



Changing perspective of capabilities in the dynamic supply chain era

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Abstract

Purpose – A review of the literature reveals that previous research on capabilities has been limited to static capabilities and have largely been firm-centric, which neglect today's evolving supply chain environment. To address this shortcoming, this paper aims to explore dynamic supply chain capabilities (DSCCS) as a path to achieving sustainable competitive advantage.

Design/methodology/approach – Logistics and supply chain literature is reviewed to provide a foundation for introducing a model of DSCCS driving competitive advantage. Propositions for future research are presented based upon the theoretical model.

Findings – The need to continuously renew boundary spanning supply chain capabilities may be facilitated by the presence of a supply chain orientation and a learning orientation found across the multiple partners.

Research limitations/implications – Supply chain organizations exist in a continually evolving environment with the best-performing firms often being characterized as agile and continually improving. The dynamic capabilities perspective provides a theoretical foundation that may be used to better understand and predict the success of supply chain firms. The work presented here is conceptual and empirical examination of the propositions should occur before any broad generalization can be drawn.

Practical implications – Long-term organizational success may be facilitated by continuous renewal and creation of new static capabilities through the use of DSCCS.

Originality/value – The paper demonstrates that dynamic capabilities may be extended beyond the traditional single-firm view to exist across the relationships developed by multiple organizations in a supply chain.

Keywords Supply chain management, Learning, Competitive advantage

Paper type Research paper



Introduction

Capabilities have been adopted by the logistics discipline as central to creating and maintaining competitive advantage. In the foundational perspective of the resource-based view (RBV) of the firm (Barney, 1991; Grant, 1991; Wernerfelt, 1984), capabilities were originally described from a relatively static view as unassailable and enduring over long periods of time. This static view of capabilities is quickly becoming impractical, as today's rapidly changing, hypercompetitive, increasingly global, supply

chain era has shrunk the half-life of competitive advantages (Barney *et al.*, 2001; Eisenhardt and Martin, 2000; Teece *et al.*, 1997).

To compete in this evolving environment, the creation of dynamic capabilities may be more appropriate. Dynamic capabilities are routines used to refresh existing, static capabilities, and/or develop new capabilities (Teece *et al.*, 1997). Dynamic capabilities differ from static, or substantive (Zahra *et al.*, 2006), capabilities because they provide the means to update and better utilize existing (static) capabilities and/or create new capabilities. Their use implies the concept of competitive advantage must move beyond the static view that presumes sustainability is the goal, to the dynamic view that considers continuous improvement for short-term advantage to be the only achievable goal (Teece *et al.*, 1997; Verona and Ravasi, 2003). Effective dynamic capabilities support this goal by allowing the firm to create a series of temporary advantages; thus, staying one step ahead of competitors in the race to achieve and maintain a long-term competitive advantage (Eisenhardt and Martin, 2000; Teece *et al.*, 1997).

Recent research has shown companies develop both internal and external (e.g. cross-organizational) capabilities (Gibson *et al.*, 2009). The multi-method study probed senior supply executives to understand what differentiates world-class supply chain organizations from the rest of the pack. The most frequently described internal capabilities were supply chain orientation (characterized by top management support and a willingness to invest) and agility (characterized by learning and continuous improvement). These internal capabilities formed the foundation for top performance, but the best organizations were also found to possess one or more capability(ies) that cut across and involved multiple organizations working together to create and maintain a competitive advantage. Both, the internal and external capabilities described in the study are dynamic in nature. We build a theoretical model to further describe the importance of this type of cross-organizational dynamic capability to supply chains.

Supply chain research has largely ignored dynamic capabilities despite the constantly changing landscape supply chain executives face. With few exceptions (e.g. collaboration as a capability), capabilities have been described as logistics or supply chain activities or processes at the firm level, as opposed to capabilities occurring across a multi-firm supply chain consisting of multiple buyers and suppliers. The current paper seeks to expand the view of capabilities described in previous literature and the paths they create to sustainable competitive advantage in supply chains in three significant ways. First, we introduce the concept of dynamic capabilities to the logistics literature. Second, we extend dynamic capabilities beyond the single firm perspective by describing how multiple firms with specific strategic orientations may create a competitive advantage for their supply chain through the mutual application of dynamic capabilities. Third, we introduce and theoretically develop two specific dynamic capabilities, knowledge accessing and co-evolving, as particularly useful in supply chain research and practice.

The paper is organized as follows. First, the paper reviews capabilities in the logistics literature and then classifies logistics capabilities into three categories. Second, dynamic capabilities are defined and described, and distinguished from static capabilities. The conceptual model is presented next, followed by a delineation of knowledge-accessing and co-evolving dynamic supply chain capabilities (DSCCS), their organizational antecedents, and the resulting impact on performance of those organizations participating in the supply chain. Research propositions are offered regarding the

relationships of the constructs in the model. Finally, we draw implications and conclusions for future research and potential insights for managers.

Capabilities in the logistics literature

The movement and storage tasks of logistics provide a fundamental enabling mechanism of supply chains. The growing importance of competing based on customer focused (Rafiq and Jaafar, 2007) and inter-organizational time-based strategies (Garcia-Dastugue and Lambert, 2007) has led several authors to describe logistics as the next source of competitive advantage available to the firm (Esper *et al.*, 2007; Fuller *et al.*, 1993; Mentzer *et al.*, 2001a; Novack *et al.*, 1994; Sharma *et al.*, 1995). The creation of distinctive logistics capabilities became a prerequisite for firms hoping to compete on the basis of differentiated logistics service. As a result, a wide array of capabilities has been discussed in previous logistics research. Table I provides a summary of capabilities described in the logistics literature, each identified as a source of competitive advantage for the firm.

Much prior logistics research has emphasized logistics as a potential source of competitive advantage through differentiated logistics service (Fuller *et al.*, 1993; Mentzer *et al.*, 2001a; Novack *et al.*, 1994; Sharma *et al.*, 1995) or as playing a supporting role to other firm-level capabilities used to achieve a competitive advantage (Closs and Goldsby, 1997; Fawcett *et al.*, 1996; Shore and Venkatachalam, 2003). We believe logistics capabilities can be classified into three primary types based on the way they have been described in the literature:

- (1) A core logistics capability represents an amalgamation of the activities, processes, and outcomes associated with the firm's overall logistics operations. In this sense, the entire logistics function is considered a potential source of competitive advantage (Fawcett *et al.*, 1996; Lynch *et al.*, 2000).
- (2) Elements or sub-processes of the logistics operation are a lower-level functional decomposition of logistics. Examples include logistics information systems capability (Closs and Goldsby, 1997) and pre-sales/post-sales customer service (Morash *et al.*, 1996).
- (3) Underlying characteristics of the logistics organization have also been described frequently in the literature. These capabilities are more easily associated with a core operating philosophy of the organization such as flexibility (Fawcett *et al.*, 1996) or integration (Hayes and Wheelwright, 1984).

While previous logistics research has explored important capabilities within these three main categories, much of the work has been rooted in the belief that capabilities, once established, create barriers strong enough to ensure a long period of sustainability (Aragon-Correa and Sharma, 2003; Reed and DeFillippi, 1990; Wernerfelt, 1984). The realities of the global marketplace have brought forth new competitors and increased the speed of innovation needed to battle competitive threats. These new realities limit the duration of advantage available from traditionally conceptualized capabilities (LaLonde, 2006). The nature of logistics capabilities in this evolving, dynamic supply chain environment is a gap needing to be addressed.

Though largely ignored in the logistics and supply chain literature, the importance of dynamic capabilities has been justified in the strategic management literature. Our ongoing research confirms that dynamic capabilities also represent a critically

Agility	Measure of a firm's ability to determine and quickly respond to changing requirements	Winter (2003)
Collaboration	An interdependent relationship where parties work closely together to create mutually beneficial outcomes	Christopher (2000) and GLRT-MSU (1995)
Customer focus	Superior skills in understanding and satisfying customers. Dimensions of this capability include: segmental focus; relevancy; responsiveness; flexibility	Sinkovics and Roath (2004)
Customization	Customizing transportation attributes for specific market segments; could also apply to logistics functions other than transportation	Zhoa <i>et al.</i> (2001)
Delivery reliability	The ability to exactly meet quoted or anticipated delivery dates and quantities	Morash and Clinton (1997)
Delivery speed	The ability to reduce the time between order taking and customer delivery to as close to zero as possible	Morash <i>et al.</i> (1996)
Distribution service performance	The provision of logistics/distribution services at a higher level than that which is generally available through competitors. This term should be considered as very similar to logistics capability	Morash <i>et al.</i> (1996)
Fast cycle capability	Improving customer responses through making decisions faster, developing new products earlier, and converting customer orders into deliveries sooner than competitors	Daugherty <i>et al.</i> (1998)
Flexibility	Ready capability to adapt to new, different, or changing requirements	Daugherty and Pittman (1995)
Information focus	The use of technology and information to achieve competitive advantage. Dimensions of this capability include: information technology, information sharing, and connectivity	Fawcett <i>et al.</i> (1996) and Morash and Clinton (1997)
Information sharing	A strategy adopted by the headquarters organization to integrate and coordinate the supply chain	Zhoa <i>et al.</i> (2001)
Innovation	Using new ideas, new technologies, and new techniques to develop creative product offerings	Shore and Venkatchalam (2003)

(continued)

Table I.
Capabilities discussed in the logistics literature

Table I.

Integration	Techniques used in achieving internal logistical operational excellence and development of external supply chain relationships	Hayes and Wheelwright (1984) and Hayes <i>et al.</i> (1988)
Learning	Ability of a logistics organization to effectively maintain and manage learning organization characteristics and convert learning outcomes to new logistics management strategies, tactics, and operations in support of further developing other logistics capabilities	Esper <i>et al.</i> (2007)
Logistics capability	(1) Activities managed under the logistics umbrella provide an area of unique organizational skills and processes [...] that can provide the firm a competitive advantage; or (2) managing activities of the logistics functional area to provide sustainable competitive advantage. Dimensions of this capability include: process capabilities and value-added services Using information technology as a means of creating competitive advantage, and as a tool for ensuring that service levels are met at the least total cost The ability to minimize the total cost of distribution Monitoring of internal and external operations The firm's ability to deal with shortages in inventory, responses to customer's short-term fluctuations in demand, or problems that occur in production due to product design changes	GLRT-MSU (1995)
Logistics information technology		Fawcett <i>et al.</i> (1997) and Lynch <i>et al.</i> (2000)
Low total cost distribution		Closs and Goldsby (1997) and Closs and Xu (2000)
Measurement		Morash <i>et al.</i> (1996)
Operational flexibility		GLRT-MSU (1995)

(continued)

Pre-sale customer service	The ability to service the customer during the purchase decision process (before the customer buys the product)	Sinkovics and Roath (2004)
Positioning	The selection of strategic and structural approaches to guide logistical operations	Morash <i>et al.</i> (1996)
Post-sale customer service	The ability to service the customer after the sale of the product to ensure continuing customer satisfaction	GLRT-MSU (1995)
Transportation reliability	Reduced variability of shipment times around the mean transit time. Also, may be considered as the absence of loss or damage	Morash <i>et al.</i> (1996)
Responsiveness to target markets	The ability to respond to the needs and wants of the firm's target markets	Morash and Clinton (1997)
Selective distribution coverage	The ability to effectively target selective or exclusive distribution outlets	Morash <i>et al.</i> (1996)
Standardization	Necessary for supply chain integration; eliminates exception processing	Morash <i>et al.</i> (1996)
Time compression	Temporal qualities of transportation used primarily to reduce supply chain inventories including expedited transportation, increased inventory velocity and minimum dwell times	Morash and Clinton (1997)
Time responsiveness	Focuses on strategies that include manufacturing, rapid response, expanded variety, and innovation	Morash and Clinton (1997)
Widespread distribution coverage	The ability to effectively provide widespread and/or intensive distribution coverage	McGinnis and Kohn (1990)

Note: Listed alphabetically

Table I.

important area for logistics managers. The following quotes from logistics executives reinforce our contention:

- [...] you must always search for the next process innovation [...] [we do not care] if our competitors find out our best practices. Once they master our best practices, we should have morphed our business the next new practices [...] Nothing is stable, you must think ahead. Director of Global Logistics, OEM.
- [...] you have to change, to adapt. It's not just the name of the game here, but an everyday part of approaching the business. We can't do things the old way [...] we have to find better ways of getting the job done everyday. Director of Distribution Operations, 3PL.
- You don't get a second chance with the stakeholders. You can reshape to fit the endlessly fluctuating market, [...] or you can be left behind [...] If you don't want to be left behind, your processes have to recreate themselves. Senior Manager of Services Delivery, OEM.
- There is no such thing as world class [...] when you get to world class on something there is always someone who takes the next step beyond Senior Supply Chain Executive, Retailer.

Each of these experienced supply chain professionals describe the importance of being prepared to change strategic logistics processes and routines before rivals can overtake these capabilities. We believe this to be an accurate representation of today's competitive supply chain environment, and underscores the importance of exploring DSCCS.

Static versus dynamic capabilities in a supply chain

Static capabilities were first described in the strategic management literature as researchers recognized the limitations of neo-classical economic theory in explaining the differing performance of companies facing similar external environments. Penrose (1959) was the first to consider the firm as a collection of resources, and her investigation into the sources of company growth laid the foundation others used to construct resource-based theory (Barney, 1991; Grant, 1991; Wernerfelt, 1984). As initially described, the RBV considers resources the only source of competitive advantage available to the firm, and advantage will not accrue to the firm unless these resources are found to be valuable, rare, inimitable and non-substitutable (VRIN) (Barney, 1991). Capabilities have replaced resources as the source of competitive advantage (Grant, 1991) and are defined as bundles of VRIN resources (Miller, 2003) resulting from the firm's ability to assemble, integrate, and deploy resources (Ray *et al.*, 2004). Since capabilities are inherently complex, the creation of new capabilities may be a slow, difficult process (Dierickx and Cool, 1989).

The original definition of capabilities is built on the assumption that once established these static capabilities will be so difficult for rival organizations to imitate that they will be very long lived (i.e. they will be sustainable). This may be true in a stable environment characterized by little innovation and slow growth. In today's globally competitive, constantly changing world stability rarely exists for long and traditionally conceived static capabilities may be more easily overcome.

Recent thinking in resource-based theory has centered around the concept of dynamic capabilities (Eisenhardt and Martin, 2000; Helfat and Peteraf, 2003; Teece *et al.*, 1997; Verona and Ravasi, 2003; Winter, 2003). Dynamic capabilities are defined as "a learned and stable pattern of activities through which the organization systematically generates new static capabilities and/or modifies existing capabilities" (Zollo and Winter, 2002).

Static capabilities still exist, but their effectiveness is determined by how quickly they can be re-engineered and upgraded using dynamic capabilities rather than a wall of inimitability. The manipulation or abandonment of old resource configurations and development of new configurations is based on changes in the firm's environment and strategic direction (Zahra and George, 2002b). When a firm is able to utilize its dynamic capabilities more nimbly and effectively than rivals, a competitive advantage may be attained and preserved for longer periods of time (Helfat and Peteraf, 2003). Since static capabilities are not self-sustaining over the long-run, dynamic capabilities are needed to act as the sub-routines used to continuously update and improve existing capabilities or create entirely new capabilities (Teece *et al.*, 1997; Winter, 2003).

Dynamic capabilities, however, have largely been ignored in the logistics and supply chain literature. While dynamic capabilities have been acknowledged in a supply chain context (Abrahamsson *et al.*, 2003; Richey *et al.*, 2005), the focus has been on operating routines (Zollo and Winter, 2002). For example, research describing the need for flexible and agile logistics capabilities has focused on the creation of a logistics system by one firm in the supply chain that can deal with swings in order volume and product variety (Christopher, 2000; Fawcett *et al.*, 1996), but stopped short of identifying dynamic capabilities as the source of flexibility and agility.

In addition, as firm boundaries have become increasingly blurred in supply chains, the difficulty of maintaining a competitive advantage through firm-centric dynamic capabilities has increased. Previous research has described dynamic capabilities as existing within the firm, ignoring the potential for greater contribution available through the web of supply chain members. Even if a single firm is able to routinely upgrade its capabilities, the effort may be quickly overcome by the greater combined resources of multiple firms working together. This suggests dynamic capabilities spanning multiple supply chain members may provide the greatest opportunity for achieving advantage when competition is considered at the supply chain level.

In summary, the existing literature reveals a void in our understanding of logistics capabilities in a changing, supply chain environment. We present the argument that dynamic capabilities are particularly relevant for the logistics and supply chain discipline in two areas. First, static capabilities may not be sustainable in the face of rapidly evolving global competition. Dynamic capabilities are the mechanism logistics organizations use to renew and/or replace static logistics capabilities. Second, as core logistics processes expand to include multiple companies in a supply chain, the possibility of creating new cross-organizational supply chain capabilities exists. The effectiveness of static boundary-spanning logistics capabilities presented in existing literature may be rapidly reduced in today's hypercompetitive, unstable environment (Friedman, 2006). Dynamic capabilities shared and utilized across multiple companies in a supply chain can lead to a more responsive, adaptive, and ultimately better performing supply chain. We adapt Zollo and Winter's definition and define a DSCCs as "a learned pattern of cross-organizational activities which facilitate the creation of new static capabilities or the modification of existing capabilities across multiple supply chain members". The question then, is how do DSCCs come into existence and what are the factors affecting their nature and use (Gadde and Hakansson, 2008; Waluszewski and Johanson, 2008)? The following section presents a conceptual model of the antecedents and outcomes of two proposed DSCCs.

A model of DSCCs

Figure 1 shows a theoretical model comprised of three interrelated components:

- (1) cultural antecedents of logistics organizations and the supply chain;
- (2) DSCCs; and
- (3) supply chain performance.

The following narrative presents research propositions derived from the model and justification for two DSCCs, knowledge accessing and co-evolving.

Dynamic supply chain capabilities

The conceptualization of dynamic supply chain capabilities is distinct from previously described dynamic capabilities. While dynamic capabilities are firm-centric, DSCCs are embedded within the collaborative routines formed between multiple supply chain partners. Thus, multiple partners may jointly develop and use DSCCs to reenergize and update existing (static) capabilities or form entirely new capabilities.

Knowledge accessing. Knowledge accessing is defined as “a dynamic capability held by two or more parties that fosters an understanding of the current knowledge resources possessed by each party” (Grant and Baden-Fuller, 2004). Each party must comprehend the breadth of skills and capabilities possessed by the other, but stops short of acquiring detailed knowledge of how to develop the other’s skill or capability. Extending the concept to a supply chain context creates a knowledge accessing DSCC. Rather than striving to acquire and absorb more knowledge, supply chain members will benefit from accessing and understanding the capabilities possessed by other supply chain members. The goal is to understand the range of capabilities that exist across the supply chain and comprehend where and when each may be best put to use. With this knowledge, each partner is positioned to apply their own capabilities and knowledge most effectively for the benefit of the entire supply chain. The efforts of supply chain partners are thus focused on task accomplishment within the scope of their own capabilities rather than a race to acquire the other’s knowledge (Hamel, 1991). A comparison of knowledge accessing versus the traditional knowledge acquisition view is summarized in Table II.

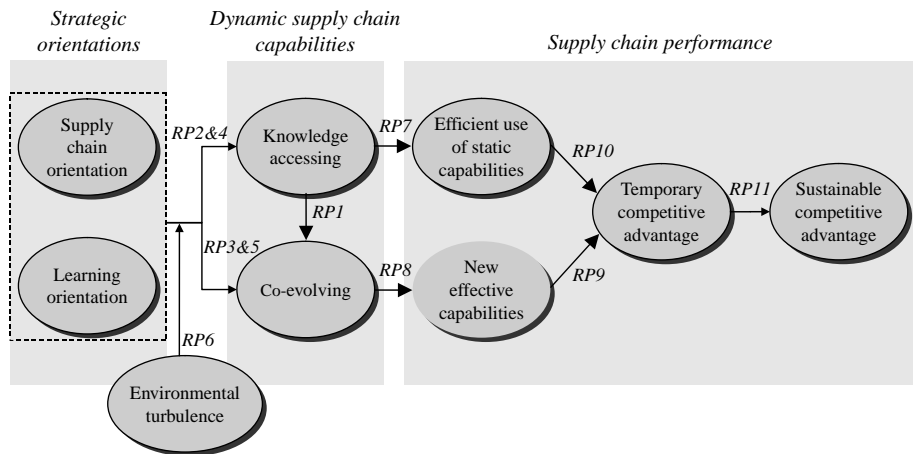


Figure 1.
DSCCs for sustainable competitive advantage

	Knowledge-accessing view	Knowledge-acquisition view
Knowledge development	Increasing knowledge specialization of each supply chain member	A general broadening of each member's knowledge base with the risk of certain members gaining leverage by absorbing knowledge at a faster rate
Knowledge alignment	Supply chain members' knowledge remains differentiated	Members' knowledge converges
Supply chain stability	Supply chain members become increasingly stable over time	As members absorb knowledge from others, supply chain becomes less stable
Supply chain longevity	Can be long-term	Life span limited to the time it takes to acquire valuable knowledge from other member(s)
Number of value-added supply chain members supported	May engage in multiple member relationships – upstream and downstream – simultaneously	Limited absorptive capacity of the firm limits the number of member relationships a firm can pursue at once
Supply chain value to members	Increases value of supply chain membership substantially	No significant increase in the value of participating in a supply chain since marginal members may be replaced once valuable knowledge has been absorbed by more powerful supply chain members
Supply chain value to end customers	Increases value to end customers as supply chain members are called upon to apply expertise appropriately	No significant increase in value to end customers because turnover in members causes commitment of less powerful members to diminish

Source: Adapted from Grant and Baden-Fuller (2004)

Table II.
Logistics knowledge accessing benefits

A knowledge-accessing DSCC allows each organization to quickly understand what partner organizations are capable of accomplishing, but does not support detailed knowledge acquisition of how specific capabilities are created. Specific capability knowledge is generally viewed as a competitive asset by the organization (Mowrey *et al.*, 1996), and because such knowledge is path dependent it may prove difficult or even impossible to transfer (Berman *et al.*, 2002; Winter, 2003). Path dependence means the originating organization developed a given capability over time as a result of the interactions of many individuals and these events are unlikely to recur (Bharadwaj, 2000; Colbert, 2004; Schroeder *et al.*, 2002). This knowledge-accessing DSCC can be learned by all member firms because the knowledge gained is not tacit; rather, the existence of capabilities can be easily shared. Tacit knowledge refers to knowledge that is difficult to articulate and takes time to learn (Polanyi, 1968), as opposed to explicit knowledge, which is knowledge that can be quickly codified and easily transferred (Levin and Cross, 2004). The tacitness is associated with the capabilities that remain inside the boundaries of the originating organization. The applicable areas for its use, however, can be readily understood through a knowledge-accessing DSCC.

Copying and internalizing a distinctive capability already possessed by a partner is redundant, reducing the overall efficiency of the inter-organizational relationship (Hamel, 1991; Levin and Cross, 2004; Pedersen *et al.*, 2008). Thus, the creation of a knowledge-accessing DSCC makes the supply chain more efficient and ensures the strengths of each partner can be brought to bear on issues that partner is best prepared to handle (Grant and Baden-Fuller, 2004). Each firm can focus its attention on continuing to develop and improve their own static capabilities, while also realizing the benefits of partners' capabilities.

Co-evolving. While knowledge accessing allows supply chain members to reduce redundancies and utilize existing capabilities more productively, a competitive business environment also demands the continuous creation of new capabilities. Co-evolving was first described as a way of capturing cross-business synergies (Eisenhardt and Galunic, 2000). The ability to continuously redefine roles and flexibly reconfigure resources is central to capitalizing on often elusive synergies (Verona and Ravasi, 2003). Co-evolving is defined as "the set of routines businesses use to reconnect webs of collaborations within and across companies to generate new and synergistic capabilities" (Eisenhardt and Martin, 2000). The notion of reconnecting collaborative webs implies collaboration cannot be viewed as a static exercise. Each collaboration, or each link between organizations, must have a defined goal of improving performance through the creation of a new capability (Eisenhardt and Galunic, 2000).

In a supply chain context, co-evolving is defined as: "a DSCC held by two or more supply chain members that facilitates the joint development of new capabilities between supply chain-oriented firms that aspire to compete on the basis of superior supply chain capabilities". It goes beyond innovation (Chesbrough, 2003; Christiansen, 2000; Flint *et al.*, 2005; Forrester, 2000; Hargadon, 2003) and new product development processes (Griffin, 1997a, b; Kahn, 2001), which focus on developing and launching innovative products and services. Co-evolving builds on McKelvey's (1997) research proposition that the evolution of an organization cannot be understood independently from the simultaneous evolution of its environment. It is two (or more) organizational knowledge systems evolving with each other to create new forms of resources. While Eisenhardt and Martin (2000) originally envisioned co-evolving at the firm-level, we conceptualize it as

a dynamic capability used by a firm to connect webs of collaborations among multiple members of the supply chain for the purpose of generating novel capabilities. For example, Fang and Wu (2006) present a case study in the Taiwan semiconductor industry of how United Microelectronics Corporation (UMC) collaborated with its internet protocol (IP) providers and customers to develop deep seated, systematic co-evolving routines (termed the “IP Master Program”) that resulted in the continuous development of new, innovative information sharing technologies, manufacturing technologies, products, and services without spending large amounts on research and development. The co-evolving helped the supply chain (defined as UMC, its IP providers, and its customers) gain the innovative advantages of shorter time-to-market and time-to-volume.

Though knowledge-accessing and co-evolving are independent DSCCs, it is important to understand their interrelationship. Zhara and George (2002a) assimilate previous absorptive capacity and dynamic capabilities research (Fichman and Kemerer, 1999; Lane and Lubatkin, 1998; Van Wijk *et al.*, 2001) and suggest the collaborative, synergistic conversion and use of organizational knowledge is facilitated by a strong comprehension of the knowledge by all organizational members. In the same manner, a primary aim of a knowledge-accessing dynamic capability is to foster the efficient use of knowledge across supply chain members, which promotes learning resources to be targeted toward the discovery of innovative, value-added capabilities. Once each member’s core skills, capabilities, and knowledge are understood, inter-organizational learning can be used to enable collaborative knowledge creation. The targeted result of these collaborations is the creation of new capabilities that the supply chain can use to differentiate itself. Thus, we make the following research proposition:

- RP1.* The higher the level of knowledge accessing possessed by supply chain partners, the higher the level of co-evolving the supply chain partners will develop.

Strategic orientations and DSCCs

Knowledge accessing and co-evolving are particularly relevant in a supply chain context, since it has been suggested that firms are finding it more difficult to develop individually all the capabilities required to keep pace in today’s competitive environment (Vargo and Lusch, 2004). To develop and enact DSCCs, we propose two strategic orientations, supply chain orientation and learning orientation (LO), must be present (i.e. antecedents). In addition, the external environment also plays an influential moderating role on the impact of organizational conditions in creating DSCCs.

Supply chain orientation. Since DSCCs exist as inter-firm sub-routines, their development is predicated on multiple supply chain-oriented (SCO) organizations working together (Hult *et al.*, 2008). SCO firms make the strategic choice to compete on the basis of superior supply chain capabilities (Defee and Stank, 2005). A supply chain orientation is defined as “the recognition of the systemic, strategic implications of the activities involved in managing the multiple flows in a supply chain of organizations” (Mentzer *et al.*, 2001b). These firms:

- possess an underlying culture that adopts a systems approach to viewing the supply chain holistically;
- undertake cooperative efforts to synchronize intra- and inter-firm capabilities; and
- value a customer focus to create unique sources of customer value (Mello and Stank, 2005).

An SCO firm builds and maintains several behavioral elements that enhance relations with strategic supply chain partners, including trust, commitment, cooperative norms, dependence, organizational compatibility, and top management support (for further review of these behavioral elements, see Mentzer, 2004). The best-performing supply chains are built on a foundation of interorganizationally shared values and goals (Defee and Stank, 2005; Gadde and Ford, 2008). Each supply chain member possessing a supply chain orientation lays the groundwork for the development of DSCCs.

Supply chain partners with an SCO will be more likely to jointly participate in the development of DSCCs because they will stress a systemic view of collaborating with other members of the supply chain for the purpose of creating a strategic advantage based on end-customer value delivery (Stank *et al.*, 2005). With a goal of coordinating inter-firm capabilities, SCO partners will seek to use this understanding to synchronize each partner's existing capabilities within the overall supply chain. Thus, adopting a SCO leads a firm to recognize and avoid redundancies in the supply chain (Min and Mentzer, 2004) and instead utilize the existing resources of each supply chain partner, facilitating knowledge-accessing routines between supply chain members:

RP2. The more SCO supply chain partners possess, the more knowledge accessing that that will occur between the partners.

Supply chain partners must possess a culture of viewing the supply chain as a whole and of recognizing the need for cooperative efforts. Without this perspective, the partners may exhibit low trust (Lambert *et al.*, 2004), not be committed to the development of new cross-organizational capabilities, and/or not receive sufficient top management support. Trust and related constructs such as openness and transparency have been found to have a positive effect on innovation as knowledge sharing becomes more frequent, richer in content, and the exchange of "private" information is promoted (Hamel, 1991; Reagans *et al.*, 2005; Uzzi and Lancaster, 2003). SCO firms exhibit cooperative norms that previous research has shown to produce new, innovative concepts (Eppinger and Chitkara, 2006; Sawhney *et al.*, 2006; Schildhouse, 2006). Thus, SCO partners will foster the relational climate and behaviors needed to develop co-evolving routines and successfully collaborate on the creation of new innovative capabilities:

RP3. The more SCO supply chain partners possess, the more co-evolving that will occur between the partners.

Learning orientation. Supply chain members choosing to work together as a systemic whole is not enough to ensure success. Dynamic capabilities arise from learning and constitute the firm's methods for modifying existing operating routines (Zollo and Winter, 2002). An LO is needed to develop DSCCs that continuously re-tool obsolete cross-organizational capabilities and develop novel capabilities. LO is defined as "the set of organizational values that influence the propensity of the firm to create and use knowledge" (Sinkula *et al.*, 1997). It is observed by a set of knowledge-questioning norms, including commitment to learning, open mindedness, and shared vision (Sinkula *et al.*, 1997).

Theories of LO assume the goal of learning is for the firm to absorb as much knowledge as possible from internal and external sources because knowledge is the most strategically important resource possessed by the firm and may be used to create

a competitive advantage (Quinn, 1992; Spender and Grant, 1996). Knowledge-based theory divides this process into two components: knowledge exploration and knowledge exploitation (Grant, 1996). The purpose of knowledge exploration (March, 1991) is for the firm to internalize knowledge through acquiring and transferring as much knowledge as possible from outside sources. In an inter-organizational context, this implies firm A seeks to increase its stock of knowledge by acquiring the knowledge possessed by firm B. This may produce a de-stabilizing effect on the relationship between supply chain partners as the firm with the faster pace of learning seizes power in the relationship, and is in a position to take advantage of the less powerful member.

For example, original equipment manufacturers (OEMs) often outsource to and develop relationships with contract manufacturers (CMs) to cut the OEM's costs and free up capital. Those same CMs are now starting to bite the OEM hand that feeds them as some CMs have become competitors as a result of mastering the intellectual capital originally possessed by the OEM. The result is distrust, years of expensive litigation, and lost profits (Arruñada and Vázquez, 2006). This firm-centric view of learning therefore becomes a barrier to success of all members in the supply chain. Alternatively, the view of inter-organizational learning we propose does not require all supply chain members to absorb the knowledge possessed by other members. Optimal performance in a supply chain context requires member firms to look beyond their own boundaries and view the larger supply chain holistically (Holmberg, 2000). This implies LO must cross firm boundaries and become a shared value held by multiple supply chain members.

Learning is a resource-intensive activity. A firm wishing to learn must dedicate people and time to the effort. Efforts to learn explicit knowledge are typically straightforward and the effort required is easily estimated since explicit knowledge is already codified, formalized, and structured (Akbar, 2003). For example, supply chain members can easily share and learn processes that have been documented by the originating firm. Alternatively, tacit knowledge is path dependent and developed over time through the accumulation of experiences and is therefore difficult or impossible to formalize (Berman *et al.*, 2002; Leroy and Ramanantsoa, 1997; Polanyi, 1968). A firm desiring to learn knowledge that is tacitly veiled must dedicate greater resources to the task and may find it impossible to estimate the effort required. LO firms recognize the risks associated with knowledge imbalance between supply chain members leading to instability in supply chain relationships, and limits to the learning capacity of any single firm because of the difficulty in transferring tacit knowledge between organizations. This recognition breeds the desire to understand the supply chain partner's distinctive existing capabilities, instead of pursuing a costly, and potentially futile, strategy of attempting to imitate the partner's tacitly held capabilities (Zahra *et al.*, 2006). Thus, we make the following research proposition:

RP4. The more LO supply chain partners possess, the more knowledge accessing that will occur between the partners.

Co-evolving demands supply chain partners exhibit an awareness of the need to change, and the perceived capacity to change effectively; each are characteristic of LO firms (Cohen and Levinthal, 1990). Learning theory contends that there are risks inherent in exercising the same, static capabilities, without exploring new ones (Zahra *et al.*, 2006).

Jointly developing new capabilities requires supply chain partners to scan and process the environment within which they operate. Without learning from and about their external environment, it is difficult for firms to recognize the inflection point when existing capabilities become outdated, or which new capabilities offer the potential for competitive advantage. Learning-oriented firms proactively question long-held routines, assumptions, and (Baker and Sinkula, 1999) beliefs about existing capabilities to foster the development of new ideas for competitive capabilities:

RP5. The more LO supply chain partners possess, the more co-evolving that will occur between the partners.

Environmental turbulence and DSCCs

Dynamic capabilities were initially identified in rapidly changing high-technology industries (Teece *et al.*, 1997) as routines used to adapt to ongoing changes in the competitive environment. When the environment is volatile, firms are more likely to adapt their objectives and strategies (Cyert and March, 1963). As Zahra *et al.* (2006) note, environmental turbulence increases the likelihood that firms will become aware of the need to repeatedly reconfigure substantive capabilities in order to remain competitive. Moorman and Minor's (1998) research supports the contention that organizations are more apt to improvise and experiment in turbulent environments.

We propose environmental turbulence is not a direct antecedent to knowledge accessing and co-evolving, but rather a moderator of the impact of the two strategic orientations on the two DSCCs. A highly volatile environment alone will not lead supply chain members to increase their understanding of each other's static, firm-centric capabilities (knowledge accessing), nor will it foster the joint development of new capabilities (co-evolving). The need for a reconfiguration of interorganizational routines results from multiple supply chain members having a proclivity toward interorganizational collaboration and learning. In turbulent environments, however, supply chain- and learning-oriented supply chain partners will be more inclined to recognize the need for knowledge accessing and co-evolving DSCCs. When supply chain members have common strategic orientations for knowledge accessing and co-evolving, their desire to develop and drive those dynamic capabilities will be enhanced in environments that are unstable:

RP6. The impact of an SCO and an LO on the level of knowledge accessing and co-evolving is greater in more turbulent environments.

DSCCs and supply chain performance

The conceptualization of the DSCCs of knowledge accessing and co-evolving has substantial supply chain performance implications at both the firm level and supply chain wide. Cross-organizational relationships require time to develop and therefore certain supply chain relationships must be consistent over an extended timeframe in order for DSCCs to be created and utilized. A knowledge-accessing DSCC allows supply chain members to more readily develop an understanding of partner capabilities, and understand the processes used by other supply chain members more completely. This broadened understanding is beneficial because it promotes more effective division of labor across the supply chain. Increased efficiencies result from clearly identifying

supply chain roles and responsibilities, assigning the most competent firm to each role, and allowing members the freedom to coordinate the execution of their distinct capabilities. Each supply chain partner can narrow resource commitments and focus its efforts on improving and updating its existing static capabilities. In addition, knowledge accessing allows redundant activities to be identified and unnecessary processes eliminated, improving overall efficiency. Efficiency is defined as how well the capabilities are utilized (Mentzer and Konrad, 1991) and is a critical criteria for judging the best supply chains (Lambert and Pohlen, 2001; Mentzer, 2004). The elimination of redundant work in the supply chain will result in greater efficiency of existing capabilities:

RP7. The higher the level of knowledge-accessing DSCC the supply chain partners possess, the greater efficiency existing static capabilities will achieve.

As supply chain members improve their ability to share and combine resources and knowledge in novel ways, new and innovative capabilities may result. The synergies produced by supply chain partners co-evolving to create new firm-specific and cross-organizational capabilities makes the supply chain more competitive and less susceptible to rival supply chains that are not as proficient in continuously creating innovative capabilities. The result of co-evolving is a flow of novel capabilities that are effective in achieving supply chain objectives. Effectiveness is defined as the ability to achieve stated goals or objectives, judged in terms of both output and impact (Mentzer and Konrad, 1991), and is a key indicator of high-performing supply chains (Brewer and Speh, 2000; Mentzer, 2004):

RP8. The higher the level of co-evolving DSCC the supply chain partners possess, the more new, effective capabilities will be continuously created.

DSCCs do not by themselves create a sustainable competitive advantage; it is the ability to continually upgrade resource configurations that may allow multiple supply chain members to obtain an ongoing advantage, in the form of a series of temporary competitive advantages (Ray *et al.*, 2004; Teece *et al.*, 1997). The result of a continuous stream of new, effective supply chain capabilities is the creation of a series of temporary advantages. As with traditionally envisioned static capabilities, new supply chain capabilities created out of a co-evolving DSCC must be VRIN (Barney, 1991) or advantage may not accrue:

RP9. The more new, effective supply chain capabilities that are continuously created by supply chain partners, the more successive temporary competitive advantages that will be realized.

This does not mean that once a new supply chain capability is created through a co-evolving DSCC that the focus is solely on creating the next innovative supply chain capability. The basis for creating a temporary competitive advantage may shift. Competing supply chains may eventually break through the barrier of inimitability and develop substitutes for a static capability. However, the supply chain may retain a competitive advantage by leveraging its experience with an existing capability to gain greater efficiencies. An existing static capability may find an extended life as supply chain partners are able to execute at a lower cost. Alternatively, the static capability may find new applications in the supply chain without increasing costs:

RP10. The more efficiently supply chain partners utilize existing capabilities, the more successive temporary competitive advantages that will be realized.

Recent complex industry structures of blurred boundaries, fluid business models, ambiguous and shifting supply chain members, and non-linear and unpredictable changes (Eisenhardt and Martin, 2000) make attaining long-term competitive advantage difficult. The strategic objective is often focused on finding the next lucrative opportunity (Lengnick-Hall and Wolff, 1999). Once that opportunity is identified, the firm then seeks the next profitable opportunity. In this way, supply chain members seek to compete by tying together a series of temporary advantages. The longer these temporary competitive advantages can be maintained, the more sustainable the competitive advantage:

RP11. The more successive temporary competitive advantages realized by supply chain partners, the more sustainable their competitive advantage.

Implications and conclusion

Leaders in organizations are constantly seeking to identify what their organization is and is not great at doing, and what it should and should not do in the future (Miller *et al.*, 2002). In essence, they evaluate potential capabilities and create new ones to achieve and maintain a competitive advantage (Tallman and Fladmoe-Lindquist, 2002; Ulrich and Smallwood, 2004). Researchers also try to gain a deeper understanding of the nature of capabilities, as reflected in strategy research that adopts the RBV as its foundation (Barney *et al.*, 2001; Lynch *et al.*, 2000; Ray *et al.*, 2004; Sinkovics and Roath, 2004). Recent hypercompetitive environment makes this more difficult as existing capabilities that were developed and researched with a static world view quickly become outdated (Wiggins and Ruefli, 2002).

The theoretical model shown in Figure 1 seeks to initially address gaps in the logistics literature by consolidating logistics research and borrowing from strategic management research to describe capabilities in the dynamic supply chain era. Specifically, the model proposes competitive advantage is achieved through DSCCs that allow supply chain members to better utilize existing capabilities and continuously create new collaborative capabilities. The model extends previous research that explores the relationship of LO on firm-centric dynamic capabilities (Esper *et al.*, 2007) to also include SCO as necessary in creating DSCCs. In particular, SCO and LO are fundamental cultural antecedents required to foster the development of DSCCs. The framework also proposes one key to achieving a series of temporary competitive advantages, and thus sustaining a competitive advantage, is through the development of knowledge accessing and co-evolving DSCCs. While this research is still in the conceptual stage, the following section highlights potential managerial and research implications.

Managerial implications

Capabilities in supply chains are found both at the individual firm level (intra-organizational) and across multiple firms (inter-organizational). To sustain competitive advantages, supply chain members must be able to leverage both types, but our model is particularly focused on gaining advantage from inter-organizational capabilities, whether they be established or new innovative capabilities. The model suggests managers involved in strategic decision making should cultivate a SCO

and LO, and seek out potential supply chain members with a similar emphasis. It is important to remember not to develop SCO and LO in isolation, but rather synergistically. The proposed model considers these characteristics important prerequisites necessary for the dynamic capabilities of knowledge accessing and co-evolving to exist. Specifically, SCO and LO must be shared characteristics found across two or more supply chain members. The development of true inter-organizational capabilities – both dynamic and static capabilities – requires the management efforts of multiple partnering organizations.

Members of successful inter-organizational supply chains must look beyond developing static, short-lived, firm-centric capabilities. Rather, managers should be willing to abandon degrading resources and focus on the development of DSCCs to extend the life of existing capabilities and provide a path to the creation of new, inter-organizational capabilities. In particular, a knowledge-accessing DSCC should be developed to improve the efficient use of existing supply chain partner capabilities, and encourage the creation of a boundary-spanning environment that supports the development of cutting edge capabilities benefiting multiple partners. The improved understanding of partner capabilities facilitates goal alignment across firms, increasing coordination and reducing redundancies. This allows each capability to have the highest yields and returns (Ulrich and Smallwood, 2004), extending the time period of temporary advantage.

The organizational attitude toward collaboration and joint capability development is a critical success factor. When collaborative activities are driven by a powerful supply chain leader organization the performance gains of any temporary advantage may be heavily slanted in favor of the more powerful firm (Maloni and Benton, 2000). Alternatively, if multiple partners are willing to target holistic supply chain-wide outcomes as a priority, then the DSCCs of knowledge accessing and co-evolving may provide a path to improved performance by all member firms. Strategic decision-making managers should identify and empower strong champions, both within their own organization, and within key supply chain members to drive collaborative, capability-creating innovations through co-evolving.

Managers must also critically evaluate their own organization's resources and capabilities, and determine which current or potential supply chain members fit best together. These are interrelated and critical steps to enabling knowledge accessing to occur. An option to consider is the creation of "supply chain capability teams" to explore opportunities available among the supply chain members. The fresh outside eyes from each partner may spot innovative uses for existing resources their supply chain counterparts consider routine (Miller *et al.*, 2002).

Implications for researchers and future directions

Future research is needed to gain better understanding of DSCCs, specifically knowledge accessing and co-evolving that are central to the proposed model. Eisenhardt and Galunic (2000) make the case that dynamic capabilities are best suited for fast paced, rapidly changing industries. Likewise, we anticipate our model may be most appropriate for, and most easily observed in, supply chains characterized by high rates of change. Our model suggests supply chain members possessing a co-evolving DSCC may be better positioned to develop leading edge supply chain capabilities. Often the best ideas come from working together, within a collaborative supply chain. The development

of genuine logistics innovations demands a combination of skills and intellectual capacity that exceeds the capabilities of an individual supply chain member (Powell *et al.*, 1996). The traditional dyadic conceptualization of co-evolving may be extended through its examination in a supply chain context. A co-evolving DSCC may involve three or more firms working together (Mentzer, 2001) to develop new capabilities.

Infusing a knowledge-accessing DSCC into logistics research provides a theoretical contribution by extending research on inter-organizational learning (Bessant *et al.*, 2003; Lukas *et al.*, 1996; Pappu and Mundy, 2002; Powell *et al.*, 1996). While previous research on inter-organizational learning emphasizes supply chain members absorbing knowledge and capabilities from each other, knowledge accessing suggests it may be more efficient for supply chain partners to acquire an understanding of each other's knowledge and capabilities. This allows the capability to be located and performed by the most appropriate supply chain member, increasing the overall success of the supply chain.

Ultimately, static capabilities become obsolete and managers must develop and implement new, more effective capabilities. Behavioral theory, however, suggests that a firm continues to utilize existing capabilities when the firm is successful (Cyert and March, 1963). While this has been conceptually examined in previous firm-centric research (Zahra *et al.*, 2006), future research should explore how supply chain members independently, and collaboratively, decide when a capability upgrade or development of a new-to-the-world capability is warranted. Highly dynamic environments may cause managers to be weary of the longevity of existing static capabilities, as a result of previous experiences with competitors trumping such static capabilities. Managers may strive for a norm of continuous improvement by experimenting (Miner *et al.*, 2001) with existing and potential new static capabilities. Thus, an interesting future research opportunity is to investigate the cost associated with developing new capabilities and upgrading existing capabilities to better understand the most profitable timing in reconfiguring static capabilities.

Further, we investigated two critically important strategic orientations, SCO and LO, as drivers for the knowledge-accessing and co-evolving capabilities. However, future research could explore the impact (negative or positive) of other strategic orientations on the development of DSCCs. For example, perhaps the supply chain members need to have a propensity to engage in the pursuit of new opportunities and actively renew existing areas of operation (Hult and Ketchen, 2001; Naman and Slevin, 1993; Zheng Zhou *et al.*, 2005). This entrepreneurial proclivity could be a strong initiator of innovative activities, which might increase the firms' chances of developing a co-evolving capability.

Dynamic capabilities have replaced the static view of capabilities in the strategic management discipline (Eisenhardt and Martin, 2000; Teece *et al.*, 1997; Verona and Ravasi, 2003), and are becoming more accepted in the logistics domain (Richey *et al.*, 2005). Dynamic capabilities have been described in previous research as existing within the firm. While we believe dynamic capabilities are relevant to inter-organizational relations, clearly more research is needed to understand dynamic capabilities within a supply chain context. Future research should explore other DSCCs, in addition to knowledge accessing and co-evolving.

In particular, future research should attempt to test the research propositions in a variety of contexts. The model constructs need to be further developed and empirically

tested, including the creation and purification of valid measures tapping each. Specifically, non-experimental survey methodology (Kerlinger and Lee, 2000) would be appropriate. Managers involved with inter-organizational supply chain practices could be targeted for the sample. In addition, our literature review could be combined with qualitative research on DSCCs to operationalize the constructs in our model (Dillman, 2000). The methodology for developing measures should be based on the guidelines provided by Churchill (1979), Anderson and Gerbing (1998), Dunn *et al.* (1994) and Mentzer and Flint (1997). The newly created items should tap the definitions that were developed using the literature base discussed in this paper. Since it is accepted as appropriate in measuring opinions, beliefs, and attitudes (DeVellis, 1991), a Likert scale could be used for each of the measures.

Further, the model addresses long-term phenomena, making a longitudinal approach appropriate. The insights gained from the literature integration and conceptual development presented in this paper should provide an appropriate starting point for development of scales to measure DSCCs. Additionally, exploration of the knowledge accessing and co-evolving DSCCs using qualitative methods is suggested as an initial next research phase. Qualitative research methods provide the ability to develop deeper understanding of phenomena (Denzin and Lincoln, 1998), and represent an appropriate path to follow given the current level of understanding of DSCCs. Qualitative methods may also be useful in identifying other forms of dynamic capabilities that exist in the supply chain environment.

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