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Servitization of SMEs: Focused on the Electrical Equipment and Metal Parts Manufacturers in South Korea

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Abstract: Servitization is becoming an essential strategy for manufacturers to gain competitive advantage, and several successful cases have already been reported. However, these success stories are mainly studied for large enterprises such as GE, IBM, Xerox, and Rolls-Royce. Therefore, it is difficult to apply the cases to the servitization of SMEs, thus in this study, the status of SMEs' servitization was examined and the applicability was studied. Among those SMEs, manufacturing of electrical equipment and basic metal parts were selected because they are related to all manufacturing industries. As a research method, companies in the relevant industry were randomly selected and CEOs, managers, and employees were interviewed. Through in-depth interviews, the company's current servitization status in the perception of different employment levels and new servitization opportunities are analyzed. As a result of the interview, the level of servitization in the industry seems to be very low, and it seems that there are very few new servitization opportunities due to the characteristics of general SMEs, such as lack of capital and human resources. Nevertheless, companies were aware that servitization was necessary for sustainability, and they could confirm their will to take on a challenge if there was an opportunity in the future.

Keywords: servitization; SMEs servitization; servitization decision making; sustainability

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1. Introduction

Manufacturers have achieved great success in recent decades with dazzling technological advances, but now that growth is reaching its limits. With technology development alone, it became difficult to differentiate products from their competitors and the competition gets more intensified continuously, so manufacturers are faced with the task of discovering new growth engines in recent years. Accordingly, a phenomenon such as servitization becomes a natural way of surviving technique for manufacturers in which to strengthen their competitiveness by using service [1–3]. Servitization refers to a phenomenon in which a manufacturing company or a service company creates additional value by providing products and services together. The combination of products and services may occur in the final product or in the process of producing a product or providing a service.

The term servitization was first used in 1988 when it was introduced as a combination of product, service, knowledge, support, and self-service [4]. In a similar concept, PSS (Product-Service System) was introduced in Europe in the mid-1990s, which explains that customer satisfaction is pursued by proposing value to corporate customers through products and services provided through business networks [5,6]. In addition to the introduced servitization, it is explained that the impact on the environment is also considered [7]. Although different definitions are implied in various studies such as servitization and PSS, including B2B and B2C business, what they all seek in common is to provide products

and services at the same time to satisfy customer needs. This is ultimately the pursuit of sustainable process design in the manufacturing industry, and furthermore, it is the presentation of a new business model that can be applied to various industries and their supply chains. Many scholars and practitioners are studying the servitization methodology and its effects through corporate cases [2,8], and attempts are being made to combine products and services not only in the simple manufacturing industry but also in various industries such as construction [9], internet related services [10], and even in medical industries [9]. In addition, the factors influencing successful servitization and failure cases are also studied [11,12]. However, most of the research, including research on methodology, have been based on case studies of specific large multi-national companies or relatively bigger enterprises. For example, GE, IBM, Xerox, Rolls-Royce and some other companies are the most frequently mentioned examples of successful servitization, but their business transition strategies cannot be applied to general SMEs due to many reasons. In addition, there are only a few studies on failure cases of the service paradox, a phenomenon in which manufacturers cannot wait for investment returns to be realized after investing in services or not enough returns from service than expected [13].

In fact, servitization is not a strange term for manufacturers as more and more companies are offering services related to their products. However, small and medium sized firms still encounter difficulties to understand the real meaning of servitization [1] and many of them have never heard of the term 'servitization'. Existing studies of servitization mostly claim that manufacturers are providing services related to their existing products [14] while others explained the servitization is an evolution of product value through the convergence of product and service [15]. Therefore, the service providing processes will be added and managing complexity between manufacturing and service providing processes will also be increased as well as its cost. Accordingly, small and medium sized firms should consider their ability and capacity to manage the service providing processes. Consequently, servitization is a difficult challenge for SMEs in both financial and managerial way. Despite all of these difficulties, servitization is an inevitable phenomenon. If small and medium-sized manufacturing companies in the electronic equipment and metal parts industry perform servitization, especially in the direction of development and design, basic technological development and manufacturing efficiency may increase in the related industries. Furthermore, all manufacturers and service providers are using different kinds of electrical equipment and basic metal parts for their products, manufacturing facilities, and even service providing equipment. Since all manufacturing and even service industries, including large and small businesses, use electrical equipment and basic metal parts, if small and medium-sized enterprises in this industry increase productivity through servitization and produce advanced products, it will contribute to the development of large enterprises and all industries as well.

Therefore, in this study, authors focused on studying servitization possibilities of relatively small companies, especially in less servitized industries, such as electrical equipment and metal parts manufacturers. To add more detailed explanations of choosing specific target industry are as follows. Most of them provide a minimum level of services due to their business environment and hence they are operating in B2B businesses. These companies are not familiar with the concept of servitization and usually having difficulties in growing their businesses. Because of their product characteristics, the investment in R&D is likely to be much higher than expected returns, which means there is less motivation to develop the technology level. Therefore, we investigate whether there are services that can be tried without requiring a lot of investment for new growth engines in this industry. Another important reason for studying this industry is that almost all industries are naturally related in use of electrical equipment and basic metal parts as mentioned above, so authors think that these companies are related to all other industries. Hence, the development of target industry can cause the development and efficiency increase of all related industries. This study examines the applicability of servitization through interviews with electrical equipment and metal parts manufacturers of various sizes in order to accurately grasp the

actual situation in areas where the service is not familiar and to see if there is a need for service.

The purpose of the research is to find out that SMEs, especially small companies with 10 to 20 employees, understand the phenomenon and importance of servitization. If they do understand the importance, the next step is to find out the opportunity of servitization by analyzing their current processes and existing service level. Accordingly, the research questions are divided into 3 parts as follows:

Question 1. Do manufacturers that are far from the general service sector know the term 'servitization'?

Question 2. Can these manufacturers implement servitization?

Question 3. Can each company understand and expect the consequences?

The questionnaire was made to reflect the purpose of research questions and consists with 17 questions. Detailed explanation and full-scale research questions can be seen in Section 3. The research method and questionnaire of this study are useful in understanding the situation of servitization in other industries as well as discussing the development directions. The questions in the research questionnaire were decided to generally project the characteristics of various industries as much as possible and will be used again in future comparative studies. Even if the sample companies are mostly based on industrial area in the southeast area of South Korea, the research method is highly generalized, and the method and result of this study can be also easily adopted to other industries and countries cases. In addition, this study also theoretically contributes to readers to understand current status of servitization of SMEs, why and what kind of challenges they face, how to solve these problems through in-depth-interviews of different perceptions from different employment level. The managerial contribution is that the use of questionnaires can help companies of all kinds to consider the current status and find out how to get started with servitization. The main contributions of this study are as follows. (1) Compared to other SME research, all of the companies expressed as SMEs show sales that cannot be considered as small companies but, medium sized companies. (2) Papers adopting a research method similar to this study targets usually less than four companies and even sometimes studies only one company. These studies cannot be generalized to others. (3) Readers can accurately understand the current status of SMEs in the target industry and think about countermeasures.

Section 2 reviews the related literature and case studies. Section 3 explains the research methodology. Section 4 describes the findings and discussions. Section 5 concludes the study and explains the limitations with future research directions.

2. Literature Reviews

Servitization research can be divided into three main directions: servitization method, case study, and servitization performance. Servitization performance studies are in two different streams that measure the actual performance results by studying stock prices, revenues and profits. In this case, servitization case study often argues the factors influencing the successful servitization and its performance together. On the other hand, there are studies to find out appropriate measurement techniques to examine the performance of servitization, which is also usually introduced with case studies.

2.1. Servitization Study, the Brief History

The introduction of servitization study were in 1988 by Vandermerwe & Rada [4], who divided servitization into three stages. Stage 1 is when a single product or service is provided, and it refers to the state of selling individual product or providing individual service in a traditional industry. Stage 2 is a case where products and services are combined to add more value to each other. Stage 3 is a case where not only products and services, but also related knowledge and support services, and even self-service is combined. In 1992, Voss [16] introduced service factory concept to British manufacturing industry. This service factory explains that manufacturing companies should provide services together

to improve competitiveness because without service, competitors can imitate them easily if they have enough money and technology. This is because the traditional driving force for competitiveness improvement such as product quality improvement by technology development and cost reduction is easy to imitate through reverse engineering. Timothy et al. (1994) [17] also argued that a manufacturing strategy based on a service approach is necessary. In addition, Meyer and Detore (1999) [18] argued that for growth in the service industry, it is necessary to apply operational concepts such as product development methods in manufacturing. After that, various studies on servitization have appeared, such as more detailed challenges, advantages and disadvantages, methods and case studies, etc. Brax (2005) [14] argued that manufacturers provide a variety of services to solve the problems they face while operating in the conventional way such as services to increase the sales of products, maintaining customer relationships, discover opportunities in matured markets, adjust various cash flows according to economic cycles, respond to customer demand, etc. In addition, it was explained that an evolutionary approach is more dangerous than an innovative approach in the process of sequentially introducing services and service provision processes related to products. In other words, adding a service to a product increases complexity and variety, but this may not necessarily lead to customer satisfaction. The addition of a service increases the customer's essential level of engagement, and the customer may find it annoying or incur additional costs.

Around this time, the two terms PSS and servitization began to appear frequently in similar studies, and each researcher has different opinions about the upper and lower attributes of the two concepts. However, in general, it is explained that servitization tends to focus on products and services themselves or the delivery process, and PSS additionally considers the impact on the environment. It is explained that the goal of PSS is to secure competitiveness, solve customer needs, and reduce environmental impact through a system consisting of products, services, network participants, and support infrastructure [19].

2.2. Servitization Methodology

The first issue is a study on the servitization methodology. There are different studies to explain servitization steps or find out factors to help servitization of companies. About steps of servitization, Kim and Mauborgne (2000) [20] proposed a buyer utility map to identify the utility propositions of products and services. Using this map, buyer's experience cycles are examined such as different customers' shopping behaviors. Additionally, the influencing factors that companies can offer to customers are explained such as environmental friendliness, risk, and simplicity. There is also a study to examine the products and the services offerings of a company from Togt (2017) [21]. She introduced a technique called servitization mapping. It analyzes the portfolio of all products and services that companies currently offer, helping them to understand their current service levels and relationships among stakeholders in the business ecosystem. It explains that this allows analysis of the current status and finds future business opportunities to find an appropriate way to analyze the current product/service offering of SMEs. Based on the analysis, it is possible to propose servitization to other SMEs. To examine the companies' product producing processes and service providing processes, process-based method is reviewed which is a servitization method based on the core processes of SMEs and the characteristics of products/services [1]. The advantage of this method is that it can be applied to any type of business, since every company has a supplier-related process, a core process to produce product or provide service, and a customer-related process. The authors argue that a company cannot succeed on its own only with a vision to run the service. Management must thoroughly understand all the detailed processes of the current company, boldly remove unnecessary or less important parts, and focus on the most important core processes to strengthen the company's core competitiveness. In order to understand every aspect of the firm, from the core process to the details of the company, it must be based on process documentation.

2.3. Servitization Case Study and Performance

Another research stream is case studies, which account for the largest volume of the research, and various studies are being conducted by country, industry, year, etc. Case studies can be divided into academic research, reports, and publications of reference books. While academic research mainly studies countries and industries extensively, reports and reference books focus on specific company cases [22]. In 1990s, many papers on case studies of companies in different countries were introduced, such as UK, New Zealand, USA, Australia, etc. They describe how companies found services that customers wanted and responded appropriately. British manufacturing companies divided the service coverage into distribution channels, after-sales support services, and in-factory services. In particular, examples of British factories applying the service factory model and using factories as showrooms, laboratories, and consulting rooms are introduced [16]. In addition, it explains the research on realizing customer satisfaction through the introduction of service processes for mass customization and the increase in flexibility through the combination of advanced services [13,23]. Twelve service types such as consulting, leasing, procurement, and transportation services and other services that can be applied to manufacturing companies are presented [9]. Other scholars divide the research direction of servitization into 15 categories, from research on general concepts and definitions to research on technical assistance, and service marketing, service management, operations management, product. Additionally, introducing five research fields such as service system and service science, reviewing existing research directions and trends related to servitization [12,24].

The performance of servitization is obviously an important issue to the firm and the scholars as well. Wang et al. (2018) [25] used meta-analytic approach for a quantitative review of the firm performance after servitization. Crozet and Milet (2017) [26] found out that servitization can increase a firm's profitability, employment, and total sales. They also argued that there is no boundary between the service industry and manufacturing industry because everybody is already in service. This phrase is also related to the purpose of our study to try to find existing service process from interviewed firms. In fact, Crozet and Milet (2017) [26] introduced that the concept of everybody is in service was already mentioned by Levitt (1972) [27]. In addition, Jang et al. (2021) [28] try to measure the servitization experience and the effect on brand resonance and customer retention. They argued that the level of such integrated and customized servitization experience can be the measure of servitization and also the factors influencing customer retention which is highly related to the long-term performance of the firm.

On other hand, servitization case studies can be divided into studies on specific countries such as the UK, Italy, Poland, France, Sweden, and Finland [29–33], specific industries such as sheet metal industry, IoT related manufacturing and chemical industry [34–36], or specific companies such as IBM, Apple, Dell, GE, and Rolls-Royce [37,38]. Additionally, studies about servitization strategy of SMEs are also increasing [30,39]. Among those variety studies including other papers not sited here, only a few studies are related to those SMEs producing equipment for electricity distribution or manufacturing of basic metal parts. However, these case studies are still targeting medium-sized companies with at least a few hundred employees, and it is difficult to find studies targeting small companies with 10 to 20 employees. In addition, there are studies on the servitization decision making process [11] and research on organizational structure. However, these studies are often focused on a single company [40,41] or on a special industry [42] other than a typical manufacturing industry, which means that those studies are difficult to generalize to other cases.

2.4. Service Paradox and Others

The service paradox was first introduced in 2009 [9]. This explains the case in which a manufacturing company cannot wait for the time to turn to black due to lack of spare funds when it has invested in the service process but does not achieve the expected return and faces financial difficulties [43]. Servitization started with the idea that companies need to

avoid cost competition and increase the value of the value chain, and empirical studies are being presented to prove that this direction is appropriate. In another case, manufacturers do not fully understand the characteristics of the service industry, ignoring the fact that service-oriented enterprises often increase their sales, but their net profit margin is much lower than that of pure manufacturing enterprises. It was analyzed that servitization was observed more in developed countries than in developing countries, and in large enterprises rather than SMEs. In other words, the smaller the size of the company, the more difficult it is to take risks [9]. As of 2004, among companies in the United States, about 5300 pure manufacturing companies and about 2500 companies that implemented servitization. Although higher, it can be seen that pure manufacturing companies account for 50.13% of the total net profit ratio, which is higher than 49.87% of service companies.

3. Research Method

The starting point for research is that there are many different industries, and some industries are not familiar with the term 'servitization'. Therefore, we try to capture the current understanding of servitization in these specific industries, where service processes are less related, such as manufacturers of electrical equipment and metal parts; an interview method was selected. Through an in-depth semi-structured interview method, each company's servitization status could be analyzed and the possibility of launching a new service can be identified. The in-depth semi-structured interview method is widely used in qualitative research because it allows variability such as additional questions depending on the interviewee's answers and leaves open the possibility of providing their experiences freely.

Most of the companies in the target industry operate mainly B2B business and are far from providing special services because they are only in the form of supplying simple products. Nevertheless, sample companies were selected and interviewed to see if there are services that these companies are already implementing or applicable in the future based on the 12 services suggested by Neely (2009) [9] which are as follows. The order of the following services is explained as the order in which they are provided the most.

Types of services the manufacturing industry can provide (Neely, 2009):

1. Design and Development Services
2. Systems and Solutions
3. Retail and Distribution Services
4. Maintenance and Support Services
5. Installation and Implementation Services
6. Financial Services
7. Property and Real Estate
8. Consulting Services
9. Outsourcing and Operating Services
10. Procurement Services
11. Leasing Services
12. Transportation and Trucking Services

In order to verify that the sample companies have an appropriate production process or operating method, sample companies were randomly selected from among the companies that received ISO 9001/14001 certification from industry code 172 which code is corresponding to metal processing. The industry code can vary depending on the country and ISO certification companies. Most of the about 200 companies from the initial list were located in industrial areas near large companies for delivery, and companies were selected in stages in consideration of the number of employees and revenue. Thirteen companies were selected, and their number of employees was 3 to 75 employees, with sales ranging from 0.1 to 100 million USD depends on different years. All companies wanted to be interviewed anonymously because the interview included questions about the company's financial situation and operating process. Additionally, since the interview was not only for the CEO, but also for middle managers and front-line employees, there were different opin-

ions within a company, so most of the interviewees wanted anonymity as well. Therefore, company and interviewee are referred to as company A or interviewee B, etc. The average number of employees at the 13 companies was 18.5 at the time of the interview, and the maximum number of employees at the largest company varies from a minimum of 75 to a maximum of 150, depending on the situation. According to the industry classification of the interviewed companies, 9 out of 13 companies are mainly producing automobile parts related products, and 4 companies are producing parts related to ships and marine engines. There are 3 companies involved in both fields, and 3 companies produce parts related to electrical equipment. Table 1 shows a detailed view of those companies.

Table 1. Interviewed company information and major products.

Company (Revenue in USD, 2021)	Major Products	Existing Services	Employees
Company A (53 million)	Steel structure, Switchgear, etc.	Design and Development service	75 employees 2 managers and 3 employees interviewed
Company B (26.4 million)	Marine engine parts, Automobile parts, etc.	Design and Development service, property and real estate service	25 employees 1 manager and 2 employees interviewed
Company C (9.25 million)	Automobile parts		25 employees 1 manager and 2 employees interviewed
Company D (3 million)	Automobile parts		21 employees 1 manager and 2 employees interviewed
Company E (9.4 million)	Metal parts, other machineries	Design and Development service	20 employees 1 manager and 1 employee interviewed
Company F (4 million)	Automobile parts		17 employees 1 manager and 1 employee interviewed
Company G (3.6 million)	Marine engine parts	Design and Development service	15 employees 1 manager and 1 employee interviewed
Company H (0.83 million)	Automobile parts		10 employees 1 manager and 1 employee interviewed
Company I (1 million)	Hydraulic parts		10 employees 1 manager and 1 employee interviewed
Company J (0.23 million)	Marine engine parts, Automobile parts		9 employees 1 manager and 1 employee interviewed
Company K (0.67 million)	Automobile parts		6 employees CEO interview only
Company L (0.2 million)	Automobile parts		5 employees CEO interview only
Company M (0.1 million)	Automobile parts		3 employees CEO interview only

Semi-structured interviews were conducted with a total of 39 people, including 13 CEOs, 11 middle managers, and 15 front-line employees. The interviews were conducted to understand the industry in depth, and the opinions of not only the CEO but also middle managers and employees were consulted to receive unbiased opinions. The average interview time was around 40 min per person, including 25 phone and video interviews due to COVID-19. The interviews were conducted from September to December 2021. Some of the interviews were performed on site and 3 company tours were available.

The summary of research questions are as follows and complete set of 17 questions in three parts including summary of answers can be found at Appendix A.

Question part 1. Do manufacturers that are far from the general service sector know the term 'servitization'?

Purpose of the question:

1. Understanding the concept of servitization.
2. Pros and cons of servitization.

Question part 2. Can these manufacturers implement servitization?

Purpose of the question:

1. Understanding the current process of the firm (through the analysis of current process by using various servitization methodologies).
2. Find processes that can be changed or propose new services.

Question part 3. Can each company predict what will happen next?

Purpose of the question:

1. Understanding of process change and consequences.
2. Changes to sustainability.

The first part of research questions asks whether companies aware of the concept of servitization and the basic understanding of manufacturing and service industry. This part can help the companies to understand the current circumstances of manufacturing industry trends and their own situation and whether they want to find a breakthrough. The second part of the research questions tried to find out if companies have a clear understanding of their processes. This can help companies understand whether they understand their own processes accurately and determine where to change to improve their processes. If a manufacturing company starts a new service or discovers an applicable process to apply among the 12 applicable services, this can be a great opportunity for companies to start a new service. The 12 applicable service categories refer to a study by Neely (2009) [9]. The third part of research questions was to determine whether companies understand consequences of servitization. Execution of servitization will change the process of the company, and if the changes are well adapted, it will lead to an increase in the competitiveness of the company, which can also be seen as an increase in sustainability. However, if the company fails to adopt the service process, service paradox may the consequences.

We gathered ideas about factors that influence servitization from several studies to decide 17 interview questions such as company's servitization level, product/service providing process, product/service lifecycle, product/service standardization degree, and the existence of complementary/substitutable products/services, etc. [31,44–46].

The next step is an interview. In order to accommodate various opinions within the company, we conducted interviews with various positions such as CEOs, middle managers, and employees, and 39 interviews were conducted in 13 companies. This includes 11 middle managers and 15 employees. Due to the COVID-19, some interviews were conducted by video calls and land lines. The interview process is as follows.

1. We tried to collect the responses to questionnaires from at least three people in each company, for example CEOs, middle managers, and employees. Because different people in different positions in the company will have different opinions and understandings of the company. However, some companies only have very little number of employees and hence there is no middle manager or enough number of employees

to conduct interviews. Therefore, only CEO interviews were conducted in those companies.
2. Each interviewee's knowledge of servitization is discussed and, if necessary, teach or explain about servitization. In order to understand and analyze the current company's status and industry circumstances, the interviews were conducted by referring to the organization chart, work manual, process charts (if possible), and other collectible materials.
3. Discuss with the interviewee about each company's applicable servitization strategy and its expected consequences.

Through the above steps, we identified the current situation of companies and discussed the possibility of servitization using existing servitization methodologies. The complete set of interview questionnaires and a summary of the answers can be found in Appendix A.

4. Findings and Discussion

A total of 39 interviews were conducted, among which 13 were CEOs, 11 were middle managers, and 15 were general employees. The companies' revenues ranged from 0.1 to 53 million dollars in 2021, and they produce products as follows.

1. Electronic equipment and switchgear, automobile and ship components including engine parts, electric circuit, and other metal parts.
2. Electric Circuit Switch, Protection and Connection Equipment (Insulated Load Break Switches, Switches, Lightening Arresters, Wire Fuses), Transformers, Insulators, Reactors, Synthetic Plastics (Protective Covers, Protective Boxes), Electric Vehicle Charger, DCU for AMI, Transmission and Distribution Hardware, Aviation Obstacle Light, Battery Energy Storage System, Lattice Steel Towers and Steel Structure (Including Steel Poles).
3. Ship engine parts, automobile parts, and other metal parts.

Summarizing the interview results, there are only two companies who run R&D department formally and two more companies are trying to develop their technological level. Therefore, only four companies are providing design and development services and only one company out of those four is providing property and real estate service. All other companies do not provide anything that could be called a specific service except a few of them have basic level of after sales service manual. The three main issues found from the interviews are as follows:

1. SMEs barely have knowledge about servitization. Although they recognize the importance of providing services such as from basic after sales services to other advanced services, they have lack of knowledge about the term and concept of servitization. When a case of servization is explained, the interviewee understands the concept but does not realize that it is a case of servitization until they hear it.. In other words, it means that companies have not been educated on the concept of servitization or the importance of services. Policy help is needed for the servitization of SMEs.
2. Even if SMEs understand servitization, they lack the motivation, resources, and time to implement it on their own. Due to the lack of human and capital resources such as service experts and funds, expectations for a return to surplus after investment are low. In addition, the industry characteristics make providing service more difficult because the main business of those SMEs is supplying their products to large companies. It is very rare to meet general consumers, and the business continues only in a B2B environment. After delivery to a large company, if there is no problem with the relevant equipment or parts, the next production schedule begins without any further responsibility. Therefore, SMEs believe (or we can say hope) that the current industrial structure and relationship will be maintained without servitization. In this case, SMEs may be inspired by the case of Hankook Tire Co., Ltd. [1] Of course, the Hankook Tire case was in the form of a large company supplying to other large companies, but an

idea can be gathered by looking at the form that combines the company's flagship products and surrounding maintenance services.

3. Small and medium-sized enterprises (SMEs) are basically afraid of new challenges while not clearing their doubts about sustainability and even failure after the trial of new strategy including servitization. Again, the main reason relates to the lack of human and capital resources. Therefore, education and support policies at the government level are needed. However, it is very unfortunate that some small companies (especially those with less than 10 employees) are not even able to use common growth strategies that have been researched and widely used due to lack of education. For example, these small businesses may not be using or are unaware of modularization, product mix changes, the use of MPS, MRP and ERP, and other effective process management techniques. If these companies can increase production efficiency, it can be expected that they will have room to think about servitization.

It is difficult to find an appropriate comparison target because there have not been many studies on small businesses to this extent, but according to Piola (2017) [39], it is explained that gradual improvement in the service level of SMEs is possible. In their study, it is introduced that predictive maintenance, warrant modeling, consumptions control, energy savings and customized use of the product will be possible to the companies with sales of 0 to 50 million Euro in Italy by using strategies such as Software-, Product- and Machine-As-A-Service (SAAS, PAAS and MAAS). If a company's production line is slightly larger and more complex, the use of integrated production control software can be considered [35]. Additionally, depending on the type of product, using remote monitoring technology [47] is an option that can be considered later. However, as explained above, it is difficult to find similar studies focused on small and medium-sized enterprises (SMEs) in terms of sales and employment scale, as in this study.

Other findings revealed that, apart from only four, companies were providing design and development services, and only one of them was providing property and real estate services, the remaining 9 companies barely provided after-sales service. This shows how far SMEs engaged in the industry are from services and points out the problems of the industrial structure itself. Obviously, there may be limitations in the types of services that can be applied to each industry, but the industrial structure that only considers cost and delivery time mainly for large enterprises can be judged as a factor hindering the development and sustainability of SMEs. Nevertheless, the three companies showed their commitment to design and development services. In addition, two companies are thinking about strengthening the current maintenance and support service, and five companies are willing to start new maintenance and support services.

5. Conclusions and Future Research Directions

In this study, 13 companies were interviewed, and although the number of companies seems small, the diversity of the sample was appropriately considered because companies of various sizes were targeted at different levels in number of employees and revenues. The number of employees varied from 3 to 75, and revenue ranged from 0.1 million USD to 53 million USD in 2021. In different years, the number of employees varies from 3 minimum to 150 maximum from sample companies, and the revenue also increases to 0.8 million USD in minimum to 100 million USD in maximum. Depending on the economic, industrial, and social circumstances, the company conditions are varied, but sample companies are fit to the purpose of the study that to identify the servitization status of small and medium sized companies, especially with around 10 to 20 employees or less. Through this study, authors were able to identify the current servitization status of small sized companies in electronic equipment and basic metal parts manufacturing industry. However, servitization may be the answer as it is very difficult to develop new growth engines for these small businesses due to lack of capital and manpower. In addition, compared to other research mostly studying relatively larger companies, we studied small

companies who need immediate help. These companies also want to be servitized, but their first goal should be the optimization of production from an operational point of view.

According to the characteristics of the relevant industry group, it seems that the service had little relevance currently, and the possibility of development was low even if few companies have shown their willingness to services. Therefore, we would like to emphasize the need for strengthening education and public relations for companies at the government level. Only 4 of the 13 sample companies are dedicated to R&D functions and have higher revenue compared to other companies with a similar headcount. This shows that even a small company can do R&D. It shows that they can coexist if large corporations and the government support SMEs through joint research or research support projects and making policy changes accordingly at the government level. Otherwise, the continued survival of these small businesses may be difficult without structural changes in the industry and the efforts of large corporations. This is because the largest company among the sample companies, which is a tier 1 supplier of state-owned energy company, was shown its skeptical view of their sustainability as well as the industry itself. Among the companies interviewed, some companies produce similar products but have development and design processes, while others simply manufacture, so if more companies are able to invest in R&D, the overall technology of the industry can be expected to develop more quickly. Advances in technology can lead to increased manufacturing efficiencies and growth across industries. In addition, unlike most existing studies, it can be said that this study has contributed greatly to the field by studying small companies with less than 10 employees. This is because, in the end, it is these small-sized enterprises that form the industrial base of large and medium-sized manufacturers, so the authors think that research on these companies should be more active.

Therefore, it seems meaningless to increase the number of companies to interview, but a time series study to see if there is any change through continuous education and publicity can be considered as a future research direction. Through the interview process of this study, the companies said that they gained knowledge about servitization and were ready to make efforts for development. Therefore, if we continuously observe the servitization situation of the companies through time series research, we believe that we will be able to obtain answers for the development of the overall industry. In addition, it is possible to find out the improvement points by checking the status of servitization in other industries and comparing them with the corresponding industries. Additionally, there are different strategies and services that can be applied to target companies such as remote monitoring systems. Furthermore, the result of this study clearly reflects the current status of small companies, making it easy to generalize to other industries, because the condition of these basic level companies is similar regardless of industries.

Finally, this research broadens the academic radius of a previously less-studied field by studying the status of servitization in industries that have little relationship with services and explains the position of SMEs on servitization in practice. Therefore, authors think that it can serve as a steppingstone for the servitization research of small and medium-sized manufacturing companies in the future, and also that this study will be helpful both academically and industrially if comparative analysis studies with other industries and time series studies are paralleled.

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Appendix A

Interview Questions (17 questions) & Answers Summary.
Interviewed company information.

1. 13 companies, number of employees from 3 to 75 (used to be 145 max), sales from 0.8 to 100 million USD.
2. Business type: manufacturing of electronic equipment and switchgear, automobile and ship components including engine parts, electric circuit, etc.
3. Only 4 companies are providing 'Design and Development services' and 1 of those 4 have property and real estate services. Otherwise, they barely provide A/S services.

Part 1. Understanding the company's knowledge about servitization and their current status. (5 questions)

1. What is the phenomenon that is called servitization? No one has ever heard of servitization but, understand the concept after the explanation with an example such as Woongjin Coway and Samsung Electronics.
2. What are the main issues of manufacturing system? Intense competition Cost reduction, intense competition (development of product and technology was only few).
3. What are the main issues of service providing? A/S services, installation, maintenance, delivery service and out-sourcing.
4. How does servitization affect the company in both positive and negative way if implemented? Possible increase in sustainability, cost and performance dilemma.
5. How much do you think the company is servitized? asked five scales (very little, little, normal, good enough, highly servitized): very little (11), little (2).

Part 2. Looking for a suitable way of servitization for the company. (8 questions)

6. What do customers value most? Price! Additionally, then quality, consistency, persistency.
7. What is/are the major strength of the company? R&D, technology (4 companies only) and nothing.
8. What is the main product/service offered? Parts and components, NPD (4 companies only who have R&D department).
9. Explain the life cycle, standardization degree of the product/service compared to its industry standard. Long enough product life cycle to lasts decades, highly standardized.
10. Are there complementary goods/services or substitutes? There are issues about new and renewable energy but not a threat at all.
11. Can customers' needs be fully satisfied with the company's strength? Cannot say fully but satisfied enough.
12. What does the company need to provide more related to question 10? Need to develop technology about new energy, renewable energy, electric car but not very important because it can never fully alternate original industry.
13. What changes are needed to the manufacturing or service providing processes including facilities, organizational structure and human resources for question 11? Not sure or needed for now maybe later.

Part 3. Understanding the consequences of servitization. (4 questions)

14. How many spare resources do the company have for the servitization? Not at all.
15. Explain the expected consequences of servitization in both positive and negative ways. It may affect the sustainability of the company but, is too costly or cannot expect any change.
16. How long will it take to become sustainable (profitable)? Not sure or never (being skeptical of the positive effect of providing service).
17. Discuss the suitable servitization method for the company. Servitization canvas maybe helpful for finding new business opportunities or check the ecosystem. However,

it is difficult to develop new product/service even if Process chart can be used in traditional way for example to examine the productivity or make it leaner.

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