

A Meta-Analysis of the Relationship Between Servitization and Firm Performance

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ABSTRACT

Servitization is considered as an important strategy for the transformation and upgrading of manufacturing firms. But the effect of servitization on firm performance is not clear. This paper studies the relationship between servitization and firm performance through meta-analysis, and makes subgroup analysis on potential moderating variables. The results show that the Servitization has a positive effect on firm performance and the relationship between the two is affected by technical level, firm size, servitization measurement dimension and firm performance measurement type.

Keywords: *Servitization, firm performance, meta-analysis*

1. INTRODUCTION

In recent years, with the advancement of economic globalization and the rapid development of information technology, manufacturing competition has become increasingly fierce. And as a new strategy, servitization has become an important choice for manufacturing firms to acquire core competitiveness. Made in China 2025 clearly states that "promoting the transformation of production-based manufacturing into service-based manufacturing", while the German concept of "industry 4.0" also sets out the goal of establishing a highly flexible production model for personalized and digitalized products and services. "Servitization" was originally described as the process of creating value by adding services to the product [1]. And what servitization can bring to manufacturing firms has become the focus of many scholars. Through empirical research, Neely found that although service-oriented manufacturing companies could receive higher sales revenue, their profit margins were relatively low [2]. Lianxing Min's research shows that servitization level is negatively related to the financial performance in the perspective of long term but it can bring market value premium in current year [3]. This phenomenon is called "Servitization Paradox". So does servitization really help manufacturing firms improve their performance? A meta-analysis is used to analyze the previous quantitative literature, so that the relationship between servitization and firm performance and its conditions have a clearer understanding.

2. RESEARCH HYPOTHESIS

2.1. Servitization and Firm Performance

Compared with the product, the advantage of service is that it is more intangible, more difficult to imitate and copy. According to the resource-based view, the competitive advantage of firms comes from the special heterogeneous resources, and the manufacturing industry through servitization is more conducive to improve the non-imitation of firm resources, thus bringing sustainable competitive advantages for firms. There are many empirical studies that show that servitization can bring positive impact on firm performance [4]. Some scholars have pointed out through empirical research that providing additional services can increase the survival opportunities of firms [4]. Based on the above studies, the following hypotheses are put forward

H1: There is a significant positive correlation between servitization and the performance of manufacturing firms.

2.2. Moderating Effect between Servitization and Firm Performance

2.2.1. Industrial technology intensity

According to the existing research, technology intensity has an important impact on manufacturing servitization. The degree of manufacturing servitization in industries with higher technical level is significantly higher than that in industries with lower technical level. For products with higher technical level, customers will need more service support due to their own capabilities, which may be difficult for other service firms to provide due to technical

barriers. For traditional firms, due to the slow product update and high homogeneity, customers generally do not rely on the firm to provide service support, so the implementation of servitization may not achieve the expected return. To sum up, a hypothesis is put forward:

H2: Under the condition of high technology, the relationship between the implementation of servitization and the performance of manufacturing firms is more significant.

2.2.2. Firm size

Many scholars believe that the size of firms has an impact on the effect of service-oriented firms. Compared with small and medium-sized firms, large-scale firms have more advantages in product diversification. According to the research, firms with higher product diversification level are more conducive to the survival of firms after implementing the servitization strategy [5]. Therefore, the following hypothesis are put forward

H2: Under the condition of large-size firms, the relationship between the implementation of servitization and the performance of manufacturing firms is more significant.

2.2.3. Types of firm performance

Firm performance is a complex and multi-dimensional variable. In the past research on the servitization of manufacturing industry, different types of firm performance are chosen by scholars. Some scholars use financial performance such as sales growth rate, sales profit rate and return on assets, while others measure non-financial performance such as relationship performance, competitive advantage and operational performance. Generally speaking, servitization of manufacturing firms has a great impact on the financial and non-financial performance of firms. However, due to the cost of implementing servitization, servitization may produce higher non-financial performance, such as improving customer satisfaction and loyalty, so as to achieve higher total sales, but it may not be able to obtain the expected high profits [2], and the financial performance of servitization often lags behind its non-financial performance. Therefore, the following hypothesis are put forward:

H5: when non-financial performance is used to measure firm performance, the relationship between servitization and manufacturing firm performance is more significant.

2.2.4. Servitization measurement dimension

Many scholars use a single indicator to measure servitization, mainly using the number of services provided by manufacturing firms or the ratio of servitization income to firm income. However, the

servitization of manufacturing firms is a complex and differentiated process. Some scholars have clearly pointed out that the most important problem in such research is that it is impossible to distinguish different types of services. In empirical research, it is also necessary to consider that different types of services may produce different results [6]. Compared with single dimension measurement, multi-dimensional measurement is more comprehensive and can reflect the width and intensity of firm services and the impact of different types of services on firm performance. In summary, the following hypothesis are put forward:

H3: When measuring servitization with multi-dimensions, the relationship between servitization and performance of manufacturing firms is more significant.

3. RESEARCH METHOD AND DATA COLLECTION

In this study, we try to carry out meta-analysis to explore the impact of servitization on firm performance. To obtain research on the relationship between servitization and firm performance, using "servitization" as keywords to search English journal articles for titles by Google Academic. Then search Chinese journal articles through CNKI. "Servitization" was originally proposed by Vandermerwe and Rada in 1988, so that we searched all relevant articles published from January 1, 1988 to December 2019, and selected 96 initial articles with empirical methods on firm performance. After obtaining the initial literature, further careful screening was carried out. And the standards are as follow: The research question must be the impact of servitization on firm performance; It must be an empirical study. And sample size and correlation coefficients (or other convertible statistical indicators) must be reported. 82 articles were finally selected which can be analyzed, including 43 English articles, 37 in Chinese and 2 in Korean.

4. CODING

After the collection, coding the literature mainly includes description and effect size. Description mainly includes basic information such as region, sample size, servitization measurement and performance measurement; effect size mainly includes correlation coefficient and other statistics which can transform to correlation coefficient such as path coefficient and regression coefficient. Then the correlation coefficients of each independent studies were transformed into Fisher's Z, which were taken as the effect size of the meta-analysis. In addition, 0-1 coding is applied to the moderating variables namely technical level, firm size, servitization measurement dimension and performance measurement type. In order to eliminate the influence of researchers' subjective judgment for ensuring the reliability of coding, two groups were divided for independent coding at the same time. If the coding result is

inconsistent, it can be determined by tracing back to the original text, checking and discussing.

4.1. Firm Size

Due to different countries' different division of firm size, for the research that does not give the specific size of firm, the firm with more than 500 employees is divided into large-scale firm, and the firm with less than 500 employees is classified as small and medium-sized firm. The dummy variable of "firm size" is set, which the code of large-scale firm is 1 and that of small and medium-sized firm is 0.

4.2. Industrial Technology Intensity

According to the relevant standards of the National Bureau of statistics of China, the aerospace aircraft manufacturing industry, electronic and communication equipment manufacturing industry, electronic computer and office equipment manufacturing industry, pharmaceutical manufacturing industry and medical equipment and instrument manufacturing industry are divided into high-tech industries, and the rest are low-tech industries. And set the dummy variable of "technical level", which the code of high-tech industry is 1, and the code of low-tech industry is 0.

4.3. Servitization Measurement Method

Considering that different measurement methods may have certain impact on the research results, the dummy variable of "servitization measurement method" is set, which the single dimension measurement code is 1, and the multi-dimensional measurement code is 0.

4.4. Performance Measurement Type

According to the common classification methods, firm performance can be divided into financial performance and non-financial performance. Based on this criteria, the dummy variable "measurement type of firm performance" is set, which the financial performance code is 1 and the non-financial performance code is 0.

5. RESULTS

5.1. Main Effect

According to the heterogeneity test results of the main effect, the random effect model was used. It can be seen from Table 1 that the comprehensive effect value is 0.163 ($P < 0.001$), which is small effect. This shows that the correlation coefficient between servitization and manufacturing firm performance is 0.163. In addition, 95% CI is 0.126-0.200, which does not include "0", indicating that the comprehensive effect value is statistically significant in this confidence interval. Therefore, there is a significant positive relationship between servitization and the performance of manufacturing firms. H1 is supported.

5.2. Moderating Effect

Meta-analysis of the main effect shows that there is a positive relationship between servitization and manufacturing firm performance, while heterogeneity test shows that the relationship between servitization and manufacturing firm performance is affected by potential moderating variables. Therefore, the possible moderating variables and subgroup analysis were carried out.

It can be seen from Table 2 that: (1) The effect size of the relationship between high-tech firms' servitization and performance ($ES = 0.142$) is lower than that of low-tech firms ($ES = 0.173$). H2 is not supported. (2) The effect size of the relationship between large-size firms' servitization and performance ($ES = 0.224$) is higher than that of small and medium firms ($ES = 0.163$). H3 is supported. (3) The effect value of the relationship between servitization and financial performance ($ES = 0.083$) is significantly lower than that of the relationship between servitization and non-financial performance ($ES = 0.235$). H4 is supported. (4) The effect size of the relationship between servitization and firm performance under the single-dimension measurement of servitization ($ES = 0.139$) is lower than that of the multi-dimension measurement ($ES = 0.163$). H5 is supported.

Table 1 Main effect results of random effect model

Method	Pooled Est	95% CI		Asymptotic		No. Of studies
		Lower	Upper	z_value	p_value	
Random	0.163	0.126	0.200	8.633	0.000	82
Fixed	0.072	0.066	0.079	22.576	0.000	82

Table 2 Moderating effect results of random effect model

Random-effects mode	Q	K-1	ES	95%CI		Z	P	I2
				Lower	Upper			
Technology Intensity	862.99	50	0.153	0.098	0.208	5.47	0.000	94.2%
High	721.29	32	0.142	0.055	0.229	3.18	0.000	95.6%
Low	133.88	17	0.173	0.117	0.229	6.07	0.000	87.3%
Size	793.12	43	0.178	0.135	0.221	8.07	0.000	94.6%
Large	194.77	10	0.224	0.082	0.365	3.09	0.002	94.9%
SME	551.91	32	0.163	0.118	0.208	7.12	0.000	94.2%
Performance	1963.67	66	0.142	0.100	0.183	6.70	0.000	96.6%
Financial	1327.03	42	0.083	0.016	0.150	2.44	0.015	96.8%
No-financial	582.85	23	0.235	0.181	0.289	8.57	0.000	96.1%
Dimension of servitization	2359.31	81	0.163	0.126	0.200	8.63	0.000	96.6%
Single-dimension	1742.94	48	0.139	0.082	0.195	4.81	0.000	97.2%
Multi-dimension	587.21	32	0.193	0.147	0.240	8.19	0.000	94.6%

6. CONCLUSION

Through meta-analysis, it can be concluded that large firm size, multi-dimension measurement of servitization and no-financial performance measurement type can promote the relationship between servitization and firm performance. Although this paper verifies that servitization has a positive effect on firm performance through meta-analysis, there are still other moderating variables that can be explored. In addition, there may be deviations in literature selection and coding, which are mainly manifested in the following aspects: for literature, it is limited to Chinese and English literature, rarely involved in other languages. Therefore, more detailed conclusions can be obtained through meta-analysis technology in the future.

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