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Designing supply chains: Towards theory development

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Abstract

This paper describes a typology for designing supply chains that work in harmony to design, produce, and deliver products with different characteristics and customer expectations. This research discusses supply chain types that are necessary for success across three types of products: standard, innovative, and hybrid. It develops a framework for categorizing the supply chain types according to product characteristics and stage of the product life cycle. The key success factor for a product change as the product moves through its life cycle, and this may require different supply chain characteristics and capabilities. The paper blends literature and theory development with cases study research to create the typology and develop a set of research questions for further investigation.

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1. Introduction

With uncertainty in customer expectation, quantum leaps in technology and high-speed Internet links, business transcends local and national boundaries. In this environment, organizations face sophisticated customers who demand increasing product variety, lower cost, better

quality, and faster response. To compete successfully, organizations are embracing supply chain management (SCM) because it focuses on actions along the entire value chain (Bechtel and Jayaram, 1997; Childerhouse et al., 2002; Tan, 2001; Vonderembse, 2002). The supply chain perspective is predicated on the fact that competition is shifting from firm versus firm to supply chain versus supply chain, and SCM is the approach to designing, organizing, and executing these activities.

SCM integrates suppliers, manufacturers, distributors, and customers through the use of

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information technology to meet customer expectations efficiently and effectively (Ansari, 1990; Childerhouse and Towill, 2002; Choi and Hong, 2002; Huang et al., 2003; Quinn, 1997; Rich and Hines, 1997; Thomas and Griffin, 1996). As a result, groups of companies can respond quickly and in a unified manner with high-quality, differentiated products demanded by fastidious final consumers while achieving system-wide advantages in cost, time, and quality (Carter, 1996; Christopher, 1992; Davis, 1993; Hewitt, 1994; Mabert and Venkataramanan, 1998; Persson and Olhager, 2002; Vonderembse 2002).

As competition shifts from a company orientation to a supply chain orientation, SCM is touted as a strategy of choice for successful competitors (Quinn, 1997; Rich and Hines, 1997). For example, in the automotive industry, competition is among DaimlerChrysler, Ford, Toyota, etc. and the supply chains that enable each of them to deliver finished product to the final customer. The development, design, production, marketing, and delivery of new cars is a team effort that begins with extracting raw materials from the earth, continues through design, fabrication, and assembly, and ends with fit and finish in the dealer's show room. When a customer buys a car, the customer chooses the output of the entire supply chain and pays all the participants. To be successful, automotive companies must develop an approach to design, organize, and execute supply chain activities from its roots in basic materials such as extracting iron ore, sand, and crude oil to the dealer network. This does not mean ownership or even direct control, but it does imply mechanisms that influence decision-making and impact system-wide performance.

Questions remain about how supply chains function and how deeply supply chain concepts are ingrained in manufacturing organizations. Recently, researchers are investigating the factors needed to design and build effective supply chains (Childerhouse et al., 2002; Cooper and Ellram, 1993; Mabert and Venkataramanan, 1998; Narasimhan and Jayaram, 1998; Pagh and Cooper, 1998; Persson and Olhager, 2002; Walker et al., 1999, 2000). This research discusses strategies and

methodologies for designing supply chains that meet specific customer expectations. Supply chain design should be, in part, a function of the product characteristics and expectations of the final customer (Calantone et al., 2002; Fisher, 1997; Reiner and Trcka, 2004; Singhal and Singhal, 2002). The research examines three types of products: standard, innovative, and hybrid, and it describes supply chain characteristics that are essential for success. Other product types may exist, but this study is limited to these three.

Standard products have stable demand, and their design characteristics and production requirements change slowly over time. As a result of this stability, customer contact tends to be periodic rather than continuous (Mason-Jones et al., 2000). Commodities like staples or fasteners are standard products that require straightforward supply chains with few participants. More interesting examples of standard products would be small appliances or hand tools like toasters or saber saws because they tend to have several suppliers providing important components. These products are usually in the latter part of the growth segment of their product life cycle or beyond.

Innovative products are new or derivative products that are aimed at new customers and markets and are designed to be adaptable to changing customer requirements. These products require close and continuous customer contact, have uncertain demand, and their product designs may be unstable (Fisher, 1997; Mason-Jones et al., 2000). Innovative products are usually in the introduction and growth stages of the product life cycle. Emerging communication technology is an example. Innovative products can also be derivative or differentiated products that re-ignites the growth potential of a product in the mature phase of the product life cycle. New computer chips and software upgrades are examples.

Hybrid products are complex products that have several to many components, which may be a mixture of standard and innovative products. Automobile or other assembled products are examples. These products are usually major purchases that are made periodically by customers after careful consideration and investigation.

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