Economic Management Journal
December 2021, Volume 10 Issue 2, PP. 42-51

Servitization, Industry Heterogeneity and Manufacturing Firm Performance

Yinghui Gao, Xiao Han, Pengbin Gao †, Hongjin Lin

School of Economics and Management, Harbin Institute of Technology at Weihai, Shandong Weihai 264209, China

†Email: gaopengbinhit@163.com

Abstract

In the process of rapid economic development, the competition in the manufacturing industry is becoming more and more fierce. As a strategic measure for many manufacturing firms to successfully improve firm performance, servitization has gradually attracted the attention of more and more managers and scholars. The study collected and processed the annual reports of manufacturing firms that disclosed information on CNINF in 2017. Through a series of screening work, the annual reports of 260 firms were finally selected as sample data. Through the regression test of the data, this study mainly discusses whether the industry type can regulate the relationship between servitization and firm performance. The results show that servitization can have a positive impact on firm performance. In addition, industry type can be used as a moderating variable to moderate the relationship between servitization and firm performance. On this basis, this paper puts forward some suggestions and countermeasures for manufacturing firms.

Keywords: Servitization; Firm Performance; Industry Heterogeneity

1 INTRODUCTION

At present, the servitization has gradually become a major trend for the development of manufacturing industry, which makes firms gradually transition the value chain from product-centered to service-centered. In the 1990s, IBM fell into development difficulties and was on the verge of bankruptcy. Through servitization, IBM successfully transformed from a manufacturing firm into an information technology and business solution firm, which is still famous today. As early as 2012, Andy investigated more than 13000 listed manufacturing firms around the world and found that manufacturing firms in various countries adopt the business model of combining products and services, of which the United States accounts for the highest 58%, followed by Finland 52% and Malaysia 45% [1]. Although the proportion is different, half or more of the manufacturing firms in many developed countries, including the United States, choose the "manufacturing + service" model, which shows that this model has great benefits to a certain extent and has become the choice of many firms. In the first half of 2018, the added value of China's service industry accounted for 54.3% of China's GDP, while the proportion of the United States and other developed countries was about 70%, compared with a certain gap. In fact, many manufacturing firms have found that it is difficult to maintain the survival and development of firms simply relying on the traditional sales model, so they began to explore the road of service.

In the 1980s, GE was still a company with 113 manufacturing plants in 24 countries around the world, and the service output value accounted for only 12%. Now the output value created by "technology + Management + service" accounts for 70% of the firm's total output value. In addition, including Nike, Haier, Apple and other firms. During the transformation of manufacturing firms to service-oriented, many firms have tasted the sweetness and found that increasing service activities can not only have a positive impact on firm benefits, but also protect and improve the maintenance of customer relations. Through the servitization, Shaangu Group has realized the transformation from "one-time sales of products" to "unlimited sales of services", which has increased the firm's GDP by 10 times in 10 years, and the output value in the service field has also increased from about 12% to more than 70% [2]. The value creation of manufacturing industry has developed from "tangible products" to "intangible

services", surpassing the concept of "product orientation" and turning to "service orientation" [3]. Moreover, made in China 2025 clearly puts forward the requirement of "promoting the transformation from production-oriented manufacturing to service-oriented manufacturing". Therefore, the business model of "product + service" has gradually won the favor of manufacturing firms, and service has become an inevitable trend for the development of manufacturing firms.

The purpose of this paper is to further explore the impact of servitization on firm performance on the basis of relevant literature review and theoretical analysis, and then introduce industry heterogeneity as a moderating variable to study the impact of servitization on firm performance.

2 LITERATURE REVIEW

In the fierce competition, the service of manufacturing firms is widely regarded as an effective way to break away from competition and the embodiment of firms meeting the needs of consumers. Xiao [4]believe that the reasons for promoting the servitization can be roughly divided into three categories: economic growth, profit and innovation. The three promotion methods, as the name suggests, are easy to understand. What is really puzzling is the function mode of servitization on firm benefits. As for the relationship between servitziation and firm performance, academic circles still have different opinions, and there are great disputes in the conclusion. Visnjic (2012) believed that firms' investment in service-oriented strategy will increase firm costs and damage firm interests [5]. Xiao [6] summarized them into three categories: the promotion theory represented by scholars, the U-shaped theory and the “saddle shaped theory” (developing first, restraining later and then raising again).

Stoughton (2003) and others pointed out that manufacturing firms selling products are not as simple as selling the products themselves, but selling the functions of the products or the services and experiences brought by the products. In other words, the reason why consumers buy products is to buy the functions of products or enjoy the services and experience brought by purchasing products, not because of the products themselves [7]. The servitization was initially basically reflected in product sales and after-sales service of products (such as installation, maintenance and other related activities). This model adds relevant services on the basis of core products, brings more value to customers, improves firm benefits to a certain extent, and enables firms to obtain certain advantages in competition. Moreover, some studies have shown that this method can bring 10% increase in profits for firms [8]. Therefore, many scholars believe that there is a positive correlation between servitization and firm performance [9-10]. Based on this, many scholar regarded service as an important way for firm development and stable interest growth [11]. Antioco (2008) affirmed the positive impact of service-oriented sales model on firm performance [12].

3 HYPOTHESIS

3.1 Servitization and Firm Performance

The concept of servitization was first put forward by Vandermenwe (1988) [13]. It is defined as a new model of “product + service”, in order to meet the needs of customers and take customers as the leading factor. Manufacturing firms no longer simply provide products for them, but provide a whole including products, consulting, technology and maintenance. We hope to increase the value of the product by adding service elements in the process of product production and use. Later, with the servitization becoming a major trend in the development of global manufacturing industry, more and more scholars devoted themselves to the research of service-oriented [14-15]. In the understanding of its connotation, some people believe that the servitization is the process of manufacturing firms gradually changing from product providers to service providers, that is, from the perspective of product services or functions rather than simply from the perspective of products themselves, products are regarded as the carrier of services, so as to further understand the concept of “servitization” [16]. Similarly, “service manufacturing” is defined as the combination of manufacturing and service, and runs through all links of the industrial chain [17]. Combined with the common business model of “product + service” in the process of servitization and existing research, this paper defines servitization as providing a collection of "product + service" in order to better meet the needs of consumers and from the perspective of consumers in the process of production and operation. Firm performance is the performance of operation efficiency and operation status in a certain period of time [18]. The evaluation

indicators of performance can be summarized as financial indicators and non-financial indicators. Due to the limitations of non-financial indicators, scholars mostly use financial indicators to measure [19].

3.2 The Effects of Servitization on Firm Performance

From the process of providing services, firms can be divided into three stages: pre-sales, in-sales and after-sales service. Among them, pre-sales and in-sales services mainly focus on training and installation, while after-sales services include maintenance, online help, product upgrading and parts management [20]. The main reasons for servitization are as follows: meeting customer needs, gain competitive advantage and increase economic benefits [21]. Service is largely driven by customers [13]. In order to maintain the relationship with customers, firms have to take into account the personalized needs of customers other than products. At the same time, due to the difficult imitation and non transferability of services, firms have realized a certain degree of differentiation in the process of providing services, which can help firms obtain a certain competitive advantage and prolong the time for firms to make profits [22]. In addition, services that rely on products to survive can not only create revenue for firms, but also reduce the variability of cash [23].

Back to the original purpose of servitization, the main purpose of service-oriented is to realize the effective transmission of product related information between firms and the market. Providing services to consumers can eliminate their uncertainty about products to a certain extent, that is, contacting consumers through the provision of services has become a way to transmit information. This increases consumers' acceptance of products [6]. In essence, service is to create more value for consumers by increasing service items, but for manufacturing firms, products are still their foundation, so they can't simply "demanufacture" [24]. Based on the above views and conclusions, the first hypothesis of this study is put forward:

H1: Servitization will have a positive impact on manufacturing firm performance.

3.3 Industry Heterogeneity and Its Effects

Industry heterogeneity due to various reasons, such as the increasing complexity of social structure and economic structure, there are various classification methods and standards for manufacturing industry. Generally speaking, there are three major perspectives, namely, classical theoretical economics, practical application and statistical classification standards and academic research [25]. Generally speaking, when classifying the manufacturing industry from the perspective of academic research, we will not only refer to the first two perspectives, but also consider the factor input in the production process. Among them, the most widely used methods are resource intensity classification, especially the element intensity classification method under this method. Although the classification of manufacturing industry from this perspective is still different, most of them are divided by the input of main elements, such as labor, capital, technology, knowledge [26].

This paper will further divide it into labor-intensive industry, capital-intensive industry and technology-intensive industry (also known as knowledge intensive industry). This is because this method is easier to operate and link with firm performance. According to the combination of practical application, statistical classification standards and factor intensive classification methods, all manufacturing firms have been divided into industries [27].

Industry type is one of the important external environments for the survival and development of enterprises. As an important factor to distinguish firms, some scholars have indeed begun to pay attention to the impact of the industry on firms. During the research on quality management, the industry type was introduced into the research model with the support of contingency theory, but the results were not consistent with expectations [28].

Nevertheless, some scholars still believe that from the relevant characteristics of different sectors of manufacturing industry, industry type is a major factor that can not be ignored. In the research on manufacturing service-oriented, through the specific analysis of the output and growth of service-oriented manufacturing in different manufacturing industries, it is found that there are differences. From the perspective of factor input and the different characteristics of several industries under the manufacturing industry, there are great differences among various departments of the manufacturing industry. For labor-intensive industries, compared with capital, technology and knowledge input, the

industry needs labor input more. In this process, firms may pay more attention to the total production of products. Considering that the relatively low product cost may not offset the input service cost, firms may not be willing to implement the service-oriented strategy. However, different from technology-intensive enterprises, for firms in technology-intensive industries, the products provided by firms have relatively high requirements for technology and knowledge, and they are also more complex, which makes it very difficult for consumers to "serve and satisfy themselves" no matter from the understanding and use of products, later upgrading and maintenance or even repair [29]. Therefore, in order to better meet the needs of consumers and increase customer value, firms will be more inclined to provide special services to help consumers complete the process of consumption. In this process, it is generally believed that although the provision of services increases the product cost, it brings higher value and enterprise income. Therefore, it is reasonable to believe that the three industries divided according to factor input have different industry characteristics.

Under the background of servitization, studying the impact of service on performance and whether the impact is different in different manufacturing industries is of far-reaching significance for understanding the relationship between service and performance, and is conducive to providing more accurate and detailed reference information for China's manufacturing firms practical significance [30]. However, at present, few scholars have conducted relevant discussion and research, and only found a few dissertations that take this issue into account. They mainly have two aspects on the impact of manufacturing industries on firm related performance: factor input and industry characteristics, which is consistent with the analysis of this paper. Although industry factors are taken into account, they are more regarded as control or on the basis of completing the empirical analysis, test it separately from the data of different industries.

Since it is reasonable to explain that different industries have an impact on the results of servitization, this paper introduces the industry of the firm as a regulating variable to analyze the impact of industry on servitization on firm performance, explore whether the industry can moderate the main effect relationship in this process, and put forward the following assumptions:

H2: Industry heterogeneity plays a moderating role in the relationship between servitziation and firm performance.

4 RESEARCH DESIGN

4.1 Data Collection

This paper selects manufacturing firms that disclose the 2017 annual report (hereinafter referred to as the annual report) on CNINF as the research object, in which all data are obtained through manual search and calculation. In order to minimize the experimental error and improve the credibility of the research results, the following screening and processing of the original data were done before the formal research: (1) all manufacturing firms that did not carry out service business (or had carried out but did not disclose in their annual reports) were excluded, and a total of 340 annual reports were obtained after elimination; (2) Excluding the firms with transaction status of ST and st *, these firms are often companies with abnormal financial or other conditions, and there are certain problems in operation, which may affect the experimental results; (3) Firms with incomplete important data such as service input, service income, sales expenses, proportion of sales personnel, main business income and cost in the annual report are excluded; (4) Eliminate the contradictory samples of the disclosed information; (5) Firms with extreme or abnormal values in the sample are excluded. All sample data were screened according to the above requirements. A total of 260 firms met all conditions. The number of effective data directly obtained from the annual report was 2860, the number of effective data processed and calculated by themselves was 1560, and the total number of effective data was 4420. We hope to complete the statistical analysis of data with the help of data processing software Stata15.0.

4.2 Defining Variables

1) Dependent variable

Firm performance refers to the performance of business efficiency and operation status of an firm over a period of time. Considering all aspects, this paper selects the index of net main business income as the evaluation index of firm

performance, because for manufacturing firms, product sales is an important source of profit, and the main business income reflects the profitability of the main business to a great extent. In this paper, the abbreviation per of the word performance is used to represent the main business income of the firm performance measurement index, per = ln (net main business income).

2) Independent variable

Servitization is one of the hot topics studied by scholars in recent years, but different from firm performance, it is relatively difficult to obtain or measure the measurement indicators of servitization. As mentioned earlier, firms without service related indicators have been eliminated in the process of data collection, and the service related indicators obtained from the firm annual report are mainly two indicators: service revenue and service investment. The service related indicators of some firms are shown as service industry indicators, which are uniformly regarded as service-oriented income and investment in this paper. It is proved to be feasible after simple verification [15]. This paper uses service input as a measurement index to measure the intensity of firm service, and uses the abbreviation ser1 of the word service: ser1 = ln (service input). The service income is used as the index to measure the service of firm, expressed by ser2: ser2 = ln (service income). This paper will measure the servitizatoin through two indicators: service intensity and service level.

3) Moderating variable

From the perspective of factor input, this paper divides the manufacturing industry into three industries: labor-intensive, capital-intensive and technology-intensive. No longer through the industry, on the one hand, there are differences in the product characteristics of firms' production and operation, on the other hand, consumers in different industries have different needs for services. In order to study whether the industry has an impact on the relationship between servitization and firm performance, this paper sets the industry as a dummy variable into the model, uses the initial letter I of industry to represent the industry variable, and correspondingly uses DI to represent the industry related virtual variables.

4) Control variable

In addition to the above variables, in order to control and eliminate other factors that will affect firm performance and then affect the experimental results, this paper also introduces the control variables into the experimental research. However, in order to avoid that too many variables may lead to more complex collinearity problems, two control variables are mainly introduced.

Firm size. To some extent, the size of a firm determines its ability to obtain resource advantages in market competition, such as policy resources and customer resources. To a large extent, firm performance will be affected by this ability. This paper sets it as one of the control resources. As one of the important characteristics of the firm size, the total assets of the firm are connected with the firm size, the total size of the firm is taken as the logarithm, and the value is taken as the measurement index of the firm size, which is expressed by size: size = ln (total assets of the firm).

Firm age. The age of a firm represents the time of operation and development since the establishment of the firm. To a certain extent, the length of this time reflects the operating ability of the firm, and affects the changes of many factors of the firm, such as goodwill, customer loyalty and so on. The most recent relationship with the age of the firm is the time since its establishment. In this paper, the time since the establishment of the firm (in years) is selected as another control variable and expressed by age.

5 RESULTS ANALYSIS

5.1 Descriptive and Correlation Analysis

Before the regression test, descriptive statistics and correlation analysis were carried out on the data involved in all variables with the help of data processing tool Stata15.0. The statistical results are shown in Table 1. The results in Table 1 show that there is a positive correlation between servitization and firm performance, and the control

variables show a negative correlation with firm performance.

TABLE 1 DESCRIPTIVE STATISTICAL AND CORRELATION ANALYSIS

Variables	Obs	Mean	Std. Dev.	Min	Max	Per	Ser1	Ser2	Size	Age
Per	260	21.379	1.509	16.673	29.599	1.000				
Ser1	260	17.385	3.46	0	24.506	0.0087	1.000			
Ser2	260	18.45	2.109	12.378	24.79	0.1003	0.0168	1.000		
Size	260	21.358	8.758	5	68	-0.2899***	0.0305	0.0359	1.000	
Age	260	22.216	1.246	18.067	26.269	-0.1253**	-0.0360	0.0545	0.2056***	1.00

Note: ** p <0.05,*** p <0.001

5.2 Regression Analysis

According to the experimental hypothesis H1, this study first conducted the following three regression tests. Model 1 first added control variables to detect the relationship between control variables and firm performance.Model 2 and model 3 respectively study the relationship between service input intensity, service level and firm performance, in order to explore whether there is a significant correlation between servitization and firm performance. According to H2 proposed above, this paper uses the constructed model 4 and model 5 to introduce the different industries of the firm into the regression model as moderating variable and carry out the regression test. In model 4 and model 5, the industry heterogeneity is set as two dummy variables (DI1 and DI2). In this study, according to different factor inputs, the manufacturing industries is divided into three industries: labor-intensive, capital-intensive and technology-intensive. The results of regression models are shown in Table 2.

TABLE 2 REGRESSION ANALYSIS

Variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
Ser1			0.033**	0.039			-0.028	0.390		
Ser2					0.102***	0.000			0.050	0.527
DI1							-2.537***	0.000	-2.589*	0.097
DI2							-1.430*	0.072	-0.910	0.591
Ser1*DI1							0.099**	0.013		
Ser1*DI2							0.070	0.135		
Ser2*DI1									0.093	0.281
Ser2*DI2									0.035	0.711
Size	1.017***	0.000	0.982***	0.000	0.931***	0.000	0.003	0.676	0.005	0.463
Age	0.002	0.673	0.003	0.585	0.005	0.410	1.029***	0.000	0.986***	0.000
Constant	-1.274	0.160	-1.070	0.238	-1.291	0.144	-0.795	0.490	-1.229	0.477
R-squared	0.711		0.716		0.727		0.724		0.731	
F-test	316.683		215.248		227.079		94.287		97.665	

Note: *** p<0.01, ** p<0.05, * p<0.1

From model 2 and model 3 in Table 2, the two independent variables selected in this study have passed the significance test, in which the service input intensity is significant at the 5% level and the service level is significant at the 1% level. According to model 2, there is a positive correlation between service investment intensity and firm performance（$\beta = 0.033$ and p-value = 0.039); Similarly, model 3 shows that there is a positive correlation between service level and firm performance（$\beta = 0.102$ and p-value = 0.000), and according to R-squared = 0.727, the fitting of the relationship between the two is ideal.

Model 4 in Table 2 is the moderating role of the industry heterogeneity on relationship between service input intensity and firm performance, and model 3 is the moderating role of the industry heterogeneity on relationship between service level and firm performance. Observing the test results of model 4, it is found that both DI1 and DI2 have passed the significance test, in which DI1 is significant at the 1% level and DI2 is significant at the 10% level.

More importantly, the cross term between service input intensity and DI1 passed the significance test at the 5% level, and β= 0.099. However, the cross term between service input intensity and DI2 did not pass the significance test. However, in general, the variables in model 2, especially the moderating variables, fit well. In contrast, model 5 found that the cross terms of industry heterogeneity and service level (ser2*DI1 and ser2*DI2) did not pass the significance level test, so it could not prove that industry heterogeneity had a moderating effect on the relationship between service level and firm performance.

According to the relevant results in Table 2, it shows that the industry heterogeneity is not irrelevant to servitization and the main effect relationship of this study. In order to more clearly and intuitively observe the relationship between servitization and firm performance among the three different industries, this paper classifies all manufacturing industries into three major industries according to the above classification method, Regression tests are conducted within the three industries to observe whether there are differences in the relationship between servitization and firm performance among different industries. See Table 3 for the specific results.

TABLE 3 MAIN EFFECT ANALYSIS

Variables	Labor-intensive Industry				Capital-intensive Industry				Technology-intensive Industry			
	Model 4		Model 5		Model 4		Model 5		Model 4		Model 5	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
Ser1	-0.010	0.853			0.042*	0.056			0.056**	0.015		
Ser2			0.130	0.337			0.079**	0.022			0.115***	0.002
Size	0.369	0.146	0.306	0.225	1.025***	0.000	1.004***	0.000	1.126***	0.000	1.083***	0.000
Age	0.027	0.489	0.014	0.719	0.002	0.783	0.002	0.660	-0.002	0.858	0.001	0.873
Constant	12.793**	0.023	11.964**	0.032	-2.111*	0.065	-2.394**	0.032	-5.134***	0.000	-5.393***	0.000
R-squared	0.112		0.145		0.877		0.880		0.765		0.770	
F-test	1.013		1.359		157.375		161.813		171.281		176.807	

Note: ** p <0.05,*** p <0.001

In order to further study the relationship between servitization and firm performance among different industries, this paper re-tests model 4 and model 5 in three industries respectively. By observing the two models of labor-intensive industries in the Table 3, it is found that the average service input intensity and service level in this industry do not pass the significance level test, which is different from the results shown by capital-intensive industries and technology-intensive industries. In capital-intensive industries, the two indicators of service have passed the significance test, in which the service input intensity is significant at the 10% level and the service level is significant at the 5% level, and the corresponding coefficients are 0.042 and 0.079 respectively. Compared with the first two industries, the technology-intensive industry fits best, because in this industry, the service input intensity is significant at the 5% level and the service level is significant at the 1% level, and the coefficients are 0.056 and 0.115. Whether from the significance level or correlation coefficient, the fitting results of firms in technology-intensive industries are the best, followed by capital-intensive industries, while labor-intensive industries fail to pass the significance level test.

6 RESULTS DISCUSSION AND CONCLUSION

6.1 Results Discussion

Table 2 reflects the test results of the moderating effect of industry heterogeneity on the relationship between servitization and firm performance. Model 2 tests whether the industry heterogeneity can moderate the relationship between service input intensity and firm performance, and model 3 tests its moderation of the relationship between service level and firm performance. In model 8, the cross term between dummy variables and service input intensity of technology-intensive industries passed the significance test at the 5% level, which is consistent with the H2 in this paper. That is, the industry heterogeneity plays a moderating role in the relationship between servitization and firm performance. However, the industry heterogeneity has not passed the significance level test of the regulatory effect of the relationship between service level and firm performance, which seems to be inconsistent with the content of

H2. The reason for this phenomenon can be explained as that under the influence of factor investment and different industry characteristics in different industries, firms will certainly make different decisions on service-oriented investment. However, the service level is better determined by the firm's own functional areas and other capabilities, which is not closely related to the industry in which the firm is located.

In order to further clarify the relationship between servitization and firm performance in different industries, a simple industry research is carried out. The results show that in labor-intensive industries, the main effect (servitization and firm performance) does not pass the significance level test; In the other two industries, the results show that servitization can have a positive impact on firm performance. In contrast, the results fit better in technology-intensive industries. For labor-intensive industries, firms mainly need to invest a lot of labor to produce products, and their products have low requirements for technology and knowledge. Therefore, consumers are fully capable of self-service at all stages of consumption (such as purchase, repair, maintenance, etc.). However, the situation is very different in capital-intensive industries and technology-intensive industries. The products (or services) provided by these firms require consumers to have a certain knowledge or technical foundation, and these knowledge often has strong professionalism. This means that not all consumers can rely on their own ability to solve relevant problems. Taking firms in technology-intensive industries as an example, from the understanding of products to the purchase of products and even the later maintenance, maintenance and even repair, due to the high technical content of products produced by firms, it is difficult for consumers to make relevant decisions in their consumption process. At this time, the service provision corresponding to each stage is particularly important. For example, in the understanding stage, relevant products, technology introduction and popularization services can be provided; In the consumption stage, provide personalized sales suggestion service according to the personalized needs of consumers; After sales can also provide maintenance, upgrading and other related services. Generally speaking, the industry in which the firm is located does have a moderating effect on the relationship between servitization and firm performance, that is, it is reasonable to believe that H2 is reasonable.

6.2 Managerial Implication

For a long time, many firms that rashly implement the servitization under the background of manufacturing service have died prematurely and fallen from the manufacturing industry. Immutable and frozen as like as two peas, the first is to identify their own location and to identify their own characteristics. Based on this, this paper will give suggestions for firms in three industries.

For firms in labor-intensive industries, the most important thing for firms is still to manufacture products through the use of a large number of labor force. Considering the characteristics of such products, the business model of "product + service" is not suitable for firms in this industry. The products provided by such firms may not only have a relatively low cost, but also have a relatively low income. Therefore, it is impossible to increase the income by adding services to the products. For labor-intensive firms, products still make their focus.

Among the three industries, the relationship between servitization and firm performance in technology-intensive industries is the best fitting firm, that is to say, for technology-intensive firms, service is an effective way to improve firm performance. Of course, for such firms, technology is still the core of such firms under the technical background of such rapid renewal, so investment in technology R&D is essential. But at the same time, because its products contain high technical content, consumers need a learning process. Moreover, it is difficult for consumers to provide self-service in this process, which provides a strong support for firm service. Therefore, while paying attention to technological development, we should also actively pay attention to the dynamic changes of market demand, not only avoid the lack of relevant service demand and supply, but also pay attention to the improvement of service quality. When there is little difference in technology, service will be an important factor affecting customer loyalty.

Capital-intensive industries can be regarded as an industry between the first two industries, and it is believed that servitization still has a positive impact on firm performance in this industry. Capital-intensive firms often need a lot of capital investment. Even if service can improve firm performance, it should be reminded that resources must be reasonably allocated according to the firms' own situation and services must be properly introduced under the condition of ensuring the normal operation of the firm.

6.3 Conclusion

Although some scholars have noticed that the results of servitization's effects may be different in different industries, there are few studies on the moderation effect of industry on the relationship between servitization and firm performance. Therefore, this paper sets the industry heterogeneity as a moderating variable and introduces it into the relevant models. It is found that the industry heterogeneity can indeed be used as an external factor to moderate the relationship between the two variables. On this basis, this paper explores the relationship between servitization and firm performance in the three industries. The results show that in labor-intensive industries, the relationship between the two does not pass the significance level test, so servitization may not be a very wise choice for labor-intensive enterprises. In the other two industries, the two are significantly correlated.

Although the conclusions related to moderating role are not completely consistent with the experimental assumptions of this paper, industry heterogeneity can indeed moderate the relationship between servitization and firm performance. This is of certain significance for enriching the relevant theories and conclusions of service-oriented manufacturing enterprises, especially the research on the moderating role of industry heterogeneity, hoping to make some contributions to the relevant research directions.

This study has some shortcomings. The data studied in this paper are cross-sectional data without panel data, so it is difficult to exclude the influence of year. When exploring the moderating role of industry heterogeneity on the relationship between servitization and firm performance, this paper only starts from the variables themselves in a hurry, and does not pay attention to the firm variables that may have cross effects with the main variables in this process. Therefore, it is difficult to ensure that other unmentioned variables have no impact on the experimental results.

ACKNOWLEDGEMENT

This work was supported by MOE (Ministry of Education in China) Project of Humanities and Social Sciences (No.20YJC630022), Shandong Province Natural Science Foundation (No.ZR2017MG033), Fundamental Research Funds for the Central Universities (No.HIT.HSS.201875).

REFERENCES

[1] Jiang Z. Li N. Impact of service innovation and manufacturing service on enterprise performance [J]. Scientific Research Management, 2015 (05): 29-37

[2] Fang R.S., Guo P.F., Li T. Analysis on the evolution process and characteristics of service-oriented transformation of manufacturing enterprises based on the case of Shaangu Group [J]. Journal of Management, 2014 (06): 889-897

[3] Song J, Chen J. Simulation analysis of the impact of service capability on knowledge acquisition of manufacturing enterprises [J]. Science of Science and Technology Management, 2018 (05): 52-64

[4] Xiao T, Huang X.M.. Test of influencing factors of service-oriented status of manufacturing enterprises [J]. Scientific research management, 2018 (02): 108-116

[5] VISNJIC I, NEELY A, WIENGARTEN F. Another performance paradox? A refined view on the performance impact of servitization[Z]. Barcelona: working paper, ESADE, 2012.

[6] Xiao T, Nie Q.H., Liu H. Research on the impact of manufacturing service on Enterprise Performance -- Based on the empirical evidence of Chinese manufacturing enterprises [J]. Science of Science and Technology Management, 2014 (04): 154-162

[7] STOUGHTON M, VOTTA T. Implementing service-based chemical procurement: lessons and results[J]. Journal of Cleaner Production, 2003,11(8):839-849.

[8] COHEN M A A N A V. Winning-in-the-Aftermarket(1)[J]. Harvard business review, 2006,84(5):129.

[9] Zhao L.L., Wei J. Matching of service innovation strategy and technical capability of manufacturing enterprises - a case study of Huawei [J]. Scientific Research Management, 2015,36 (5): 118-126

[10] Qu Wn. Research on Influencing Factors of service transformation of manufacturing enterprises based on service innovation [J]. Scientific Research Management, 2012,10 (33): 64-72

[11] BANDINELLI, G. Servitization in oil and gas sector: outcomes of a case study research[J]. Journal of Manufacturing Technology Management, 2011,23(1):87-102.

[12] ANTIOCO M, MOENAERT R K, LINDGREEN A, et al. Organizational antecedents to and consequences of service business orientations in manufacturing companies[J]. 2008,36(3):337-358.
[13] Vandermerwe S, Rada J. Servitization of business: adding value by adding services[J]. European Management Journal, 1988, 6(4): 314-324.
[14] VISNJIC I, NEELY A, WIENGARTEN F. Another performance paradox? A refined view on the performance impact of servitization[Z]. Barcelona: working paper, ESADE, 2012.
[15] BAINES T, LIGHTFOOT H W, BENEDETTINI O, et al. The servitization of manufacturing: a review of literature and reflection on future challenges[J]. Journal of Manufacturing Technology Management, 2009,20(5):547-567.
[16] L W A, M S, L F. Servicizing: The Quiet Transition to Extended Product Responsibility[J]. Boston: Tellus Institute, 1999
[17] Sun L.Y., Gao J, Zhu C.Y. Service Oriented Manufacturing: a new product model and manufacturing paradigm [J]. China Mechanical Engineering, 2008,19 (21): 1600-1604
[18] S R K, P D N. The balanced scorecard-measures that drive performance[J]. Harvard Business Review, 1992:71-79.
[19] Chen X.H., Yu T. Research on the relationship between marketing capability and technological innovation and market performance -- An Empirical Study Based on China's small and medium-sized listed enterprises [J]. Scientific Research, 2013,31 (4): 585-595
[20] La Londe B J, Zinszer P H, National Council of Physical Distribution Management. Customer service: meaning and measurement[M]. National Council of Physical Distribution Management, 1977.
[21] Li J.H., Ma L.Y., Huang Q.B.. Empirical analysis on the "service dilemma" of Chinese manufacturing enterprises [J]. Science of Science and Technology Management, 2015,36 (06): 36-45
[22] R O, R K. Managing the transition formproducts to services[J]. International Journal of Service Industry Management, 2003,14(2):160-172.
[23] V M. Product services: From a service suppor_x0002_ting the product to a service supporting the client[J]. Journal of Business & Industrial Marketing, 2001,16(1):39-58.
[24] Li Q, Yuan Y.J., Sun J. Review of research on service-oriented manufacturing enterprises [J]. Science and Technology and Management, 2017,19 (04): 14-18
[25] Bao S.M., Zhang T.B.. Evolution and new progress of manufacturing industry classification system [J]. Journal of Northeast University of Finance and Economics, 2017 (05): 25-33
[26] Zhou Y. Wang G.S., Zhou X. Industrial division from the perspective of factors [J]. Contemporary Finance and Economics, 2006 (03): 88-91
[27] Jiang J, Yang H.F., Yang L.G.Empirical Study on the impact of changes in labor structure on the upgrading of manufacturing structure [J]. Scientific Decision Making, 2018 (08): 73-94
[28] Li Z, Su Q, Song Y.T.. Empirical Study on the impact mechanism of quality management practice on enterprise performance [J]. Scientific Research Management, 2008 (01): 41-47
[29] Lin L, Wu G.S.. Empirical Study on service enhancement differentiation mechanism of manufacturing enterprises in China [J]. Management World, 2007,6:103-113
[30] Li X.H., Zou Z.X.. Productivity effect analysis of manufacturing input service [J]. Journal of Capital University of Economics and Trade, 2015,17 (02): 39-45