



## Factors that influence Chinese automotive suppliers' mass customization capabilities



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### ABSTRACT

China is one of the largest and most rapidly growing automotive markets in the world. In such a dynamic environment, mass customization (MC) is considered crucial to developing and maintaining the competitiveness of automotive suppliers. Literature has suggested that the MC capability of a firm can be achieved by systematically (1) coordinating suppliers, (2) implementing modularity-based manufacturing practices, and (3) postponing key production steps that determine specialized product features and performance. However, since research has also indicated that the Chinese manufacturing context differs substantially from others around the world; it is unclear if these same MC practices are as applicable for Chinese automotive suppliers.

This study applies social dilemma and resource dependency theories to explore MC capabilities in Chinese automotive suppliers, and determines that some, but not all, MC practices are pertinent in the Chinese market. The practices which were found to be significant were: tactical alignment increases product and process modularity design; and product modularity design, process modularity design, and supplier segmentation can directly or indirectly increase mass customization capabilities. Relationships between tactical alignment and postponement practices and between postponement practices and mass customization capabilities were not found to be statistically significant in the Chinese context. These novel MC results are valuable since they can help guide automotive manufacturers and suppliers in their expansion into and throughout the Chinese market.

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### 1. Introduction

China presents a promising and unique automotive market. China became the largest automotive market in the world in 2009 and its year-on-year growth rate was predicted to be as high as 45% (The Guardian, 2010). At the same time, the Chinese manufacturing context differs substantially from others around the world due to its unique government structure, cultural expectations, and manufacturing priorities (Li, 2000a; Lockström et al., 2010; Zhao et al., 2006).

China's automotive manufacturing sector is a critical and complementary supply chain partner to many other industries, including corporations such as Sinopec (a petroleum and petrochemical producer) and auto design firms such as CH-Auto and IAT Automobile Technology Co. (Jones, 2011; Shirouzu, 2012;

Tang, 2009). Although the recent global economic crisis has had some limited impacts on volume, China's manufacturing sector has once again begun to expand (BBC, 2012). To remain successful in this dynamic environment, Chinese auto makers and their suppliers must continue to develop and reinforce a strong manufacturing and supply chain infrastructure (Li, 2012). Experiencing rapid changes and challenges in the automotive manufacturing sector, it has been suggested that the Chinese manufacturing sector must "reinvent itself to survive" (Yang, 2012). To do so in this fast growing economic sector, overall manufacturing infrastructure can be improved through strategies that address mass customization contextual factors (Li, 2000a, 2000b; Phaal et al., 2011).

Mass customization (MC) capabilities are considered crucial for manufacturing firms to remain competitive in response to the dynamics and the uncertainties across global supply chains. MC capability is "the ability to produce varieties of customized products quickly, on a large scale and at a cost comparable to mass-production through technical and managerial innovations" (Tu et al., 2004, p. 152). MC provides customer value with its

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responsiveness and cost effectiveness (Pine, 1993; Tu et al., 2004). MC can be achieved through manufacturing practices that are related to modularity (Pine, 1993; Tu et al., 2004) and postponement (Feitzinger and Lee, 1997; Van Hoek et al., 1999; Li et al., 2006). At an industry level, Hallgren and Olhager (2006) have suggested that the level of MC is affected by factors that are related to product, market, and process capabilities.

Research has previously addressed certain manufacturing issues in Chinese food production and furniture industries at companies such as Shineway, Yurun Co. Ltd., and Shanghai Aurora Furniture (Han et al., 2011; Robb et al., 2008), Chinese global supply chain management practices (Lee and Humphreys, 2007; Li et al., 2012), or some other aspects of the Chinese automotive industry in companies such as Dongfeng and Changguang Battery Co. Ltd. (Fuchs et al., 2011; Lockström et al., 2010; Mao et al., 2009). Hallgren and Olhager (2006) examined the implementation of MC strategies in a global context. However, Zhao et al. (2006) found that none of the manufacturing strategies found by other researchers in the rest of the world (based on data from the US, South America, Europe, and Asia Pacific) were found in their Chinese study. This finding suggests that research results from other contexts may not be readily applicable to China.

While a few recent studies have examined the Chinese automotive suppliers (Liao and Hong, 2007; Liao et al., 2011; Lockström et al., 2010), research focusing on the implementation of MC strategy and particularly its related factors in the Chinese automotive industry is rare (Lin et al., 2012; Yao and Liu, 2009). The understanding of what factors will influence Chinese automotive suppliers' MC capabilities remains limited. This study therefore intends to fill the research gap on mass customization strategies in the Chinese automotive sector and contribute to operations management research by exploring the following questions:

- (1) What are the major theoretical and literature-derived practices for achieving mass customization (MC)?
- (2) Are the previously supported MC relationships (built on theory and verified by data from predominantly Western supply chains) still applicable for suppliers in China?
- (3) Are there any specific MC findings that can be derived from data provided in the context of Chinese automotive suppliers?

The remainder of this paper is organized as follows. Section 2 builds a theoretical framework for achieving mass customization capabilities, including construct definition and hypotheses development. Instrument and large-scale survey development are described in Section 3. Section 4 reports the results of measurement model and hypotheses testing and examines the analytical

results. Discussion is presented in Section 5 and conclusions and limitations are provided in Section 6.

## 2. Theoretical framework and hypotheses

Literature has suggested that the mass customization capability of a firm can be achieved by systematically (1) coordinating suppliers, (2) implementing modularity-based manufacturing practices, and (3) postponing key production steps that determine specialized product features and performance (Lee, 2004; Krishan and Ulrich, 2001; Salvador et al., 2002; Tu et al., 2004; Pine, 1993; Feitzinger and Lee, 1997; Van Hoek et al., 1999; Li et al., 2006). Four MC practices suggested in the literature include supplier segmentation (Dyer et al., 1998), modularity product design (Krishan and Ulrich, 2001; Salvador et al., 2002; Tu et al., 2004), modularity process design (Pine, 1993; Tu et al., 2004), and postponement practices (Feitzinger and Lee, 1997; Van Hoek et al., 1999; Li et al., 2006). However, these four practices cannot be automatically implemented by supply chain members (i.e., buyers and suppliers) without an integration mechanism that stimulates suppliers to encourage all supply chain members to utilize mass customization products, markets, and process capabilities.

Previous literature has suggested that the supply chain strategy of partner relationships can influence the buyer–supplier structure in a process that adheres to the precepts of social dilemma theory and resource dependency theory (Zeng and Chen, 2003), specifically through the reciprocity payoff structure between a buyer and a supplier (i.e., tactical alignment). Tactical alignment strongly binds buyers and suppliers on responsibility allocations and can therefore lead to effective and efficient activities of modularity-based practices and postponement practices (Lee, 2004).

This study develops an integrated model to link tactical alignment to MC practices and, then, to MC capabilities. The research model is based on the theories of mass customization, supply chain management, social dilemma, and resource dependency. Each is briefly described in Section 2.1. The constructs and hypotheses of the proposed relationships between these constructs are defined and supported through a more thorough literature review provided in Sections 2.2–2.6.

### 2.1. Theoretical model

#### 2.1.1. Mass customization and supply chain practices

To satisfy demanding customers, MC utilizes modularity product design, modularity process design, postponement process design, and supplier segmentation. The supply chain practices addressed in this study will therefore be modularity product

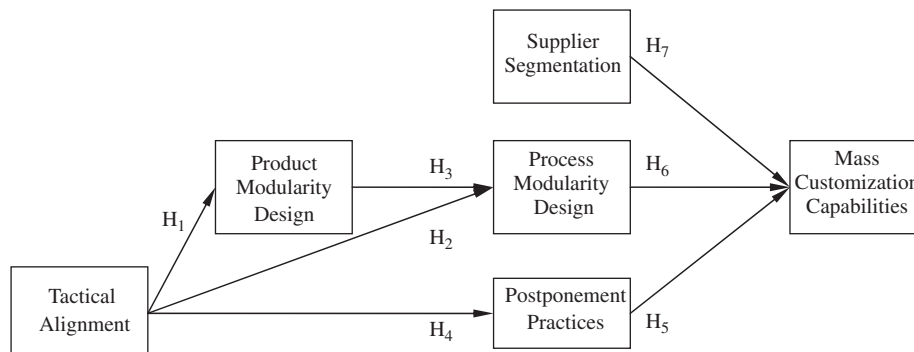


Fig. 1. The research model.

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