Journal of Purchasing & Supply Management 21 (2015) 51–63

Contents lists available at ScienceDirect

Journal of Purchasing & Supply Management

journal homepage: www.elsevier.com/locate/pursup

Distribution co-opetition and multi-level inventory management performance: An industry analysis and simulation

Jeff Shockley[a,*], Gary Fetter[b,†]

[a] Department of Supply Chain and Information Management, School of Business, College of Charleston, 66 George Street, Charleston, SC 29424, USA
[b] Department of Information and Decision Science, College of Business, Valparaiso University, 1909 Chapel Drive, Valparaiso, IN 46383, USA

ARTICLE INFO

Article history:
Received 15 November 2012
Received in revised form
15 September 2014
Accepted 20 September 2014
Available online 11 October 2014

Keywords:
Co-opetition
Inventory management
Supply Chain
Beer game
Simulation

ABSTRACT

Research notes supply chains where competitors selling the same types of products at the same level of the supply chain may work together to achieve superior profits, using the term "co-opetition" to describe the phenomenon. Using a co-opetitive supply chain design in the bearing and power transmission industry as a practical guide, we develop a multi-level simulation to compare the effects of serial versus a co-opetitive supply chain design on inventory management, order fulfillment, and cost performance. Specifically, we examine supply chain network membership, product demand volatility, and in-transit shipping consolidation effects in our model. This research aims to (1) quantify the performance benefits to be expected from co-opetition and (2) examine the structural conditions present that may enable these co-opetitive networks to achieve value-added inventory cost and delivery performance. We find that the co-opetitive distribution strategies can significantly improve inventory management performance when supply chains have a larger number of competing products, manufacturer's product freight-billing allows for in-transit shipping, and supply networks have a longer reach.

1. Introduction

In this study, we examine the supply network elements of co-opetitive integration efforts within a specific industry distribution channel to improve supply chain inventory management performance. Supply chain management research has adopted the term "co-opetition" (Brandenburger and Nalebuff, 1996) for describing horizontal supply chain relationships where suppliers both "compete and collaborate with each other simultaneously" (Bengtsson and Kock, 2000, p. 411). Additional value can be created in these networks when manufacturers competing in the same industry can effectively coordinate their distribution functions, exploit mutually beneficial transshipment opportunities, or can work in joint product/process development efforts. However, supply chain goals must first be aligned by developing measurements and/or incentives within the supply chain structure that protect a firm from exploitation (or opportunism) by other member firms (Hamel et al., 1989).

How pervasive is supply chain co-opetition? In the beverage industry, producers Nestle and Ocean Spray have worked together to expand supply chain collaboration efforts into areas such as procurement, purchasing, and warehouse management for similar product lines (Seigfried, 2012). Academic research argues cooperative linkages like these between and among product or part suppliers have proliferated (Gomes-Cassares, 1996), and that as many as 50% of all alliances involve competitors in the same industry (Harbison and Pekar, 1998). Firms want to fully optimize their existing supply network structures, even if that means working with an industry competitor to share transportation costs, to handle volatile demand, or to effectively manage an evolving customer base (Seigfried, 2012). Similarly, Lejeune and Yakova (2005) suggested that supply chains will follow evolutionary patterns in which higher levels of trust and goal congruence are achieved as parties develop stronger distribution relationships. Therefore, we may see more co-opetitive supply chains emerge over time in different industries, and more opportunities to expand supplier collaborations to improve distribution effectiveness.

Despite the literature espousing supply chain co-opetition, little research has quantified inventory management performance benefits or has considered how these networks are optimized for specific industries. Schmoltzi and Wallenburg (2011) note that 50–70% of all horizontal joint ventures will fail because the performance implications from such alliances are unclear for the participating firms. While some research has examined actual supply chain collaborative-competitive structures using more qualitative case study approaches (e.g., Bengtsson and Kock, 2000), it is

* Corresponding author. Tel.: +1 843 953 7070.
E-mail address: shockleytj@cofc.edu (J. Shockley).
† Deceased as of October 17, 2014.

http://dx.doi.org/10.1016/j.pursup.2014.09.002
1478-4092/

important to both quantify co-opetitive supply chain performance benefits and to examine the impact of key structural interactions present in specific supplier networks. There is also little practical guidance to structure these arrangements to improve distribution performance effectiveness. As such, it is important to explain the underlying mechanics of complex supplier systems (Buhman et al., 2005), as well as demonstrate their broad performance impact.

Inventory management and fulfillment performance metrics are critical for studying different supply chain systems. For example, multi-level supply chain simulations are used in a variety of research studies to examine inventory management performance and the effect of different ordering conditions, and/or inventory control policies, within different supply networks (e.g., Sterman, 1989; Chen et al., 2000; Chen and Samroengraja, 2000; Dejonckheere et al., 2003; Croson and Donohue, 2003; Chatfield et al., 2004), but no known studies have quantified the potential inventory and fulfillment performance benefits of co-opetitive distribution systems. Specifically, this research explores the following research questions by analyzing a supply chain design in the bearing and power transmission equipment industry:

- What co-opetitive distribution structures may be most effective at improving inventory flow coordination, lowering total supply chain costs, and improving stockout performance for a particular supply chain?
- How might performance vary under the different structural conditions (shipping-type, product proliferation and variability, number of competing network members/products, etc.) that are particularly germane to co-opetitive distribution networks for a specific industry?

For purposes of this research, “performance” considers only the inventory fulfillment performance of the industry supply chain. Supply chain inventory total cost, amplification of orders, response time, and the number of stockouts will be the primary outcome metrics of interest, consistent with other studies that have examined inventory management by players in behavioral “Beer Game” experiments (Croson and Donohue, 2003), or those using forecast-ordering simulations for modeling performance in multi-level (multi-echelon) supply chains (e.g., Chen et al., 2000; Chen and Samroengraja, 2000; Dejonckheere et al., 2003; Chatfield et al., 2004).

1.1. *Organization of the paper*

In Section 2, we briefly review the relevant theory on co-opetition, demand coordination hubs and consortiums, the Bullwhip Effect, and the use of simulations for examining multi-level supply chain inventory management performance. In Section 3, we analyze co-opetition in the North American bearing and power transmission (BPT) equipment industry supply chain to illustrate how the network is structured for co-opetition. Section 4 estimates the supply chain performance benefits of co-opetition using a multi-level supply chain simulation. Section 5 then discusses the research findings and contributions, and explores possible future research areas.

2. Theoretical development

When companies share information vertically within the supply chain, the network benefits because its members can more effectively coordinate their ordering and inventory control policies (e.g. Lee et al., 1997). Research consistently shows that the demand forecast coordination greatly reduces amplification and oscillation of inventory orders in multi-echelon supply chains (the Bullwhip Effect), and provides the most benefits for the upstream suppliers (e.g., Croson and Donohue, 2003; Chatfield et al., 2004). Multiple carriers can now deliver items from dispersed destinations quickly and cost-effectively, because they can better leverage electronic ordering technology and scale to more fully utilize network information to improve inventory management (Grahovac and Chakravarty, 2001). Extant research suggests that supply network structures will evolve to become more integrative and behaviorally complex in this way (Gnyawali and Madhavan, 2001), and may achieve additional value from new forms of distribution coordination in some industries where competitors can share resources for their mutual advantage.

2.1. *Co-opetition*

Brandenburger and Nalebuff (1996) addressed the notion of business products and services as complements to show that competitors can cooperate to take advantage of value-adding resources and opportunities. For example, direct competition may occur between two television stations, but they may also indirectly compete or complement with another form of entertainment content, like a movie theater. Competitors may also sell or market similar types of products at the same echelon of the supplier network but may be able to leverage joint network resources to create additional value for supply chain members. Supply chain research studying co-opetition has generally defined competitors as “actors that produce and market the same product” or end-product (Bengtsson and Kock, 2000, p. 415), but has deemphasized the role complementary products and services play at different stages of the distribution system.

Successful co-opetition requires specific relational forms that will allow competitors to share community property. Lejeune and Yakova (2005) argued that co-opetitive supply chain systems are structured for dyadic and parity-based relationships that protect members, allowing them to treat the same dyad or group as equivalent and undifferentiated with respect to group decision-making. Moreover, competitive firms in different industries located farther away from end-customers (more perceived distance) have been found to be more likely to co-operate for the greater good of their common end-customers (Bengtsson and Kock, 2000). Regardless, companies need to have secure defenses in place to protect and disguise sensitive information from competitors (Hamel et al., 1989), and will need to align supply chain specific goals for different types of supplier co-opetition in different industries. This is because there is no one universal “cookie-cutter” co-opetitive supply chain design, as some may be more competition-dominated and others more cooperative (Bengtsson and Kock, 2000).

Competitive interaction can be more a function of the industry network structure than of relationships (Bengtsson and Kock, 2000; Gadde and Mattsson, 1987; Holmlund and Kock, 1995). For example, research shows that the level of supply network complexity can prohibit opportunism (Gnyawali and Madhavan, 2001). In cases where there is structural equivalence among the supply chain members, there is usually some sort of central actor (e.g., Toyota in its supply chain or a joint-venture hub) and a sufficient network membership density (Gnyawali and Madhavan, 2001) to manage the collaboration. For horizontal co-opetition to be successful in these cases, some sort of “hybrid-integrative-governance structure” must help coordinate the system (Kotzab and Teller, 2003, p. 272) and all its shared resources. In many supply chains, a central actor (or supply chain captain) generally rules the network and prevents supply base competitors from taking advantage of the other members (Whang, 1995).

2.2. *Distribution coordination and inventory management in multi-level supply chains*

Coordinating demand forecasts to improve profits or reduce costs in the distribution channel has been extensively discussed in