

# COMPLEMENTARY IMPLEMENTATION OF MASS CUSTOMIZATION PRACTICES: EVIDENCE FROM CHINESE MANUFACTURERS

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## ABSTRACT

More and more academia distills the essence of mass customization and identifies the logic of an effective implementation. Using a large-scale survey in China, this study finds that both cost leadership and differentiation strategies lead to mass customization practices. Using simultaneous equation modeling (an econometric method), we find that successful mass customization implementations use elicitation, process flexibility technology and logistics in complement. Firms who can successfully implement the three initiatives of mass customization, i.e. elicitation, process flexibility and logistics, in a complementary manner will increase their operational performance in terms of cost and product/service quality.

**Keywords:** mass customization, competitive strategy, complementary, China

## INTRODUCTION

Since its first appearance, mass customization was considered as an important concept in management field [1]. From operations management's perspective, researchers have identified some commonly used mass customization practices. According to [2] and [3], mass customization system is composed of three subsystems: *elicitation, process flexibility technology and logistics*. However, they did not fully explore the implications of the sub system as a whole. Competitive strategy might be an important antecedent of mass customization practices because it guides manufacturers' decisions on process choice, technology, capacity and how to build key capabilities [4]. On the other hand, manufacturing practices do not exist in isolation and therefore may need to be considered concurrently. The presumption of adoption decisions in manufacturing practices is that those practices should have complementary effects [5]. This paper aims to address these issues through achieving the followings: explore the impact of competitive strategies on mass customization practices; identify the complementary effects among mass customization practices; investigate the impact of complementary among mass customization practices on firm's operational performance. Our conceptual model is shown in Figure 1.

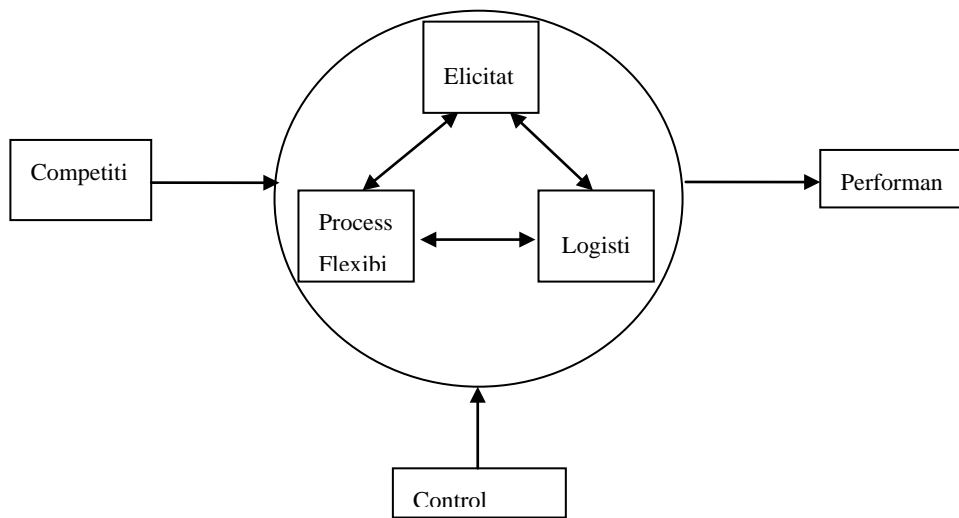


Figure 1 Conceptual Framework

## THEORETICAL BACKGROUND

### Mass customization system

Based on the observations of successful mass customizers, [2] and [3] proposed a conceptual framework of mass customization system which includes three groups of manufacturing practices: elicitation, process flexibility technology, and logistics. Elicitation is “a mechanism for interacting with the customer and obtaining specific information” [3]. Process flexibility technology is the “production technology that fabricates the product according to the information” [3]. Berman further explained that process flexibility technology is composed of both flexibility in design and manufacturing processes [2]. Logistics is about “subsequent processing stages and distribution that are able to maintain the identity of each item and to deliver the right one to the right customer” [3]. Berman explained that the logistics system includes two kinds of practices: JIT supply chain, which accelerates the material flow; and an integrated logistics information system (ILIS), which facilitates the information flow [2].

### The impact of competitive strategy on mass customization practices

The goal of mass customization system is to develop, produce, market, and deliver goods and services with enough variety that nearly every one finds what they want with low cost [6]. This philosophy breaks the competitive strategy paradox and focuses on achieving the advantages of overall cost leadership and differentiation simultaneously. To achieve this, mass customizers pursues both economic of scope and scale by combing the “pull” and “push” methods and relocating the decoupling point in the manufacturing process [7][8][9]. We propose the following hypothesis:

*H1a: The differentiation strategy is positively related to elicitation*

*H1b: The differentiation strategy is positively related to process flexibility technology*

*H1c: The differentiation strategy is positively related to logistics*

*H2a: The cost leadership strategy is positively related to elicitation*

*H2b: The cost leadership strategy is positively related to process flexibility technology*

*H2c: The cost leadership strategy is positively related to logistics*

### **Complementarities and performance implication**

Complementary effect, which is developed in economics theory, can be used to explain the behind logic of the adoptions of various practices. The concept of complementary is that “Activities are Edgeworth complements if doing (more of) any one of them increases the returns to doing (more of) the others” [10, pp. 181]. High performing manufacturing companies don’t implement any practice in an accidental manner. On the contrary, the successful companies always implement different practices in a reasonable and logical way in order to take the advantage of complementary effect among groups of practices [5]. In the same way, we expect that manufacturers who want to be mass customizers should implement the three initiatives of mass customization, i.e. elicitation, process flexibility technology, and logistics, in a complementary way [2][3]. The three elements describe an entire process of how mass customization operations creating value.

Therefore, we proposed the following hypothesis:

*H3: The adoption of elicitation, process flexibility technology, and logistics would be complementary.*

Firms who can successfully exploit the logic of complementarities would outperform other companies [11]. The logic of complementarities is similar to the concept of “fit” in many strategic management studies. The congruence among those practices forms a bundle to achieve higher performance [12][13]. [14] and [15] suggested that some supply chain management practices are complementary in improving supply chain performance. We argued that besides the improving operational performance directly, the mass customization practices also influence the performance jointly. Therefore, we proposed the following hypotheses:

*H4a: Manufacturers who adopt mass customization practices in complementary way will achieve lower cost.*

*H4b: Manufacturers who adopt mass customization practices in complementary way will achieve higher product/service quality.*

## **RESEARCH METHODOLOGY**

### **Data collection and respondent profile**

The data were collected from three cities (Beijing, Guangzhou, and Shanghai) in China. Totally 614 agreed to participate and completed the questionnaire, which represents a response rate of approximately 23 percent. Ten cases were excluded because of missing values. A non-response bias test was conducted by checking the differences between the first wave of respondents and later returns [16]. The results of t-test showed no significant difference between the two waves of responses, which suggests that no significant non-response bias presents in this study. Since our data are gathered from a single respondent, Harman’s single-factor test was performed to examine the possibility of common method bias [17]. The results show that eight factors are presented and the biggest

variance explained is merely 20%. We conclude that no single factor emerges from the factor analysis and no general factor explains most of the variance. Accordingly, there is no serious common methods bias in our study.

### Questionnaire design

All items in the questionnaire are extracted from previous literature. We also include three control variables in our analysis – city, industry type, and plant size. Translation-back-translation was used to develop the Chinese version of the questionnaire. Then the questionnaire was pilot-tested by more than 40 manufacturing managers from China to ensure ensured that the it was comprehensible to the target Chinese respondents and was accurately translated from the original English version. All measurement items used to address these constructs are measured by seven-point Likert scales and listed the Appendix.

### Measurement validation

First, we conduct EFA to identify the constructs to be used in further analysis. The Cronbach’s alpha is used to verify the reliability of each construct recommended by Flynn et al. (1990). Second, we perform a confirmatory factor analysis (CFA) model using the LISREL 8.54 program to test the validity. Results show that the convergent and discriminant validity are insured.

## STATISTICAL ANALYSIS AND RESULTS

### Simultaneous equation method, system equation, and estimation

As suggested by [5] we test the first three hypotheses using the method of simultaneous equation. We use each of initiatives of mass customization system as dependent variable, competitive strategy as exogenous variables, and plus some control variables. The parameters in the equations are estimated by seamless unrelated procedure (sur) in SAS 9.0. The results are shown in Table 1.

Table 1 Results of Simultaneous Equation Method

	<i>Equation [1]</i>	<i>Equation [2]</i>	<i>Equation [3]</i>
	<i>Elicit</i>	<i>Pflex</i>	<i>Logis</i>
<i>Intercept</i>	1.05***	-0.10	1.32***
<b><i>Competitive Strategy</i></b>			
<i>CostL</i>	0.40***	-0.001	0.11**
<i>Diff</i>	0.08**	0.30***	0.13***
<b><i>Dimensions of Mass Customization</i></b>			
<i>Elicitat</i>		0.28***	0.22***
<i>Pflex</i>	0.14***		0.32***
<i>Logis</i>	0.13***	0.39***	
<b><i>Control Variable</i></b>			
<i>NoE</i>	0.052**	0.02	-0.03
<i>GZ</i>	0.55***	-0.29**	-0.52***

<i>SH</i>	0.18**	0.08	-0.41***
<i>Food</i>	-0.35***	0.13	-0.30*
<i>Textile</i>	-0.05	0.14	-0.40***
<i>Machine</i>	-0.25**	0.33***	-0.27**
<i>Plastic</i>	-0.12	0.05	-0.10
<i>Model statistics</i>			
<i>F value</i>	41.36***	28.16***	23.28***
<i>Adj R<sup>2</sup></i>	0.48	0.38	0.35

Table 1 shows that all of three system equations are significant. The adjusted  $R^2$  is 0.48, 0.38 and 0.35 respectively. Further, the regression coefficients of elicitation, process flexibility technology and logistics in each of three equations are all significant. For example, in equation [1], the coefficients of PFLEX and LOGIS are 0.14 and 0.13 respectively. Both of them are significant and positive. This indicates a positive association between elicitation, process flexibility and logistics. The adoption of elicitation is positively associated with both cost leadership and differentiation strategies. As to process flexibility technology, the estimated parameters in equation [2] suggested that PFLEX is positively related to elicitation, logistics system and differentiation strategy, but insignificantly related to cost leader strategy. Equation [3] shows that logistics system is positively associated with elicitation, process flexibility technology, cost leadership strategy and differentiation strategy. Therefore, H1a, H1b, H1c, H2a, H2c, and H3 are supported by our data but H2b is not.

### Performance implications of complementarities

We conduct two hierarchical regression analysis using cost performance and product/service quality performance respectively. In both regressions, we consider the main effects of three elements of mass customization system, i.e. elicitation, process flexibility technology, and logistics, in first step. In the second step, we add the interaction term between any two of three elements in first model.

Table 2a Results of Hierarchical regression

Variables	Model 1	Model 2	VIF in Model 1	VIF in Model 2
Elicitation (E)	.307***	.329***	1.214	1.486
Process flexibility (F)	.251***	.231***	1.395	1.663
Integrated logistics system (L)	.097**	.069*	1.413	1.494
E*L		.099**		1.627
F*L		.091**		1.229
E*F		.028		1.870
$R^2$	0.268	0.296		
$R^2$ Change	0.268***	0.028***		
F value	73.19***	41.77***		

Note: 1. Dependent variable is cost performance

2. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 2b Results of Hierarchical regression

Variables	Model 1	Model 2	VIF in Model 1	VIF in Model 2
Elicitation (E)	.384***	.404***	1.214	1.486
Process flexibility (F)	-.017	-.061	1.395	1.663
Integrated logistics system (L)	.190***	.195***	1.413	1.494
E*L		-.054		1.627
F*L		.089**		1.229
E*F		.125***		1.870
R <sup>2</sup>	0.230	0.251		
R <sup>2</sup> Change	0.230***	0.021***		
F value	59.87***	33.36***		

Note: 1. Dependent variable is product/service quality performance

2. \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

Table 2a shows that all main effects have significant and positive impact on firm's cost performance. And, the interactions between elicitation and logistics and between process flexibility technology and logistics are significant, which suggests complementarities improve cost performance. However, the interaction between elicitation and process flexibility is insignificant. The results demonstrate that the complementarity between elicitation and process flexibility has no positive effect on cost performance. Table 2b shows that all elements are positively related to product/service quality performance except process flexibility technology. The interaction terms between process flexibility technology and logistics and between elicitation and process flexibility technology are significant and positive. That means the process flexibility technology needs to work together with elicitation and logistics in order to be effective to product/service quality performance. The complementarity between elicitation and logistics are not beneficial to manufacturer's product/service quality performance. Therefore, H4a and H4b are partially supported by our data.

## DISCUSSION AND CONCLUSIONS

We find that both cost leadership and differentiation strategies positively related with mass customization practices and mass customizers should implement elicitation, process flexibility technology and logistics in a complementary manner. Moreover, our analysis suggests that manufacturers who can successfully exploit the complementary effect will outperform other competitors in terms of operational performance.

Although this study makes several academic and managerial contributions to supply chain management, it has some limitations that may represent future research directions. The use of Chinese data could also limit the generalization of the findings. Furthermore, the cross-sectional data used in this study limited the implications of the results. Therefore, the longitudinal study is required to validate our findings.

## REFERENCE

Due to the page limitation, references available upon request from [yinanqi@gmail.com](mailto:yinanqi@gmail.com)