



Review

Competitive supply chain network design: An overview of classifications, models, solution techniques and applications



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ABSTRACT

Supply chain network design (SCND) determines the structure of a chain and affects its costs and performance. SCND deals with a variety of decisions such as determining number, size and location of facilities in a supply chain (SC) and may include tactical decisions (such as distribution, transportation and inventory management policies) as well as operational decisions (such as fulfilling customers demand). SCND has a voluminous literature. Most of the literature deals with a single SC and ignores the existing competitor SCs and future emerging ones. However, SCs compete together to capture more market shares. Even if there is not any competitor at the moment, SCs should be prepared for possible future competitive situation at the SCND stage. On the other hand, many competitive models assume that the supply chain network (SCN) and its structure already exist. Few research papers consider both aspects of design and competition. In this paper, we provide a review of SCND literature and highlight the effects of competitive environment on SCND. We review, classify, and introduce the major features of the proposed models in both SCND and competition literature. After investigating proposed competitive SCND models we develop a general framework for modeling the competitive SCND problems considering managerial insight and propose potential areas for future research.

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Contents

1. Introduction	93
2. Scope and research methods	95
3. SCND classifications, paradigms and analyses	100
3.1. SCND decisions and classifications	100
3.2. SCM and SCND paradigms and classifications	100
3.2.1. Lean SC	100
3.2.2. Agile/responsive SC	100
3.2.3. Green SC	100
3.2.4. Sustainable SC	100
3.2.5. Risk management in SC	101
3.3. Critical analysis	101
4. Competitive models	101
4.1. Competition in business context	101
4.2. Competitive characteristics	102
4.3. Classification of competitive characteristics	102
4.4. Review of different types of competition	102
4.4.1. Static competition	102
4.4.2. Dynamic competition	102
4.4.3. Competition with foresight	102

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4.5.	Customer behavior in competitive markets	102
4.5.1.	Certain customer behavior	103
4.5.2.	Uncertain or probabilistic customer behavior	103
4.6.	Competition between SCs	105
5.	Competitive SCND	105
5.1.	Static competition in SCND	106
5.2.	Dynamic competition in SCND	106
5.3.	Competition with foresight in SCND	106
6.	Case examples of competitive SCND	107
6.1.	Car manufacturing SCNs	107
6.2.	Airline SCNs	110
6.3.	Online bookstores SCNs	110
6.4.	Apparel manufacturing SCNs	110
6.5.	Agri-food SCNs	110
6.6.	Poultry SCNs	110
6.7.	High-tech SCNs	110
7.	Competition in special SC and logistics networks	111
7.1.	Competitive global SCND	111
7.2.	Maritime SCN	111
7.3.	SCN and disaster	112
7.4.	Urban logistics network	112
7.5.	Humanitarian/relief SCND	112
8.	Managerial contribution and framework	113
8.1.	Classifications	113
8.2.	Framework and structure of competitive SCND	113
8.3.	Managerial insight	114
9.	Future research	114
9.1.	Knowledge management in competitive SCND	114
9.2.	Incremental and dynamic SCND and competition	115
9.3.	Competitive SCND in decentralized markets	116
9.4.	SCND for competitive markets in procurement	116
9.5.	Multi-criteria SCND	116
9.6.	More realistic SCND objectives	116
	Acknowledgments	116
	References	116

1. Introduction

Today's marketplace is competitive and dynamic. Rapid technology development, globalization and customers' varied expectations are changing the type of markets' competitions from competitive independent firms to competitive supply chains (CSCs) [17,129,134]. Today's e-business circumstance is another key factor that makes it possible for different firms to be able to compete as integral part of SCs. Naturally, efficient coordination of individual firms in the form of SCs requires better management of material flow throughout their network structure.

According to Deloitte Consulting report [28], experts of different large industries in America and Canada comprising automotive, high-tech, aerospace and consumer product industries believe that in the near future instead of competition among individual firms, the whole SCs will compete against each other. There are several instances of competing SCs in different industries; the competition between amazon.com and barnesandnoble.com in the book market [13], the competition between Microsoft-HTC and Nokia-Symbian SCs in the electronic industry [129].

Moreover, Rice and Hoppe [99] believe "The conventional wisdom is that competition in the future will not be company vs. company but SC vs. SC. But the reality is that instances of head-to-head SC competition will be limited. The more likely scenario will find companies competing-and winning-based on the capabilities they can assemble across their supply networks".

According to a Delphi study conducted in Massachusetts Institute of Technology (MIT), majority of respondents (around 70%) agreed that SC vs. SC will be type of completion in the future [99]. On the other hand, SC networks (SCNs) play a key role in this

competition; the respondents' opinions about "how SCs will compete" is as follows [99]:

- 36 % believe formal SC vs. SC compete (strategic set of firms in supply network compete).
- 5% believe informal SC vs. SC (set of firms in supply network compete) compete.
- 23% believe the most powerful firm (so-called channel master) determines competition.
- 14% believe single firm competes on supply network design.
- 23% believe firm competes on costs of supply network and/or capabilities of service.

It seems that CSCs are the leading entities of today and future markets. Thus the competitiveness should be considered in all stages of designing new SCs. Designing the physical network structure of a chain is called SCND. Due to the fact that the structure of a SC has a great effect on its overall performance, resilience, costs and competitiveness [108] SCND is considered as one of the most important stages of designing a new chain which impacts all the future tactical and operational decisions of the chain.

Simchi-Levi and Kaminsky [117] consider SCND as the primary and the most important step for decreasing (increasing) the whole costs (profits) of chains. SCND deals with making decisions at different levels, from the strategic ones (about the characteristics of facilities such as size, type and locations) to some more tactical decisions about shipment and inventory The strategic and costly SCND decision has the most significant impact on return on investment (ROI) of the chain [117]. Considering the impact of competitive markets in designing the network structure of a chain

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