1. Flowchart of the research process of this study

2. Literature Review

2.1. Technological Innovation of SMEs

Technological innovation refers to all the activities in which everyone in the company, including managers, thinks creatively and executes the activities to improve

the competitiveness and survival of the company. In view of the definition of technological innovation presented in the Oslo Manual, the first Oslo Manual (Organisation for Economic Co-operation and Development, 1992) focused on the technological innovation of manufacturing products and processes. The 3rd Oslo Manual (Organisation for Economic Co-operation and Development, 2005) classifies innovations into product, process, organizational, and marketing innovations. In the 4th Oslo Manual (Organisation for Economic Co-operation and Development, 2018), innovation is divided into product innovation and business process innovation. Product innovation refers to a new or improved product or service significantly different from a company's existing product or service when introduced to the market. This implies operational support functions such as business management.

The technological innovation is of paramount importance for SMEs. This can be explained as follows (Park & Son, 2012). First, SMEs tend to lead the technological innovation of the industry when new disruptive technological innovations emerge, and when large corporations with existing large-scale facilities and solid knowledge bases respond conservatively, the technological innovation of entrepreneurial SMEs plays an important role. Second, in terms of the industrial ecosystem, SMEs form a network with large corporations and are in charge of supplying specific materials, parts, or services, and in this process, the technological innovation of SMEs is essential. Third, in technology-intensive industries, the correlation between company size and R&D activities can be inversely proportional; thus, SMEs place technological innovation activities at the center of management.

Considering the importance of the technological innovation of SMEs, the justification for the government's support of SMEs is as follows, supported by Ahn (2019). The reason why the government should support the technological innovation of SMEs is the occurrence of market failures, and the reasons can be divided into two broad categories. First, the efficient market operation means perfect competition in which the resource allocation occurs efficiently. In a real market, imperfect competition occurs due to information asymmetry. Second, the high uncertainty of R&D makes it difficult for companies to predict the effects of R&D investment. This may lead to inefficient resource allocation due to the passive investments of companies.

Such market failure justifies government intervention in SME R&D (Ahn et al., 2020), the details of which are as follows: First, government support can contribute to the national economy by improving the competitiveness of individual companies through the correction of the inefficient allocation of resources due to market failure. Second, government support can improve the R&D capabilities of companies so that the knowledge produced by universities and research institutes is used effectively. Third, the knowledge produced with the support of the government is actively spilled into different industries as well as the same industry, creating positive externalities and increasing the economic utility of society as a whole.

Based on the 3rd Oslo Manual, this study analyzes the technological innovation mechanism model of SMEs. According to this model, SMEs consider external factors such as the market environment, laws and regulations, government response, and the innovation capabilities embodied in the company and then invest in innovative resources and perform innovation activities to achieve the performance created by innovation.

2.2. Effects of Government R&D Subsides on the Innovation Performance of SMEs

Previous studies on the government's R&D support policy for SMEs have mainly focused on funds, manpower, and other policy measures. First, most previous studies have analyzed the effects of government funding on the innovation performance of SMEs (Seo & Lee, 2007; Yoo & Park, 2006; Shin & Choi, 2008; Park & Lee, 2012; Kang, 2013; Yoon & Yoon, 2013; Noh & Song, 2014; Seo & Lee, 2014; Jang, 2016; Oh & Kim, 2017).

Seo and Lee (2007) found the amount of government R&D support to have a moderating effect on the technological innovation capacity and level of technology management, which have been proven to increase. Shin and Choi (2008) demonstrated that government R&D funding has a positive moderating effect on the innovation performance of SMEs. In other words, the more financial support a company receives, the stronger the relationship between R&D and innovation.

Lee et al. (2009) found that direct technology development support, which is represented by the government's technology development project and industrial transformation technology development support, improved the performance of SMEs in terms of labor productivity and TFP. This result implicates that government support for technology development contributes to the improvement of corporate performance via the facilitation of private R&D investment. In addition, both the two-step Tobit-DPD model and the Tobit-FE dynamic model show that the total R&D investment of SMEs has a positive effect on corporate performance.

Having analyzed the data of the "Small and Medium Business Technological Statistical Survey" conducted by the Korea Federation of Small and Medium Enterprises, Park & Lee (2012) found the R&D funding policy to have significantly contributed toward technological competitiveness and had a significant positive effect, especially in small-scale manufacturing enterprises with fewer than 50 employees. Seo and Lee (2014) found the government support ratio to affect the R&D efficiency. In the study of Noh & Song (2014), the analysis carried out found government support to significantly contribute toward the patent application

and registration of companies, but the effect on commercialization and royalty income was not significant.

Lee et al. (2014) studied the effect of government technology development support on the technological innovation performance of SMEs. To verify the effect of the government's technological development support on the technological innovation performance of SMEs, an empirical analysis targeting 271 domestic SMEs was conducted by them. The results of the study showed that government technology development support had a significant positive (+) effect on the innovation performance of SMEs.

Lee et al. (2015) categorized government R&D support into financial and non-financial strategies targeting SMEs via the use of data from the "Manufacturing Industry Technology Innovation Survey," conducted every two years by the Science and Technology Policy Institute. They further analyzed the performance of technological innovation on the basis of type. At the same time, since the performance of R&D can vary in accordance with the characteristics of each company, they classified the performance variables into technology development possibility, technological innovation, and technological originality to approach the relationship between the support method and the characteristics of the performance. The analysis revealed that government R&D support has a positive effect on the technological performance of SMEs.

Jang (2016) found that the amount of government support provided to the 4,258 companies that received development technology commercialization funds in the 2011–2014 period had an effect on the companies' number of patents, sales, total assets, net income, net asset return ratio, operating profit ratio, number of insured persons, and number of full-time workers. By performing a regression analysis (OLS) of the impact, Jang (2016) derived significant positive effects for all the indicators except profitability indicators such as total asset return and operating profit ratio. Jang (2016) confirmed the importance of continuous government support, as the economic and social performance of SMEs that received government support twice or more, such as technological performance, growth potential, and profitability improvement, was greater than that of a one-time occurrence. In terms of the impact of government support on the performance of SMEs, Jang (2016) found that government support had a direct positive effect on patent registration, growth potential, and employment increase among SMEs. Although the effect of registration is evident, it has been confirmed that registration has no effect on profitability. Lastly, Jang (2016) found that while economic performance centered on growth indicators such as government support, technological performance, and sales, total assets had a positive effect on the increase in employment size; the effect of profitability indicators is yet to be shown.

Oh and Kim (2017) analyzed the performance of R&D support provided to SMEs by dividing performance indicators into three areas: growth potential, profitability, and innovation. In the growth performance index, it was confirmed that the R&D support beneficiaries performed statistically better than the non-beneficiaries in all of the growth rates of sales, employment, assets, and liabilities. In the profitability performance indicator, unlike the growth performance indicator, it was found that the performance of the beneficiary company compared to the non-beneficiary company did not significantly improve statistically with respect to all of the increases in ROA, ROE, and operating profit per sale. In terms of innovation, it was confirmed that the companies that received government support increased their own R&D investment for three years and maintained this level after that.

Second, several studies focus on how the government's human resources and technological and cooperation support affect the innovation performance of SMEs (Seo & Lee, 2007; Shin & Choi, 2008; Ryu & Kim, 2010). Seo and Lee (2007) found the technological cooperation network formation support system to have a positive (+) moderating effect on the existence and level of specialization of R&D departments. The policy objective of the Technology Cooperation Network Support Program is to revitalize cooperative relationships with organizations and human resources that have external R&D expertise with SMEs that lack the ability to conduct technological development on their own. Shin and Choi (2008) found government R&D manpower support to have a positive moderating effect on SMEs' innovation performance, but technological support had no statistically significant effect. In other words, the more a company receives human resources support, the stronger the relationship between R&D and innovation. Ryu & Kim (2010) confirmed the effects of regulations, incentives, and information provision on SME innovation by using the number of patent applications registered over the past three years as a dependent variable for the data from the 2008 Korean Enterprise Innovation Survey. The results show that the more positively perceived the degree of influence on the use of technology information provided, the more positively it had a positive effect on corporate innovation. However, it was found that even if the degree of influence of the provision of human resource training was positively perceived, it did not have a statistically significant effect on innovation performance. Park & Lee (2012) confirmed that some of the infrastructure policies have a positive effect on the technological competitiveness of SMEs, but the technological guidance and information support fields do not directly affect technological competitiveness. Choi (2018) analyzed the effects of R&D funding, human resource support, and technological support on the achievement of product innovation performance by focusing on innovative SMEs belonging to the domestic manufacturing industry. According to the results, the effectiveness of government R&D support differs

according to the type of innovation pursued by SMEs. While government R&D support did not have a direct effect on the achievement of radical product innovation, government R&D workforce support was found to be effective in achieving gradual product innovation. It was confirmed that financial and technological support has a negative effect on the achievement of a gradual product innovation.

These prior research results have the advantage of identifying the factors that improve the technological innovation performance of SMEs from a microscopic perspective. However, the criticism that the government's R&D support is insufficient for the technological innovation performance of SMEs does not provide proper evidence. In particular, overlapping support has repeatedly been raised in the R&D field of SMEs. Accordingly, it is necessary to discuss the policy alternatives that can be used to solve the ineffectiveness of R&D overlapping support methods.

3. Research Design

3.1. Research Questions

The concept of overlapping benefits can be understood based on the R&D projects of the Ministry of SMEs and Startups. Among SMEs' R&D, the R&D project supported by the Ministry of SMEs and Startups and the KOSBIR (In addition to the Ministry of SMEs and Startups' own R&D support project, since 1998, the government and public institutions have been supporting SME R&D through the Small and Medium Business Technology Innovation Support System (KOSBIR) to induce the expansion of R&D support for SMEs. KOSBIR is a system that benchmarks the US Small Business Innovation Research (SBIR) system (Ministry of SMEs and Startups, 2022)) support project for each department are promoted together, which can be seen as overlapping support and excessive support toward some companies. The reason for such a problem is that only R&D under the jurisdiction of the Ministry of SMEs and Startups has a limited graduation system, so there is a limit to preventing the overlapping of benefits with the projects of other ministries. This leads to the possibility of hindering the participation of new SMEs in R&D by impairing the efficiency of government R&D resources that should be supported for the growth of SMEs owing to the overlapping benefits. The main research questions related to the existing overlapping benefits are as follows: What is the status of the government's R&D support provided to companies that benefit from overlapping beneficiaries? What are the characteristics of companies that benefit from overlapping beneficiaries? Are the duplicate beneficiaries contributing to the creation of innovative outcomes? What cause overlapping benefits and what are the problems caused by overlapping benefits? Should duplicate benefits be prevented? If so, what should I do?

3.2. Data and Methods

The criteria for selecting the research object of this study are as follows: The first criterion was relevance to SMEs and R&D funding. The research object focuses on SMEs and their involvement in government R&D projects. The selection was driven by the importance of SMEs in the economy and the government's emphasis on promoting technological innovation and corporate growth through R&D support. The second criterion was timeframe. The research object covers the period between 2012 and 2018. This timeframe was chosen to analyze a substantial duration and gather sufficient data to examine the effects of government R&D support on beneficiary companies' performances. The third criterion was overlapping beneficiaries. The study specifically targets companies that have received government R&D support more than twice. This selection criterion allows for investigating overlapping benefits and their impact on the financial and technological performance of these companies.

Thus, to examine the status of the support provided to marginal businesses and the overlapping benefits related to the R&D funding method for SMEs, data were collected based on the SME R&D project support performance (NTIS). To be precise, a dataset was constructed by combining the corporate financial data from the NICE evaluation information with the support status and performance data of government R&D projects conducted under the supervision of SMEs during 2012–2018. First, by calculating the number of beneficiaries of government R&D projects supported by a specific company between 2012 and 2018, the companies that have benefited more than twice are defined as double beneficiaries, and the distribution of duplicate benefits, the characteristics, and the performance of the duplicate beneficiaries have been analyzed. Next, we analyzed the distribution of the government R&D support provided to marginal companies, their characteristics, and the performance of the marginal companies among the companies that had experienced (at least once) being the beneficiaries of the government R&D tasks hosted by the SMEs between 2012 and 2018.

4. Empirical Analysis Results

4.1. The Distribution of Overlapping Benefits

Table 1 shows the companies that received government R&D support at least once during 2012–2018 by classifying them on the basis of the number of beneficiaries. Companies that received support only once accounted for approximately 43% of all the beneficiaries (27,982 in total), while companies that received support twice or more accounted for approximately 57% of all the beneficiaries. As for the average amount of government R&D support provided per project, it was found that the amount of support received by a two-time beneficiary company was larger than that received by a one-time beneficiary company (KRW 112 million). A two-time beneficiary received 155 million won, a three-time beneficiary received 188

million won, and a four-time beneficiary received 208 million won.

Table 1. Distribution by a number of beneficiaries of government R&D beneficiaries more than once (2012-2018)

The number of benefits	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
The number of companies	12164	6227	3097	1864	1226	843	580	396	310	235
Ratio	43.47	22.25	11.07	6.66	4.38	3.01	2.07	1.42	1.11	0.84
Cumulative ratio	43.47	65.72	76.79	83.45	87.84	90.85	92.92	94.34	95.44	96.28
Average government R&D support per project (KRW million)	112	155	188	208	234	260	266	290	284	303
The number of benefits	**11**	**12**	**13**	**14**	**15**	**16-20**	**21-25**	**26-30**	**31 and more**	**Total**
The number of companies	215	154	129	89	94	207	79	44	29	27,982
Ratio	0.77	0.55	0.46	0.32	0.34	0.74	0.28	0.16	0.1	100
Cumulative ratio	97.05	97.6	98.06	98.38	98.72	99.46	99.74	99.9	100	100
Average government R&D support per project (KRW million)	296	357	323	364	348	333	318	366	246	276

Table 2 shows the companies that benefited from government R&D during 2012–2018 by dividing them into manufacturing and nonmanufacturing industries. Of all the beneficiaries (26,498 in total, excluding the missing values), the manufacturing sector companies accounted for about 65%, with the average number of beneficiaries being about three.

Table 2. Government R&D beneficiary status by companies in manufacturing/non-manufacturing industry in 2012-2018

	The number of companies (units)	**Ratio (%)**	**The number of beneficiaries (Average)**	**Average per company Government R&D support (KRW million)**
Manufacturing	17,189	64.87	3.01	697
Non-manufacturing	9,309	35.13	2.88	633
Total	26,498*	100	2.96	675

* Excluding missing values among 27,982 companies

4.2. Characteristics of Duplicate Beneficiaries

Table 3 shows the financial and technological performance of companies based on the number of beneficiaries during 2012–2017. Here, financial performance was measured by the company's sales (million won) for the year, the sales growth rate (%) compared to the previous year, R&D expenses (million won), the number of employees, the number of technology fee collections (pieces), the amount collected (won in thousands), and the number of commercialization cases (pieces). Each performance was calculated as the average value of the company's performance for each year from the first benefit year between 2012 and 2017 to the end of 2017 (Table 4).

Table 3. The financial and technological performance of companies by a number of beneficiaries (2012-2017, average value)

The number of benefits	**The number of companies (a total of 24,352 excluding missing values)**	**Financial performance**				**Technological performance**			
		Sales (KRW million)	**Sales growth rate (%)**	**In-house R&D expenses (KRW million)**	**The number of employees**	**The number of domestic and foreign patents**	**The number of technology fees**	**Technology fee collection (1,000 won)**	**The number of commercialization cases**
1	11,710	13,400	323	572	48	0.08	0.0001	4,009	0.05
2	5,072	11,100	157	487	43	0.18	0.0011	27,227	0.20
3	2,483	10,900	76	590	45	0.24	0.0025	44,288	0.18
4	1,502	11,500	60	563	47	0.35	0.0055	194,226	0.26
5	1,019	13,700	34	713	52	0.37	0.0025	29,018	0.33
6	688	15,200	84	859	57	0.38	0.0044	238,244	0.21
7	421	16,700	68	982	60	0.48	0.0016	18,464	0.45
8	332	19,000	26	1,078	73	0.63	0.0015	13,203	0.47
9	238	18,200	23	1,053	71	0.66	0.0172	69,582	0.38
More than 10 times	887	20,400	53	1,617	80	1.06	0.0111	993,739	1.48
	Average value	13,100	181	662	51	0.21	0.0017	69,415	0.19
	The number of companies to be analyzed (excluding missing values)	18,205	16,370	13,756	12,540	24,352	24,352	24,352	24,352

Table 4. The number of companies in the first beneficiary year (2012-2017)

The first beneficiary year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
The number of companies	6,622	3,408	3,212	3,448	3,533	4,129

Tables 5 and 6 show the financial and technological performances of each beneficiary in the manufacturing and nonmanufacturing sectors, respectively. Having looked at the 30 or more duplicate beneficiaries, it was found that the companies in the bio, medical, and IT sectors received significant government R&D support, mainly in the manufacturing sector.

Table 5. Financial performance of companies by a number of beneficiaries (2012-2017, average value): comparison between manufacturing and nonmanufacturing industries

The number of benefits	**The number of companies**		**Sales (KRW million)**		**Sales growth rate (%)**		**In-house R&D expenses (KRW million)**		**The number of employees**	
	Manufacturing (16,347)	**Non-manufacturing (9,137)**	**Manufacturing**	**Non-manufacturing**	**Manufacturing**	**Non-manufacturing**	**Manufacturing**	**Non-manufacturing**	**Manufacturing**	**Non-manufacturing**
1	7,782	4,675	16,700	6,534	325	305	651	358	55	32
2	3,368	1,923	12,300	8,303	58	350	498	442	46	35
3	1,700	873	12,300	7,522	61	103	619	497	47	39
4	1,043	492	12,900	8,299	66	52	530	657	50	40
5	706	328	15,400	9,540	35	32	724	663	53	49
6	462	232	18,700	7,800	34	185	924	704	65	38

Continuation of Table 5										
7	280	150	18,000	14,000	23	152	881	1,168	66	48
8	227	110	22,400	11,600	25	33	1,154	910	78	61
9	166	75	19,000	16,300	22	26	966	1,248	73	66
More than 10 times	613	279	21,400	18,100	19	127	1,501	1,880	84	72
	Average value		15,300	8,181	153	234	687	579	55	39
	The number of companies to be analyzed (excluding missing values)		12,248	6,384	11,096	5,625	9,825	4,186	8,578	4,170

Table 6. Technological performance of companies by a number of beneficiaries (2012-2017, average value): comparison between manufacturing and nonmanufacturing industries

The number of benefits	The number of companies		The number of domestic and foreign patents		The number of technology fees		Technology fee collection (1,000 won)		The number of commercialization cases	
	Manufacturing (16,347)	Non-manufacturing (9,137)	Manufacturing	Non-manufacturing	Manufacturing	Non-manufacturing	Manufacturing	Non-manufacturing	Manufacturing	Non-manufacturing
1	7,782	4,675	0.08	0.08	0.0001	0.0001	3,084	4,909	0.06	0.06
2	3,368	1,923	0.17	0.18	0.0010	0.0011	26,171	25,976	0.23	0.12
3	1,700	873	0.23	0.25	0.0016	0.0040	43,904	40,469	0.19	0.17
4	1,043	492	0.36	0.34	0.0025	0.0122	51,204	511,494	0.27	0.25
5	706	328	0.35	0.43	0.0021	0.0030	18,256	50,855	0.38	0.20
6	462	232	0.38	0.38	0.0040	0.0050	253,070	202,559	0.23	0.18
7	280	150	0.44	0.56	0.0024	0	27,762	0	0.50	0.39
8	227	110	0.59	0.70	0.0015	0.0015	16,887	5,000	0.33	0.75
9	166	75	0.62	0.73	0.0082	0.0364	85,304	32,000	0.32	0.51
More than 10 times	613	279	1.10	0.95	0.0074	0.0192	205,395	2,708,024	0.83	2.89
	Average value		0.21	0.20	0.0012	0.0025	31,912	129,369	0.18	0.21
	The number of companies to be analyzed (excluding missing values)		16,347	9,137	16,347	9,137	16,347	9,137	16,347	9,137

4.3. The Relationship between Overlapping Support and Beneficiary's Performance Companies

The results of the empirical analysis of the impact of government R&D benefits in 2012–2017 on the beneficiaries' performance is as follows. In consideration of the time lag of the results calculated after the input, the average value of the performance by year from the first beneficiary year after that was used. First, probit regression was performed using the dependent variable of the increase in sales among financial performance. If the sales growth rate is greater than 0, it is coded as 1; otherwise, it is coded as 0. As independent variables, whether or not there was any experience of receiving multiple benefits twice or more and the number of beneficiaries was used. The first beneficiary company was coded as a dummy variable as a base. As for the other control variables, the number of employees and business type (dummy variables of manufacturing, information and communication, and professional, scientific, and technological services in accordance with the industry standard classification) were input into the analysis model. According to the analysis results presented in Tables 7 and 8, whether the target SMEs benefited from the overlapping benefits and the number of beneficiaries had a statistically significant positive (+) effect on the increase in the sales of the company.

Table 7. Effect of duplicate benefits on sales growth: Probit analysis results

Probit regression	Regression coefficient	Standard error	z-value	P-value
Whether to receive duplicate benefits	0.14	0.03	5.21	0.00***
The number of employees	-0.00	0.00	-1.64	0.10*
Manufacturing	-0.02	0.04	-0.41	0.68
Information and communication industry	0.13	0.05	2.54	0.01**
Professional, scientific and technical service industry	0.06	0.06	1.02	0.31
Constant term	0.46	0.04	11.05	0.00***

Notes: Number of obs = 11,653; LR chi2(5) = 48.41; Prob > chi2 = 0.0000; Log likelihood = -6985.1572; Pseudo R2 = 0.0035; * p < .1; ** p < .05; *** p < .01

Table 8. Effect of the number of beneficiaries on sales growth: Probit analysis results

Probit regression	Regression coefficient	Standard error	z-value	P-value
The number of benefits	0.03	0.00	7.50	0.00***
The number of employees	-0.00	0.00	-1.91	0.06*
Manufacturing	-0.01	0.04	-0.25	0.80
Information and communication industry	0.14	0.05	2.69	0.01***
Professional, scientific and technical service industry	0.07	0.06	1.11	0.27
Constant term	0.45	0.04	11.28	0.00***

Notes: Number of obs = 11,653; LR chi2(5) = 81.11; Prob > chi2 = 0.0000; Log likelihood = -6968.8074; Pseudo R2 = 0.0058; * p < .1; ** p < .05; *** p < .01

Next, the effect of government R&D support on the sales growth of beneficiary companies was examined based on the number of overlapping beneficiaries. To this end, a simple regression analysis (OLS regression) was performed on the model in which the sales growth rate was set as the dependent variable and the government R&D support amount was set as the independent variable by classifying the companies that received the support twice, thrice, four times or more. To normalize the dependent variable, the natural logarithm value was taken and used through log transformation. The minimum value of the sales growth rate is -1.51, and if it has a negative value, we add 2 to make it positive, and then conduct the log transformation. As for the other control variables, the number of employees and business type (dummy variables of manufacturing, information and communication, and professional, scientific, and technological services in accordance with the industry standard classification) were input into the analysis model. According to the analysis results presented in Tables 9 and 10, the effect of government R&D support on the increase in sales of the target SMEs had a statistically significant positive (+) effect on the

beneficiaries receiving the support the second and third times.

Table 9. The effect of government R&D support on sales growth rate: twice overlapping beneficiaries

OLS regression	Regression coefficient	Standard error	z-value	P-value
Government R&D support amount	0.00	0.00	2.20	0.03**
The number of employees	-0.00	0.00	-4.24	0.00***
Manufacturing	-0.05	0.03	-1.85	0.06*
Information and communication industry	0.07	0.03	2.15	0.03**
Professional, scientific and technical service industry	0.01	0.04	0.41	0.68
Constant term	0.83	0.02	33.70	0.00***

Notes: Number of obs = 2,479; F(5, 2473) = 11.10; Prob > F = 0.0000; R-squared = 0.0220; Adj R-squared = 0.0200; * p < .1; ** p < .05; *** p < .01

Table 10. The effect of government R&D support on sales growth rate: thrice overlap beneficiaries

OLS regression	Regression coefficient	Standard error	z-value	P-value
Government R&D support amount	0.00	0.00	1.66	0.10*
The number of employees	-0.00	0.00	-3.57	0.00***
Manufacturing	0.01	0.03	0.51	0.61
Information and communication industry	0.03	0.03	0.84	0.40
Professional, scientific and technical service industry	0.12	0.04	2.81	0.01***
Constant term	0.78	0.03	28.68	0.00***

Notes: Number of obs = 1,467; F(5, 1461) = 5.05; Prob > F = 0.0001; R-squared = 0.0170; Adj R-squared = 0.0136; * p < .1; ** p < .05; *** p < .01

However, as shown in Table 11, which is the result of analyzing the companies that have been beneficiaries more than four times, the effect of government R&D support on their sales, growth was not statistically significant. The number of beneficiaries is 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19. In addition, the effect of government R&D support on sales growth was not statistically significant, even in the results of separately analyzing companies more than twenty times.

Table 11. The effect of government R&D support on sales growth rate: four times or more overlapping beneficiaries

OLS regression	Regression coefficient	Standard error	z-value	P-value
Government R&D support amount	-0.00	0.00	-0.38	0.71
The number of employees	-0.00	0.00	-5.01	0.00***
Manufacturing	-0.01	0.01	-0.88	0.38
Information and communication industry	0.02	0.02	1.40	0.16
Professional, scientific and technical service industry	0.01	0.02	0.76	0.45
Constant term	0.81	0.01	62.84	0.00***

Notes: Number of obs = 3,941; F(5, 3935) = 8.13; Prob > F = 0.0000; R-squared = 0.0102; Adj R-squared = 0.0090; * p < .1; ** p < .05; *** p < .01

Among the technological achievements, the number of domestic and foreign patents was set as a dependent variable, and as an independent variable, Poisson regression was used for the model that used the number of beneficiaries along with whether or not they had the experience of receiving multiple benefits twice or more. As for the other control variables, the number of employees and business type (dummy variables of manufacturing, information and communication, and professional, scientific, and technological services in accordance with the industry standard classification) were input into the analysis model. According to Tables 12 and 13, whether the target SMEs benefited from overlapping and the number of beneficiaries had a statistically significant positive (+) effect on the increase in sales of the corresponding company.

Table 12. Effect of duplicate benefits on the number of domestic and foreign patents: Poisson analysis results

Poisson regression	Regression coefficient	Standard error	z-value	P-value
Whether to receive duplicate benefits	1.56	0.06	27.61	0.00***
The number of employees	0.00	0.00	14.80	0.00***
Manufacturing	-0.02	0.06	-0.43	0.67
Information and communication industry	0.11	0.07	1.57	0.12
Professional, scientific and technical service industry	-0.02	0.08	-0.25	0.81
Constant term	-2.51	0.07	-34.40	0.00***

Notes: Number of obs = 12,332; LR chi2(5) = 1199.37; Prob > chi2 = 0.0000; Log likelihood = -8909.0913; Pseudo R2 = 0.0631; * p < .1; ** p < .05; *** p < .01

Table 13. Effect of the number of beneficiaries on the number of domestic and foreign patents: Poisson analysis results

Poisson regression	Regression coefficient	Standard error	z-value	P-value
The number of benefits	0.06	0.00	49.86	0.00***
The number of employees	0.00	0.00	11.07	0.00***
Manufacturing	0.25	0.06	3.99	0.00***
Information and communication industry	0.36	0.07	5.07	0.00***
Professional, scientific and technical service industry	0.23	0.08	2.73	0.01***
Constant term	-1.77	0.06	-29.09	0.00***

Notes: Number of obs = 12,332; LR chi2(5) = 1106.48; Prob > chi2 = 0.0000; Log likelihood = -8955.5403; Pseudo R2 = 0.0582; * p < .1; ** p < .05; *** p < .01

Next, the effect of government R&D support on the number of domestic and foreign patents was examined based on the number of overlapping benefits. Poisson regression analysis was performed on a model in which the number of domestic and foreign patents was set as a dependent variable and government R&D support was set as an independent variable by classifying the companies that received support twice, thrice, four times, or more. As for the other control variables, the number of employees and business type (dummy variables of manufacturing, information and communication, and professional, scientific, and technological services in accordance with the industry

standard classification) were input into the analysis model. According to the analysis results presented in Tables 14, 15, and 16, the effect of government R&D support on the number of domestic and foreign patents of the analyzed SMEs was not only applicable to the beneficiaries who had received the support twice and three times but also to the ones who had received the support four times or more. This was also found to have a statistically significant positive (+) effect. The number of beneficiaries is 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19. In addition, by separately analyzing the companies with 20 or more visits, it was found that the amount of money provided as government R&D support had a statistically significant positive (+) effect on the increase in sales.

Table 14. The effect of government R&D support on the number of domestic and foreign patents: twice overlapping beneficiaries

Poisson regression	Regression coefficient	Standard error	z-value	P-value
Government R&D support amount	0.00	0.00	27.80	0.00***
The number of employees	0.00	0.00	5.47	0.00***
Manufacturing	-0.43	0.13	-3.26	0.00***
Information and communication industry	-0.17	0.16	-1.06	0.29
Professional, scientific and technical service industry	-0.81	0.22	-3.65	0.00***
Constant term	-1.74	0.12	-14.36	0.00***

Notes: Number of obs = 2,613; LR chi2(4) = 430.53; Prob > chi2 = 0.0000; Log likelihood = -1362.4017; Pseudo R2 = 0.1364; * p < .1; ** p < .05; *** p < .01

Table 15. The effect of government R&D support on the number of domestic and foreign patents: thrice overlapping beneficiaries

Poisson regression	Regression coefficient	Standard error	z-value	P-value
Government R&D support amount	0.00	0.00	20.67	0.00***
The number of employees	0.00	0.00	5.10	0.00***
Manufacturing	0.17	0.19	0.87	0.38
Information and communication industry	0.00	0.23	0.00	1.00
Professional, scientific and technical service industry	0.07	0.26	0.27	0.78
Constant term	-2.09	0.18	-11.50	0.00***

Notes: Number of obs = 1,521; LR chi2(4) = 294.75; Prob > chi2 = 0.0000; Log likelihood = -893.04876; Pseudo R2 = 0.1416; * p < .1; ** p < .05; *** p < .01

Table 16. The effect of government R&D support on the number of domestic and foreign patents: four times or more overlapping beneficiaries

Poisson regression	Regression coefficient	Standard error	z-value	P-value
Government R&D support amount	0.00	0.00	46.01	0.00***
The number of employees	0.00	0.00	9.54	0.00***
Manufacturing	0.07	0.07	0.94	0.35
Information and communication industry	0.24	0.09	2.78	0.01**
Professional, scientific and technical service industry	-0.05	0.10	-0.48	0.63
Constant term	-1.20	0.07	-16.79	0.00***

Notes: Number of obs = 3,996; LR chi2(4) = 1390.80; Prob > chi2 = 0.0000; Log likelihood = -3917.6702; Pseudo R2 = 0.1507; * p < .1; ** p < .05; *** p < .01

5. Discussion and Conclusions

5.1. Main Findings of This Study

The Korean government has continuously expanded the R&D investment in SMEs to promote economic development via the promotion of technological innovation and corporate growth. However, it has come to be pointed out that the government's R&D support to SMEs falls under the supplier-centered overlapping or the 'sprinkling' supports method. It is time to diagnose the problems with the R&D support method for SMEs raised in response to overlapping support. Therefore, this study empirically analyzed the overlapping R&D support provided to SMEs. First, the effects of government R&D support on the financial and technological performance of beneficiaries were analyzed for companies that received double government R&D support twice or more between 2012 and 2018. The analysis revealed that the number and status of government R&D benefits had a statistically significant positive (+) effect on the sales increase in a company. The effect of government R&D support on the increase in sales of SMEs was found to have a statistically significant positive (+) effect on the 2nd and 3rd beneficiaries. The analysis of the effect of government R&D support on the technological performance of beneficiary companies revealed that the number of overlapping benefits and beneficiaries had a statistically significant positive (+) effect on the number of domestic and foreign patents of the company. The effect of government R&D support on the number of domestic and foreign patents held by SMEs was found to have a statistically significant positive (+) effect not only on the beneficiaries that received grants twice and three times but also on the companies that received grants four or more times.

5.2. Implications of the Study

The results of this study have the following implications: First, it is necessary to establish an optimization plan for overlapping support. As shown in the empirical analysis results, it is necessary to note that the overlapping beneficiary tasks supported up to three times have a positive effect on the sales growth and technological performance of SMEs to some extent. Currently, in the case of the 'graduation system' target project of the Ministry of SMEs and Startups, SMEs that have completed four or more tasks cannot apply for the 'graduation system' project. Some of these are considered appropriate. Therefore, to prevent the overlapping support provided to specific SMEs, it is necessary to expand and promote the 'Small and Medium Business R&D Graduation System which is implemented for the tasks of the Ministry of SMEs and Startups and the Ministry of Trade, Industry, and Energy, to all the offices. At the same time, even SMEs that have received overlapping benefits should be considered for creative and challenging tasks. To this end, it is necessary to classify the support stages in accordance with the level of innovation capability and the size of the company and to enhance the voluntary innovation capability of SMEs through step-by-step support in accordance with the innovation capability

and size of the applicant company.

Next, it is necessary to streamline the Korean government has R&D support systems for SMEs. It is necessary to improve the current system, which is supported not only by the R&D support provided to SMEs dedicated to the Ministry of SMEs and Startups, Korea's unique SME support system, but also, without a synergistic effect, by the R&D support provided to SMEs from other ministries. To this end, it is necessary to build a database of the current status of project participation, performance histories, and company status of SMEs, R&D-performing companies, and researchers and use it for strategic support. In particular, it is necessary to continuously manage the history of where and how many SMEs are capable of conducting R&D among the current SMEs. To this end, it is necessary to establish a system of mutual linkage and cooperation between the government ministries' small- and medium-sized enterprise (SME)-related information systems (Small and Medium Business Administration's SME Support Project Integrated Management System (SIMS), National Statistical Office, National Tax Service, etc.) and private enterprise data. In addition, it is necessary to seek a way to make it mandatory to consult the budget authorities (Ministry of Strategy and Finance and Science and Technology Innovation Headquarters) and the Ministry of SMEs and Startups for new or changed projects in relation to SME R&D support projects.

5.3. Academic Contribution of the Study

This paper makes a significant academic contribution by examining the overlapping government R&D support provided to SMEs in Korea. This study analyzes the effects of overlapping support on the financial and technological performance of beneficiary companies. What sets this research apart from existing literature is its focus on the positive impact of overlapping support on sales growth and technological performance of SMEs, particularly for the second and third beneficiaries.

More specifically, this paper offers a novel perspective on the relationship between government R&D support and the performance of SMEs by specifically addressing the issue of overlapping benefits. Unlike previous studies that focused on the overall impact of R&D support, this research dives deeper into the effects of multiple and repeated benefits on SMEs. By analyzing the financial and technological performance of companies that received overlapping support, the study reveals that there is a positive and statistically significant impact on sales growth and technological achievements, especially for the second and third beneficiaries. This unique insight challenges the conventional understanding of R&D policy and highlights the importance of considering the dynamics of overlapping support when designing effective strategies for promoting SME performance.

Additionally, the paper highlights the need for optimizing and streamlining the support system, proposing the expansion of the "Small and Medium Business R&D Graduation System" and the establishment of a comprehensive database for strategic support. These findings provide valuable insights for policymakers and contribute to the ongoing discussion on effective government support for SMEs.

5.4. Limitations of the Study

The limitations of the application of the results from this study are as follows: The first limitation is related to context-specific findings. The research is focused on the Korean government's R&D support for SMEs within the specified timeframe. The applicability of the results to other countries or regions with different policies, economic conditions, and business environments may be limited.

The second limitation is regarding generalizability. The study findings are based on a specific sample of companies that received government R&D support more than twice. The results may not be representative of all SMEs or companies with different levels of support and may not be applicable to those outside the scope of the study.

The third limitation concerns the timeframe and evolving policies: the research covers the period from 2012 to 2018, and government policies and support mechanisms may have changed since then. The applicability of the findings to present or future contexts, where policies and programs may have evolved, could be limited.

The final limitation is with respect to potential confounding factors. The analysis considers several control variables; however, there may be other factors influencing the performance of SMEs that are not accounted for in the study. Other contextual, industry-specific or internal factors may impact the results and limit the direct application of the findings.

5.5. Recommendation for Future Research

Based on the limitations of this study, there are several recommendations for future research in the field of R&D policy for SME performance. First, it would be beneficial to conduct a more in-depth analysis of the specific factors or mechanisms that contribute to the positive effects of overlapping benefits on SMEs. Exploring the underlying processes and identifying the key drivers behind these outcomes would provide valuable insights for policymakers. Second, further research could focus on investigating the potential negative consequences or challenges associated with overlapping benefits, such as resource allocation issues or dependency of government support. Understanding these drawbacks would help develop strategies to mitigate their impact and ensure sustainable growth for SMEs. Lastly, comparative studies across different countries or regions could shed light on the contextual factors that influence the effectiveness of overlapping benefits, allowing for a more nuanced understanding of

their implications in different contexts.

Acknowledgments

This article is based on the results of "Innovation performance of SMEs and how to create it - Analysis of R&D policy issues and policy challenges for SMEs" (KISTEP Research Report 2019-01).

Authors' Contributions

Conceptualization, S.A.; methodology, K.-H.L.; validation, S.A.; writing-original draft preparation, S.A.; writing-review and editing, K.-S.K. and K.-H.L.; funding acquisition, K.-H.L.

References

[1] AHN, J.M., LEE, W., & MORTARA, L. (2020). Do government R&D subsidies stimulate collaboration initiatives in private firms? *Technological Forecasting and Social Change*, 151, art. 119840. https://doi.org/10.1016/j.techfore.2019.119840

[2] AHN, S.-G. (2019). *Innovative performance of SMEs, how to create them? 2019-055*. Korea Advanced Institute of Science and Technology Evaluation.

[3] CHOI, J. (2018). The impact of government R&D support on SME innovation performance: focusing on the moderating effect of firm characteristics. *Journal of Public Administration* 56(2), pp. 213-248. https://doi.org/10.1016/j.jik.2022.100176

[4] JANG, H.-J. (2016). Analysis of the Effects of Government Support on Small and Medium Enterprises R&D Fields – Focusing on Technical, Economic, and Social Performance. *Korean Society and Public Administration Research*, 26(4), pp. 195-218.

[5] KANG, S.-M. (2013). The Effect of R&D Efforts of Domestic Small and Medium Enterprises on Innovation: Focusing on the Moderating Effect of Government Policy Support. *The Impact of Korean SMEs' R&D Effort on Innovation - The Moderating Effects of Government Policy Supports*, 32(1), pp. 1-18. http://doi.org/10.29214/damis.2013.32.1.001

[6] LEE, B., LEE, S., & WE, S. (2014). The Effect of Government R&D Supports on SME's Technological Innovation Performance in Korea. *Asia-Pacific Journal of Business Venturing and Entrepreneurship*, 9(5), pp. 157-171.

[7] LEE, H.-S., LEE, J.-S., & PARK, J.-M. (2015). Analyzing the Technical Performance of SMEs by Type of Government R&D Support. *Journal of Technology Innovation*, 18(1), pp. 73-97. Retrieved from https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART001982204

[8] LEE, W.-S., BYUN, I.-S., PARK, J.-H., & KIM, B.-H. (2009). *Private R&D to achieve 5% of GDP in R&D investment, Policy Study 2009-29*. Institute for Science and Technology Policy.

[9] MINISTRY OF SMES AND STARTUPS (2022). *The Ministry of Government Legislation provides all legal information in Korea*. Retrieved from https://www.law.go.kr/%EB%B2%95%EB%A0%B9/%EC%A4%91%EC%86%8C%EA%B8%B0%EC%97%85%EA%B8%B0%EC%88%A0%ED%98%81%EC%8B%A0%EC%B4%89%EC%A7%84%EB%B2%95

[10] NOH, Y.-H., & SONG, C.-S. (2014). A study on the Performance of Small and Medium Business Support-Type R&D Projects. *Industrial Economy Research*, 27(6), pp. 2403-2429. Retrieved from https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART001948436

[11] OH, S.-H., & KIM, S. (2017). Analyzing the Current Status and Performance of R&D Support for SMEs. *STEPI Insight Vol. 211*. Science and Technology Policy Institute. Retrieved from https://policy.nl.go.kr/cmmn/FileDown.do?atchFileId=163589&fileSn=42711

[12] ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (1992). *Oslo Manual (1st edition)*. European Commission.

[13] ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (2005). *Oslo Manual (3rd edition)*. European Commission.

[14] ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (2018). *Oslo Manual (4th edition)*. European Commission.

[15] PARK, C., & SON, S. (2012). *Evaluation of SMEs' technological innovation capacity and analysis of global policy trends (Ⅲ)*. Research Institute for Science and Technology Policy.

[16] PARK, M., & LEE, H. (2012). Technical Support Policy for Innovative SMEs. *Trade Information Research*, 14(1), pp. 197-218. Retrieved from https://koreascience.kr/article/JAKO201216636295190.pdf

[17] RYU, S., & KIM, S. (2010). An empirical study on the impact of policy tools on innovation in SMEs: Focusing on the manufacturing industry. In *Proceedings of the 2010 Spring Conference of the Korea Association for Policy Analysis and Evaluation* (pp. 111-133). Korea Association for Policy Analysis and Evaluation.

[18] SEO, C.-J., & LEE, C.-H. (2007). An Empirical Study on the Effect of the Government R&D Support System on the Determining Factors of the Technology Management Level of Small and Medium Enterprises: Focusing on the Moderating Effect of the Government R&D Support System. In *9th Management Association Summer Papers*.

[19] SEO, C.-J., & LEE, C.-H. (2014). A Study on Factors Affecting the Efficiency of the Government's Technology Development Project for Small and Medium Enterprises. *Journal of the Korean Society for Production Management*, 25(1), pp. 1-21. http://doi.org/10.21131/kopoms.25.1.201403.1

[20] SHIN, J.-K., & CHOI, Y.-A. (2008). R&D and innovation in SMEs: The moderating effect of government policy support. *Korean Corporation Management Review*, 15(1), pp. 119-132.

[21] YOO, H.-R., & PARK, S.-J. (2006). An Empirical Study on the Influencing Factors of the Performance of Small and Medium Enterprise R&D Support Policy. In *Proceedings of the 50th anniversary of the Korean Society of Public Administration and the 2006 Fall Conference* (pp. 963-984).

[22] YOON, J.-W., & YOON, S.-S. (2013). An empirical analysis of the effect of government R&D support on business exploratory activities. *Journal of Technology Innovation*, 16(1), pp. 279-302.

参考文:

[1] AHN, J.M., LEE, W., 和 MORTARA, L. (2020). 政府研发补贴是否会刺激私营企业的合作举措？技术预测和社会变革，151，文章119840. https://doi.org/10.1016/j.techfore.2019.119840

[2] AHN, S.-G. (2019). 中小企业创新绩效如何打造？2019-055。韩国科学技术评价院.

[3] CHOI, J. (2018). 政府研发支持对中小企业创新绩效的影响:关注企业特征的调节作用 公共管理杂志 56(2)，第213-248 页. https://doi.org/10.1016/j.jik.2022.100176

[4] JANG, H.-J. (2016). 政府支持对中小企业研发领域的影响分析——关注技术、经济和社会绩效。韩国社会与公共行政研究，26(4)，第 195-218 页.

[5] KANG, S.-M. (2013). 国内中小企业研发努力对创新的影响：关注政府政策支持的调节效应。韩国中小企业研发努力对创新的影响——
政府政策支持的调节作用，32(1)，第1-18 页. http://doi.org/10.29214/damis.2013.32.1.001

[6] LEE, B., LEE, S., 和 WE, S. (2014). 政府研发支持对韩国中小企业技术创新绩效的影响。亚太商业风险与创业杂志，9(5)，第 157-171 页.

[7] LEE, H.-S., LEE, J.-S., 和 PARK, J.-M. (2015). 按政府研发支持类型分析中小企业的技术绩效。技术创新杂志，18(1)，第 73-97 页。从...获得 https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART001982204

[8] LEE, W.-S., BYUN, I.-S., PARK, J.-H., 和 KIM, B.-H. (2009). 私人研发研发投资占国内生产总值的5%，政策研究2009-29。科学技术政策研究所.

[9] 中小企业和初创企业部 (2022). 政府法制部提供韩国的所有法律信息。从...获得 https://www.law.go.kr/%EB%B2%95%EB%A0%B9/%EC%A4%91%EC%86%8C%EA%B8%B0%EC%97%85%EA%B8%B0%EC%88%A0%ED%98%81%EC%8B%A0%EC%B4%89%EC%A7%84%EB%B2%95

[10] NOH, Y.-H., 和 SONG, C.-S. (2014). 中小企业支持型研发项目绩效研究。工业经济研究，27(6)，第2403-2429页。从...获得 https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART001948436

[11] OH, S.-H., 和 KIM, S. (2017). 中小企业研发支持现状及绩效分析。科学技术政策研究所洞察卷。211.
科学技术政策研究所。从...获得https://policy.nl.go.kr/cmmn/FileDown.do?atchFileId=163589&fileSn=42711

[12] 经济合作与发展组织 (1992). 奥斯陆手册（第一版）。欧盟委员会.

[13] 经济合作与发展组织 (2005). 奥斯陆手册（第三版）。欧盟委员会.

[14] 经济合作与发展组织 (2018). 奥斯陆手册（第四版）。欧盟委员会.

[15] PARK, C., 和 SON, S. (2012). 中小企业技术创新能力评价及全球政策趋势分析（三）。科技政策研究所.

[16] PARK, M., 和 LEE, H. (2012). 创新型中小企业技术支持政策。贸易信息研究，14(1)，第 197-218 页。从...获得 https://koreascience.kr/article/JAKO201216636295190.pdf

[17] RYU, S., 和 KIM, S. (2010). 政策工具对中小企业创新影响的实证研究——以制造业为中心
韩国政策分析与评估协会2010年春季会议记录（第 111-133 页）。韩国政策分析与评估协会.

[18] SEO, C.-J., 和 LEE, C.-H. (2007). 政府研发支持体系对中小企业技术管理水平决定因素影响的实证研究——
以政府研发支持体系的调节作用为中心。第九届管理协会夏季论文.

[19] SEO, C.-J., 和 LEE, C.-H. (2014). 政府中小企业技术开发项目效率影响因素研究。韩国生产管理学会杂志，25(1)，第1-21 页. http://doi.org/10.21131/kopoms.25.1.201403.1

[20] SHIN, J.-K., 和 CHOI, Y.-A. (2008). 中小企业的研发与创新：政府政策支持的调节作用。韩国企业管理评论，15(1)，第 119-132 页.

[21] YOO, H.-R. 和 PARK, S.-J. (2006). 中小企业研发支持政策绩效影响因素实证研究。韩国公共行政学会成立50周年暨2006年秋季会议论文集（第 963-984 页）.

[22] YOON, J.-W., 和 YOON, S.-S. (2013).

政府研发支持对企业探索活动影响的实证分析
技术创新杂志，16(1)，第 279-302 页.