Chapter VIII

Understanding and Managing the Intrinsic Dynamics of Supply Chains

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Abstract

Both academically and practically, one of the most interesting aspects of supply chains is their intrinsic dynamic behavior. Dynamic interactions can cause unexpected and undesirable results. There are both external and internal reasons for this. Externally, severely competitive environments, consumer behavior and technological innovations are major concerns for supply-chain management. These affect both the structure and behavior of the supply chain and force it to be more flexible and agile. Internally, the supply chain is a multi-echelon system composed of a scratched-together and shifting set of players whose preferences and
intentions often differ. This may create and amplify the information distortions, lags, and tricks of business within the supply chain. The combined effects of these external and internal factors make Supply Chain Dynamics (SCD) active and complex. In this chapter, we discuss the influences, mechanisms, and effects of SCD.

Supply Chain Dynamics

“A supply chain is dynamic and involves the constant flow of information, products and funds between different stages. Each stage of the supply chain performs different processes and interacts with other stages of the supply chain.” (Chopra & Meindl, 2001, pp. 4-6)

This statement points out the essence of SCD. It is an interaction of processes among participants from different companies and levels. The purpose of supply chain management is to maximize supply chain profitability, which is total profit to be shared across all supply chain stages. It can be concluded that the essence of the supply chain is its dynamics and that how to manage it is one of the most important tasks to maximize supply chain profitability.

SCD features arise from external and internal factors. External factors are drivers for the supply chain to change its structure and therefore have a close relationship with the planning and designing process. Major external factors are the intensity of competition, consumer behavior and technological innovations. Severe competition in the market puts pressure on manufacturers, distributors and retailers to cut costs while maintaining the same quality or service level (or increase the quality or service level under the same costs). The supply chain becomes the major arena for competition in modern business because it is often inefficient for any single company to produce a whole product and maintain the entire, often global, distribution channel (Bradley et al., 1999). As supply chains become worldwide, they must cross the boundaries between company groups. Hence, severe competition in the market makes the supply chain very important and forces it to change continuously.

We find the following analogy helpful in connection with these concepts. Consider the first order vector linear differential equation system given by $x'(t) = Ax(t) + u(t)$. Here, $u(t)$ is an exogenous vector input series that may be regarded as analogous to the external influences on the system. While the
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