Influence of Organizational Elements on Manufacturing Firms' Service-enhancement: An Empirical Study Based on Chinese ICT Industry

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Abstract--**Despite the growing awareness of the importance of servitization of manufacturing, relatively little study has been performed on how organizational elements may or may not enhance the value creation of manufacturing, and even less in the developing countries. The present study aims to bridge this gap by examining the impact of a set of organizational elements on the service- enhancement in a sample of ICT industry in China. The results of a multivariate analysis indicate that the degree of service-enhancement (measured by product, customer and financial performance) can be well explained by five organizational elements (service technological capability, strategic orientation (including market and innovation orientation), organization design, and resources endowment). Therefore, it is necessary for organizations to consider organizational elements in implementing servitization in manufacturing firms.**

I. INTRODUCTION

Service led competitive manufacturing strategy has aroused broad interest from academia, business, and even government[23] , an interest largely based on a belief that a move towards service will create additional value adding capabilities for traditional manufacturers. Contrary to the economic benefits expected, firms frequently encounter problems orienting their industrial sales forces toward these new organizational objectives [26, 35], which is called "service paradox" [12]. Substantial investment in extending the service business may lead to increased service offerings and higher costs, but does not generate the expected correspondingly higher returns.

A growing body of research on service transition strategies cites the necessity of this transition, yet we still know little about what drives their success or failure [3]. Some recent research seeks insights into the unique resources, strategies and distinctive capabilities that manufacturers need to transition effectively into services [35, 38]. However, the prior studies are mainly focus on the qualitative description of phenomena and still lack a systematic analysis framework. Moreover, most of the existing studies take developed countries and regions (e.g. USA; Australia; Hong Kong, China) as the background and lack studies toward developing regions. This paper seeks to fill a gap in the literature by identifying organizational characters of firms who attempt to make the transition to service-led growth. Our work advances in this direction by theoretically and empirically examining whether some organizational elements have a positive impact on services-enhancement in manufacturing firms. Our empirical study uses data from 142 random samples of firms in Chinese ICT manufacturing sectors. The results and conclusions reached allow us to outline some practical recommendations for manufacturing firms interested in servitization.

The remainder of the paper is organized as follows. In the next section, we present the theoretical foundations related. Then we put forward some theoretical hypothesis and conceptual model concerning the organization elements on service-enhancement in manufacturing firms. We then go on to describe the data collection and methodology, followed by the empirical results. Lastly, we discuss the findings, implications and limitations of our research.

II. THEORETICAL FOUNDATIONS

A. Concept of Service-enhancement

Research on service-enhancement in the manufacturing firms is originated from the study on dynamic evolution of the service's position in the manufacturing. Under the background of knowledge-economy and globalization of economics, product economy transits gradually to a service-oriented economy, more manufacturing industry use services to enhance the competitiveness of their products and harvest new value from services transition, which Western scholars name this phenomenon as the "service-enhancement" [2, 37]. There are several alike terms such as "service-based value innovation" [21], "product servicizes" [34] and "value-added product" [20]. Most of these concepts are from a business strategy perspective, focusing on the impact of services on manufacturing enterprises' competitive strategy choice and competitive advantage, which is a description of the results of services innovation. The core idea for the kind definitions is that manufacturing enterprises seek to enhance their competitiveness of products by offering services to tangible products, and gradually take service as an important source of value creation [37]. Thus, the nature of the service-enhancement is service innovation in manufacturing enterprises. It describes the impact of service innovation on manufacturing enterprises from the result orientation. Pappas and Sheehan [30] believe that service-enhancement is the result of increasing of the service intensity in the manufacturing business operation process.

B. Organizational factors enabling Firms' Service-enhancement

While there has been substantial research on the antecedents for successive service innovation in 'pure' service sectors, the literature remains relatively silent on necessary antecedents for the innovation of product-related services [13]. In business practice, manufacturing firms develop product-related services unsystematically.

Employing case-based and qualitative analysis, researches make some exploration on the organization characters which may impact service-enhancement in manufacturing firms. E.g., Gebauer et al. [14] investigate the success factors for achieving higher service revenues in product manufacturing companies. Through an extensive benchmarking project conducted with a variety of firms, they highlight that a clear service-development process and extensive knowledge of market conditions and customer needs have a positive impact on the service business. The criteria for selecting and innovating new services must be derived from the service or corporate strategy to ensure that corporate goals and customer needs receive the appropriate service development focus. Yang et al.[38] investigate what strategies the manufacturing firms conduct to enhance their value creation. Through four case studies, they conclude that high-valued service strategies vary according to the manufacturing service firms' industry context, organizational conditions, and service itself. Employing one case research, Neu and Brown [27] conclude that forming high-performing business services in product manufacturing firms stems largely from managers' ability to create internal alignment among several organizational factors that collectively "fit" conditions in the market. Through a multi-case study, Gebauer et al. [13] find that involvement of frontline employees, information sharing, multifunctional teams, funnel tools, information technology, internal organization, presence of service champion, autonomy of employees, market testing, market research, strategic focus, external contacts, availability of resources, management support and training and education have a significant effect on service innovations. Kastalli and Van Looy [19] find that the ability of servitization to create value on the level of the product and the customer is more positive. Through nine in-depth case studies, Ettlie and Rosenthal [11] identify factors of corporate culture patterns, sponsorship tendencies and chief executive sponsorship etc, which impact service innovation success in manufacturing firms. In particular, the literature points to 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 [4]. Only a small number of studies use quantitative analysis. E.g., Michael et al. [24] conduct an empirical survey of 137 companies in Nordic countries to explore the organizational parameters and service business orientations that explain relative product sales and service volume of manufacturing companies.

From the existing studies listed above, we can find that the prior exploration of organizational factors that enable the formation of high-performing business services in manufacturing firms still sticks on the phenomena description and generalization. Research on the influential factors that affect enterprise's service-enhancement has not formed an analysis framework yet. In addition, majority of the prior studies are based on interviews and case studies, which the external validity of the antecedents could not be assessed accurately. Research in the area would benefit from insights attained from quantitative analyses. In addition, prior studies mostly concentrate on firms in developed country. There are significant differences between developed and developing countries in terms of the extent to which manufacturing has servitized [25]. Applying the results to other regions could further enhance the transferability and generalizability of the results. This paper seeks to fill a gap in the literature by identifying the main organizational factors which impact firms' degree of service-enhancement through quantitative analysis based on sample from ICT industry in China.

III. RESEARCH HYPOTHESIS AND CONCEPTUAL FRAMEWORK

This paper investigates the influence of internal organization factors on manufacturing firm service-enhancement, including technological capability, strategic orientation, organization design, and resources endowment.

A. Technological capability and service-enhancement

Whether specific service activity is carried out smoothly or not depends mostly on advanced technology. As an important foundation and tools, advanced technology allows manufacturing firms to make better use of labor, equipment and materials that result in financial savings and improvements in product quality and reliability, especially for the information and communication technology (ICT). Evidence demonstrates that ICT can have a relevant impact on value creation for they bring superior responsiveness to operation processes and improve product offering. Promotion and development of ICT has dramatically changed the production and profit model of manufacturing enterprise. In particular, companies that are able to embed such superior responsiveness into their product offering can further boost value creation [1]. Through case studies, Jagtap and Johnson [16] indicate that IT capability is beneficial to improve service performance. Greater IT capability would lead to a higher degree of service process innovation [6].

Based on the analysis above, we hypothesize:

Hypothesis 1*:* The service technological capability is closely related to service-enhancement in manufacturing firms. The stronger is firms' service technological capability, the higher degree is firms' service-enhancement.

B. Strategic orientation and service-enhancement

Strategic orientation determines firms' understanding on how to obtain a competitive advantage, how to treat consumer, and how to establish strategy and define own business areas. This study investigates the role of market and innovation orientations in firms' service-enhancement.

The willingness of consumers to change their preferences is related to the degree of firms' service-enhancement, which requires companies not only to focus on different consumer needs, but also to the dynamic changes in consumer demand.

A market-orientation, particularly the systematic identification of customer needs, constitutes an indispensable prerequisite for developing new and successful services [10]. Firms with market orientation tend to be more in-depth understanding of the actual needs of the customer and provide differentiated marketing mix for different target markets [22]. Companies which succeed in extending the service business are those which obtain comprehensive information on customer needs [12].

Innovation orientation marks firms' degree of openness to new things, and their passion on innovation. Innovation orientation can develop staffs' creativity, stimulate creative solutions, promote active learning, and ultimately improve product performance. In addition, innovation orientation can encourage firms to break the original framework to create a new business. Thus, the companies of the stronger innovation orientation may have stronger inclined to develop high degree of novelty products, improve the level of services increase.

Based on the analysis above, we hypothesize:

Hypothesis 2a*:* Market orientation is closely related to service-enhancement in the manufacturing firms. Stronger is firms' market orientation, the higher degree is firms' service-enhancement.

Hypothesis 2b*:* Innovation orientation is closely related to service-enhancement. The stronger is firms' innovation orientation, the higher degree is firms' service-enhancement.

C. Organization design and service-enhancement

Organization design is related to connection mode among departments or in a whole organization, which includes institutional design that ensuring inter-departmental communication, collaboration and power integration. It decides the formalization, complexity and centralization of one enterprise. It is a key factor that affects the efficiency of an organization and determines the organizations' official report relationship. Effective implementation of a service strategy requires supporting organizational arrangements [12]. Thus, when pursuing servitization, firms' vision of service should also embody the organization design. In general, a more flexible organizational structure, and taking innovation as an integrated process will help foster future service capability. A flexible, agile, and creative organization design can break the information barriers among the organizations, and transmit information directly and unobstructed, thus improve customer service, increase service revenue.

Based on the analysis above, we hypothesize:

Hypothesis 3*:* Firms organization design is closely related to service-enhancement. The organization design is more conducive for knowledge interaction and collaboration, the higher degree is firms' service-enhancement.

D. Resources endowment and service-enhancement

Service is a process of series interaction between consumer and enterprise. To implement a service strategic effectively, firms needs financial resource and human resource for providing qualified service. According to the resource-based view, enterprise is a collection of various resources. The performance difference among enterprises is due to their different resources endowment [36]. Enterprises with different service strategy are inseparably related to the resources endowment they have. Increasing investment on organization resources may improve the quality of service and customer satisfaction. Compared to product innovations, service innovations are particularly related to human resource development and closer links to customers [32]. The role of frontline employees in successful implementation can be especially important because employees often "are the service" in service contexts [5]. As such, service innovations will succeed only insofar as the employees embrace and capable.

Based on the analysis above, we hypothesize:

Hypothesis 4*:* Enterprise resources endowment is closely related to service-enhancement, the more richness of firms' resources, the higher degree is firms' service-enhancement.

Fig. 1 summarizes the determinants of service-enhancement in manufacturing firms included in our research model.

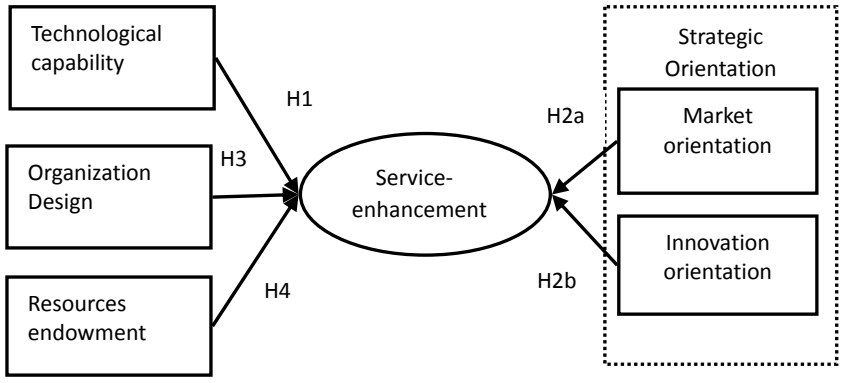

Fig.1. Determinants of service-enhancement in manufacturing firms

IV. RESEARCH METHODOLOGY

A. Sample and data collection

This research adopts Chinese ICT manufacturers as the demonstration examples, including the "computer product", "Computer peripherals", "data storage media", "computer components", "electronic communications equipment", "audio-visual electronics", "semiconductor", "optoelectronic components and equipment", and "electronic components". Note that the respondents are given full understanding of the new service development process before answering the questionnaires. The respondents had at least three years' relevant work experience in that industry. Marketing and senior managers were asked to answer this questionnaire to improve the answers' validity. With the aid of the staffs work at local science and technology Bureau and other acquaintance, questionnaires were sent out to 258 companies at the beginning of August 2013. 180 questionnaires were returned by October 2013, in a response rate of 69.8%. Among the returned questionnaires, 142 were valid, with the valid response rate 55.3%. Therefore it can ignore the non-response bias. The following status description and analysis is derived from this survey. Table 1 summarizes the sample characteristics in terms of firm size (sales avenue), and firms age. The sample firms are distributed in a broad range and firm size are also quite well distributed. Most of the firms have set up above 5 years (81.0%).

B. Measurement of variables

Taking into consideration of the recommendations put forward by Churchill [7], this paper develops measurement scales for each variable including "service technological capability", "market orientation", "innovation orientation", "organization design", "resources endowment" and "degree of service-enhancement. Measurement items from the literature are cited to support our arguments. Comments from scholars and experts are also included. All measurement scales have a Likert marking system from 1 to 7, where 1 is "totally disagree" and 7 is "totally agree".

Prior to the survey administration, the questionnaire was validated through a pretest that was carried out through several personal interviews with senior managers and small sample test. This allowed us to clarify our survey items and revise any potential deficiency. Minor adjustments were made on the basis of specific suggestions and the reliability and validity test toward each measurement variables based on small sample data. Through purified, we form the final survey scales which includes five measurement items for service technological capability, four items for market orientation, three items for innovation orientation, three items for organization design, four items for resources endowment, seven items for the degree of service-enhancement as presented in Table 2. The related literature sources is also presented.

C. Main analysis method

Three types of statistical methods are used in the analysis: reliability statistics; exploratory factorial analysis (EFA) and regression analysis. The reliability statistics and EFA are used to test the reliability and validity of the variables measurement. The regression analysis is used to examine the impact of organizational elements on the service-enhancement in manufacturing firms. Statistic software SPSS 21.0 is utilized to establish data analysis.

V. STATISTICS ANALYSIS

A. Reliability and validity test

The internal consistency measures are conducted in order to assess the reliability of the measurement instruments. The Cronbach's Alpha coefficient for each variable is calculated based on the points graded for each respondent. Based on Nunnally [28], the reliability level is acceptable if the value is at least 0.7. In this paper, the Cronbach's Alpha coefficient of service technological capability, market orientation, innovation orientation, organization design, resources endowment and degree of service-enhancement are all larger than 0.7. Therefore, this study meets the requirements for reliability. In addition, to verify that items tapped into their stipulated construct, exploratory factorial analysis is employed. The relatively high factor loading scores verified the construct validity in the questionnaires, as listed in table 3.

TABLE 1. SAMPLE FIRM' S CHARACTERISTICS

Firm size (million RMB)	No. of responses	% responses over the total sample	Firm age（year）	No. of responses	% responses
<1	5	3.52	<3	7	4.93
1～10	12	8.45	3～5	20	14.08
10～30	26	18.31	5～10	35	24.65
30～100	28	19.72	>10	80	56.34
100～300	24	16.90			
300～1000	22	15.49			
>1000	25	17.61			

TABLE 2 SURVEY ITEMS AND RELATED LITERATURE SOURCE

Variables		Item Description	literature source
Technological capability		JS1: Our company has established a perfect service system of technical analysis	De Boer[9]
		JS2: Our company can quickly identify the role of new service technologies for practices work.	
		JS3: Our company can quickly understand and master the new service technical knowledge	
		JS4: Our company can quickly applied the new technology to the service process	
		JS5: Our company can take advantage of new technologies to improve and perfect the service system continuously	
Strategic orientation	Market orientation	SC1: Our company has repeatedly told our staff that the success of the business depends on its ability to meet market demand	Jaworski & Kohli [17]
		SC2: Our company's main objectives is determined by the satisfaction of customer	
		SC3: Our company's strategy to gain competitive advantage is based on understanding customer needs	
		SC4: Our company can and will act quickly to respond to competitors	
	Innovation orientation	CX1:Our company attaches great importance to R & D investment	Olsen *et al.* [29]; Karagozoglu[18]
		CX2: Our company constantly introduce new products/ services/ technology	
		CX3: Our company's sales in the past five years, include many new products or services	
Organization design		ZS1: Our company can freely share knowledge across departments	Roberts[31]; Dai & Zhu[8]
		ZS2: Cooperation between the various departments in our company is close	
		ZS3: The staff of various departments do mutual assistance and cooperation frankly	
Resources endowment		ZY1: Our company has adequate financial resources to support service activities	Haber & Reichel[15]
		ZY2: Our company has adequate staff to provide support to the services	
		ZY3: Our company has sufficient operation and services experience	
		ZY4: Our company has a strong production capacity	
Service-enhancement		SE1：Compared to similar companies, our company's products/services is very professional.	Wu & Lin[37]; Michael *et al.*[24]; Shen[33]
		SE2：Compared to similar companies , our company's products or services has a high level of personalization	
		SE3：Compared to similar enterprises, our company's products has a high level of service	
		SE4: Compared to similar companies , our products or services has a high level of customer satisfaction	
		SE5: Compared to similar companies, the satisfaction of our customers is very high	
		SE6: Compared to similar companies ,our company's customers has a high level of loyalty	
		SE7: Compared to similar companies, the proportion our company's services income to the total revenues is high.	

TABLE 3 THE RESULTS OF RELIABILITY AND FACTOR ANALYSIS

variable		item	loadings	Cronbach's α
Strategic orientation (Result 1)	Market orientation	SC1	.846	.857
		SC2	.871	
		SC3	.758	
		SC4	.686	
	Innovation orientation	CX1	.877	.888
		CX2	.861	
		CX3	.843	
(Result 2)	Technological capability	JS1	.833	.919
		JS2	.714	
		JS3	.772	
		JS4	.669	
		JS5	.680	
	organization design	ZS1	.872	.904
		ZS2	.749	
		ZS3	.808	
	resources endowment	ZY1	.765	.875
		ZY2	.743	
		ZY3	.658	
		ZY4	.813	
Service-enhancement (Result 3)		SE1	.821	.928
		SE2	.818	
		SE3	.865	
		SE4	.908	
		SE5	.905	
		SE6	.779	
		SE7	.760	

- Result 1：The EFA of strategic orientation: KMO=0.845，Bartlett statistic is significantly different from 0（P＜0.001）, two factors explained 75.43% of the total variance;
- Result 2: The EFA of technological capability, organization design, and resources endowment: KMO=0.930, Bartlett statistic is significantly different from 0（P＜0.001）, three factors explained 77.94% of the total variance;
- Result 3: The EFA of service-enhancement: KMO=0.827，Bartlett statistic is significantly different from 0（P＜0.001）, the factor explained 70.30% of the total variance.

B. Influence of organizational elements on service-enhancement

In this study, the multiple linear regression is used to analysis the relationship between organizational elements and service-enhancement, the results shown in Table 4. As can be seen in table 4, the regression coefficients of service technological capability, market orientation, innovation orientation, organization design and resources endowment are all positive and significant ($p<0.01$). This indicates that service technological capability, market orientation, innovation orientation, organization design, resources endowment have a positive and significant impact on service-enhancement, thus our research hypothesizes H1, H2a, H2b, H3, H4 are verified.

VI. CONCLUSION AND DISCUSSION

This paper examines the impact of a set of organizational elements on service-enhancement in manufacturing firms. Based on the empirical research with the data from 142 Chinese ICT manufacturing firms, this paper concludes that service technological capability, market and innovation orientation, organization design are positive related to firms' service-enhancement. This result is coincided with the research conducted by Gebauer et al. [13][14] , Michael et al. [24], Neu and Brown [27], which co-verified arguments by using developing regions' empirical data . This paper enriched the study of influence of organizational elements on service-enhancement in manufacturing firms by consideration the comprehensive internal organizational factors. The contribution of this paper consists in providing a system framework on the antecedents necessary for the service-enhancement by manufacturing firms.

This research can provide theoretical guide for manufacturing firm to implement servitization. As is proved by theoretical and empirical analysis in this paper, service-enhancement in manufacturing companies is influenced strongly by internal organizational factors such as service technological capability, market orientation, innovation orientation, organization design, and resources endowment. Therefore, it's necessary for service management practitioner to monitor these success factors and gain an understanding of their impact. In order to effectively improve service-enhancement, enterprises should strengthen their market-oriented and innovation-oriented, develop service technical capability vigorously, built a learning organizational structure to promote knowledge interaction and collaboration within the organization, improve efficiency of resource utilization and pay more attention on human resource development.

Although this study achieves the desired goal, and give some meaningful results, we must acknowledge that the results have limitation. First is the limited sample size. Although the author spent much energy to collect data, 142 valid questionnaires is still narrow, which needs larger sample inspection. Second, this paper just studies the influence of organizational elements on firms' service-enhancement directly, and doesn't consider the interdependence relationship between various factors, which deserves further discussing. Third, this paper is just a static research. However, in the different stages of servitization, the influence factors may be different. Future research can focus on the dynamic evolution of the influence factors along with the servitizaiton in manufacturing firms.

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TABLE 4 MULTIPLE REGRESSION ANALYSIS: IMPACT OF ORGANIZATIONAL ELEMENTS ON SERVICE-ENHANCEMENT

Variable	Standardized coefficient	t	Sig.	Model statistics
Service technological capability	.184 ***	4.515	.000	R^2=.941 Adjusted R^2=.939 F =433.079*** DW =1.829
Innovation orientation	.199 ***	4.180	.000	
Market orientation	.362 ***	7.511	.000	
organization design	.098 **	3.144	.002	
resources endowment	.207 ***	3.992	.000	

Dependent variable is degree of service-enhancement; N=142; P ** ＜0.01; P *** ＜0.001; 0<VIF<10

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