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Implementation of a responsive supply chain strategy in global complexity: The case of manufacturing firms

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ABSTRACT

Although a responsive supply chain is an integral part of order-winning manufacturing strategies, it has not been clear how firms build a responsive supply chain in global manufacturing environments. Built upon a synthesis of the existing literature and relevant theories, this paper presents a research model that defines the drivers, strategy, and practices of a responsive supply chain and the performance outcomes. This paper is one of the rare empirical studies that identify key variables relevant to the implementation of a successful responsive supply chain. The effective implementation of a responsive supply chain requires a careful definition of a responsive supply chain strategy in terms of the product range, and the frequency and innovativeness of the product offerings. Firms also need to provide key implementation practices (i.e., sharing of information with customers, collaboration with suppliers, use of advanced manufacturing technology) to achieve pull production to achieve responsiveness to the market. This study also suggests that the key contextual factors that influence the extent of implementation of a responsive supply chain strategy are mostly the size of firms, industry characteristics, and customer and supplier bases, rather than the location of manufacturing firms. This paper shows that the effective implementation of a responsive supply chain strategy involves the integration of inter-organizational resources (i.e., socio-relational and techno-process integration) across the global supply chain to enhance pull production capabilities.

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1. Introduction

In an era of worldwide economic downturn, a global supply chain is fraught with greater demand uncertainty, higher risk, and increasing competitive intensity. As such, the success of global manufacturing activities often hinges on a manufacturing firm's flexibility in terms of its ability to adapt its supply chain to dynamic changes in customer needs and preferences. Since such flexibility can be enhanced by increased access to real-time customer information throughout the supply chain, many leading-edge manufacturing firms have attempted to enrich their customer information sources and share real-time customer information with their supply chain partners. Thus, the main principle of supply chain management (SCM) is that firms must become more customer-centric, information-intensive, and flexible. This is referred to henceforth as "responsive" SCM. Responsive SCM is different from traditional SCM in that the former aims at increasing customer bases and long-term

profitability through agile demand planning, whereas the latter has focused heavily on increasing cost-saving opportunities through improved efficiency in outsourcing, production planning, and logistics processes. Although improved efficiency throughout the end-to-end supply chain can enhance a firm's competitiveness, it will not necessarily make the firm an order winner. The rationale is that improved efficiency alone will not help the firm differentiate its products from those of its competitors.

For example, auto parts makers that won accolades for efficient manufacturing have suffered from hyper-competition and have gone bankrupt due to their failure to make their operations more flexible (Hugos, 2007). Similarly, Motorola's market share in the U.S. cell phone industry plummeted from 60% in 1994 to 31% in 1998 and then to 16% in 2002 due to its lack of responsiveness to the growing customer demand for digital technology (Finkelstein, 2003). To make it worse, Motorola in 2008 laid off 150 research and development (R&D) staff in its attempt to reduce product development costs and was criticized by its customers for uninspired hand-set lineups that contributed to further losses in its revenue and market share in the cell phone industry (Deffree, 2008). As these examples illustrate, the efficiency-based supply chain often presumes that customer demand is predictable or stable. However, this assumption often does not hold for highly

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customized and short life cycle products such as toys (Wong et al., 2006); semiconductor (Donk and Vaart, 2007), fashionable apparel (Brun and Castelli, 2008; Storey et al., 2005), personal computers (Kapuscinski et al., 2004), consumer electronics (Catalan and Kotzab, 2003), and automobiles (Holweg, 2005). Indeed, Lee (2004) observed that efficiency-based, cost-saving supply chains tend to be more vulnerable to unanticipated shifts in customer demand than do responsive supply chains. Similarly, Porter (1996) argued that efficiency-based, cost-saving supply chains might lead firms to concentrate on short-term gains instead of long-term profitability and thus such firms might be reluctant to invest in new product development and technological innovations more suited to changing customer needs and preferences.

As an alternative to the efficiency-based supply chain, Heikkilä (2002), Reichhart and Holweg (2007), and Gunasekaran et al. (2008) have examined a responsive supply chain that can better cope with today's demand oscillation. However, the influence of a responsive supply chain strategy on a firm's performance has yet to be tested empirically. To initiate such empirical research, this paper attempts to make the following contributions: First, this paper conceptualizes a responsive supply chain and clarifies its role in improving strategic advantages from a focal company perspective. Second, this paper constructs an integrative research framework that captures the essence of a responsive supply chain based on a synthesis of prior studies. Third, this paper empirically assesses the impacts of a responsive supply chain strategy on a firm's performance and subsequent competitiveness.

To put it simply, a responsive supply chain focuses on market responsiveness as a core element of the supply chain processes. It aims to increase customer value throughout the supply chain. To elaborate, the main objectives of a responsive supply chain are (1) to improve agility in order to enhance responsiveness to customer demands. In other words, the responsive supply chain aims at providing customers with the right product at the right time in the right place by utilizing point-of-sales information; (2) to increase flexibility in order to respond to changing customer demands by streamlining and centralizing the supply chain planning processes including new product development and market expansion; (3) to reduce risk by removing the potential sources of supply chain bottlenecks and disruptions. In this paper, we will examine how significantly a responsive supply chain strategy influences the level of information sharing with end-customers, the development of collaborative practices with suppliers, the use of advanced manufacturing technology, and the pull production strategy that has been employed as a way to improve manufacturing efficiency.

2. Theories of responsive supply chain management

Over the last two decades, supply chain management (SCM) has risen to prominence due to its emphasis on long-term strategic benefits including strategic alliances (or business linkages) among a network of business organizations (Hong et al., 2009b; Brown and Bessant, 2003; Storey et al., 2006). Acknowledging the strategic focus of supply chains, a number of researchers have examined the different roles that strategy plays in improving supply chain efficiency. Among these researchers, Fisher (1997) observed that product characteristics influenced demand variability, while lead time dictated the type of supply chains that shaped different forms of supply chain strategy. More recently, the paradigms of build-to-order production and rapid-fire order fulfillment have been presented as a viable strategy that helps to improve supply chain responsiveness to volatile demand (Gunasekaran and Ngai, 2005; Reichhart and Holweg, 2007; Holweg, 2005; Sharif et al., 2007). This stream of research aims to understand the front end of the demand side better and then to

make the supply chain effective through extensive, proactive information sharing with customers (Sharif et al., 2007). In fact, a clear understanding of customer demand through proactive information sharing with customers allows a manufacturing firm to better understand the dynamics of changing customer demand and then gives such a firm more incentives to collaborate with its suppliers to reduce demand uncertainty (Holweg and Pil, 2001; Holweg et al., 2005). Such proactive interaction with customers and suppliers eventually enables a manufacturing firm to streamline its production process from downstream to upstream in the supply chain, thereby making its pull production process seamless.

2.1. The order winner and order qualifier framework

Hill (2000) stressed that the purpose of manufacturing strategy should not be limited to operational efficiency but, rather, should be extended to the creation of strategic advantages by reflecting on market volatility and trends. This can be made possible by meeting both order-qualifying and order-winning criteria (Hill, 2000). To meet order-qualifying and order-winning criteria, management needs to determine the specific domains of its manufacturing system (Hill, 2000; Slack and Lewis, 2002). Five domains are identified by Skinner (1965, 1985): (1) plant and equipment; (2) production planning and control; (3) labor and staffing; (4) product design and engineering; and (5) organization and management. Slack and Lewis (2002) rework the content of manufacturing strategy into four areas: (1) capacity; (2) supply networks; (3) process technology; and (4) development and organization. These four areas involve structural and infrastructural issues. In this reworking, a structural domain is defined as "the physical arrangement and configuration of the operation's resources," such as the physical size and location of operations, while an infrastructural domain is referred to as "the activities that take place within the operation's structure," such as process technology (Slack and Lewis, 2002). Thus, the ultimate aim of management is to match "the performance of an operation's resources with the requirements of its markets" (Slack and Lewis, 2002).

Mason-Jones et al. (2000) extended the concepts of order winners and order qualifiers to the supply chain context. These authors regarded order qualifiers as market qualifiers and order winners as critical differentiators. They observed that firms striving for a lean supply chain regarded quality and reliability as market qualifiers, while low price was viewed as an order winner. Similarly, firms stressing supply chain agility tended to view quality and reliability as market qualifiers, while regarding lead time as an order winner. In these authors' argument, what differentiates the agile supply chain from the lean supply chain is the increased velocity of supply chain operations. Their view was shared by Aitken et al. (2005), who underscored the importance of supply chain agility for winning orders. Aitken et al.'s study also recognizes the order winner and order qualifier framework proposed by Hill (2000) as the important aspect of supply chain strategy. In particular, as Fig. 1 displays, direct linkage to a responsive supply chain strategy using the order winner and order qualifier framework is relevant to both responsive and lean supply chain strategies.

Since this framework reflects market status as it was until the late 1990s, it is not up to date. In the 21st century, the competition has become more intense and technology development has been accelerated. As a result, the product development life cycle has been shortened and product variety has been increased considerably. Customers go beyond acceptable quality and ask for more innovative and eye-catching products. For example, Apple captured the hearts of its customers by introducing innovative, fashionable products such as iPod, iTunes, iPhone, and iPad. Likewise, Nintendo transformed the landscape of competition in the video game market and broadened its customer bases by

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