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Study on Measures to Activate Technology Startup through National R&D Support Project

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Abstract

Purpose- The purpose of this study is to increase the effect of public technology transfer through government R&D support to secure the competitiveness of public technology startups. The government's R&D budget in 2019 is over 20 trillion won, and there is a legitimate need to increase the performance of technology startups through such R&D results. **Research design, data, and methodology-** In this paper, we comprehensively analyzed the current status of public research institutes and R&D support projects suitable for founders and analyzed and presented cases of follow-up research conducted by the Institute of Science and Technology Jobs to analyze actual performance cases of R&D support institutes. **Results-** In this conclusion, a developmental model of public technology entrepreneurship was proposed to increase the performance of public technology commercialization with the scalability of research institutions. In order to create a public technology information system between consumers and suppliers, a Steinweiss-type technology commercialization model for public technology commercialization, and a job-creating enterprise-type linkage R&D support business model were presented to create the results of R&D support organizations. **Conclusions-** Through the results of this study, it is meaningful to analyze the performance cases of technology commercialization of R&D support institutions, which have not been studied so far, to build competitiveness of research institutions and to present a growth model for the spread of technology startups. This study has implications in terms of suggesting a way to build competitiveness in technology commercialization between market demanders and suppliers by linking existing public technology startups, which deviated from the simple commercialization support system, with job creation by expanding the R&D support system.

Keywords: R&D Support Organization, Technology Commercialization, Technology Start-up Model

JEL Classification Code: L10, M10, M30

1. Introduction

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The government's R&D budget is over 20 trillion won. Government R&D project support plays a role in revitalizing technology startups, and is an essential part for business growth through technology development by founders. The government's R&D budget should be presented in terms of effective use of the budget, and various outcomes resulting from the growth of start-up companies should be created.

Accordingly, the budget of domestic R&D expenditure shows a continuous trend of increasing, and various achievements are being created. R&D expenses paid to researchers are leading to excellent patents and papers. The volume of patent applications by domestic researchers continues to increase, and the results of thesis are also increasing.

However, despite the achievements of these research achievements, the achievements of technology start-ups are limited. In particular, the performance of start-up founders in Korea remains at a level that is extremely insufficient compared to global companies. Through research and development support projects, many start-up companies are still experiencing many difficulties, and technology start-ups of public technology reflect the more difficult start-up reality in particular.

As a result of a survey of the commercialization status of 1,808 technologies owned by public research institutes surveyed by the Korea Institute for Industrial Technology Promotion, it was found that the commercialization success technologies of companies transferred to universities and donation centers were at the level of 15%, and that 50% of technologies had stopped commercialization (Kim, 2015).

In order to revitalize the start-up of such public technology, the founder's competitiveness is being built by supporting national R&D projects, but it can be seen that there is a limit to the growth power of the founders. Although various government support systems have been established in terms of creating technology commercialization of public research results, it is necessary to identify problems in technology startup by measuring the effects that are actually delivered to founders and to suggest appropriate alternatives.

From the perspective of commercializing public technology, R&D support is considered essential. In order to commercialize a technology, it must go through various processes, and it must be developed into a technology suitable for the product and market. The most secured part of technology requires a strategy of investment in R&D from the viewpoint of linking the product to the market and from the viewpoint of commercialization.

It is said that the decisive influence on the purchase of new products is the online social influence. Recently, customers are paying attention to their purchasing decisions in a smart environment. (Han, 2018). In recent years, the purchasing environment of customers has changed in many parts, and the R&D support business is also changing to be customer-oriented accordingly.

Therefore, in this thesis, a follow-up survey was conducted and performance analysis was conducted on companies that received the benefits of the R&D project supported by the Science and Technology Job Promotion Agency under the Ministry of Science and Technology Information and Communication, which is carrying out the government R&D support project. Through performance analysis, we analyze the status of companies that have received national R&D projects and the performance aspects of the projects to study systematic support plans for government-sponsored projects, and to prepare policy alternatives to build competitiveness of public technology founders.

There are few research papers on the actual condition survey of companies on domestic R&D project support, and there are no research data that provide detailed policy implications for technology start-up. Therefore, this paper aims to present the effectiveness of national R&D costs through surveys on the actual condition of such R&D support organizations to create corporate performance, and to discover policy alternatives for the successful implementation of public technology commercialization.

2. Government R&D Support and Technology Commercialization Status

2.1. Prior Research

Park et al. (2015) studied the factors that affect the technology developed by public R&D institutions in the process of commercialization. It is judged that the technology of public research institutes has been commercialized in order to understand the needs of consumers and has sufficient technical capabilities.

Park and Chang (2016) found that through a study on the impact of the commercialization performance of SMEs that received technology transfer from the public sector, SMEs that succeeded in commercialization based on public technology increased the success rate of commercialization as the number of successful technology development and intellectual property registrations increased. Revealed that. Yang and Choi (2010) researched the outcomes of the R&D business system for

technology commercialization of research results held by public research institutes in terms of technology commercialization. It was suggested that the improvement of qualitative systems is more important than quantitative performance in order to create corporate performance.

Most of the prior researches on technology commercialization are papers on the analysis of performance factors in the process of commercialization, and research on technology commercialization related to R&D performance is insufficient. R&D support is highly related to the government's policy, and the level of analyzing performance factors can be seen mostly in studies on how to measure performance in the process of commercialization.

In order to reinforce research in technology commercialization, it is necessary to basically relate to the perspective of commercialization of research results, and methods that can dramatically increase the support system for R&D must appear.

2.2. Government R&D Support Status

The total R&D budget in 2019 is the largest ever, exceeding 20 trillion won. Accordingly, the government's R&D performance is also on the rise. Looking at the performance of government R&D in <Table 1> below, the number of patent applications and registrations increased significantly in 2016 compared to 2015. In terms of national R&D commercialization, the creation of such R&D results is considered to be an important time to create competitiveness of domestic technology ahead of the 4th Industrial Revolution. Although companies have various purposes for technology transfer, most of them are approached from the aspect of developing new products or new businesses, and this aspect is leading to vitalization of technology startups. Lee (2018) stated that the support system for various commercialization processes is important because commercialization of R&D can create positive synergies for companies.

Table 1: Government R&D Outcome(Unit: number of cases)

Division	2013	2014	2015	2016
Number of domestic patent applications	23,766	27,005	28,192	30,807
Number of patents registered in Korea	14,151	15,193	14,975	16,670
Number of overseas patents	4,357	4,480	4,316	4,923
Number of overseas patents	1,270	1,670	1,891	2,121
Number of technical fees collected	5,284	6,885	7,372	8,849
Technology fee collected (KRW 100 million)	2,431	2,311	3,169	2,661
Number of commercialization	15,315	21,205	20,088	28,031

Source : 2016 National R&D Project Performance Analysis Report, NTIS

The domestic R&D budget is also increasing the basic support for the researcher's technology development project, but the reality is that the founder's support business for the market-creating product development project is also steadily increasing. In particular, the government is establishing various support systems for technology commercialization companies linked to start-ups in order to increase the effect of job creation while providing R&D support to companies due to the youth job problem.

<Table 2> is a chart showing the trend of R&D expenditures by research subject. The proportion of large corporations is on the decline in 2017 compared to 2016, and mid-sized companies are on a sharp increase. This is interpreted as a part to establish an export-led corporate growth policy by establishing a support system for mid-sized enterprises in terms of securing competitiveness due to lack of R&D funds of domestic mid-sized enterprises.

Table 2: Execution trend by research subject(Unit: KRW 100 million, %)

Division	2014		2015		2016		2017		increase	
	Price	importance	Price	importance	Price(A)	importance	Price(B)	importance	B-A	%
National and Public Research Institute	8,788	5.0	9,579	5	9,883	5	10,016	5.2	133	1.3

Research Institute	74,966	42.5	78,235	41	78,305	41	78,838	40.7	532	0.7
University	41,023	23.3	42,617	23	42,727	23	44,052	22.7	1,325	3.1
major company	6,923	3.9	6,278	3	4,871	2	4,192	2.2	-679	-13.9
Midsize company	5,437	3.1	6,130	3	7,442	5	9,504	4.9	2,062	27.7
Small business	24,150	13.7	27,902	15	28,973	16	31,686	16.3	2,713	9.4
Ministry of Government	4,473	2.5	6,181	3	6,281	2	4,692	2.4	-1,589	-25.3
Etc	10,635	6.0	11,825	6	11,562	6	10,948	5.6	-615	-5.3
Sum	176,395	100.0	188,747	100	190,044	100	193,928	100	3,883	2.0

Source : 2017 National R&D Project Research and Analysis Report, NTIS

2.3. Technology Commercialization Status of Public Research Institutes

Public technology commercialization refers to the process of commercialization by transferring public technology. For domestic public technology, universities and public research institutes apply for patents through technology development, and the results of these patents are commercialized by companies through technology transfer. In the process of commercialization, the role of supporting public technologies to have various growth bases is needed, and in this process, R&D projects are supported as national projects. <Table 3> below shows the status of departments in charge of technology transfer and commercialization.

Table 3: Current status of personnel in departments dedicated to technology transfer and commercialization(Unit: persons,%)

Division		Number of cases	Number of personnel (persons)		Manpower composition (%)	
			Sum	Average	Full-time	Non-regular workers
all		278	1,018	3.7	64.0	36.0
Organization type 1	Public Research Institute	62	394	6.4	70.3	29.7
	National and public testing and research institutes and non-profit corporations	73	144	2.0	81.9	18.1
	University	143	480	3.4	53.5	46.5
Organization type 2	National Science and Technology Research Association Affiliated research institute	23	253	11.0	78.7	21.3
	Specific research institute	10	63	6.3	28.6	71.4
	Professional Production Technology Research Center	16	56	3.5	75.0	25.0
	Other public research institutes	13	22	1.7	81.8	18.2
	National and Public Testing and Research Institute	43	88	2.0	78.4	21.6
	Non-profit corporations and organizations	30	56	1.9	87.5	12.5
	National and public universities	27	150	5.6	37.3	62.7
	Private university	116	330	2.8	60.9	39.1

Source : Ministry of Trade, Industry and Energy (2017), 2017 public research institute technology transfer commercialization survey report

<Table 4> below is a chart of the technology utilization rate of newly acquired technologies by public research institutes in 2016. The technology utilization rate of newly acquired technologies is calculated as an index by dividing the number of newly acquired technologies transferred in the current year by the number of newly acquired technologies in the year. As shown in the table below, research institutes affiliated with the National Science and Technology Research Association showed the highest technology utilization rate of 11.7%, while that of national and public universities remained at a low level of 4%. In particular, private universities showed a higher rate of technology utilization than national and public universities at 17.2%.

Table 4: Technology utilization rate of newly acquired technologies by public research institutes

Division		Fiscal year 2016 Secure new technology (cases)	Of new technology in 2016 Previous (case)	Technology utilization rate (%)
Public laboratory	Research institute under the National Science and Technology Research Association	6,888	807	11.7
	Professional Production Technology Research Center	1,383	59	4.3
	Specific research institute	2,103	48	2.3
	Other related public institutions (including special corporations)	263	0	0.0
	National and public testing and research institutes, non-profit corporations, etc.	1,368	121	8.8
	Sub Total	12,005	1,035	8.6
University	National and public universities	6,900	276	4.0
	Private university	13,586	2,336	17.2
	Sub Total	20,486	2,612	12.8
Sum		32,491	3,647	11.2

Source : Ministry of Trade, Industry and Energy (2017), 2017 public research institute technology transfer commercialization survey report

In the case of <Table 5>, it was found that 49.4% of the respondents answered that they did not know the use of the transferred technology or the status of commercialization. This can be considered to mean that the post-management of the transferred technology is not properly conducted. 31.2% of respondents answered that the introduced technology was at the level of preparation and progress for use. It is understood that 50% of the level is not used after technology is introduced, and it is also an important implication in that there is a need for effective operation support measures for technology commercialization after technology transfer.

Table 5: Usage status of the introduced technology

Usage status of the introduced technology	Number of technology transfer contracts	
Profit (sales) generated by being utilized for product and service production and process improvement	1,760	(10.8%)
Preparation and progress stage for utilization (facility investment, additional R&D, etc.)	5,069	(31.2%)
Transferred technology is not currently being used	1,389	(8.6%)
Not knowing the use of transferred technology or the status of commercialization	8,023	(49.4%)
Number of valid technology transfer contracts	16,241	(100.0%)

Source : Ministry of Trade, Industry and Energy(2017), 2017 public research institute technology transfer commercialization survey report

3. Public Technology Commercialization Performance Creation Plan

3.1. COMPA's Achievement Creation Case Study

COMPA(Commercializations Promotion Agency for R&D Outcomes), as a national R&D support organization, is a public institution under the Ministry of Science and Technology, operated for the purpose of creating jobs based on science and technology, and supports R&D support projects and technology commercialization. The Institute of Science and Technology Jobs has a very high level of technology transfer performance, with 1,236 projects supported from 2013 to 2017, and 1,200 technology transfer results. <Table 6> below is a chart that summarizes the support tasks and technology transfer performance of the Institute of Science and Technology Jobs.

These technology transfer achievements have achieved high performance as a national R&D project support organization, which creates the results of public technology transfer and increases the effect of corporate support, thereby creating sales and employment effects of initial public technology commercialization.

Table 6: COMPA support tasks and technology transfer performance

Division	2013	2014	2015	2016	2017	2018	Sum
COMPA support tas k(Number of cases)	91	202	258	287	398	-	1,236
Technology transfer performance (Number of cases)	33	81	153	488	472	47	1,274

Source : COMPA(Commercializations Promotion Agency for R&D Outcomes) internal data

In this study, we analyzed the performance cases of technology commercialization targeting companies that benefited from COMPA, a government R&D support organization. In order to analyze the technology commercialization status of government R&D beneficiaries, this study surveyed 996 companies supported by COMPA from 2013 to 2017. In this paper, I will present a plan to build the competitiveness of technology commercialization through the performance of technology transfer through the performance analysis of COMPA.

In particular, since there are not many cases of analyzing the current status of technology commercialization companies of national R&D support organizations, and there are few previously studied data, the case of COMPA in this study is studied in terms of building the competitiveness of public technology commercialization. It is judged to be worth it. <Table 7> is a chart of COMPA's technology transfer performance by R&D business.

Table 7: Technology transfer performance by COMPA business (Unit: case, KRW 100 million)

Business name	Division		2013	2014	2015	2016	2017	Sum
Large Business Unit Performance management	Technology transfer	Number of cases	8	13	7	173	25	226
		Technical fee	19.3	13.9	23.1	117	42.8	216.1
	Technical fee per case		2.4	1.1	3.3	0.7	1.7	1.0
	Input budget		35.3	44	43.4	58.4	67.2	248.3
	Number of technology transfers per KRW 100 million in budget		0.2	0.3	0.2	3.0	0.4	0.9
	productivity(%)		54.7%	31.6%	53.2%	200.3%	63.7%	87.0%
Research achievement Commercialization support	Technology transfer	Number of cases	7	27	45	89	220	388
		Technical fee	8	37	62.4	67	177.5	351.9
	Technical fee per case		1.1	1.4	1.4	0.8	0.8	0.9
	Input budget		21	125	139	152.3	152.3	589.6
	Number of technology transfers per KRW 100 million in budget		0.3	0.2	0.3	0.6	1.4	0.7
	productivity(%)		38.1%	29.6%	44.9%	44.0%	116.5%	59.7%
Spread of results Empowerment	Technology transfer	Number of cases	13	33	90	211	215	562
		Technical fee	5.3	30.5	67.3	106	150.6	359.7
	Technical fee per case		0.4	0.9	0.7	0.5	0.7	0.6
	Input budget		9.2	10	10	10	10	49.2
	Number of technology transfers		1.4	3.3	9.0	21.1	21.5	11.4

	per KRW 100 million in budget							
	productivity(%)		57.6%	305.0%	673.0%	1060.0%	1506.0%	731.1%
Sum	Technology transfer	Number of cases	28	73	142	473	460	1,176
		Technical fee	32.6	81.4	152.8	290	370.9	927.7
	Technical fee per case		1.2	1.1	1.1	0.6	0.8	0.8
	Input budget		65.5	179	192.4	220.7	229.5	887.1
	Number of technology transfers per KRW 100 million in budget		0.4	0.4	0.7	2.1	2.0	1.3
	productivity(%)		49.8%	45.5%	79.4%	131.4%	161.6%	104.6%

* Productivity: (Technology fee/investment budget) X100 → ROI concept of creating technology fee compared to input budget (Return on Investment)
Source : COMPA(Commercializations Promotion Agency for R&D Outcomes) internal data

Public technology commercialization has technical excellence, but since market demand development is not easy, it is difficult to measure the economic performance of commercialization in the short term. In particular, even if technology is transferred due to the superiority of technology, there is a lot of need for additional research and development in connection with the market. In particular, it is difficult to derive economic results in terms of commercialization with only technology without developing a business model. Romijn and Albaladejo (2002) argued that innovation activities were a very important factor for early companies.

Table 8: Sales and job creation performance status

Division	Sales		Employ	
	Number of cases	Ratio	Number of cases	Ratio
Within 1 year	75	74.3%	175	83.3%
Within 2 year	20	19.8%	29	13.8%
Within 3 year	4	4.0%	4	1.9%
Within 4 year	1	1.0%	1	0.5%
Within 5 year	1	1.0%	1	0.5%
More than 5 years	0	0.0%	0	0.0%
Sum	101	100.0%	210	100.0%

* Within 1 year: When economic performance occurs in the year of technology introduction Within 2 years: When economic performance occurs in the year following technology introduction

3.2. Proposal of Public Technology Commercialization Results Creation plan

3.2.1. Public Technology Information System Construction for R&D Support Projects

Public technology commercialization has a higher barrier to entry than other startups in terms of transferring the researcher's technology and developing additional R&D. Therefore, it is very important to provide a process that enables customers to quickly and easily recognize patent information and information on R&D support projects.

Even if you want to access public technology easily, there are many cases where you do not know in detail how to approach it, and even in the case of R&D tasks, the approach to public announcements has been improved in many areas and can be understood, but it is a situation that requires consulting from experts. In particular, it is important to obtain information on commercialization appropriate to the appropriate type because the R&D task is divided into support projects to suit the characteristics of the project in a policy. And only when appropriate information about such R&D projects is presented to consumers and suppliers and consulting on which projects are suitable, companies will help to create results through the projects.

Table 9: Technology transfer technology recognition pathTechnology transfer technology recognition path (n=625, multiple responses)

Division	Performance management of large-scale projects		Support for commercialization of research results		Strengthening the ability to spread performance		Sum	
	Number of cases	Ratio	Number of cases	Ratio	Number of cases	Ratio	Number of cases	Ratio
Joint R&D project	53	49.5%	104	40.8%	118	44.9%	275	44.0%
Researcher Introduction	22	20.6%	79	31.0%	59	22.4%	160	25.6%
Technology trading platform	6	5.6%	8	3.1%	5	1.9%	19	3.0%
Self-investigation	10	9.3%	27	10.6%	41	15.6%	78	12.5%
Private technology transaction Introduction of specialized institutions	4	3.7%	14	5.5%	9	3.4%	27	4.3%
TLO Introduction	6	5.6%	14	5.5%	25	9.5%	45	7.2%
Etc	6	5.6%	9	3.5%	6	2.3%	21	3.4%
Sum	107	100.0%	255	100.0%	263	100.0%	625	100.0%

Source : COMPA(Commercializations Promotion Agency for R&D Outcomes) internal data

In the case of government R&D projects, there are various commercialization support, but the reality is that it is different for each institution, and it is difficult for a business operator to properly grasp the characteristics of the support project. In terms of supporting such projects, consulting support for projects such as the nature and scope of support provided to many founders and researchers is required. Therefore, in order to increase the competitiveness of project support, it is also necessary to expand the systematic support service of project information. It is necessary to establish an information-integrated technology commercialization process information network that comprehensively supports project types, support consulting, technology marketing, technology transfer, investment support, and growth support by establishing a project portal for commercialization based on public research results. For simple R&D project support, there are many difficulties in how and how companies, which are the subject of technology commercialization, participate, and it is necessary to prepare alternatives to lead the participation of excellent companies.

Jung (2017) pointed out that the biggest problems that appear in the distribution process of e-learning are the lack of quality content and the lack of consumer confidence in e-learning content. As such, the information system provides customer value for which content provision is very important. Yoon and Lee (2017) stated that entrepreneurial-minded companies had a rapid initial growth rate. As such, it will be important for early start-ups to strengthen the speed of the spread of the capital market.

3.2.2. 'Stein Vice Type' Business Model Linked to R&D Support

In order to revitalize public technology commercialization, above all, a system that can build the competitiveness of R&D support institutions must be accompanied, along with methods that support the continuity of commercialization of companies linked to the current stage of R&D support. This is because companies' self-sustainability is reduced to a large extent to be approached as a simple commercialization support system, and economic support such as funds, manpower, and systems is important for companies, but innovative growth methods that solve corporate problems are also important.

Kwang, Moo and Jeong (2014) said that it is important to discover a technology commercialization model for startups starting technology commercialization.

As such, commercialization of public technology refers to the process of commercialization based on technology, and competitive growth is realized only through the innovation process required at various stages. The innovation of the market based on technology results in the participation of internal and external customers, and the technology commercialization agents have technological competitiveness to solve market problems. In the case of venture companies, there are various studies showing that the capacity of innovation activities is closely related to the activities of knowledge sharing, thereby enhancing the growth power of companies.

Kwon (2017), stated that in the case of venture companies, the participation of experts in solving issues such as marketing, R&D, and production increases through product innovation and marketing innovation, and the participation of external customers increases, resulting in a smooth interaction between customers and suppliers. Accordingly, a research result was published that product innovation and marketing innovation have a positive effect on venture companies through mutual learning effects.

In the study of Suh and Yoon (2017), small and medium-sized enterprises (SMEs) stated that developing strategies for startups, actively changing business environments, and operating organizations efficiently are linked to market-oriented marketing activities.

Venture companies must have innovation capabilities to create continuous technological superiority and competitiveness, and knowledge management has very important value in this respect (Kogut & Zander, 1992).

In addition, Romijin and Albaladejo (2002) argued that the learning effect through technology innovation capability of venture companies has an edge in market competitiveness, and the value for innovation activities for knowledge management is important.

It is necessary to develop a platform for sharing knowledge and technology and business development of innovation support in order to increase the level of technical knowledge of early companies and increase the innovation capability of companies. In this respect, companies learn their own competitiveness and knowledge, recognize the necessity of technology in the process, and have the competitiveness to change the technology into a more advanced form. Currently, technology developers and companies are promoting commercialization from the perspective of technology transfer, but there are many limitations for small-scale companies in providing the engine for innovative technology. We need a platform that perfects the innovation of knowledge technology that fosters the capacity of innovation.

Romijin and Albaladejo (2002) argued that technological innovation is more effective than the introduction of internal technology, as it is possible to quickly access the market of technology and to understand the technology with the competitive advantage between suppliers and consumers by recognizing the direction in which companies grow Insisted.

It is important to establish competitive R&D technology commercialization from customers by maintaining competitiveness in the form of reinvestment through profit generation and thorough customer-centered service marketing, rather than finishing with support to technology transfer companies in terms of national R&D support. I think it is. To this end, it is necessary to establish a support system for the entire cycle of process technology commercialization, and to partially support the virtuous circle technology commercialization area by completing a profitable technology commercialization model. Kogut and Zander (1992) argued that technology commercialization requires technological scalability and R&D projects linked to companies. From this point of view, national R&D projects need to enhance the performance of technology commercialization to spread results.

3.2.3. Job Creation Performance Model Linked to R&D

Research on the creation of employment effects through research and development has been interpreted from various perspectives and has not been clearly concluded. The reason for this is that there are various types of companies, and there are variables in which R&D costs can vary depending on the support of labor costs, and it is interpreted that there is no clear definition of the employment coefficient calculated in terms of R&D.

In the commercialization of public technology, it is difficult to judge which technologies are currently successful from the commercialization point of view. In public technology, the perspective on which stage R&D funding is needed is important, and to make this judgment, analysis of the growth paths of various companies by stage is necessary. However, there are many limitations in promoting such data-based technology commercialization in Korea, and the reality is that there is a lack of data systems that can analyze commercialization performance.

As statistics-based technology commercialization performance analysis is carried out, it is very important at what stage public technology start-up companies need R&D funds and which growth paths should be supported at each stage of support.

In order to commercialize public technology, a dedicated fund must be established to become the basis for investment in early companies. Public technology requires a variety of funds to be put into the commercialization process, and the creation

of public funds is urgently needed on this basis. In particular, it is expected that the actors who operate public funds will be more effective in the public aspect than the general private fund operator. This is because the public-based ecosystem needs support linked to the entire start-up process, and this part requires a role of supporting companies to reach the start-up process along with profitable support.

Jobs are the result of technology commercialization, and as technology transfers or entrepreneurs increase, the effect of job creation will be greater. Therefore, in order to reinforce the competitiveness of technology commercialization, it will be important to enhance the performance of technology commercialization through cooperation with companies with great job creation effects.

From this point of view, in order to spread the commercialization of public technologies, policy support to secure competitiveness in the creation and operation of public funds will be needed.

In this respect, government R&D support projects are expected to have a direct or indirect impact on employment effects. Bae (2015) analyzed how the experience of business and government R&D support projects affects the employment growth rate. As a result of the analysis, it was found that the scale of corporate R&D investment and government R&D investment had a significant effect on the employment growth rate. Bogliacino and Vivarelli (2012) stated that while government investment in R&D temporarily reduces employment, new businesses or new product launches increase employment.

4. Conclusion

This research paper was studied from the viewpoint of requiring efforts to increase the effect of job creation by building a company's technological commercialization competitiveness through efficient operation of national R&D support projects. It is also important to realize job growth through R&D investment, but the ability to adequately cope with job changes as new growth projects emerge will also be important. When the domestic R&D budget in 2019 exceeds 20 trillion won, the 4th industrial revolution now has the effect of increasing jobs, but also increasing the instability of employment.

In terms of enhancing the effectiveness of government R&D investment, it is necessary to discover a support system that can build competitiveness for companies and differentiate support solutions in line with the 4th industrial revolution that is changing differently from the past. Despite entering the 4th industrial era, if we stick to the past R&D support system, it will be difficult to apply it to the environment of companies. Accordingly, it is necessary to increase the expertise of R&D support from various angles and develop a commercialization support model to increase the competitiveness of effective and timely R&D support and technology commercialization.

Therefore, in this thesis, the current status of public research institutes and research and development support projects were reviewed, and the competitiveness of public technology commercialization was reviewed by verifying the achievements of the research and development support project organizations and discovering success cases. Accordingly, a developmental model for public technology commercialization was presented by reviewing the performance of the R&D support project promoted by the Institute of Science and Technology Job Promotion.

The implications in this paper are as follows.

First, domestic research papers have a section on the current status of public technology commercialization, but few papers have grasped the status of the research support organization. In this respect, research on the results-creation plan of the research support institution and the confirmation of the results of the beneficiary companies of the research project can be expanded to promote public technology commercialization in the future.

Second, by providing the recognition that it is necessary to develop the support area for the entire technology commercialization by having a periodic linkage of technology commercialization, rather than simply operating the R&D support project, the implications for establishing a virtuous cycle in which reinvestment takes place were discovered. This aspect is judged to be a meaningful study from the viewpoint of presenting the competitiveness that can grow public technology commercialization.

Third, it suggested the necessity to develop a job creation model through R&D support projects, and it is expected that it could be used as a developmental model for commercialization support institutions by presenting a corporate-type linkage model. It was proposed to reinforce the support system for commercialization so that the current R&D support commercialization can be linked with companies to produce a substantial job creation effect. It is expected that research is needed on ways to increase synergy between companies, research institutes, and founders by establishing a purchase-determined start-up model at the initial stage to increase the effect of corporate-type job creation.

In the future, it is necessary to analyze various performance factors of the research support project and expand it to the aspect of accurate surveys, such as by region, period of study, and age of founder. Systematic R&D project support should be

created by analyzing the factors that create results through active follow-up surveys of national R&D research support projects. In that respect, research and research functions should be established in the aspect of supporting commercialization based on national science and technology. Until now, there are few cases in which the research and research functions of national R&D project support organizations have been established. Unlike in the past, it seems that the function of research support is realistically necessary in terms of improving the effectiveness of policies, moving away from the role of simply performing support projects.

The field to be studied in the future will require research that can evaluate how government R&D projects affect the growth of companies and which projects are helpful to companies. This paper raises the necessity of these empirical studies, and considers the value of research in terms of judging how important R&D performance is in technology commercialization and how its role can be contributed.

It must be developed into a technology commercialization that is actively linked to national R&D by analyzing the growth factors of the overall technology commercialization by having a periodic linkage of technology commercialization, and it has been developed into a virtuous cycle structure in which reinvestment of technology transfer and investment returns is made. It should be developed by commercialization of technology.

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