

SERVITISATION OF THE MANUFACTURING INDUSTRY IN JAPAN

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ABSTRACT

The recent decline in the profitability of Japanese manufacturers has led to 'service innovation' or servitisation – the development of advanced service businesses utilising information technology. This study analyses 13,322 companies in the Japanese manufacturing industry and finds that servitisation contributes to their profitability. The major difference between servitisation companies and others is that the former sell products to end consumers. We examine two case studies of companies which have built mechanisms to facilitate continuous service provision.

KEY WORDS

Servitisation, R&D expenditure, service innovation, diversification.

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Introduction

In the Japanese manufacturing sector, the practice of over-diversification slowed in the 1980s, with a consequent trend towards returning the focus to the main business. However, the recent decline in the profitability of manufacturers has returned attention to diversification as a way to once again improve profitability. In particular, there is a growing interest in 'service innovation', namely the development of advanced service businesses utilising information technology in combination with high value-added products. This is also referred to as servitisation. Indeed, there has been extensive research on advanced cases and competitive strategies of service innovation (e.g. Oláh et al., 2017). Nevertheless, there are only a few empirical analyses focusing on the profitability of servitised manufacturing companies.

To fill this gap in the literature, we explore how manufacturing companies change their businesses to improve their profitability through diversification based on data from the Japanese manufacturing industry. Specifically, we analyse the correlation between the degree of diversification of 13,322 manufacturing companies and their profit ratios. Furthermore, in order to identify strategies that help new businesses improve their profitability, we conduct two case studies of companies that provide products to end consumers and analyse their servitisation mechanisms. Moreover, few researchers have analysed service diversification and profitability, even though service innovation is crucial for the manufacturing industry. Hence, we take a step in this direction and find that servitisation contributes to the profitability

of manufacturing companies. In particular, the servitisation ratio of the processing assembly industry close to the end consumer is high, while that of material industries (providing industrial materials and so on) is relatively low. In terms of the relationship between diversification and profitability, the coefficients of the servitisation ratio are significantly positive. Thus, our findings show that diversification into services which are related to the core field may enable a company to differentiate itself from its competitors and reap benefits from diversification.

Consequently, we analyse two cases of manufacturing companies in which services contribute to profits. These companies have established a mechanism that makes it easy to continuously provide services to end customers. More specifically, they develop and sell products that facilitate product adjustment in the after-sale period, provide information on safety and usage, enable product maintenance, and handle related products that customers require from other companies. In this manner, these companies are able to increase profits by enhancing customer lifetime value.

1. Literature review

Existing research has thoroughly analysed the relationship between diversification and profitability with respect to each type of diversification strategy such as specialised, vertical, main business and intensive, main business and diffusion, related and intensive, related and diffusion, as well as unrelated types (Rumelt 1974). Although there are various classifications for such strategies, the academic literature typically distinguishes between 'diversification in related fields' and 'diversification in non-related fields'. Rumelt (1974) concludes that the profit ratio of companies which diversify only in the field related to 'core competence and competitiveness' is

relatively high. Other studies also show that 'companies diversifying in related fields' have higher profitability than 'companies diversifying in non-related fields' (Christensen and Montgomery 1981). Moreover, Chakrabarti et al. (2007) examine the impact of diversification on performance for firms operating in six Asian countries at different levels of institutional development. The results indicate that diversification negatively impacts performance in more developed institutional environments, while improving performance only in the least developed environments.

In Japan, Imai et al. (1975) and Yoshihara et al. (1981) empirically analysed domestic companies. Yoshihara et al. (1981), for example, considered more than 100 representative companies in Japan in their case study. Kodama (1995) shows that, in the high-tech industry, diversification in the downstream direction strongly correlates with sales growth, and industries with declining export competitiveness exhibit upstream diversification. In addition, prior research analysing statistical data on the Japanese manufacturing industry shows that diversification in non-related fields has reduced profitability, while diversification based on technology opportunities improves profitability (Gemba and Kodama, 2001). Kim et al. (2004) conclude that powerful keiretsu member companies are able to place more emphasis on growth when pursuing product and international diversification. Less powerful keiretsu member firms are subject to strong monitoring and emphasise profitability (Kim et al. 2004). Fukui et al. (2006) examine the industry diversification of the 142 largest Japanese manufacturers in 1973-98. They find that the firms in the research sample steadily increased diversification. Furthermore, their results show that the average relationship between diversification and company performance is negative.

In addition, research on the service innovation of individual companies has been conducted. For example, as a result of advances in servitisation (Vandermerwe and Rada, 1988), the manufacturing industry does not provide individual products, but rather integrates products and services and provides new value to customers. Research on PSS (product service system) providing services as a system is increasing (Morelli 2003; Baines et al., 2007). The main purpose of PSS is to reduce the environmental impact of the entire product life cycle by adding services to the product. The focus is on the system that provides the use of the product, not the product itself (Mont, 2004; Bertoni, 2013).

Nevertheless, few empirical analyses focus on recent trends and the outcomes of the diversification of manufacturing companies (Lin and Chang, 2015; Hashai, 2015). Since the diversification strategy of Japanese manufacturing companies has likely undergone significant changes since the 2000s, there is a need to analyse these developments empirically. The present study bridges this gap in the literature.

2. Materials and methods

Data sources

Most conventional studies of diversification utilise company data. However, many Japanese companies do not publish detailed sales data by business field (Delios and Beamish, 1999). Historically, these restrictions on data collection have caused difficulties in conducting detailed quantitative analyses. Therefore, extant studies analyse about 100 companies at most (Geringer et al., 1989). In reality, data on diversification in Japan has been accumulating over time. This data is based on large-scale surveys that target not only large companies but also small and medium-sized ones. It can thus be considered detailed and objective data. Companies

are also obliged by law to carefully complete their databases, and data aggregation must be strictly followed to ensure sufficiently high reliability.

In Japan, there are two sources of data. First, the Science and Technology Research Report of the Statistics Bureau of the Management and Coordination Agency has provided data based on R&D investments by product category at the company level since 1970, tabulated according to industry. The second data source is the nationwide Basic Survey on Corporate Activity (BSCA) published by the Ministry of Economy, Trade and Industry¹. The company-level data set of the BSCA comprises 13,322 companies across the Japanese manufacturing industry. We use survey data from FY2008.

The BSCA classifies sectors at the three-digit level (e.g. 091 livestock foodstuff manufacturing industry; 092 fishery food item manufacturing industry; 093 fine grain, milling industry; and 099 other food manufacturing industry). If the two digits at the beginning of the figure refer to the same industry, we integrate them into the same industrial classification. Thus, in our study the four industries provided as examples are classified as the food manufacturing industry. Overall, the manufacturing industry is composed of 24 sub-industries.

Variables

Table 1 presents the definitions of the variables used in this study. In extant studies that analyse diversification and profitability, several indicators are adopted as dependent and independent variables. To verify the relationship between the sales of each company and profitability, we perform

¹ This data is usually only available publicly by business field and industry. However, it is possible to obtain company-level data upon acceptance of an application to the Ministry of Economy, Trade and Industry for academic use. We used this company-specific data in our analysis.

multiple regression analyses with the ordinary income ratio as the dependent variable and the following independent variables: sales ratio of each segment, R&D ratio², and company size (Montgomery and Wernerfelt, 1998; Markides, 1995).

The sales ratio of each segment of a company means that the company has diversified (i.e. several companies have many sales segments). The sales ratio of

each segment in this study is defined as the sales amount of each business field divided by the company's total sales. Since we consider the R&D ratio to be a proxy of the technical strength of each company, we assume that it has a positive impact on profitability. Company size is added since large companies are more profitable than smaller companies due to economy of scale effects.

Table 1. Definition of the variable

Variable	Definition
Ordinary income ratio	Ordinary income/gross sales
Sales ratio of each segment	Sales by each segment/gross sales
R&D ratio	R&D expenses/gross sales
Company size	Log 10 (gross sales)

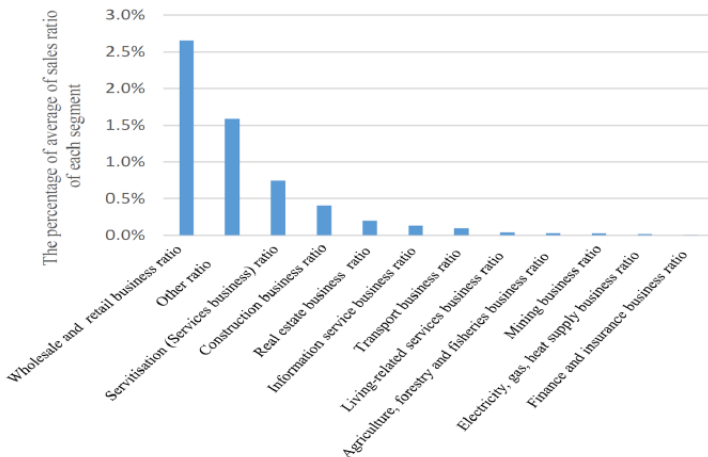
Source: Own elaboration.

3. Research results

Figure 1 shows the average sales ratio of each segment for all manufacturing companies. The sales ratio of the main manufacturing and processing business is the highest at 94.1%. However, this is excluded from Figure 1 in order to accurately understand diversification. The sales ratio

outside the manufacturing industry is relatively low, with the highest ratio recorded for the wholesale and retail trade business with a value of 2.7%. Although the manufacturing industry has been expected to servitise recently, the average sales ratio of service businesses is below 1%.

Figure 1. Average of sales ratio of each segment of all manufacturing companies



Source: Own elaboration.

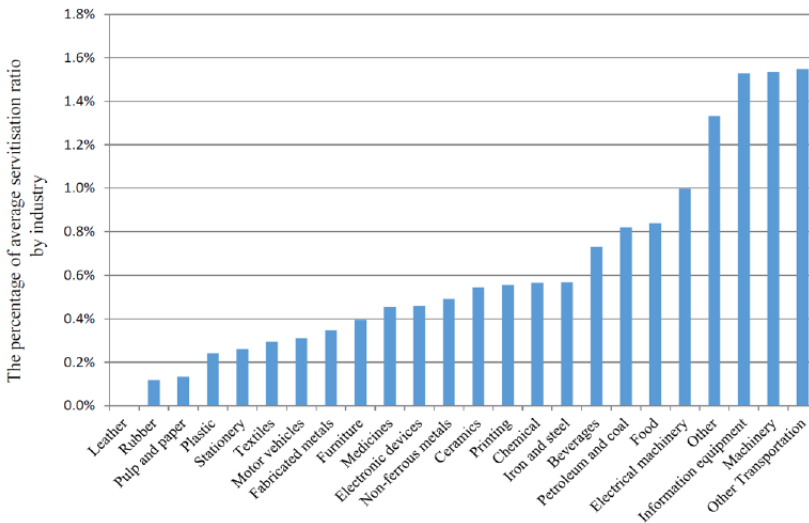
² The data on the sales–R&D expenditure ratio of each company is not compiled in the BSCA. Instead, it was integrated with data from the Science and Technology Research Report. For Legislation

Acts: The Act of 12 March 2004 on social assistance Acts. U. 2004., No. 64 item. 593.

Further, the degree of servitisation varies significantly across industries. As shown in Figure 2, it is the highest in the other transportation machinery industry (around 1.6%), but 0% in the industry with the lowest sales ratio (the leather industry). As an

overall trend, the servitisation ratio of the processing assembly industry close to end consumers is high, while that of material industries (providing industrial materials and so on) is relatively low.

Figure 2. Average servitisation ratio by industry



Source: Own elaboration.

Next, the results of the multiple regression analysis are discussed. Table 2 shows that company size, R&D ratio, the sales ratio of the manufacturing/processing business (termed main business ratio), and the sales ratio of each business in diversified fields (Wholesale and retail business ratio, Servitisation ratio, Construction business ratio, etc.) are relatively high. The correlation coefficient between each independent variable is low and there is no evidence of multicollinearity.

In addition, the coefficient of company size is positive and statistically significant. However, the coefficients of the R&D ratio and the main business ratio are significant but negative. In the relationship between diversification and profitability, the coefficients of the servitisation ratio are significantly positive; however, those of the

wholesale and retail business ratio and construction business ratio are significantly negative. R&D is a core field of investment and, although this investment does not contribute to earnings, servitisation increases profit. Thus, the fact that diversification into services is done in relation to the core field suggests the possibility that diversification leads to competitive differentiation advantages. However, it is impossible to analyse the revenue model of every individual company in this study. Consequently, in the next section, we analyse two cases of manufacturing companies in which services contribute to their profits.

Table 2. Results of the multiple regression analysis (the ordinary income ratio as the dependent variable)

Variables	Company Size	R&D ratio	Main business ratio	Wholesale and retail business ratio	Servitisation ratio	Construction business ratio	Intercept
Coefficient	0.285	-19.4	-0.318	-0.328	0.538	-0.646	-0.535
t-value	20.8	-72.3	-2.75	-2.15	2.38	-2.39	-4.34
Significance level	1%	1%	1%	5%	1%	5%	1%

Notes: (NB) Determination coefficient (adjusted): 0.283

The wholesale and retail ratio, servitisation ratio, and construction business ratio are the independent variables.

Source: Own elaboration.

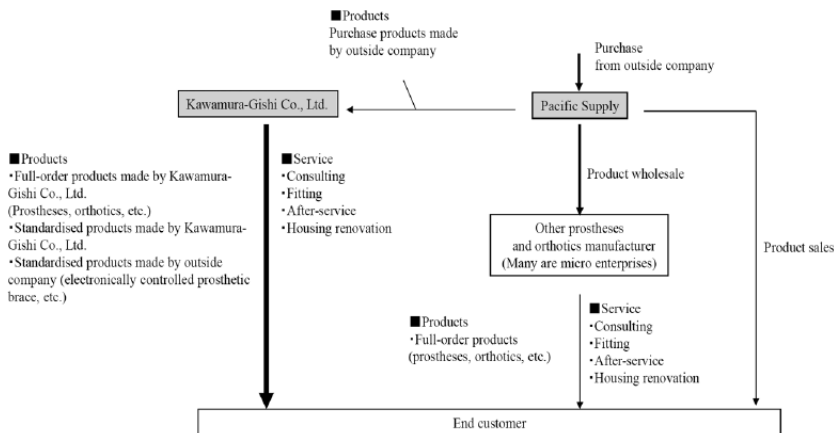
4. Case studies of companies providing products to end consumers³

Kawamura-Gishi Co., Ltd., prostheses and orthotics maker

Founded in 1946, Kawamura-Gishi Co., Ltd. is a small to medium-sized company that manufactures and sells prostheses and orthotics. The company first began manufacturing full-order prostheses and orthotics adapted to the customer's body and sold them directly to individuals with disabilities according to their needs. Subsequently, in 1968, Kawamura-Gishi established Pacific Supply Co., Ltd. as a dis-

tributor and subsidiary to purchase products from other companies that they could not deal with as Kawamura-Gishi Co., Ltd. (Figure 3). In addition to prostheses and orthotics, the company continues to provide welfare tools such as wheelchairs, walking sticks, electric care beds, and hoists. Together with the delivery of welfare equipment, follow-up, and equipment maintenance, it also provides services such as welfare remodelling to assist people with disabilities in leading independent lives. Thus, Kawamura-Gishi Co., Ltd. is a servitised manufacturer that builds ongoing relationships with customers by providing a variety of products and services.

Figure 3. Sales route of Kawamura-Gishi Co., Ltd.









Source: Own elaboration.

³ The case studies are based on the work of Shikata et al. (2010, 2013).

Furthermore, after the initial sale, the customer's prostheses and orthotics can be adjusted at his or her place of residence in response to changes in physical abilities and daily life (Figure 4). This also includes providing additional products and services necessary for customers to live comfortably, such as product maintenance, related

goods sales, and house renovation. Thus, customer relationships are maintained, increasing the lifetime value obtained from customers. Kawamura-Gishi Co., Ltd. also emphasises customer retention by converting customers into repeat customers. Therefore, its strategy focuses on expanding customer lifetime value.

Figure 4. Full_order and adjustable products of Kawamura-Gishi Co., Ltd.

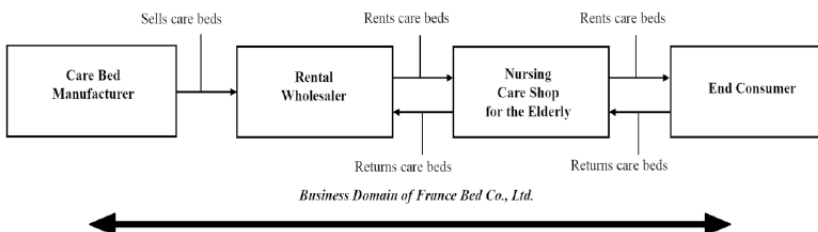
Full-order products	Adjustable product
 <ul style="list-style-type: none"> • Leg orthosis Moulds make according to the customer's shape 	 <ul style="list-style-type: none"> • Size adjustable type of leg orthosis Size and function can be adjusted on site
 <ul style="list-style-type: none"> • Full-order wheelchair Made according to the customer's shape 	 <ul style="list-style-type: none"> • Size adjustable wheelchair Seat width and sitting height can be adjusted.
 <ul style="list-style-type: none"> • Order gorset Created by craftspeople according to the customer's shape 	 <ul style="list-style-type: none"> • Size adjustable gorset When used, it is adjusted with a belt and conformed.

France Bed Co., Ltd., electric care bed manufacturer

France Bed Co., Ltd. conducts a rental business for electric care beds in Japan's public nursing care insurance system. Fig-

ure 5 illustrates the value chain of the care bed business.

Figure 5. Value chain of the rental care bed business



Source: <http://www.francebed.co.jp/>

In the public nursing care insurance system, the care bed business is divided into two markets: sales and rental. The manufactured care beds are sold to distribution businesses known as rental wholesalers. Rental wholesalers hold welfare equipment and rent them to nursing care shops, which, in turn, rent to end consumers (usually people aged 65 years or older who receive public nursing care certification). If consumers use public nursing care insurance, they can rent care beds. They pay 10% of the monthly rental fee, with the remaining 90% paid by their insurance. Used care beds are returned to the rental wholesaler through the care shop—the former then cleans, disinfects, maintains, and stores them until they are rented again. In this business, it is necessary to provide continuous after-sales service to the end consumer during the rental period, including advice on the proper use of the products, proposals for peripheral devices, security assurance, product maintenance, and repair. As elderly individuals who suffer from dementia and their families are among the users of public nursing care insurance, holistic services that include proper product selection and education are essential.

France Bed Co., Ltd. is a leading manufacturer of care beds, with rental wholesalers integrated into the company. A nursing care shop, which serves as a window for supplying products and services to public nursing care insurance beneficiaries, is also integrated, and the company handles

the manufacture, sale, rental, and service of care beds. The company is thus vertically integrated into the nursing care bed industry. Manufactured care beds are sold to rental wholesalers and then rented to end consumers through their own nursing care shops. Therefore, it is possible to control system performance, which includes the product and after-sales service, through the integrated company.

This company's vast knowledge of products and services allows it to provide appropriate services to customers (Hijikata, 2001). France Bed Co., Ltd. can thus rival other companies in terms of product performance and safety. The information flow between the businesses integrated into the company is crucial, as this allows it to perform regular follow-ups (Table 3). As a result, customer value increases, and customer relationships are maintained. Through this flow, the company provides customers with useful information, maintenance, and peripheral products to continuously use care beds with comfort. This ultimately leads to relationship-building. In other words, through servicing, the manufacturing industry optimises customer value, which, in turn, establishes customer relationships. By maintaining continuous relationships with customers, France Bed Co., Ltd. can sell peripheral products through a nursing care shop which it manages. Hence, its strategy maximises customer lifetime value, and thus profit.

Table 3. Information flow in France Bed Co., Ltd.

Receiving \ Sending	Care bed manufacturer	Rental Wholesaler	Nursing Care shop	End Consumer
Care bed manufacturer		How maintain products Introduce better equipment to maintain products • Long life without trouble Service parts on the basis of defect rate	How to match products to consumer • Choose product kind (care bed or wheelchair?) • Choose product type (size? function?) • How to use?	Suggest a new product
Rental Wholesaler	Quality information • Defect rate of product • Weak point of product Sales information • Turn over for rental products • Hot item Welcome and order process • Online system between manufacturer and distributor		Sales information • Turn over for rental products • Net increasing rate • Hot item	
Nursing Care shop	Quality information • Reception of products Sales information • Hot item Welcome and order process • Online system between manufacturer and care shop	Sales information • Turn over for rental products		Sales information • Turn over for rental products • Net increasing rate • Hot item
End Consumer	Quality information • Reception of products Sales information • Hot item		Quality information • The reception for products Sales information • Hot item	

Source: Own elaboration.

5. Discussion

In the scope of this research, we first empirically analysed the degree of diversification of manufacturing companies and its relationship with profitability by using data on 13,322 companies. Although we found that the manufacturing industry has

not been sufficiently servitised, the results showed that a higher rate of servitisation is related to higher profitability. By contrast, the profitability of companies with high R&D and sales ratios in their core business tends to be low. This result clearly

highlights the current predicament of Japanese manufacturing companies. Our finding on the ability of servitisation to increase revenues suggests that diversification into services requires strategies other than R&D to be developed in relation to the core business.

In the second step, since it is impossible to analyse the revenue model of individual companies owing to data limitations, we examined the examples of two case-study companies which have successfully implemented servitisation strategies. We found that the servitisation strategy of Kawamura-Gishi Co., Ltd., a maker of prostheses and orthotics, is based on building ongoing relationships with customers, thus increasing customer lifetime value. France Bed Co., Ltd., a producer of electric care beds, vertically integrates rental wholesalers and nursing care shops in-house, allowing customers to easily use their products. It also provides useful information, maintenance, as well as peripheral products to build and maintain ongoing relationships with customers.

These servitised manufacturing industry firms have established a mechanism that makes it easy to provide services to end customers on a continuous basis. They develop and sell products that facilitate product adjustment in the after-sale period, provide information on safety and usage, take care of product maintenance, and handle related products that customers require from other companies. In this manner, these companies have opted for a profit-maximising strategy by expanding their points of contact with customers. In other words, these companies are able to increase profits by enhancing customer lifetime value.

Conclusions

In the literature on the diversification of manufacturing companies, there are few studies that investigate more than 10,000 companies. Given the large sample size, this research has great significance for the literature. Furthermore, in this research, the results show that the profitability of companies with high R&D and sales ratios in their core business tends to be low. This result is consistent with the current situation in which Japanese companies have invested more in R&D than companies in other developed countries in the world, but these investments have not translated into superior corporate performance. This suggests that, in addition to the need to undertake further research into our finding that servitisation by firms in the manufacturing industry has a positive impact on business performance, further research is also needed on the relationship between R&D expenses and corporate performance. In fact, studies on the impact of new product development and service models on corporate profitability are being published within servitisation and PSS research. In this regard, it is necessary to investigate how the manufacturing industry can create a business that successfully integrates products and services by analysing individual companies.

One limitation of our study is that we used survey data from 2008. Hence, further empirical research using data from other fiscal years will be necessary in the future to verify the robustness of our results. Indeed, whether the same results can be obtained for other years remains an important analytical question.

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