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# A Study on Policy effects on Boosting R&D Intensity of Domestic Companies

**Mun-Jeong Kang[1], Jin-Taek Jung[2*] and Jung-Wan Hong[3]**

[1]Department of Knowledge Service and Consulting, Hansung University, Seoul, Korea; mjkang@talpiot.or.kr
[2]Department of Public Administration, Hansung University, Seoul, Korea; jungjt@hansung.ac.kr
[3]Department of Industrial and Management Engineering, Hansung University, Seoul, Korea; jwhong@hansung.ac.k

## Abstract

**Background/Objectives:** A variety of R&D policies for small businesses are being implemented, but R&D investment of small businesses is extremely weak. The aim of this study is to find the causes for this and to suggest effective policies. **Methods/Statistical Analysis:** To find the causes for weak R&D investment of small companies, a survey was conducted with 300 small companies, which had invested in R&D from 2012 to 2014. For this survey, structured questionnaires were distributed and there was an interview using telephone and fax from August 19th to September 22nd 2015. Also, a survey was conducted with 829 of 1,675 mid-sized companies that belong to the Association of High Potential Enterprises of Korea and 102 effective responses were analyzed. **Findings:** The rate of R&D success in the small companies that received government support was 59.2%, but it was mostly focused on performance or quality improvement. At every stage, the companies considered insufficiency of funds and complex administrative procedures as major failure factors. They preferred funding and prototype production support as the most required policies. On the contrary, the mid-sized companies showed a lot of demands for professional manpower, facilities and equipment purchase support. This demonstrates there is a need to offer opportunities for joint use of specialized test equipment's. **Application/Improvements:** This study has big significance by studying the demands of the companies, but further research would need to observe if the policies suggested serve as continued growth engines.

**Keywords:** Mid-Sized Companies, Policies, R&D, Small and Medium-Sized Companies

## 1. Introduction

The Small and Medium Business Administration expanded the R&D support to develop export promoting companies from 80 billion won in 2015 to 450 billion won in 2016 to accelerate development of new growth fields and export in small and medium-sized companies. Separate from this, approximately 350 billion won is supported to companies with high potential of export of technology development products. Also, related departments and business linkage is expanded to maximize the synergy effect of R&D to support focused on R&D projects linked with the market[1]. However, regardless of this quantitative support, success rate of R&D in domestic companies has been investigated to be 59.2%[2]. However, 69.2% of this value has been shown to be focused on enhancement of performance or quality of existing products that R&D success rate to create new development power is low. Shin Dong-ho et al. argued that R&D investment and policies of Korean government are important factors[3] to improve technology commercialization.

For this, a. difficulties of technology development of companies are grasped through investigations on R&D industrialization subject to overall small and medium-sized companies, b. the current condition of R&D of mid-sized companies is focused on, the effect of R&D

* *Author for correspondence*

support policies by the government subject to mid-sized companies is practically researched, and d. the direction of R&D policies on mid-sized companies is to be proposed.

## 2. Current Condition of Small and Medium-Sized Company R&D

### 2.1 Investigation Background

The current condition of R&D industrialization of mid-sized companies that are conducting R&D activities is grasped and investigation was performed to search factors that promote industrialization of R&D results.

### 2.2 Method of Investigation

Investigation was performed on 300 small and medium-sized companies with R&D records reported to the Korea Federation of Small and Medium Business in the past 3 years from 2012 to 2014 and the phone and fax investigation using structured surveys was performed from August 19th 2015 to September 2nd 2015.

### 2.3 Main Investigation Contents

As shown in the Table 1. Along with basic company information of small and medium-sized companies possessing R&D records, routes to obtain R&D results, recent R&D industrialization records and purposes, factors of industrialization failure and difficulties, requirements of government support, and types of required consulting support were investigated. R&D results refer to technology with completed R&D and technology introduced from exterior sources, and success and failure of industrialization refers to the release in the market with application of R&D results in products.

**Table 1.** Currect condition of researched companies

| Classification | | Number of Companies (Quantity) | Percentage (%) |
|---|---|---|---|
| Total | | 300 | 100.0 |
| Sales | Less than 10 billion won | (120) | 40.0 |
| | 10~30 billion won | (100) | 33.3 |
| | 30 billion won or higher | (80) | 26.7 |
| Percentage of R&D Investment in Contrast with Sales | Less than 3% | (101) | 33.7 |
| | 3~10% | (149) | 49.7 |
| | 10% or higher | (50) | 16.7 |
| Business History | Less than 10 years | (50) | 16.7 |
| | 10~20 years | (143) | 47.7 |
| | 20 years or longer | (107) | 35.7 |
| Employees | Less than 49 employees (Small company) | (164) | 54.7 |
| | 50 employees or more (Medium company) | (136) | 45.3 |

#### *2.3.1 Route of Obtaining R&D Results*

As shown in the table 2. 70.7% main routes to obtain R&D results were shown to be self-developed and 22.7% were

**Table 2.** Route of obtaining R&D results

| Classification | | Cases | Self-Development | Joint Development | Introduction of Technology | Consigned Development |
|---|---|---|---|---|---|---|
| Total | | (300) | 70.7 | 22.7 | 4.0 | 2.7 |
| Sales | Less than 10 billion won | (120) | 70.8 | 24.2 | 2.5 | 2.5 |
| | 10~30 billion won | (100) | 70.0 | 22.0 | 4.0 | 4.0 |
| | 30 billion won or higher | (80) | 71.3 | 21.3 | 6.3 | 1.3 |
| Percentage of R&D Investment in Contrast with Sales | Less than 3% | (101) | 62.4 | 29.7 | 5.0 | 3.0 |
| | 3~10% | (149) | 71.8 | 22.1 | 4.0 | 2.0 |
| | 10% or higher | (50) | 84.0 | 10.0 | 2.0 | 4.0 |
| Business History | Less than 10 years | (50) | 64.0 | 24.0 | 6.0 | 6.0 |
| | 10~20 years | (143) | 69.2 | 25.9 | 3.5 | 1.4 |
| | 20 years or longer | (107) | 75.7 | 17.8 | 3.7 | 2.8 |
| Employees | Less than 49 employees (Small company) | (164) | 69.5 | 23.8 | 3.7 | 3.0 |
| | 50 employees or more (Medium company) | (136) | 72.1 | 21.3 | 4.4 | 2.2 |

shown to be joint-developed. Companies with higher percentage of R&D investment in contrast with sales showed many self-developments and companies with lower percentage of R&D investment in contrast with sales showed many cases of introduction of technology. It can be known that rapid development is promoted through introduction of technology in early stages of company development and that R&D activities are gradually increased to secure own technology.

### *2.3.2 Types of Analysis that Companies Conduct in R&D Planning Phases*

As shown in the table 3. It was shown that 62% of companies most commonly conduct technology trend analysis and business validity analysis in R&D planning phases. Companies with longer business history showed high percentage of technology trend analysis and business validity analysis and companies with shorter business history showed high percentage of industry trend analysis. It can be known that early companies approach in macroscopic perspective viewing the overall industry and that specific goal market is not determined. Also, it can be known that the interest on goal market and core technology increases as the company develops.

## 2.4 Industrialization Record of the Last 3 Years

Industrialization means the case where R&D results are applied in products or processes and are shown in the market as products. As shown in the table 4. For the

**Table 3.** Types of analysis conducted in R&D planning phases

| Classification | | Cases | Technology Trend | Business Validity | Market Trend | Industry Trend | None |
|---|---|---|---|---|---|---|---|
| Total | | (300) | 62.0 | 62.0 | 53.7 | 24.3 | 1.0 |
| Sales | Less than 10 billion won | (120) | 62.5 | 56.7 | 50.0 | 22.5 | - |
| | 10~30 billion won | (100) | 56.0 | 66.0 | 57.0 | 24.0 | 2.0 |
| | 30 billion won or higher | (80) | 68.8 | 65.0 | 55.0 | 27.5 | 1.3 |
| Percentage of R&D | Less than 3% | (101) | 65.3 | 61.4 | 50.5 | 19.8 | 2.0 |
| Investment in Contrast | 3~10% | (149) | 60.4 | 63.1 | 55.7 | 28.2 | 0.7 |
| with Sales | 10% or higher | (50) | 60.0 | 60.0 | 54.0 | 22.0 | - |
| Business History | Less than 10 years | (50) | 58.0 | 68.0 | 42.0 | 32.0 | - |
| | 10~20 years | (143) | 60.1 | 59.4 | 51.7 | 22.4 | 1.4 |
| | 20 years or longer | (107) | 66.4 | 62.6 | 61.7 | 23.4 | 0.9 |
| Employees | Less than 49 employees (Small company) | (164) | 56.7 | 57.9 | 51.8 | 22.0 | 1.2 |
| | 50 employees or more (Medium company) | (136) | 68.4 | 66.9 | 55.9 | 27.2 | 0.7 |

**Table 4.** Industrialisation record during 2012~2014

| Classification | | Cases | Total Cases of Obtaining R&D Results Industrialization Success | Industrialization Failure | No Attempt | Industrialization in Progress | |
|---|---|---|---|---|---|---|---|
| Total | | (300) | 1,822 | 1,078 | 78 | 102 | 564 |
| Sales | Less than 10 billion won | (120) | 616 | 388 | 16 | 26 | 186 |
| | 10~30 billion won | (100) | 436 | 231 | 16 | 29 | 160 |
| | 30 billion won or higher | (80) | 770 | 459 | 46 | 47 | 218 |
| Percentage of R&D | Less than 3% | (101) | 503 | 300 | 16 | 26 | 161 |
| Investment in | 3~10% | (149) | 1,050 | 617 | 54 | 65 | 314 |
| Contrast with Sales | 10% or higher | (50) | 269 | 161 | 8 | 11 | 89 |
| Business History | Less than 10 years | (50) | 280 | 174 | 9 | 12 | 85 |
| | 10~20 years | (143) | 808 | 490 | 29 | 42 | 247 |
| | 20 years or longer | (107) | 734 | 414 | 40 | 48 | 232 |
| Employees | Less than 49 employees (Small company) | (164) | 744 | 435 | 21 | 39 | 249 |
| | 50 employees or more (Medium company) | (136) | 1,078 | 643 | 57 | 63 | 315 |

responding companies, there were a total of 1,822 cases of results gained through R&D during the 3-year period between 2012~2014. Among these cases, there were 1,078 cases with success in industrialization, 78 cases with failure in industrialization, 102 cases with results without attempt of industrialization, and 564 cases of industrialization currently in progress. As shown in the table 5. In conclusion, the success rate of industrialization can be seen as 59.2% based on 1,078 cases that have succeeded in industrialization.

## 2.5 Method of Using R&D Results for Cases of Successful Industrialization

After gaining R&D results, they were used to analyze industrialization types in the cases of successful industrialization. As shown in the table 6. It was investigated that 69.2% of the companies most commonly used the R&D results to enhance the performance or quality of existing products. Also, it was shown that higher R&D intensity (percentage of R&D investment in contrast to sales) showed higher percentage of companies that create sales or royalty income through R&D results.

## 2.6 Analysis of Industrialization Failure Causes

The main reason of failure of attempt of industrialization through R&D results was shown to be the lack of marketability (50.0%). As shown in the table 7. Following, lack of technology competitiveness (47.2%) to use results was shown. Companies with shorter business history and fewer employees showed high percentage of lack of funds for the cause of industrialization failure.

Furthermore, companies that responded that R&D results that have failed in industrialization or have not attempted industrialization to strategically secure for future use was shown to be the highest by 72.1%, companies that responded not to use the results and simply secure was shown to be 22.1%, and companies that responded to technology transfer with charge or free of charge was shown to be 5.9%. It was investigated that companies with higher sales showed many responded to consider future value of use and companies with lower sales responded not to use the results.

## 2.7 Analysis of Difficulties by Industrialization Phases

Industrialization phases were investigated by classifying them into 3 phases of a. Application of Technology, b. Manufacturing Prototype, and c. Production of Launch Products. The phase with the most difficulties among the three phases was shown in the step of application of technology by 38.3%, 33.0% in manufacturing prototype, and 28.7% in production of launch products in which it was shown that there are many difficulties in the early stage of business. Companies with shorter business history showed difficulty in the production phases of prototypes and launch products, and companies with longer business history showed difficulty in the application of technology phase which is the early stage of industrialization.

Specifically, 30.3% responded as lack of funds as

**Table 5.** Success rate of industrialisation during 2012~2014

| Classification | | Cases | Industrialization Success | Industrialization Failure* | Industrialization in Progress |
|---|---|---|---|---|---|
| Total | | (300) | 59.2 | 9.9 | 31.0 |
| Sales | Less than 10 billion won | (120) | 63.0 | 6.8 | 30.2 |
| | 10~30 billion won | (100) | 53.0 | 10.3 | 36.7 |
| | 30 billion won or higher | (80) | 59.6 | 12.1 | 28.3 |
| Percentage of R&D Investment in Contrast with Sales | Less than 3% | (101) | 59.6 | 8.3 | 32.0 |
| | 3~10% | (149) | 58.8 | 11.3 | 29.9 |
| | 10% or higher | (50) | 59.9 | 7.1 | 33.1 |
| Business History | Less than 10 years | (50) | 62.1 | 7.5 | 30.4 |
| | 10~20 years | (143) | 60.6 | 8.8 | 30.6 |
| | 20 years or longer | (107) | 56.4 | 12.0 | 31.6 |
| Employees | Less than 49 employees (Small company) | (164) | 58.5 | 8.1 | 33.5 |
| | 50 employees or more (Medium company) | (136) | 59.6 | 11.1 | 29.2 |

* Failure of Industrialization: Includes cases of failed industrialization and cases without attempt of industrialization

**Table 6.** Methods of using R&D results

| Classification | | Cases | Enhancement of Performance/ Quality of Existing Products | Development of New Product | Efficiency of Production Process/ Reduction of Production Costs | Domestication of Product | Creation of Royalty Export (Transfer of Charge) | Etc. |
|---|---|---|---|---|---|---|---|---|
| Total | | (300) | 69.2 | 65.6 | 27.3 | 22.5 | 3.5 | 0.9 |
| Sales | Less than 10 billion won | (120) | 67.0 | 64.9 | 26.6 | 24.5 | 6.4 | - |
| | 10~30 billion won | (100) | 66.2 | 67.6 | 24.3 | 23.0 | 2.7 | 1.4 |
| | 30 billion won or higher | (80) | 76.3 | 64.4 | 32.2 | 18.6 | - | 1.7 |
| Percentage of R&D Investment in Contrast with Sales | Less than 3% | (101) | 68.2 | 60.6 | 36.4 | 19.7 | 1.5 | 1.5 |
| | 3~10% | (149) | 73.8 | 68.0 | 23.0 | 23.8 | 1.6 | 0.8 |
| | 10% or higher | (50) | 56.4 | 66.7 | 25.6 | 23.1 | 12.8 | - |
| Business History | Less than 10 years | (50) | 60.5 | 53.5 | 37.2 | 25.6 | 7.0 | - |
| | 10~20 years | (143) | 69.5 | 73.3 | 23.8 | 20.0 | 2.9 | - |
| | 20 years or longer | (107) | 73.4 | 62.0 | 26.6 | 24.1 | 2.5 | 2.5 |
| Employees | Less than 49 employees (Small company) | (164) | 72.3 | 63.9 | 27.7 | 20.2 | 5.0 | 0.8 |
| | 50 employees or more (Medium company) | (136) | 65.7 | 67.6 | 26.9 | 25.0 | 1.9 | 0.9 |

* Responding Company BASE: Responding companies that have experienced success in industrialization of R&D results in the past 3 years ('12~'14)

**Table 7.** Causes of industrialisation failure

| Classification | | Cases | Lack of Marketability | Lack of Technology Competitiveness to Use Results | Occurrence of Dispute of Existing Competitive Technology(Product) or Technology(Patent) | Lack of Funds (Additional Technology Development, Prototype/Mass Production of Product, etc.) |
|---|---|---|---|---|---|---|
| Total | | (36) | 50.0 | 47.2 | 19.4 | 16.7 |
| Sales | Less than 10 billion won | (11) | 36.4 | 18.2 | 18.2 | 27.3 |
| | 10~30 billion won | (11) | 63.6 | 63.6 | 9.1 | 9.1 |
| | 30 billion won or higher | (14) | 50.0 | 57.1 | 28.6 | 14.3 |
| Percentage of R&D Investment in Contrast with Sales | Less than 3% | (9) | 55.6 | 77.8 | - | 22.2 |
| | 3~10% | (22) | 59.1 | 40.9 | 22.7 | 18.2 |
| | 10% or higher | (5) | - | 20.0 | 40.0 | - |
| Business History | Less than 10 years | (6) | 50.0 | 16.7 | 33.3 | 50.0 |
| | 10~20 years | (20) | 50.0 | 50.0 | 15.0 | 15.0 |
| | 20 years or longer | (10) | 50.0 | 60.0 | 20.0 | - |
| Employees | Less than 49 employees (Small company) | (15) | 46.7 | 46.7 | 6.7 | 33.3 |
| | 50 employees or more (Medium company) | (21) | 52.4 | 47.6 | 28.6 | 4.8 |

| Classification | | Cases | Occurrence of Technological Difficulty | Lack of Marketing Competence | Lack of Manpower Using Results | Lack of Prototype/ Launch Product/Production Facility/Equipment |
|---|---|---|---|---|---|---|
| Total | | (36) | 16.7 | 16.7 | 13.9 | 13.9 |
| Sales | Less than 10 billion won | (11) | 36.4 | 18.2 | 9.1 | 36.4 |
| | 10~30 billion won | (11) | - | 18.2 | 18.2 | 9.1 |
| | 30 billion won or higher | (14) | 14.3 | 14.3 | 14.3 | - |
| Percentage of R&D Investment in Contrast with Sales | Less than 3% | (9) | - | 33.3 | - | 11.1 |
| | 3~10% | (22) | 13.6 | 4.5 | 18.2 | 13.6 |
| | 10% or higher | (5) | 60.0 | 40.0 | 20.0 | 20.0 |
| Business History | Less than 10 years | (6) | - | - | 33.3 | - |
| | 10~20 years | (20) | 20.0 | 20.0 | 10.0 | 20.0 |
| | 20 years or longer | (10) | 20.0 | 20.0 | 10.0 | 10.0 |
| Employees | Less than 49 employees (Small company) | (15) | 26.7 | 13.3 | 6.7 | 20.0 |
| | 50 employees or more (Medium company) | (21) | 9.5 | 19.0 | 19.0 | 9.5 |

* Responding Company BASE: Responding companies that have experienced failure in industrialization of R&D results in the past 3 years ('12~'14)

the difficulty mainly sensed in the phase of applying technology and 24.0% responded that there is difficulty in technological parts. Investigating by sales, companies with lower sales responded that funds and companies with higher sales responded that technology and demand (debouche) are difficulties. The largest difficulty shown in the second phase of manufacturing prototype was responded as funds by 48.0% in which it can be known that high fund difficulty is experienced compared to the application of technology phase. While companies with lower sales and shorter business history have large difficulties in funds, companies with higher sales and longer business history responded to have main difficulties in facility and equipment aspects. 35.3% responded that lack of funds is a large difficulty in the third phase of manufacturing launch products and 35.0% responded that demand related (debouche) factors are difficulties. Companies with lower sales responded that funds were difficulties and companies with higher sales responded that need of demand (debouche) were difficulties.

Lack of funds applies as the largest difficulty in the procedure of R&D industrialization and it can be said that support of prototype manufacturing can be of great help when governments support companies in R&D projects as higher funds are required especially in the prototype phase.

## 2.8 Problems of Government R&D Support

However, most companies of 33.0% responded that the largest problem in the procedure of receiving R&D support by the government was filling out complicated documents and 26.0% responded support based on government outcome without reflecting opinion of sites. Along with this, 63.0% responded that support of funds through technology and business value assessment are required by government level to promote business and support of equipment and installation for inspection and production (31.3%) followed.

## 2.9 Implications

Summarizing the results investigated above, R&D success rate by government support was shown to be 59.2% and 69.2% of this value was shown to be focused on improving performance or quality of existing products. Lack of funds is considered as the cause of failure in all phases, but difficulties were shown in complicated administrative procedures to receive government support. Therefore, R&D support on future small and medium-sized companies to support of prototype manufacturing with characteristics supporting required funds can substantially increase R&D intensity. Furthermore, it can be considered important to objectively evaluate marketability and

business value using professional manpower and reduce burden of writing company documents.

## 3. Current Condition of Mid-sized Company R&D

In Korea, the concept of mid-sized companies was established in 2014 through the "Special Act on Medium-Sized Companies." Thus, companies excluding small and medium-sized companies, large companies, and public organizations are defined as mid-sized companies based on the "Framework Act on Small and Medium-Sized Enterprises," "Monopoly Regulation and Fair Trade Act," and "Public Bodies Management and Accountability Act. "Regarding the R&D field of mid-sized companies, there are previous studies such as the study of deducting political plans to induce investment through wide survey investigations based on the awareness of problems of stagnant R&D investment of domestic mid-sized companies and reduction of mid-sized companies[4]. However, practical researches on the slump of R&D investments in actual mid-sized companies is lacked. For this, practical investigation was conducted on the World Class 300 business which is being enforced to develop mid-sized companies since 2011 to conduct practical research on political effectiveness and if government policies are increasing R&D intensity.

### 3.1 Subjects and Method of Investigation

The population of investigation was subject to domestic manufacturing mid-sized companies in which 829 companies among 1,675 companies possessed by the Korea Federation of Mid-Sized Companies were investigated. Survey investigation was conducted at the Korea Institute of Science and Technology Evaluation and Planning R&D Budget Policy Department in December 2014 and there were 102 valid responses.

### 3.2 Current Condition of Domestic Mid-sized Companies

As shown in Table 8, there are a small number of mid-sized companies by 0.12%, 9.7% of employment percentage, and low total sales of 15.4%. However, they have a significant role in the development of domestic industry by occupying 15.7% of export and 21.9% of corporate tax. However, it is shown in Table 9 and 10. that there 64.1% of mid-sized companies do not have any R&D investment records.

**Table 8.** Percentage of Mid-sized companies contrast to total companies

| Classification | SME | Mid-Sized | Large | Total |
|---|---|---|---|---|
| Corporations (Number) | 3,250,485 | 3,846 | 1,669 | 3,256,000 |
| Exports ($100 million) | 960 | 877 | 3,749 | 5,596 |
| Employees (10,000) | 917 | 116 | 161 | 1,194 |
| Sakes (Trillion won) | 1,751 | 629 | 1,703 | 4,083 |
| Corporate Tax (Trillion won) | 8 | 8 | 21 | 37 |
| R&D (Trillion won) | 11 | 6 | 27 | 43 |

Data: Korea Federation of Mid-sized Companies (2014)

Data: Korea Federation of Mid-sized Companies (2014)

**Table 9.** Number of corporations by R&D intensity* & segment

| R&D Intensity | Total Industry | Manufacturing Industry | Non-manufacturing Industry |
|---|---|---|---|
| None | 2,464 | 713 | 1,751 |
| Lower than 1% | 798 | 524 | 274 |
| 1.0~3.0% | 289 | 237 | 52 |
| 3.0~5.0% | 120 | 92 | 28 |
| 5.0~10.0% | 93 | 64 | 29 |
| 10.0~30.0% | 68 | 37 | 31 |
| 30.0% or higher | 14 | 8 | 6 |
| **Sum** | **3,846** | **1,675** | **2,171** |

* R&D Intensity = R&D investment/sales

**Table 10.** R&D intensity by sales segment

| Scale of Sales | Industry | Total Manufacturing |
|---|---|---|
| Lower than 150 billion won | 1.07% | 1.51% |
| 150~300 billion won | 0.84% | 1.12% |
| 300~500 billion won | 0.77% | 1.10% |
| 500 billion won ~ 1 trillion won | 0.93% | 1.08% |
| 1 trillion won or higher | 0.80% | 0.79% |
| Total | 0.88% | 1.09% |

Data: Small and Medium Business Administration (2014)

### 3.3 R&D Condition of Mid-sized Companies

88.2% of the 102 investigated mid-sized companies showed to operate R&D departments such as research centers and higher sales size showed higher percentage of possessed departments. 12 companies without organizations in charge of R&D did not require department because separate R&D outsourcing was possible. Also, unlike small and medium-sized companies, a high value of 79.4% of mid-sized companies had experience of joint R&D with exterior organizations and it was shown that most joint developments were conducted with universities (33.3%). The host with the highest influence related to R&D was shown to the CEO (52.9%) and R&D related departments (30.4%) followed. Also, it was investigated that ideas on new business and R&D direction were mainly provided by R&D departments (76.2%).

### 3.4 Result Analysis on R&D of Mid-sized Companies

Companies without patents in the past 3 years were shown to be the highest among the investigated companies by 28.4%, an average of 14.9 patent applications, and an average of 13.6 registrations were shown. 53.9% of the companies responded that a systematic process regarding patents is secured and managed while 8.8% of the companies did not manage patents. Companies with higher sales showed systematic R&D result management.

### 3.5 Analysis of R&D Difficulties of Mid-sized Companies

Unlike small and medium-sized companies, 57.8% of mid-sized companies responded that professional technology manpower is lacked and that advanced R&D is being conducted. Next, lack of research installation and materials was responded and support of professional manpower and professional equipment was shown as a significant factor for R&D support in mid-sized companies. Looking into the reason of mid-sized companies that do not participate in R&D support businesses, 25.6% showed to consider support scale and expected effect to be small and to lack business of interest. This implies that professional support in new fields with large scale is required unlike small and medium-sized companies.

### 3.6 Analysis on R&D Intensity of World Class Companies

Until now, the government has introduced the Strategies for Developing Specialized World-Class Mid-Sized Companies (Mar. 13, 2010)," "3000+ Project for Mid-Sized Companies (Aug. 9, 2012)," and "Building Growth Ladder for Mid-Sized Companies (Sept. 17, 2013)." Based on this, there is the "World Class 300" which is the most representative overall supported program by the government. Active support policies are being enforced in which 942.9 billion won among the total of 1.8 trillion won is organized in related companies. There are currently 183 companies subject to the World Class 300 Project support in 2015 in which the average of mid-sized companies, R&D intensity and export percentage were investigated to confirm if significant results existed.

As shown in the table 11. The companies selected in the World Class 300 Project showed high result indexes in all fields compared to ordinary mid-sized companies (sales of 40 billion won ~ 1 trillion won). Especially, high increase rate of sales followed by high sales percentage was shown. However, slight decrease of R&D intensity was shown in which it was shown that support must be strengthened to secure future development power in medium and long term perspective.

**Table 11.** Comparison between medium-sized companies and WC300 companies

| Classification | Growth Rate of Sales | R&D Intensity | Export Percentage | Business Profit Rate |
|---|---|---|---|---|
| Average of Medium-sized Companies 2011~2013 | 11.14% | 1.1% | 14.16% | 4.39% |
| WC300 Selected Companies 2014 | 25.19% | 5.43% | 49.2% | 7% |
| WC300 Selected Companies 2015 | 27.71% | 4.87% | 47.63% | 10.24% |
| WC300 Selected Companies Data: Small and Medium Business Administration (2015) | - | 4.17% | 56.4% | - |

### 3.7 Implications

It was shown that mid-sized companies have high demand on professional manpower, facilities, and equipment as definition on core technology that should be secured or

investigation on industry and target market has been completed in which source technology or development of highly advanced technology is required. Therefore, it can be known that the R&D support by the government on mid-sized companies to use professional test equipment together and provide professional manpower or professional information can increase the effect of R&D. Moreover, the World Class 300 which is the representative support of mid-sized companies shows high R&D intensity along with high export percentage compared to ordinary mid-sized companies, but this implies that effect by support exists.

## 4. Conclusions

This study shows which effects R&D support policies on small and medium-sized companies and mid-sized companies have and the problems and direction of the government R&D support business by each scale were confirmed through practical analysis. As R&D results are deducted after 3~5 years of launching, additional research on the application of government support to the power of continuous development is required through continuous follow-up studies in the future..

## 5. Acknowledgment

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## 6. References

1. Small and Medium Business Administration. Direction of Main Small and Medium Business Administration Policies. Available from: www.smba.go.kr/eng/index.do, Date accessed: 2016.
2. Korea Federation of Small and Medium Business. Investigation of Current Condition of Small and Medium-sized Company R&D Industrialization. Available from: www.kbiz.or.kr/home/homeIndex.do?menuCode=eng, Data accessed:9- 2015.
3. Dong-Ho S, Mi-sun K, Byeong-Hee L, Jae-Soo K. Factor Analysis for Improved Commercialization of Technologies Developed on Korea National R&D Projects. Indian Journal of Science and Technology. 2015; 8(9):405–14.
4. Jin GS, Soo KG. A Study on Current Condition of Mid-Sized Company R&D Investments and Policy Plans to Induce Investment (Research Report). Korea Industrial Technology Foundation Technology Policy Research Center. 2009; 1–30.