

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. It discusses supply chain types that are necessary for success across three types of products: standard, innovative, and hybrid.

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 because it focuses on actions along the entire value chain. The supply chain perspective is predicated on the fact that competition is shifting from firm versus firm to supply chain versus supply chain, and supply chain management is the approach to designing, organizing, and executing these activities.

Supply chain management (SCM) integrates suppliers, manufacturers, distributors, and customers through the use of information technology to meet customer expectations efficiently and effectively. 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.

As competition shifts from a company orientation to a supply chain orientation, supply chain management is touted as a strategy of choice for successful competitors. 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. For success, companies must develop an approach to design, organize, and execute supply chain activities.

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. 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. 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.

SUPPLY CHAIN TYPES

A lean supply chain (LSC) employs continuous improvement efforts that focus on eliminating waste or non-value steps along the chain. It is supported by efforts to achieve internal manufacturing efficiencies and setup time reduction, which enable the economic production of small quantities and enhance cost reduction, profitability, and manufacturing flexibility to some degree. The short setup times provide internal flexibility, but a LSC may lack external responsiveness to customer demands, which can require flexibility in product design, planning and scheduling, and distribution in addition to manufacturing.

As the rate of market change increases, the LSC approach has evolved into “multiple niche competition,” which is the production of any volume, even a single unit, combined with the ability to satisfy multiple market segments. Organizations recognize that along with the added variety and responsiveness squeeze, they must remain adaptable to future changes. Customer requirements are continuously evolving and product life cycles are growing shorter, therefore, along with being lean, supply chains must respond to the market. As a result, successful organizations move from concept to cash flow in a fraction of the time.

The agile supply chain (ASC) paradigm relates to the interface between companies and markets, an external perspective on flexibility. Successful implementation involves responding to rapidly changing and continually fragmenting global markets by being dynamic, context-specific, growth-oriented, flexible across the organization, and driven by customer. An ASC focuses on responding to unpredictable market changes and capitalizing on them through fast delivery and lead-time flexibility. It deploys new technologies, methods, tools, and techniques to solve unexpected problems. It utilizes information systems and technologies as well as electronic data interchange capabilities to move information faster and make better decisions. It places more emphasis on organizational issues and people (knowledge systems and empowered employees), so decision-making can be pushed down the organization. It is a systemic approach that integrates the business, enhances innovations across the company, and forms virtual organizations and production entities based on customer needs.

In addition to lean and ASCs, this research proposes the existence of an intermediate chain known as the hybrid supply chain (HSC). A HSC generally involves “assemble to order” products whose demand can be forecasted with a relative accuracy. The chain helps to achieve mass customization by postponing product differentiation until final assembly. The lean or agile supply chain techniques are utilized for component production with different characteristics. For example, air bags would most likely be produced with a LSC while engine electronics might require the innovation found in an ASC. In addition, the agility is needed to establish a company-market interface to understand and satisfy customer requirements.

IDENTIFY PRODUCT TYPES

Understanding the characteristics of the product is essential to design a supply chain that meets customer expectations. This section describes three product types (standard, innovative, and hybrid), relates these product types to the product life cycle, and discusses the factors that are critical for designing effective supply chains.

Standard Product

The market for standard products tends to be stable, and demand can be forecasted accurately. Standard products tend to have long life cycles where designs change incrementally. This ensures well-defined and predictable processes for product design and manufacturing. Manufacturer may find it useful to establish a long-term relationship with its suppliers for high quality materials, just-in-time delivery, and quantity discounts. With predictable demand patterns and consistent processes, cost minimization can be pursued very effectively, especially in the mature phase of the product life cycle. The characteristics of the LSC fit the needs of the standard product well.

Innovative Product

Innovative products are new products that require sophisticated design and/or manufacturing capabilities. They are significantly different from current products, and they often represent a breakthrough in product concept and design. They often satisfy emerging customer needs and in some cases needs that customers have yet to articulate. They usually command a premium price, which has the potential to increase profits. Innovative products generally have a shorter product life cycle than standard products. Once introduced and found to be successful, competitors quickly emulate innovative products because they command premium prices. As demand grows and competitors emerge, innovative product can become standard product where cost and quality are dominate characteristics. This forces the original manufacturer to constantly interact with customers to generate new ideas that drive a steady stream of new and improved product types.

Hybrid Product

The hybrid product is a complex product that includes a mix of standard and innovative components. To respond, LSC and ASC are combined to provide the components needed in final assembly. The link with the final consumer of the hybrid products is based on the concept of agility. Hybrid products tend to have a long product life cycle with a certain degree of improvement or innovation offered periodically. These innovations most frequently occur at the module or component level. For example, in automobiles, fuel injectors have replaced carburetors to increase fuel efficiency, and air bags have supplemented seat belts to improve safety. A critical decision for the manufacturer is often what to produce inside the company and what to buy from suppliers.

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