



An empirical study of servitization paradox in China



Jing Hua Li^{*}, Li Lin, De Ping Chen, Li Ya Ma

Institute of Modern Services, Zhejiang Shuren University, Hangzhou, China

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ABSTRACT

There is a paradox experienced by manufacturing firms attempting to servitize that their substantial investment in adding services to the existing product portfolio does not bring expected higher returns. The purposes of this paper are to gain more understanding as to the servitization status in Zhejiang Province of China and the influence of servitization on business performance of manufacturers. We conduct a regression analysis based on 134 listed manufacturing firms in 12 sectors in Zhejiang Province of China in 2012. Our results show that there is a significant positive relationship between servitization and business performance for manufacturing firms in Zhejiang; a U-shape relationship between servitization and profit per capita of firms is identified. In addition, the strategy of servitization is more suitable for larger firms and the effect of servitization in boosting business performance becomes more prominent once servitization has grown beyond certain threshold.

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1. Introduction

In conventional sense, the offering of service is deemed to consume resources and capital while product offering is a firm's source of revenue; that's why services have long been thought as a burden on manufacturers since they have to provide certain services (such as after-sale services) so to maintain steady revenue from their product offerings. With the subprime crisis in 2008 devouring a substantial number of manufacturers, firms home and abroad have been trying new ways to survive the critical moment. Servitization is among the strategies that firms employ when they abandon the tradition to focus only on tangible products and turn to service offerings for vitality.

For a manufacturing firm, servitization can at least bring the following three benefits: (1) due to the unduplicated feature of services, a firm can enhance customer satisfaction and loyalty through offering of unique and unparalleled services, thus strengthening the firm's competitiveness; (2) a firm's revenue can be increased through services provided with long accumulated professional knowledge; this is a typical case where knowledge is transformed to economic benefits as knowledge-based service offerings promotes the product selling and ultimately boost the development of the firm; (3) in reality, resources are always limited with fluctuating prices, while servitization can reduce a firm's dependency on resources so to minimize the impact of resource price volatility on the firm's profitability; by adding services into the portfolio, the firm no longer depend only on products as its source of profit through "moving its eggs into different baskets". As to the society, on one hand, employment can be increased through growing investment in human resources with the progress of servitization; on the other hand, by integrating resources and increasing efficiency in energy consumption, servitization can realize conservation of resources, and the negative influence of economic growth on environment can also be minimized.

It can be seen that the transformation of manufacturing firms towards servitization is more than an innovation of business model but also a worldwide transition of economic pattern. This trend is caused by the imperative demand of firms to enhance and maintain

^{*} Corresponding author.

E-mail addresses: jhli@zjsu.edu.cn (J.H. Li), kantarlily@126.com (L. Lin), 1710652531@qq.com (D.P. Chen), mly90113@126.com (L.Y. Ma).

competitiveness while adapting to new market environment. However, many manufacturers, unfortunately, are not reaping expected returns when stepping into servitization. Based on annual reports of listed companies in Zhejiang, China, this paper investigates the paradox that manufacturers encounter on the path to servitization.

2. Literature review

2.1. Servitization

The term “servitization” was first coined by [Vandermerwe and Rada \(1988\)](#) as “the increased offering of fuller market packages or ‘bundles’ of customer focused combinations of goods, services, support, self-service and knowledge in order to add value to core product offering”. [Robinson, Clarke-Hill, and Clarkson \(2002\)](#) also proposed similar definition of servitization as “an integrated bundle of both goods and services”. Other researchers define servitization from a strategic perspective, such as the definition given by [Lewis, Portioli, and Slack \(2004\)](#) that servitization is “any strategy that seeks to change the way in which a product functionality is delivered to its markets.” [Ren and Gregory \(2007\)](#) consider servitization as “a change process wherein manufacturing companies embrace service orientation and/or develop more and better services, with the aim to satisfy customer’s needs, achieve competitive advantages and enhance firm performance.” Most scholars agree that servitization is the transitional strategy adopted by product-centric firms by integrating (not simply “adding”) services into core product offerings in order to obtain and secure position in the fierce competition ([Bowen, Siehl, & Schneider, 1991](#); [Gadiesh & Gilbert, 1998](#); [Quinn, Doorley, & Paquette, 1990](#); [Wise & Baumgartner, 1999](#)). Basically, moving from one extreme of the [Hill’s \(1999\)](#) product-service continuum towards the other extreme, servitization follows the transition line from pure product manufacturers to service providers ([Chase, 1981](#); [Oliva & Kallenberg, 2003](#)).

In general, the following perspectives are among the most prevailing concerning the concept of manufacturing servitization. The first is product-integration or industry-integration. Looking from this perspective, manufacturing servitization is deemed to be the integration of products and services. Manufacturing firms change from simply focusing on the process of production and providing products and related add-on services to paying attention to the process of service and offering “product-service packages”; these integrated and service-dominated packages which include products, services, supports, self-services and knowledge, serve as the major source of firm profits and customer satisfaction ([Vandermerwe & Rada, 1988](#)). [Berger and Lester \(1997\)](#) have verified this phenomenon and proved that the trend of servitization had emerged in developed countries and that the industry of productive service played a role in promoting the growth of manufacturing firms; they put forward the concept of “service enhancement” and believed that the integration of manufacturing and services is the new trend of industrial development. Furthermore, better understanding of the customers’ overall needs through providing services in addition to products will enable manufacturers to develop new generations of products ([Kastalli & Van Looy, 2013](#)).

The second is the transformation of roles for manufacturing firms. The integration of products (including physical and service products) or industries (including manufacturing and service industries) also means the transformation of roles for manufacturing firms. [White, Stoughton, and Feng \(1999\)](#) defined servitization from the perspective of manufacturing firms and pointed out that servitization is the dynamic transition in the role of manufacturing firms from product manufacturers to service providers. The transition of roles also means the transition of such aspects as “products”, operation modes and mentality. Many researchers also based their study on such transitions.

The third is the transfer of firm value. Based on the contribution of services to firm value, some scholars proposed that the process of manufacturing servitization is the process in which firm value gradually transfers to services. [Szalavetz \(2003\)](#) suggested that this transfer can be reflected in two aspects: firstly, the efficiency of internal services within the firm surpasses that of the other traditional determining factors such as human resources, technology, or operational efficiency, and constitutes the major source of competitiveness for the firm; secondly, product-related external services have become more and more complex and important to customers. This angle of study has become the mainstream of manufacturing servitization research because it highlights the value of customers to firms.

Servitization is believed to be customer-driven and aim to lock out competitors, lock in customers and increase level of differentiation through setting up barriers to competitors, third parties and customers, creating dependency, differentiating the market offering and diffusing new innovations ([Vandermerwe & Rada, 1988](#)). Bundling services with products can diffuse risk, create new channel of revenue, enhance pricing power through increasing customer loyalty and improve resistance to outsourcing, thus, generating shareholder value and firm value ([Fang, Palmatier, & Steenkamp, 2008](#)) and improve the firm’s resistance to environmental changes ([Neely, 2008](#)). To be more specific, servitization can facilitate sales of goods, lengthen customer relationships, and balance the effects of economic cycles with different cash-flows, thus, creating more growth opportunities for the firm to respond to demand in the matured markets ([Brax, 2005](#)). Similarly, three generic benefits (financial, strategic, and marketing) associated to service maneuvers presented by [Mathieu \(2001\)](#) stated that service offerings can not only gain the company profits (financial), sharpen competitive edge (strategic), but also can attract customers and meet extensive customer demands not limiting to maintenance or after-sale services (marketing). Another interesting point is that servitization tends to be more environmentally-friendly compared to traditional mode of pure manufacturing in that product life cycles are extended through such servitized efforts as maintenance, upgrading and remanufacturing while consumption of materials and resources is reduced to a large extent ([Kastalli & Van Looy, 2013](#)). In addition, product diversification can be realized and production costs be much reduced since economies of scope can be achieved by leveraging technological and marketing capabilities across products and services through bundling products with services ([Gebauer, Krempf, Fleisch, & Friedli, 2008](#)). Also, in most cases, economies of scale can be realized since manufacturers having expertise in providing

certain services will concentrate their resources to service offerings so that customers can choose to outsource such services instead of seeking or providing services by themselves (Kastalli & Van Looy, 2013).

2.2. Servitization paradox

Chase (1981), Oliva and Kallenberg (2003) believed that for manufacturing firms undergoing servitization, there is a transition stage between being a pure product manufacturer and a service provider; this is also a common phenomenon in reality. Although many manufacturing firms have launched servitization, it is very difficult to obtain potential financial gains from the explorative service businesses. Due to increasing costs and lack of corresponding returns, the growth in service revenue fails to meet its intended objective; Gebauer, Fleisch, and Friedli (2005) first termed this phenomenon “service paradox in manufacturing companies”. Similarly, Neely (2008) found that even adding services to core product offerings increases revenue, firms that do so usually perform less well than conventional manufacturing firms who stick to pure product offerings; there seem some risks hidden behind this phenomenon. In particular, Kowalkowski, Kindström, Alejandro, Brege, and Biggemann (2012) casted doubts on how far the transition towards servitization can be planned or implemented, since, in reality, the transition is mostly reactive and contingent, and, in most cases, happens when service has been built into certain scale. Based on Vroom's expectancy theory, Gebauer, Fleisch, and Friedli (2005) interpreted the service paradox caused by cognitive errors during the process of manufacturing servitization through the three factors in managerial motivation and the mechanism of self-realization. Managers' suspicion in servitization, their preference to avert risks, their psychological dependency on physical products and the self-realization of these mentalities all lead to hardship in the implementation of servitization. Gebauer, Fleisch, and Friedli (2005) also mentioned the obstacles that corporate culture and organizational structure have imposed on servitization and proposed corresponding solutions.

Although the benefits of servitization are very well understood, in reality, only a handful of manufacturing firms are implementing intensive servitization of high level, among which the successful ones are even less. This situation has led to hesitation among many firms. It seems that heavy investment in increasing services does not necessarily bring revenue or profitability. So, what indeed has caused such paradox?

There exists “a cultural and cognitive bias against services and service-specific values such as heterogeneity and flexibility, since these values contradict traditional manufacturing goals and practices such as standardization and efficiency (Bowen, Siehl, & Schneider, 1989)”. It is mentioned in this paper that the smooth implementation of servitization calls for transformation of various areas inside and outside the firm, such as organizational structure, corporate culture, resource allocation, operation modes and relationships with internal and external stakeholders. All these imply potential risks brought by uncertainty and complexity during the transformation process. Besides, to some degree, the firm's success also depends on uncontrollable factors such as the overall industrial environment or even the global economic or financial environment; therefore, it is no exaggeration to say that sometimes it is pure luck that the firm is betting on. Nevertheless, firms do have great level of control over what it will achieve. Kastalli and Van Looy (2013) divided the process of servitization into three stages and explained the possible reasons behind the paradox. They pointed out that “there is a possible curvilinear relationship between service sale and profitability characterized by two saddles or a cubic relationship”. The first stage begins with unintentional servitization; when benefits of such move have been harvested, the firm turns to make deliberate effort towards more intensive servitization so to push the curve upwards; however, during the second stage, since investment is usually increased, profit is absorbed by such increased investment cost, which brings the curve back down; it is during the third stage that the firm achieves economies of scale and makes more profit; in addition to the learning effect that occurs at this stage, the curve makes another turn and heads upward again. Therefore, the so called “paradox” literally happens at the second stage where profit is offset by increased costs (Kastalli & Van Looy, 2013).

On the way of seeking solutions to overcoming servitization paradox, scholars have proposed many suggestions. By simply adding services to the existing product offerings is not a wise idea and usually brings negative financial performance. Usually, thorough and comprehensive organizational transformation is required (Parida, Sjödin, Wincent, & Kohtamäki, 2014). From the organizational level, Cook, Bhamra, and Lemon (2006) studied servitization paradox and believed that major changes should be invited when a firm considers the strategy of servitization; these changes include optimization of human resources, establishment of new departments, and introduction of new professional knowledge, all of which consume large amount of time and capital. Culturally, firms should increase service awareness, through recognizing the risks of extending the service business and believing in the economic potential of service offerings (Gebauer, Fleisch, & Friedli, 2005). Practically, Brax (2005) suggested “a profound and formal information system and information management practice” to “guarantee continuous customer-oriented services”. Meanwhile, attention should be paid to the overall utility that customers get from the package containing both products and services that the firm offers, so the firm should stand on the customers' perspectives and make decisions leading to more effective integration of products and services. The manufacturers have to look at the value chain through customers' eyes (Wise & Baumgartner, 1999) and explore opportunities to create new sources of revenue by observing customer behaviors and perceive the potential demand to satisfy thus creating more value for the firm. During the transitional process, disruption may occur due to imperfect complementarities between existing production process and the services added, which will call for the establishment of an independent and professional department or organization taking full charge of the service offering. Also, a brand-new process adapting to the service orientation should be created and implemented (Gebauer, Fleisch, & Friedli, 2005; Oliva & Kallenberg, 2003).

As is mentioned earlier in this paper, during the transitional process towards servitization, the firm initially experiences a short-term gain from adding services to existing product offerings; after a while, a decline of returns will set in when profit is absorbed by increasing investment; this is when the firm experiences the servitization paradox. There is a profitability hurdle at this stage that if the company overcomes certain circumstances, profit will finally pick up and go towards a promising direction. Once the

firm is able to cross the threshold at the second stage through strengthening capabilities in various ways, the investment in implementing servitization will finally be transformed into economies of scale ensuring a more sustainable development of the firm (Kastalli & Van Looy, 2013). Therefore, firms preliminarily implementing servitization should not be over optimistic about the initial returns gained; instead, they should stay prudent and ponder over the possibility that the critical bottleneck at the second stage can be overcome by their own capabilities and potential. If the firm does not have enough confidence in their capability, efforts towards servitization should temporarily be suspended until enough strength is gained, since the path of servitization is the process of constant strengthening of a firm's capability (Neely, 2008).

Although related case studies have proved the tremendous potential of servitization, empirical researches have yielded mixed results due to challenges of formulating and implementing service business models. Some empirical studies proved the negative effect of servitization on profitability while other large-scale studies have identified a U-shape relationship between servitization and performance, where positive results reappear only once a critical scale of services is achieved (Fang, Palmatier, & Steenkamp, 2008). Through studying the data collected from 477 listed companies from 1990 to 2005, Fang, Palmatier, & Steenkamp (2008) have proved the existence of “servitization paradox” and found that only when service revenue accounts for 20% to 30% of the company's total revenue will servitization play a significant role in enhancing firm value. However, the performance impact of servitization seems to be highly contingent on the industry, and the nature and size of the service portfolio (Fang, Palmatier, & Steenkamp, 2008). Meanwhile, Neely (2008) studied listed manufacturing companies from 25 countries to explore the relationship between servitization and firm performance and found that although manufacturing firms that also provide services achieved higher sales revenue than those “pure manufacturing firms”, the ratios of profit to revenue for servitized firms are still lower than traditional “pure manufacturing firms”; this may be caused by higher labor cost and working capital cost that servitization requires; and the case is especially true with larger firms (which means, larger firms are better off if they stick to the traditional pure manufacturing pattern). It seems that servitization in larger firms is more problematic than that for smaller firms. So Neely (2008) suggested that due to challenges in shifting mindset, the challenges of timescale and the challenges in transforming business models, larger firms should think twice before migrating to the servitization approach. By classifying product-related services into 8 categories, Chen (2010) studied 418 Chinese listed manufacturers and 609 American listed manufacturers and concluded that there is an inverted U-shape relationship between servitization and business performance for Chinese manufacturers and a significant positive relationship between servitization and business performance for American manufacturers.

In conclusion, most studies hold that the level of servitization can enhance manufacturers' performance, while paradox will be encountered during this process; also, the relationships between servitization and firm performance vary with different developing levels or different countries. In order to carry the related studies further, this paper conducts an empirical study concerning the relationship between servitization and firm performance based on data collected from listed manufacturing firms in Zhejiang Province, China.

3. Methodology

3.1. Sample and data

We selected firms from various cities in Zhejiang, such as Hangzhou, Wenzhou, Shaoxing, Ningbo and Taizhou, etc., and eliminated industries with few listed firms so the sample selected is representative of most manufacturing firms in Zhejiang. This paper is based on the data collected from annual reports in 2012 of listed manufacturing firms in Zhejiang Province. Because many firms are involved in a number of industries, we categorize selected firms into their corresponding industries based on the Notice of Industrial Classification Results of Listed Companies by the Fourth Quarter of 2012 issued by China Securities Regulatory Commission in 2013.¹ Industries selected and the respective number of samples can be seen in Table 1.

3.2. Variables

3.2.1. The independent variable

There are many definitions for service, this paper sees service as corresponding to the product that a firm offers and defines it as the economic activity directly or indirectly provided to customers besides the product itself in order to satisfy customer demand. For example, even though no customer utility can be directly increased by research and development, it can satisfy customer demand through the media of products.

Due to the innate complexity of services, it is difficult to find an accurate and measurable indicator for manufacturing servitization that is both convenient and universally applicable. Taking into consideration of the fact that only a handful of firms have transformed completely from selling products to selling solutions, while the majority of them are still at the stage of increasing services into the portfolio, we choose service quantity (the number of service types) as the indicator for servitization (the independent variable), which is also a well accepted indicator adopted by scholars such as Neely (2008) and Chen (2010).

Based on the study of Hochertsch (2002), we categorize services in manufacturing firms into the following three types: (1) Product-oriented service. After ownership of the product is transferred to clients, the firm provides them with training and technical services such as installation, repair and maintenance, upgrading and consulting services. (2) Use-oriented service. The clients pay rental fee to

¹ See the industrial classification results of listed companies on <http://www.law51.net/lawjr/lawjr13.htm>.

Table 1
Industrial distribution of samples.

No.	Industry	Quantity
1	Electrical machinery and equipment manufacturing	22
2	Garment and apparel industry	7
3	Textile industry	6
4	Chemical fiber manufacturing	6
5	Chemical raw materials and chemical products manufacturing	13
6	Computer, communication and other electronic equipment manufacturing	21
7	Metal products industry(including ferrous metal smelting and rolling processing industry)	8
8	Automobile manufacturing	11
9	General equipment manufacturing	17
10	Rubber and plastic products industry	6
11	Pharmaceutical manufacturing	11
12	Special equipment manufacturing	6
Total		134

the firm and only have the right to use the tangible product while the ownership of the product still belongs to the firm. This way is especially effective for those firms manufacturing products with high value and low frequency of usage. (3) Result-oriented service. In this case, the firm no longer sells product but service contracts. For example, instead of selling air-conditioners to their clients, the central air-conditioner manufacturers now choose to provide their clients an office environment with stable temperature along with the related installation and maintenance services; and the firm only charges the clients by the service hour and the type of services offered.

However, the above classification is still a little broad without enough accuracy in describing the state of servitization. For instance, it is noticed that only a few firms provide result-oriented services while almost all firms can provide the first two types of services as long as the condition allows. Therefore, it remains difficult for us to study the paradox that firms encounter with such way of classification.

On the basis of the above, Neely (2008) proposed the type of “integration-oriented service” which is reflected by manufacturing firms' extension of their operational activities into such fields as retailing, distribution, financial services, business consulting, transportation and logistics. Based on the above-mentioned viewpoints, Chen (2010) categorized services provided by manufacturing firms into the following eight types: (1) goods and technical services, such as installation, repair, maintenance and product testing; (2) consulting and training services; (3) leasing services; (4) sales services, including distribution, wholesaling, retailing, importing and exporting; (5) software development; (6) financial services, such as the financing services provided to clients and distributors; (7) transportation and logistics services; and (8) result-oriented services. This way of classification is appropriate in that it not only further analyzes services provided by manufacturing firms but also reflects all basic characteristics of these services. This paper follows the principle line of product life cycle and makes further adjustment and extension to the above way of classification (as is shown in Fig. 1).

As to the stage of research and development, because the nature of technical research and development in manufacturing firms is very similar to that of software development in the IT industry, considering software development in the IT industry as services while omitting the R&D activities in the manufacturing firms will cause operational errors and data distortion; after all, R&D activities account for a major portion of the firm's investment, thus should be fairly reflected in the study. Therefore, this paper summarizes technical development, software R&D and research and design activities in manufacturing firms into one type of service. At the production stage, with profound product knowledge long accumulated, the firm can utilize its knowledge to provide technical support services and knowledge support services to its clients. At the product circulation stage, firms can provide clients with logistics services such as transportation and storage; they can also provide financial services to clients purchasing bulky commodities. At the sales stage, firms can choose to sell products directly (through wholesaling, retailing, importing and exporting, etc.), or gain profits through leasing the ownership of their products; this paper sees the transfer of technology as a sales activity. So far, rarely can we see any

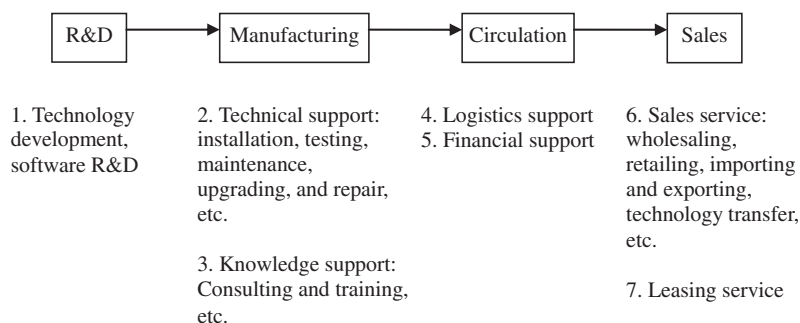


Fig. 1. Classification of service in manufacturing. Note: this classification is modified based on the classification of Chen (2010).

manufacturing firms realizing the transformation from product offering to pure service offering (i.e. the result-oriented service), thus, the type of result-oriented service is omitted in this paper.

When calculating the service quantity in each manufacturing firm, some special cases are handled in these ways: (1) if the firm is involved in one dominant industry and multiple other industries, we only calculate its service quantity in the dominant industry; this is to avoid the calculation error occurring when the data for minor business gets the same degree of attention as the data for major business does when data is processed with great simplification; on the contrary, if the firm is involved in multiple industries with similar large proportions, and there exist major gaps of knowledge and capability requirement among these businesses, we first calculate the total number of service types (service quantity) in each industry that the firm is dealing with and then add them up to get the final count; this is because of the fact that the increase of service types will distract managerial attention thus affecting the firm's profitability; also, the existence of major gaps of knowledge and capability requirement means that the firm has to repeatedly invest large amount of capital in each business operation, therefore, separate calculation is needed before summation; (2) as to service businesses that are irrelevant to manufacturing and account for only a minor proportion, such as property management and private-house leasing, in order to avoid distortion of the dependent variable, we omitted these businesses in the screening process. In conclusion, the service quantity that the firm offers with (SERVICE) is identified as the independent variable based on the above classification of services.

3.2.2. The dependent variables

To more accurately reflect the relationship of inputs and outputs of a firm, we choose the pre-tax return on equity (ROEbt = total profit / net assets) and post-tax return on equity (ROEni = net profit / net assets) as two of the dependent variables. In addition, we choose the pre-tax per capita profit of the firm (PCPbt = total profit / total number of employees) as the third dependent variable to observe the changes of individual contribution to the firm after adoption of servitization.

3.2.3. The control variables

In order to avoid the influence of unnecessary factors, this paper controls the influence of shareholding ratio of the largest shareholder (SHARE), firm size (SIZE), and asset–liability ratio (DEBT) on the business performance of the firm. Since some researchers confirmed a significant positive relationship between the shareholding ratio of the largest shareholder and firm performance, while the research of other scholars identified an inverted U-shape relationship between ownership concentration and firm performance, this

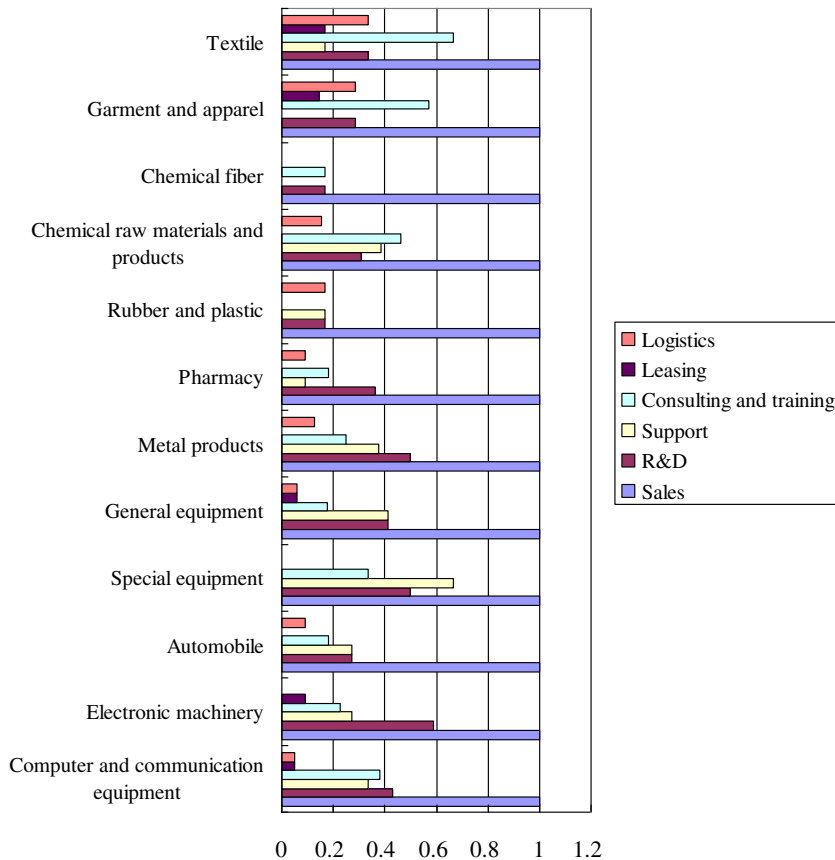


Fig. 2. Service quantity in manufacturing industry of Zhejiang Province.

paper adds “SHARE²” as another control variable in the study. If the values of the above variables such as “SIZE” are large, we then take the value of their natural logarithm. After a preliminary statistical analysis, the structure of service quantity in each industry is shown as Fig. 2.

It can be seen from the above chart that among all the services provided by firms, the most common service is the sales service; this is because sales is the direct source of profit for a firm no matter how far the firm has progressed on the path of servitization. In addition to sales, R&D, technical support, training and consulting services are also the major targets of investment for numerous manufacturing firms. According to statistics, there are 40% manufacturing firms engaging in R&D investment (including research design and software development, etc.); there are 29% manufacturing firms providing consulting services and 28% providing technical support services; the investment in leasing and logistics is relatively small and scarcely is any manufacturing firm offering financial services. The chart also shows that there are relatively more service types demonstrating higher level of servitization in industries such as textile, garment and apparel, special equipment manufacturing, chemical raw materials and chemical products manufacturing. The average service quantity in each sub-industry is shown in Fig. 3.

We can see from the above chart that the service quantities in each sub-industry basically range from 1 to 3 with an average number of 2.1. The above data structure can be explained in the following two aspects. On one hand, the data reflects factors of industrial characteristics. Zhejiang Province is famous for the development in its private enterprises, especially in the industries such as textile and garments. Regional clusters have long been formed represented by Haining Leather City, Xinchang Woolen Sweater City and Shengzhou Tie City, and some famous brand-name enterprises such as Youngor, Shanshan and Baoxiniao are also enjoying great reputation worldwide. Since the amounts of funds invested are not very large for those private firms, they mostly engage in such industries as the light industry or some emerging industries. The industrial characteristics determine the orientation of servitization for such firms. For example, the products provided generally are not the ones with high value and low frequency of usage; therefore, there is no necessity in providing leasing services or specialized financial services; however, it is within the scope of a firm's ability to provide technical support or consulting services based on its long-time accumulated industrial knowledge and skills. On the other hand, the data shows the state of mind for most manufacturing firms in Zhejiang. Seldom have any firm made the critical breakthrough and recognized the urgent needs and importance of servitization. Aside from the data in the sales section, the overall level of servitization is still quite low with average service quantity of less than 1.5. There is still very large room even for the development of such services as consulting and technical support even though they are relatively easier to be launched. The state of mind to get satisfaction from manufacturing qualified products has constrained many manufacturing firms to realize the significance of providing services.

3.3. The empirical analysis

3.3.1. The correlation matrix

The correlations between dependent variables and the other variables (independent and control variables) are shown in Table 2. All coefficients in the table are significant. The detailed analytical process is shown in the following sections.

3.3.2. Servitization and ROE

Previously, researchers have confirmed an inverted U-shape relationship between service quantity and business performance of the firm, and the relationship between shareholding ratio of the largest shareholder and business performance also shows similar pattern. Taking into account the possible existence of heteroscedasticity, we conducted a test for heteroscedasticity and returned with the

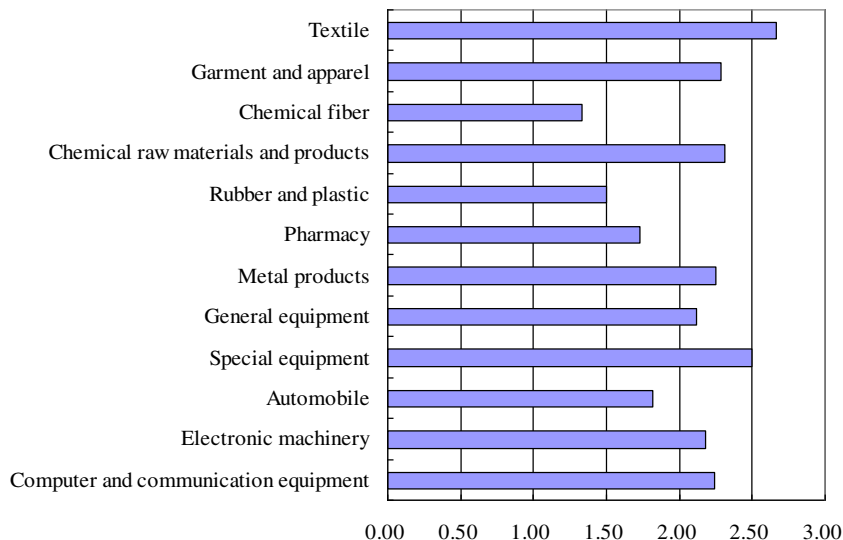


Fig. 3. Average service quantity in each sub-industry.

Table 2
The correlation matrix.

	SERVICE	SHARE	ROEbt	ROEni	PCPbt	DEBT	SIZE
Mean	2.134	0.362	0.057	0.050	9.233	0.326	21.344
Std. dev.	1.088	0.141	0.135	0.131	50.263	0.164	0.792
SERVICE	1.000						
SHARE	0.025	1.000					
ROEbt	0.138	0.248**	1.000				
ROEni	0.126*	0.245**	0.997**	1.000			
PCPbt	0.217**	0.057	0.676**	0.688**	1.000		
DEBT	0.099	−0.106	−0.277**	−0.277**	−0.113	1.000	
SIZE	0.096	0.232**	0.237**	0.250**	0.279**	0.216**	1.000

* The significance level is $p < 0.05$.

** The significance level is $p < 0.01$.

result $n \cdot R^2 = 20.743 > \chi^2_{0.05}(7) = 14.067$, indicating the presence of heteroscedasticity. The regression results after eliminating heteroscedasticity through weighting (with the weight being the reciprocal of the absolute value of the residual error) are shown as Table 3.

For each of the above item, the significance level is much lower than 0.05, and the significance level of the F value of the equation is 0.000 (< 0.05), indicating high level of significance; adjusted R^2 equals to 0.9664, indicating good coherence with real data. Similar method is used with ROEni and the results are shown as Table 3 also.

The two models are basically consistent with each other. The following can be seen from the above statistical results. First, service quantity is positively related to business performance of a firm. The study of Chen (2010) on Chinese firms showed an inverted U-shape relationship between service quantity and business performance with the inflection point occurring when service quantity is at roughly 2.4. However, our research on manufacturing firms in Zhejiang Province does not support the same conclusion. Second, there is an inverted U-shape relationship between the shareholding ratio of the largest shareholder and business performance of the firm. This conclusion is consistent with that of Du and Liu (2002)'s study. According to calculation, a firm performs best when this ratio stays around 46%. Third, there is a significant negative relationship between asset–liability ratio and business performance of the firm, and this is in line with most study results of other researchers. Fourth, the size of a firm has a positive influence on its business performance, which indicates the ubiquity of economies of scale in the manufacturing industry. Last, when the firm is relatively small, economies of scale have a greater contribution to business performance than servitization does; gradually, when the firm is built into certain scale, the launch of servitized projects plays a greater role in promoting business performance than the continuous effort in increasing the scale of operation does; this is because the marginal effort (including physical and managerial) put into building the firm scale is much greater than the effort needed to integrate services into the existing product portfolio; in addition, only when the firm has grown into certain scale will the great flow of business bring about prominent results from servitization; this is because that actually there exists a natural logarithmic relationship between service quantity and return on equity of the firm.

3.3.3. Servitization and PCPbt

Similarly, the relationship between service quantity and pre-tax return on equity (PCPbt) is shown in Table 3 also. Because of the diversity of the forms of employment in current firms, it is difficult to determine the discrepancy between the number of employees listed in a firm's annual report and the firm's actual number of employees; therefore, to avoid interference of extreme conditions, when studying the per capita profit of the firm, we used the Z value of the per capita profit and eliminated data 3 units below or above the Z value. Because there exists heteroscedasticity (since $n \cdot R^2 = 20.394 > \chi^2_{0.05}(7) = 14.067$), we first eliminated heteroscedasticity by taking the reciprocal of the absolute value of the residual error as the weight and found that the relationship between the shareholding ratio of the largest shareholder and per capita profit is not significant; after eliminating the item of the shareholding ratio of the largest shareholder (SHARE), each item in the table demonstrates good level of significance, and the F statistics also show good significance; Adjusted $R^2 = 0.9109$, showing good fit of the equation. So the following can be seen from the above table that.

Table 3
Regression results.

Variables	SERVICE-ROEbt	SERVICE-ROEni	SERVICE-PCPbt
C	−19.81125***	−26.88627***	−50.24622***
SERVICE	2.782186***	5.489745***	2.521009**
SERVICE ²	−0.374152	−3.076799***	1.048930
SHARE	18.95913***	29.59666***	36.38259***
SHARE ²	−14.53496***	−22.36361***	−31.18633***
DEBT	−23.87412***	−28.28087***	−38.61491***
SIZE	19.89791***	24.75868***	50.29118***
Adjusted R^2	0.914266	0.949196	0.971222

Weight: 1 / ABS(RESID).

** The significance level is $p < 0.05$.

*** The significance level is $p < 0.01$.

First, there is a U-shape relationship between service quantity (SERVICE) and per capita profit (PCPbt). Based on our calculation, it can be estimated that when service quantity is less than 2, per capita profit decreases with the increase of service quantity; and when service quantity is more than 2, service projects erode less into the per capita profit; but it is only when service quantity exceeds 4 that the positive influence of service quantity on per capita profit can be displayed. Second, the shareholding ratio of the largest shareholder is negatively related to per capita profit of the firm. The marginal rate of contribution of the shareholding ratio of the largest shareholder to return on equity demonstrates a decreasing trend, while per capita profit decreases with the increase of the shareholding ratio of the largest shareholder. Third, there is a positive correlation between firm size and per capita profit and a negative correlation between asset–liability ratio and per capita profit. This indicates that the expansion of a firm enables its employees to create more profit while liability will cause profit erosion.

4. Discussion

The above empirical results give us the following implications. First, there still is great space for manufacturing servitization in Zhejiang Province. Our empirical analysis suggests that the service quantity's erosion to per capita profit only starts to diminish when service quantity exceeds 2 and the positive contribution of service quantity to per capita profit begins to show when service quantity is further increased to around 4. Currently, the average service quantity of manufacturing firms in Zhejiang is 2.1, indicating great room for the development of manufacturing servitization. Continuous endeavor is still indispensable in order to reap the rewards of servitization.

Second, more investment in human resources is needed to promote servitization. On one hand, service is more dependent on manpower than on physical resources; taking into account the current developing stage of manufacturing servitization in Zhejiang, the demand for more investment, especially in the aspect of human resources, becomes more urgent. On the other hand, based on our empirical result that service quantity is positively related to return on equity and has a U-shape relationship with per capita profit, the average service quantity in manufacturing firms of Zhejiang (2.1) is right at the bottom of the U curve, which implies that the contribution of servitization towards a firm's profitability mainly derives from the enhancement of human resource investment, rather than the increase in per capita profit. So at the current stage, in order to be lucrative, more efforts should be made to promote servitization through increase of human resource investment. In the meantime, manufacturing servitization can create more job opportunities thus reducing the employment pressure in the society.

Third, the driving force of servitization to a firm's profitability should be gained through moderation and composure, which requires steady accumulation of capabilities. With continuous advance in servitization (after exceeding the inflection point), a firm's total profit will be enhanced with increase in both number of employees and per capita profit; therefore, the impetus of servitization on profitability grows stronger with the progress of servitization. However, it usually takes a rather long time (before the inflection point) before the promoting effect of servitization sets in. To put it another way, the contribution of service quantity (SERVICE) towards business performance of a firm is far less (3 to 4 times less) than the contribution of the growth of firm size (SIZE) at the earlier stage (before the inflection point). Nevertheless, with the expansion of firm size, it becomes extremely difficult to further advance by an order of magnitude ($SIZE = \ln(\text{asset})$): with gradually reduced slope, the growing of asset will increase the difficulty in expanding the firm size). On the contrary, it becomes easier for the firm to turn to servitization with long accumulated knowledge, skill and experience (but before the inflection point when the scale of the firm is still small, it is very costly and ineffective if a firm rushes onto the path of servitization). Therefore, the effect of servitization shows its marvel only when a firm has grown into certain scale, so timing is very important in implementing the servitization strategy. Furthermore, the firm should be meticulous in handling the managerial complexity derived from scale expansion so to avoid negative impact of size growth and meet challenges as Neely (2008) has mentioned when stating that larger firms meet more problematic situations with implementing servitization.

The result of this study shows a positive correlation between service quantity and a firm's return on equity (rather than the previously assumed inverted U-shape relationship). This can be explained from the following aspects. First, the industrial development in Zhejiang is at a more mature stage than that in other provinces in China. The dynamic progress of private firms and fierce market competition have strengthened the awareness of service in most firms; at the same time, with maturity in each sub-industry, there are more industrial knowledge and experience available for firms to refer to. Also, resources can be optimized and integrated to promote servitization through such ways as establishment of strategic partnership, equity participation and merger and acquisition. Therefore, the strong industrial foundation in Zhejiang has created a favorable external environment for servitization in manufacturing firms.

Second, the rapid introduction of advanced management thought is another essential factor. On one hand, Zhejiang is a major province of education with hundreds of thousands of college students graduating with excellent grasping of market trends; this has injected a powerful driving force into the economic development of Zhejiang. On the other hand, more and more entrepreneurs have realized their insufficient educational background and are paying great attention to the managerial aspects through self-enhanced learning or hiring professional managers. And the rapid introduction of advanced management thought has been escorting the smooth development of servitization.

Meanwhile, we also noticed the relatively low level in service quantity indicating the general immaturity of current status in servitization. This also has, to some extent, explained the U-shape relationship between service quantity and per capita profit. The immaturity of servitization has led to many loopholes during the implementation process causing the phenomenon that per capita profit drops even with increase in service quantity. A firm has to wait until it develops to the stage where the deepening of servitization increases the efficiency in resource management thus boosting the increase in per capita profit.

5. Conclusions and managerial implications

Based on the data collected from 134 listed manufacturing firms within 12 sub-industries in Zhejiang province, this paper studies the current situation and problems encountered in the aspect of servitization in Zhejiang, the results are as follows.

First, based on the characteristics of product life cycle, we clearly classify servitization into 7 categories: R&D, technical support services (such as installation and repair), knowledge support services (such as lease consulting), financial service, logistics service, sales service and leasing service. Since seldom has any firm in Zhejiang transformed to complete result-oriented service offering, we omitted this category. Second, our data indicates that aside from sales services, manufacturers in Zhejiang mainly focus on services such as R&D, technical support, training and consulting and pay much less attention to leasing or financial services. In general, the average service quantity provided by manufacturing firms in Zhejiang is around 2.1. Third, service quantity is positively related to business performance of the firm; when service quantity is less than 2, per capita profit decreases with increase in service quantity; when service quantity exceeds 2, the decreasing trend in per capita profit starts to weaken; when service quantity reaches around 4, the contribution of service quantity to per capita profit begins to show and becomes greater as the service quantity continues to grow.

Based on the above research results, the following managerial implication is put forward for manufacturing firms in Zhejiang. First, timing is crucial in implementing servitization. Plunging in servitization without careful consideration tends to decentralize resources and bring obstacle to the normal operation of the firm. When a firm is still in a relatively small scale, it lacks capacity to support the development of services, and the contribution of the services added to the portfolio may not be obvious taking account of the preliminary costs in launching service projects. Therefore, in order to minimize potential risks, manufacturing firms should first estimate if the expected return from servitization outweighs the cost occurs based on their current capacity and bring them prominent profitability.

Second, perseverance is the key for firms having implemented servitization. From our earlier analysis, it can be seen that no instant effect can be produced during the process of servitization. Servitization is no plain sailing and usually is a long course; firms should restrain from their anxiety to achieve quick success. Our data analysis also confirms this truth in that the initial introduction of servitization will bring drops in per capita profit until the lowest point is reached where service quantity equals to around 2; beyond this point, everything will become smooth with servitization continuously gaining momentum and finally (when service quantity grows beyond 4) pushing the business performance of the firm to a record high.

Third, service innovation should be strengthened while multiple channels should be exploited to develop services. This paper only studies the overall characteristics of servitization without further exploration in the degrees of servitization that firms carry out. In real practice, firms could initiate innovative service project based on their individual resource bases so to provide specialized and customized services to the market, thus further reinforcing competitiveness.

Last, the potency in service-offering should be intensified. Servitization signifies the transfer of a firm's strategic focus towards services, so it is far from enough that the firm implements servitization simply through adding services into the portfolio; more attention should be paid to the actual customer experience that services bring about. In addition, the implementation of servitization has placed the firm into a more competitive battle field that the firm's success can no longer rely on pure product offering but also on its competency in providing outstanding services. Davies (2004) believes that service offering derives more of its profit from the terminal market; and in developed countries, large-scale manufacturing firms have been focusing on satisfying personalized demand of the customers through providing "integrated solutions" with system integration and product-service packages. Therefore, manufacturing firms implementing servitization should concentrate on their customers and enhance their core competitiveness through providing more customized "integrated solutions".

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References

- Berger, S., & Lester, R. (1997). *Made in Hong Kong*. New York, NY: Oxford University Press, 105–110.
- Bowen, D., Siehl, C., & Schneider, B. (1989). A framework for analyzing customer service orientations in manufacturing. *Academy of Management Review*, 14(1), 75–95.
- Bowen, D., Siehl, C., & Schneider, B. (1991). Developing service-oriented manufacturing. In I. Kilmann (Ed.), *Making organizations competitive* (pp. 397–418). San Francisco, CA: Jossey-Bass.
- Brax, S. (2005). A manufacturer becoming service provider—Challenges and a paradox. *Managing Service Quality: An International Journal*, 15(2), 142–155.
- Chase, R. (1981). The customer contact approach to services: Theoretical bases and practical extensions. *Operations Research*, 24(4), 698–706.
- Chen, J.X. (2010). An empirical test of the effect of manufacturing service-orientation on corporate performance: A comparison between Chinese and American enterprises. *Journal of Business Economics*, 4, 33–41.
- Cook, M.B., Bhamra, T.A., & Lemon, M. (2006). The transfer and application of product service systems: From academia to UK manufacturing firms. *Journal of Cleaner Production*, 14(17), 1455–1465.
- Davies, A.C. (2004). Moving base into high-value integrated solutions: A value stream approach. *Industrial and Corporate Change*, 13(5), 727–756.
- Du, Y., & Liu, L.G. (2002). Ownership structure and governance efficiency: An empirical analysis of listed companies in China. *Management World*, 11, 124–133 (in Chinese).
- Fang, E., Palmatier, R.W., & Steenkamp, J.E.M. (2008). Effect of service transition strategies on firm value. *Journal of Marketing*, 72(9), 1–14.
- Gadiesh, O., & Gilbert, J.L. (1998). Profit pools: A fresh look at strategy. *Harvard Business Review*, 76(3), 139–147.
- Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the service paradox in manufacturing companies. *European Management Journal*, 23(1), 14–26.
- Gebauer, H., Krempf, R., Fleisch, E., & Friedli, T. (2008). Innovation of product-related services. *Managing Service Quality: An International Journal*, 18(4), 387–404.

- Hill, P. (1999). Tangibles, intangibles and services: A new taxonomy for the classification of output. *Canadian Journal of Economics*, 32(2), 426–446.
- Hochertsck, W.N. (2002). Towards a theory of sustainable product service systems. *INSEAD-CMER Research Workshop on Sustainable Product Service Systems* (pp. 3–27).
- Kastalli, I.V., & Van Looy, B. (2013). Servitization: Disentangling the impact of service business model innovation on manufacturing firm performance. *Journal of Operations Management*, 31(4), 169–180.
- Kowalkowski, C., Kindström, D., Alejandro, T.B., Brege, S., & Biggemann, S. (2012). Service infusion as agile incrementalism in action. *Journal of Business Research*, 65(6), 765–772.
- Lewis, M., Portioli, S.A., & Slack, N. (2004). *Beyond products and services: Opportunities and threats in servitization*. Paper presented at IMS International Forum, Italy.
- Mathieu, V. (2001). Service strategies within the manufacturing sector: Benefits, costs and partnership. *International Journal of Service Industry Management*, 12(5), 451–475.
- Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing. *Operations Management Research*, 1(2), 103–118.
- Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160–172.
- Parida, V., Sjödin, D.R., Wincent, J., & Kohtamäki, M. (2014). A survey study of the transitioning towards high-value industrial product-services. *Procedia CIRP*, 16, 176–180.
- Quinn, J.B., Doorley, T.L., & Paquette, P.C. (1990). Beyond products: Service-based strategy. *Harvard Business Review*, 68(2), 58–67.
- Ren, G., & Gregory, M. (2007). *Servitization in manufacturing companies*. Paper presented at 16th Frontiers in Service conference, San Francisco, CA.
- Robinson, T., Clarke-Hill, C.M., & Clarkson, R. (2002). Differentiation through service: A perspective from the commodity chemicals sector. *Service Industries Journal*, 22(3), 149–166.
- Szalavetz, A. (2003). "Tertiarization of manufacturing industry in the new economy: Experiences in Hungarian companies", working papers. *Hungarian Academy of Sciences*, 134.
- Vandermerwe, S., & Rada, J. (1988). Servitization of business: Adding value by adding services. *European Management Journal*, 6(4), 314–324.
- White, A.L., Stoughton, M., & Feng, L. (1999). *Servicizing: The quiet transition to extended product responsibility*. Report submitted to U.S. Environmental Protection Agency, Office of Solid Waste. Boston: Tellus Institute.
- Wise, R., & Baumgartner, P. (1999). Go downstream: The new imperative in manufacturing. *Harvard Business Review*, 77(5), 133–141.