Is Sustainable Korean Economic Growth Centered on Small-Sized and Medium-Sized Companies Possible? Focused on Innovative Small and Medium Companies

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Received 20 February 2022; Revised 22 April 2022; Accepted 26 April 2022; Published 17 May 2022

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Korea should grow small-sized and medium-sized companies and promote the development of the Korean economy in order to respond appropriately to the environment such as the fourth industrial revolution, COVID-19, and rapid changes in the international market. Under these circumstances, it is necessary to categorize innovative small and medium companies to establish hypotheses, compare, and validate their performance in order to consider the possibility of a small and medium-sized business-oriented economy. Among the policies for supporting small and medium companies, the government focused on the economic and technical performance of the small and medium companies, focusing on the certified small and medium companies. Through this, not only South Korea but also other countries want to provide insights to consider one of the various measures for economic growth.

1. Introduction

Due to the rapidly changing environment at home and abroad, which is unpredictable, the conglomerate-led export industry promotion policy, which was driving the growth of the Korean economy, faced limitations. In order to solve this problem, public opinion has been expanded that small-sized and medium-sized companies, which account for the majority in the industrial structure, should be grown and quality jobs should be created through this.

According to Korea’s 2016 data, the majority of Koreans think that the nation’s economic structure is biased toward large companies and that it should be reorganized into an economic structure centered on small-sized and medium-sized companies to correct it. According to the data, 94.4% of the respondents said they were biased toward large companies and cited "deepening the gap between large and small companies (wage, technology, etc.)" (57.6%) and “deepening the bias of financial and human resources” (40.1%) as the biggest economic and social problems. In addition, 94.2% said yes to the question of whether it is necessary to shift from a large company centered to a right market economic structure centered on small-sized and medium-sized companies to balance the growth and gap of the economy. Korea’s small-sized and medium-sized companies have a high quantitative status in the Korean economy, but their qualitative roles such as production and value-added (productivity) creation are still insufficient. In 2019, President Moon of Korea said at the 2019 Korea Small and Medium Business Conference, “The government has been trying to fundamentally change the framework of policy by putting small and medium companies at the center of the economy.”

For this purpose, the government shall foster a number of competitive small-sized and medium-sized companies to create quality jobs along with the overall economic growth and promote the realization of the national economy. Therefore, this paper aims to provide implications by...
organizing contents around innovative small-sized and medium-sized companies for research.

In this situation, the goal of this study was to categorize innovative small-sized and medium-sized companies and establish a research hypothesis to examine the possibility of an economic growth centered on small-sized and medium-sized companies and analyze them using data from the small-sized and medium-sized companies' technical statistical survey in Korea. The specific research goals set to achieve this are as follows.

First, the relationship between whether small-sized and medium-sized companies are certified for innovation and technical performance is confirmed.

Second, the relationship between the economic comparative advantage and technical performance of small-sized and medium-sized companies and innovative certified companies is confirmed.

Third, the relationship between policy support for small-sized and medium-sized companies and innovative certified companies and the technical performance of companies is confirmed.

Fourth, the relationship between the network experience of small-sized and medium-sized companies and innovative certified companies and the technical performance of companies is confirmed.

2. Literature Review

2.1. Small-Sized and Medium-Sized Companies and Innovative Small-Sized and Medium-Sized Company's Certification System

2.1.1. Concept of Small-Sized and Medium-Sized Companies. The concept of small-sized and medium-sized companies is used as a relative concept for large companies. The definition of small-sized and medium-sized companies may vary depending on the policy goals of each country, and it is not easy to set uniform standards because the scope of small-sized and medium-sized companies is differentiated according to the economic structure and stage of economic development. In general, overseas companies that meet either the number of regular workers or sales or both are defined as small-sized and medium-sized companies.

In the case of Korea, as in other countries, the dualized small-sized and medium-sized companies' scope standard of the number of regular workers and sales was maintained, and from January 1, 2015, the small-sized and medium-sized companies scope standard was reorganized based on sales. These Korean small-sized and medium-sized companies are companies with relatively small workplaces compared to large and medium-sized companies and refer to corporate enterprises and individual businesses that operate for profit. The targets that can be small-sized and medium-sized companies are as follows: (1) Total sales or assets by the industry meet the standards prescribed by the Presidential Decree. (2) The actual independence of ownership and management, such as equity ownership or investment relations, meets the standards prescribed by the Presidential Decree. (3) A social enterprise prescribed by the Presidential Decree among social enterprises. (4) Among cooperatives, federations of cooperatives, social cooperatives, and social cooperatives, those prescribed by the Presidential Decree meet the scale criteria (appearance criteria) and independence criteria (based on affiliated relationship criteria).

In addition, the application requirements presented in Article 3 of the Enforcement Decree of the Framework Act on small-sized and medium-sized companies are as follows: (1) The principal industry operated by the company and the average sales or annual sales of the company meet the criteria. (2) Total assets of less than 500 billion won. (3) Excluding companies affiliated with the diagnosis of companies with restricted mutual investment. (4) In the case of a corporation with a total asset of 500 billion won or more, foreign corporations are included, but excluding enterprises that are the largest investors with more than 30/100 of shares, etc. (5) In the case of a for-profit corporation, the affiliated company meets the standard for calculating the average sales.

2.1.2. Overview of the Innovative Small-Sized and Medium-Sized Company’s Certification System. The term “innovative small-sized and medium-sized companies” means companies that generate higher value-added commodities than general companies through technology and management innovation activities. Korea operates three major certification systems: Venture, Inno-biz, and Main biz.

First, venture companies are companies prescribed in “Article 2 of the Special Measures for the Promotion of Venture Companies Act,” and among companies with high technology or growth potential, they are fostered by the government for the purpose of strengthening international competitiveness. Second, innovation (small-sized and medium-sized companies) is a combination of innovation and business that refers to small-sized and medium-sized companies that have secured competitiveness based on technological superiority. The system was introduced in 2001 under “Article 15 of the Small and Medium Companies Technology Innovation Promotion Act” and “Article 13 of the Enforcement Decree of the Act.” Third, main business (management innovation) is a combination of management, innovation, and business, which refers to a company certified as a management innovation by “the Ministry of SMEs (small-sized and medium-sized) and Startups” in Korea. Unlike product and process-oriented innovation, it was introduced in 2006 as a system operated under “Article 15 of the Small and Medium Business Innovation Promotion Act” and “Article 13 of the Enforcement Decree of the Act.”

2.1.3. Innovative Small-Sized and Medium-Sized Company Status. As of 2018, a total of 71,646 innovative small-sized and medium-sized companies were registered. Venture companies account for the highest proportion (36,820), Inno-biz companies (18,095) and management innovation companies (16,733) account for half of the proportion compared to venture companies. Innovative small and medium business status is shown in Figure 1.
2.2. Factors Affecting the Performance of Small-Sized and Medium-Sized Companies

2.2.1. Technical and Organizational Factors. The innovation activities of small-sized and medium-sized companies responsible for the nation’s economy are emerging as a very important national task. Many countries recognize small-sized and medium-sized companies’ innovation activities and make great efforts to develop their own innovation capabilities [1].

Comanor [2] argues that research and development activities increase as companies increase in size, indicating that steady R&D and technology development activities must precede in order for companies to continue to innovate and be competitive. Scherer [3] also argued that research and development and innovation activities grow larger as an entity grows to a certain critical scale, but then proportionally. Teece [4] argued that while superior technology is important, it is difficult to succeed by itself, the importance of complementary assets and market information, and the dynamic ability to recognize and capture opportunities are important.

Tidd et al. [5] argues that the biggest component of innovative management challenges is developing capabilities at the organization and system level and that successful organizations constantly generate new knowledge, spread it through the organization, and quickly produce results. Chang [6] studied success factors, not success factors, and he analyzed the cause, process, and type of failure through a follow-up study of 192 venture companies, suggesting that failure and survival of venture companies are not related to age or size. In addition, the failure of venture companies is reported to be closely related to changes in the environment and organizational problems such as the organizational structure and system.

2.2.2. Economic and Technical Performance. Research on corporate management performance has long been done in various fields. Examples include a variety of studies on securing competitive advantage from a resource perspective [7], a resource compliance perspective [8], and an industrial organizational perspective [7], which emphasizes the environmental characteristics of a company. There is also a study [9], which describes the factors that can generate high returns through continuous competitive advantage in terms of the external environment. Among them, the resource compliance perspective can measure the performance of the entity, focusing on the resources and capabilities of the entity’s competitive advantage. The key to this is using companies. Identifying as a unique collection of intangible resources [7], resources are oils. An intangible asset and competence is defined as a part of the resource, organizational capability, administrative heritage, core competence, tangible asset, intangible asset, competence, and so on [10].

In this work, prior studies with these views and classifications have recognized certified companies as influencing all internal resources in terms of resource compliance, which can be compared with each other, but are specifically based on technical and organizational resources. Studies of the technical performance of certification firms have been conducted with various variables, especially studies such as comparison, technology, and organization among certification firms can be examined as follows:

Lee et al. [11] said in a study titled “Technology Innovation and Performance Differences and Policy Implications between Small-Sized and Medium-Sized Companies” that showed higher innovation performance (intellectual property rights, new product sales) than ordinary small-sized and medium-sized companies. Oh [12] focused on the status and problems of small business policies, focusing on the research report of the Small Business Institute and the National Scientific Advisory Committee, and suggested that innovation activities were not carried out properly after receiving support. Yoo and Yang [13] found that innovative activities affect technical performance such as intellectual property rights and level of technology.
Furthermore, an analysis of the impact of innovation on economic performance found that it had a positive effect on sales growth but a negative effect on operating profitability. In a study titled "The Effect of Management Innovation Techniques and Performance Management System Properties on Small and Medium Business Performance," Cho and Lee [14] analyzed that both financial performance indicators and non-financial performance indicators have a controlling effect on business performance. In a report titled "Innovation Characteristics Analysis and Policy Implications for Small and Medium Businesses," Hong [15] analyzed the innovation characteristics of small-sized and medium-sized enterprises and said that the success rate of technology development and commercialization are higher than that of ordinary small-sized and medium-sized companies. Park et al. [16] conducted a survey on 315 samples of Inno-biz-certified companies and venture-certified companies located in Daegu and North Gyeongsang Province in the "Studies on the Impact of Product Innovation and Management Innovation on Corporate Performance." The analysis showed that both product innovation and management innovation had a definite impact on corporate performance and that the interaction effects of product innovation and management innovation could be significant. Lee [17] said in a study titled "Linked Policy between Innovative Small and Medium Businesses" that venture companies increased 20.8% in employment, but 14.4% in innovative small-sized and medium-sized companies, indicating that venture companies have a higher employment rate than innovative small-sized and medium-sized companies. Damanpour [18] emphasized the importance of organizational characteristics as a prior factor in managerial innovation in the study of "Application of Innovation Effects and Organizational Performance." Wu and Lin [19] found that innovation has a positive effect on innovation quality and innovation performance by verifying the correlation and impact between innovation strategy, organizational innovation, innovation quality, and innovation.

2.3. Mechanisms in Which Certification Systems Affect the Performance (Control Variables). If selected as a certified company, various government support will be followed, especially financial support such as payment guarantees will be mainstream, and the certification itself will increase the external credibility of the company. Based on this, it has a very positive impact on corporate performance [20].

Kim et al. [21] compared the before and after the certification of Inno-biz companies in the "Studies on Management Performance" and also compared the performance of Inno-biz companies and venture companies and general companies. The sample analyzed 189 companies certified as Inno-biz from 2001 to 2007 and did not support the hypothesis that Inno-biz certification would improve management performance, but some supported the hypothesis that Inno-biz and venture companies performed better than ordinary companies. Yoo and No [22] surveyed 644 companies that received both venture certification and innovation certification in 2010 in "A Study on the Effectiveness of Venture Certification and Innovation Certification." According to the analysis, only "funding and investment improvement (financial effect)" for venture companies improved productivity, technical inefficiency existed in the verification of technical inefficiency, and in the case of Inno-biz, productivity improvement was not effective. Jung et al. [23] selected nine ratios, including growth indicators, profitability indicators, and productivity indicators, and conducted a "distributed analysis" on the financial performance of innovative small-sized and medium-sized companies. As a result, the growth indicators (sales, total capital, equity) all differ significantly at 5% significant level, the profitability indicators only differ significantly at 10% significant level, and the return on equity was rejected. In addition, the productivity index showed that the value-added rate was rejected, and the total capital investment efficiency and facility investment efficiency differed significantly at a 10% significant level.

3. Methodology

3.1. Characteristics of Data. According to the COVID-19 situation in 2020, the data of the 2017-2018 small-sized and medium-sized companies’ technical statistical survey was utilized, and the sample design consisted of the following.

The base date is December 2016, and the survey dates from July to November 2017, with administrative data contained in the data as of 2016, and survey data collected since July 2017. The analysis unit is companies, and the population is "small-sized and medium-sized companies performing technology development" with sales exceeding 500 million won, and the sample population is 3,300 out of 57,039 companies.

However, while the sample is not representative of small-sized and medium-sized companies, evidence can be found to determine the differences in effectiveness of different types of government intervention, and comparisons by industry and size can also be made within the "Technology Development Performance of Small-Sized and Medium-Sized Companies.” List of companies used in the study is shown in Table 1.

3.2. Measurement of Main Variables. There are four main variables: the size of the company, the stage of corporate growth, the type of company, and the group of technology companies. The size of the companies was based on sales, divided into seven subgroups, and the sales of each company were measured separately by one million won. The corporate growth phase was divided into the entry period (= within 3 years), the growth period (sales, share growth trend), the maturity period (continued profitability), and the decline period (continued decline in related indicators). The types of companies were divided into "general small-sized and medium-sized companies” and "innovative small-sized and medium-sized companies,” and only three types of innovative companies were included: Inno-biz, venture companies, and management innovative companies. The technology companies’ group was classified into high technology, intermediate technology, and general-purpose technology companies according to the characteristics of the technology. Small and medium business technical statistical survey file design is shown in Table 2.
Table 1: List of companies used in the study (small-sized and medium-sized companies’ technical statistical survey in Korea, 2017-2018).

| Sortation | List of companies                                                                 | Provisioning agency                                      |
|-----------|-----------------------------------------------------------------------------------|----------------------------------------------------------|
| 1         | Management innovation company                                                     | Main biz association                                     |
| 2         | Inno-biz corporation                                                              | Inno-biz association                                     |
| 3         | Venture company                                                                   | Korea Technology Finance Corporation                     |
| 4         | Technology innovation leading small and medium companies                           | Korea Technology Finance Corporation                     |
| 5         | Single parts per million (PPM) certified companies                                | Korea Chamber of Commerce and Industry                   |
| 6         | A company that supports development and patent technology commercialization       | Korea SMEs and Startups Agency                            |
| 7         | Companies with subsidiary research institutes                                     | Korea Industrial Technology Association                  |
| 8         | R&D challenges performed by small and medium businesses                           | Korea Technology and Information Promotion Agency for SMEs|
| 9         | Green biz company                                                                 | Korea Standards Association                              |
| 10        | Korea Industrial Standard (KS)-certified company                                  | Korea Standards Association                              |
| 11        | Excellent software (GS)-certified company                                          | Telecommunications Technology Association                 |
| 12        | New technology-certified companies/Environmental mark-certified companies          | Korea Environmental Industry and Technology Institute     |
| 13        | Technology development expense execution company                                 | Korea Enterprise Data Co. Ltd.                           |
| 14        | 2016-2017 technical statistical device population                                 | Korea Federation of SMEs                                 |

Table 2: 2017 small and medium business technical statistical survey file design (small-sized and medium-sized companies’ technical statistical survey in Korea, 2017-2018).

| Sortation | Content                                                                                                         |
|-----------|-----------------------------------------------------------------------------------------------------------------|
| Company size | More than 500 million won-less than 2 billion won  |
| Company growth stage | Entry period  |
| Company type | General small-sized and medium-sized companies  |
| Core technology life cycle | Entry period  |
| Technology development organization type | Affiliated research institute  |
| Technology company group | High technology  |
| Novelty of technology | World’s first new technology  |
| Experience in utilizing technical development support | None  |
| Step-by-step application experience | Use experience by type  |
| Support for planning, development, and commercialization stage | Detergent, market, manpower, information support  |
3.3. Research Model and Research Hypothesis. In this study, we wanted to find out whether a sustainable small-sized and medium-sized companies-oriented economy centered on innovative small-sized and medium-sized companies are possible. To this end, the government intends to use data from the 2017-2018 small-sized and medium-sized companies’ technical statistical survey to determine what statistical meaning is between each variable as shown in Figure 2.

Based on this research model, the following research hypothesis was determined based on previous research studies investigated in the literature review.

Research hypothesis 1. There will be a positive link between whether innovation is certified or technical performance.

Research hypothesis 2-1. The association of the definition (+) will emerge between the economic comparative advantage and technical performance of the entity.

Research hypothesis 2-2. There will be a greater link between the economic comparative advantage and technical performance of the entity in an innovative certification entity.

Research hypothesis 3-1. There will be a positive link between the policy support and the firm’s technical performance.

Research hypothesis 3-2. There will be a greater link between the policy support and technical performance in an innovative certification company.

Research hypothesis 4. There will be a positive connection between network experience and the technical performance of the company.

4. Results and Discussion

4.1. Revenue, Profit, and Business Age. We analyzed whether sales and profits are proportional to sales, profit, and business age. The results showed that the relationship between the size of a company based on sales and profitability was not constant and that relatively high profit rates were found in companies with relatively small sales (KRW 2 billion or less KRW 20-5 billion) and very large companies (KRW 50 billion-150 billion).

Furthermore, an analysis of the superiority of longer surviving entities showed that overall sales tended to
increase as the age of the entity increased, especially in the 20th or so year, which is higher than the average (red line).

Thus, although the relationship between the age of the entity and profitability is not constant, it can be said that it tends to converge as the age increases. The distribution of profitability according to company size and average sales by company age is shown in Figure 3.

4.2. Innovative Small and Medium Companies. An analysis was conducted on whether innovative small-sized and medium-sized companies are better compared to innovative small-sized and medium-sized companies. The results show that innovative companies have average sales of 2 billion won higher than general small-sized and medium-sized companies, but there is no statistically significant difference in the operating profit. In addition, innovative companies hold higher domestic patents on average than ordinary small-sized and medium-sized companies.

In addition, as a result of analyzing whether innovative companies receive more government support, innovative companies were raising an average of 2 billion won more
research and development costs than ordinary small-sized and medium-sized companies.

Thus, innovative companies had higher experience and frequency of technology development support systems than ordinary small-sized and medium-sized companies. Comparative analysis of small-sized and medium-sized companies with innovative ones is shown in Figure 4.

Furthermore, for a time series analysis of which form of innovative small-sized and medium-sized companies are better, we analyzed several indicators such as average sales, permanent employees, average R&D investment, R&D external procurement, and intellectual property registration. Time series analysis for innovative small businesses and general small and medium businesses is shown in Figure 5.

4.3. Technical Factors and Sales/Profit. An analysis was conducted to confirm that the stage of corporate growth and the core technology life cycle are in line with the introduction-growth-maturity-decline (Kendall’s tau-b = 0.8877).
Furthermore, the analysis of whether technology investments increase profitability shows that the technical factors account for the variations in sales (R^2 = 14.96), but little for profitability (R^2 = 0.0090).

Thus, rather than being profitable, larger firms are more likely to make active technology investments, indicating that they are more likely to be technology investments → revenue growth → technology investments. Technical
Table 4: Analysis of policy support and technical factors.

| Patent count_domestic | Linear regression | Number of obs = 3,300 (7, 3292) |
|-----------------------|------------------|----------------------------------|
|                       | Coef.            | Robust std. err. | t     | P > | t | (95% conf. Interval) |
| Support for development stage | 2.203341 | 0.7105447 | 3.10 | 0.002 | 0.8101865 | 3.596495 |
| Support for planning stage | 2.75787 | 0.9360819 | 2.95 | 0.003 | 0.9225078 | 4.593231 |
| Support for commercialization stage | -0.1736566 | 1.050388 | -0.17 | 0.869 | -2.233137 | 1.805824 |
| Support experience_Tax system | 1.674722 | 1.0745 | 1.56 | 0.119 | -0.4320346 | 3.781479 |
| Support experience_personnel | -0.3582412 | -6588455 | -0.54 | 0.587 | -1.65003 | 0.933547 |
| Support experience_information | 0.3434764 | 1.237649 | 0.28 | 0.781 | -2.083164 | 2.770116 |
| Support experience_Sales | -0.7995844 | 0.594801 | -1.34 | 0.179 | -1.96582 | 0.3666506 |
| Cons | 1.887127 | 0.17452 | 10.81 | 0.000 | 1.54948 | 2.229306 |

| Support system_satisfaction level | Linear regression | Number of obs = 1,630 (7, 1622) |
|----------------------------------|------------------|----------------------------------|
|                                   | Coef.            | Robust std. err. | t     | P > | t | (95% conf. Interval) |
| Support for development stage | -0.1855886 | 0.0412361 | -4.50 | 0.000 | -0.2664701 | -0.104707 |
| Support for planning stage | -0.2736084 | 0.0430402 | -6.36 | 0.000 | -0.358287 | -0.1891882 |
| Support for commercialization stage | 0.3024803 | 0.053477 | 5.66 | 0.000 | 0.1976466 | 0.407314 |
| Support experience_Tax system | 0.0887017 | 0.0356825 | 2.49 | 0.013 | 0.018713 | 0.1586904 |
| Support experience_personnel | 0.005743 | 0.0503394 | 0.11 | 0.909 | -0.0929941 | 0.10448 |
| Support experience_information | 0.2154647 | 0.013524 | 4.97 | 0.000 | 0.1304321 | 0.3004973 |
| Support experience_Sales | 0.0720378 | 0.0455605 | 1.58 | 0.114 | -0.0173257 | 0.1614014 |
| Cons | 2.543172 | 0.036848 | 69.02 | 0.000 | 2.470897 | 2.615447 |
factors and sales/benefit analysis are shown in Figure 6 and Table 3.

4.4. Policy Support and Technical Factors. According to an analysis of whether companies experienced policy support or not led to technology development, companies that experienced policy support in the development and planning stages had higher patents on average than those that did not. In addition, the analysis of how the support system would have increased satisfaction, and companies experiencing policy support in the development and planning stages were less satisfied, and the commercialization support experience was likely to increase satisfaction. It also identified that entities that have experienced tax support and information support are likely to experience increased satisfaction compared to those that do not. Analysis of policy support and technical factors is shown in Table 4.

4.5. Network and Technical Factors. The analysis of which partners’ collaboration helps develop technology shows that partnerships with large companies have a significant impact on patent acquisition.

Furthermore, the analysis of which partners are financially beneficial to collaborate with shows that partnerships with large companies are likely to be beneficial in terms of funding technology development. Collaboration with national universities and foreign companies also contributed significantly to raising technology development costs, but collaboration with mid-sized and small-sized companies or collaboration with civilians and organizations did not contribute much. Analysis of network and technical factors is shown in Figure 7 and Table 5.

4.6. Comprehensive Analysis by Analysis between Variables. The age of the companies and the type of companies (innovative) are likely to affect the economic performance (profitability) of small and medium companies. Therefore, these characteristics should be controlled. In particular, innovative small-sized and medium-sized companies tend to have a relatively high frequency of policy support and
excellent R&D procurement performance compared to general small-sized and medium-sized companies. The weak link between technical and economic performance did not lead to higher profitability of observable technological excellence of small-sized and medium-sized companies. On the other hand, the economic conditions of small-sized and medium-sized companies were highly likely to affect technology investment. Companies with development and planning support experiences were relatively good at technical performance, but their satisfaction with the support system was rather low. On the other hand, the commercialization phase and information support experience were found to be factors that increase satisfaction. Although partnerships with large companies and foreign companies are likely to have positive links to technological achievements, it can be seen that they should distinguish between direct performance such as patent counts and indirect performance such as procurement of development.

4.7. Relationship between Corporate Characteristics and Innovative Certification and Technical Performance. The relationship between corporate characteristics and innovative certification and technical performance is relatively high, but no evidence has been found that innovative certification operates an efficient business model or performance system compared to ordinary small-sized and medium-sized companies.

In other words, there may be an inverse causal relationship between innovative corporate certification and technical performance, and it may be possible that companies that were excellent in the first place were certified as innovative companies, not innovative companies. Analysis of the relationship between corporate characteristics and innovative certification and technical performance is shown in Table 6.

4.8. Relationship between Experience in the Policy Support and Technical Performance. Policy support was found to be related to technical performance (number of patents, procurement performance) and positive (+). However, the association between policy support and patent ability was not greater in innovative companies, and the association between policy support and procurement performance was greater in innovative companies. In other words, although innovative-certified companies are likely to have higher access to technology development.

Table 6: Analysis of the relationship between corporate characteristics and innovative certification and technical performance.

| Type                                      | Variables                                                                 | Model 1-1 (Number of patents) | Model 1-2 (Procurement performance) |
|-------------------------------------------|---------------------------------------------------------------------------|-------------------------------|-------------------------------------|
| Company characteristics                   | Growth stage (Entry-growth-maturity-decline)                              | X                             | X                                  |
|                                           | Company age                                                               | X                             | X                                  |
|                                           | Operating profit compared to sales                                        | X                             | X                                  |
|                                           | Number of regular employees                                               | O (+)                         | O (+)                              |
|                                           | Implementation of performance compensation system (vs. Not yet implemented)| O (+)                         | O (+)                              |
|                                           | Innovative-certified companies (vs. general small and medium companies)    | O (+)                         | O (+)                              |
|                                           | Number of obs = 3,300 O = significant/X = insignificant(+)= positive(−)= negative |                               | R2 0.0131                         |
|                                           | Number of obs = 3,300 O = significant/X = insignificant(+)= positive(−)= negative |                               | R2 0.247                          |

| Type                                      | Variables                                                                 | Model 2-1 (Number of patents) | Model 2-2 (Procurement performance) |
|-------------------------------------------|---------------------------------------------------------------------------|-------------------------------|-------------------------------------|
| Company characteristics                   | Growth stage (Entry-growth-maturity-decline)                              | X                             | X                                  |
|                                           | Company age                                                               | X                             | X                                  |
|                                           | Operating profit compared to sales                                        | X                             | X                                  |
|                                           | Number of regular employees                                               | O (+)                         | O (+)                              |
|                                           | Implementation of performance compensation system (vs. not yet implemented)| O (+)                         | O (+)                              |
|                                           | Innovative certified companies (vs. general small and medium companies)    | O (+)                         | O (+)                              |
|                                           | Operating profit compared to sales + innovative                            | X                             | X                                  |
|                                           | Number of regular employees + Innovative                                  | X                             | X                                  |
|                                           | Implementation of performance compensation system + Innovative            | X                             | X                                  |
|                                           | Number of obs = 3,300 O = significant/X = insignificant(+)= positive(−)= negative |                               | R2 0.0129                         |
|                                           | Number of obs = 3,300 O = significant/X = insignificant(+)= positive(−)= negative |                               | R2 0.250                          |
support systems, no evidence was available to support the possibility of higher technical performance with the same support. The analysis of relationship between experience in policy support and technical performance is shown in Table 7.

4.9. Relationship between the Type of Policy Support and Technical Performance. Among step-by-step policy support, support at the development stage and planning stage was found to be highly related to the number of patents, while tax support was found to be related to the process of procuring patents and development costs. Policy support belonging to sales support was found to have a positive relationship with development cost procurement performance, but it was found to have a negative relationship with the number of patents.

In other words, there is a possibility that there is a difference between the target of the market support policy and the target of other types of support policies. Alternatively, a market support policy may consider the possibility of a higher link to economic and financial performance than to technology development. The analysis of the relationship between type of policy support and technical performance is shown in Table 8.
4.10. Relationship between the Network/Partner Type and Technical Performance. The presence or absence of experience using collaborative partners itself was found to have little connection with technical performance, and negative (-) connection between the presence of collaboration with private research institutes and the number of patents was found. There was a positive connection between cooperation with foreign companies and the performance of procurement of development costs, and negative (-) connection between college or mid-sized companies and procurement performance. In other words, there was no strong finding to support the network's effect, rather, it could raise the possibility that selective partnership-collaboration would weaken the positive impact of investment on technical performance, depending on the firm's financial conditions. The analysis of the relationship between network/partner type and technical performance is shown in Table 9.

4.11. Summary of Analysis Results. In this study, the six hypotheses established were verified based on the research model, and the results of the overall hypothesis analysis are shown in Table 10.

5. Conclusions

This study aims to provide implications for a diverse approach to whether the Korean economy can be created around sustainable small-sized and medium-sized companies. For this study, data from the Korean small-sized and medium-sized companies technical statistics survey were used, and 3,300 out of 57,039 sample populations were analyzed based on stratification extraction and weight of each type (28 in each type) and size (7 in stage).

Through this study, the following implications can be discussed. First, the group of innovative certified companies...
also showed higher technical performance compared to the group of small-sized and medium-sized companies engaged in technology development activities. However, additional analysis will be needed on whether the innovation certification system has made this difference. This is because the possibility cannot be ruled out that a company that was originally superior received innovation certification. Second, although corporate size and organizational power were related to technical performance, it was difficult to find a link between “profitability” and technical performance, as the technology development itself was a mid- to long-term process, and cross-sectional data alone. However, when the size of the company itself can be the result of capital accumulation, it can be said that the economic performance of the company in the mid- to long-term is likely to have a positive impact on technical performance. Third, we found a positive link between government policy support and the technical performance of the company. However, no evidence has been found that policy support for innovative-certified companies is more efficient in producing technical results than policy support for general small-sized and medium-sized companies. Fourth, the network effects assumed that collaboration will affect technical performance can vary significantly depending on collaborative partners. In particular, collaboration with private universities and private research institutes was negatively related to technical performance.

Based on these implications, it can be said that it is important not only academic but also in practical terms for municipal authorities, institutions, and organizations that implement policies to foster small-sized and medium-sized companies. On the other hand, the limitations of this study and future research tasks are presented as follows. The “2017-2018 Small-Sized and Medium-Sized Companies Technical Statistical Survey” data used in this study are cross-sectional data measured only in a single year and may have an endogeneity problem. In other words, the cause and effect measurements can be made at the same time, resulting in endogenous problems, especially problems that rely solely on the theory of whether the cause precedes the result. To solve this problem, the research hypothesis was limited to “relatedness” rather than “causal,” while potential assumptions for later causal analysis were explored, and a more reasonable model was established by conducting a multilateral analysis of associations between variables. Thus, future research projects may consider estimating tool variables for endogenous control.

There may also be problems with sample selection. The focus of this study is on the comparison between innovative-certified companies and general small-sized and medium-sized companies, but stratification extraction was implemented only for industries and sizes during the sampling process. First, we wanted to analyze the magnitude of the effect of convenience on sample selection by performing a regression analysis on a pooled sample and comparing and reviewing the results separately with the sample selection.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

This work was supported by the Industrial Strategic Technology Development Program (p0013990, Convergence technology diffusion type Professional Human Resources Development Project) funded by the Ministry of Trade, Industry, and Energy (MOTIE, Korea).

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