Supply Chain Innovation: A Dynamic Capability Perspective

Santanu Mandal
shaan.nitw@gmail.com
Doctoral Research Scholar, IBS Hyderabad
Visiting Scholar, Oklahoma State University

Dr. Surajit Ghosh Dastidar
Associate Professor
Faculty of Operations & IT
IMT Hyderabad, India

Dr. Sourabh Bhattacharya
Associate Professor
Faculty of Operations & IT
IMT Hyderabad, India

Abstract:

New products and processes along with improvement in existing ones are the key features of an innovative supply chain. Using theoretical lenses of RBV and dynamic capabilities, the study formulates a conceptual framework for antecedents and consequences of supply chain innovation from a firm perspective.

Keywords: Supply chain innovation, dynamic capabilities, environmental uncertainty

Introduction

Recently, supply chain operations have been hampered by an increasing no of natural and man-made disruptions. Coupled with an increasing global reach and product complexity, firms are finding it tough to provide innovative products and services to their customers. However, the quest for competitive advantage has always compelled firms to for innovation in supply chains and that may be the reason for identifying the most innovative organization by ACSCMP (American Council of Supply Chain Management Professionals) and rewarding the same with their “Supply Chain innovation Award”. Arlbjorn et al. (2011) noted in this regard “…..among the nominees have been prestigious organizations such as the U.S. Air Force, Motorola, Kellogg’s, and Blockbuster Inc. The list of award winners includes companies like Intel, Cisco Systems Inc., and Hewlett-Packard. The winner is selected out of 45–50 submissions each year, based upon criteria related to the degree of innovativeness, impact on overall supply chain, and sustainability in results (revenue, cost savings, etc.)”.
This signifies the relevance of supply chain innovation investigation in the recent context. Though considered as an important area, large scale empirical based research is lacking. Most of the studies that been instrumental in investigating innovation in supply chains adopted the conceptual view (Flint et al., 2005, Grawe, 2009). There have been a lack of investigation of supply chain innovation as a capability along with its antecedents and consequences. In this regard, the current study holds relevance in two important dimensions. Using the resource based view and dynamic capabilities perspective, it formulates a conceptual model consisting of several capability based antecedents and outcomes. Secondly, the proposed model will be tested empirically in future studies. Thirdly, by adopting a capability based approach for formulating a framework for supply chain innovation; the study also contributes to the theory building in supply chain innovation literature.

The paper has been structured as follows. The next section discusses supply chain innovation mainly from a logistics perspective followed by a discussion of the relevant theories and how they shape our proposed framework. The next section discusses the hypotheses development along with the antecedents and consequences.

**Theoretical foundation**

**SC Innovation**

Supply chain innovation has been defined from multiple perspectives. However, the earlier conceptualizations (e.g. Flint et al., 2005) largely borrow from the definition proposed by Rogers (1995, p.11): “Innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption”. Logistics innovation need not be new to the world, but it may result in providing a new service to its customers. For e.g. Flint et al. (2005) focused on innovation that is more helpful to customers for e.g. a better and enhanced service that is new. Though innovation emphasizes idea generation, but it’s not beneficial or deemed important in a supply chain perspective unless it results in something valuable to the customers. Chesbrough (2003) underscored the importance of innovation thinking in leading to innovation; however the allied literature on innovation itself stresses the importance of processes and technology in emanating successful innovations (Christiansen 2000a, 2000b, Kahn, 2001). Literature also cites how the innovation takes place in organizations and markets (Rogers, 1995; Chesbrough, 2003). Firms are constantly thriving to develop and test new ideas, products and services. Mainly for service industries, supply chain innovation is a compulsory for ensuring effective service delivery (Chapman et al., 2003). Drucker (1985) indicated innovation as a tool directed specifically for entrepreneurs. Afuah (1998) defined innovation as:

“a process of turning opportunity into new ideas and putting these into widely used practice. Innovation facilitates create new technical skills and knowledge that can help develop new products and/or services for customers”.

The literature on SC innovation is sparsely developed. SC innovation refers to tools that can improve firm processes directed for efficient supply chain management through seamless integration with suppliers, manufacturers, distributors and customers (Lin, 2008). Several other benefits like cost and lead-time reduction, generation of new operational strategies and flexibility development are also offered by SC innovation (Stundza, 2009). Besides literature on supply chain innovation is highly fragmented. Zinn (1996) in his study concluded that logistics
innovation can be enhanced using increased competition and capital shortage as incentives. Flint et al. (2005) interviewed several logistics executives and found a host of activities as indications of being innovative viz. setting the stage activities; customer clue gathering activities; negotiating, clarifying and reflecting activities; and inter-organizational learning. Flint et al. (2008) empirically explored extend of innovation management and extent of supply chain learning management as antecedents for supply chain innovation. Resources when combined, can lead to increased level of specialization and innovation (Hakansson and Persson, 2004). Chapman et al. (2003) explored in a similar context relating to factors leading to innovation in logistics services and found that knowledge, technology and relationship networks as the relevant factors. Panayides and So (2005) empirically found organizational learning to mediate the relationship between relationship orientation and logistics innovation. Several studies have investigated performance under innovation. Gellman (1986) examined innovative performance of railroads under deregulation and found regulation, labor influence and lack of channel member innovation as barriers to innovation in the allied industry. Autry and Griffis (2008) using social network theory propounded structural capital, relational capital and supply chain knowledge development to be positively associated with innovation-oriented performance. Wagner (2008) proposed a model of logistics innovation consisting of several related activities like internal search and development, external search and development, investment in infrastructure and capital goods, acquisition of knowledge and training and education etc. that can lead to innovations in logistics.

The resource based view of the firm and the dynamic capabilities perspective:

We relied on the resource based view complemented with the dynamic capabilities perspective for developing our framework. There exist differences in firm performances which is mainly due to firm resource heterogeneity. Barney (1991) argued in the RBV framework that a firm can attain sustained competitive advantage through suitably deploying its resources and capabilities that are often rare, valuable, not substitutable, and difficult to imitate. Further these resources and capabilities are viewed as bundles of tangible and intangible assets that comprises for e.g. a firm’s management skills, its organizational processes and routines, and the information and knowledge it controls (Wernerfelt, 1984; Barney et al., 2001). RBV searches for the internal enablers of sustainable competitive advantage (SCA) and aims to explain the performance differential between firms in the same industry. RBV assumed resources to exist. But simple existence of resources will not be enough and hence later researches (Eisenhardt and Martin, 2000; Teece, 2007) concentrated on how they are combined to match the accompanying environment for better performance and for attaining competitive differentiation. This gave rise to the dynamic capabilities perspective (Teece, 2007).

Dynamic capabilities refer to ‘the firm’s ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments’ (Teece 1997, p. 516), and consist of ‘difficult-to-replicate enterprise capabilities required to adapt to changing customer and technological opportunities’ (Teece 2007, pp.1319–1320). Dynamic capabilities are learned and stable patterns of behavior through which a firm systematically generates and modifies its way of doing things; so that it can become more effective. These can refer to particular processes or routines that combine, transform or renew resources into new competencies as markets evolve (Eisenhardt and Martin 2000). Consequently, dynamic capabilities are often developed over time instead of bought in the market and are not only determined by a firm’s
tangible and intangible resource base at a given point in time, but also by the decisions it has made throughout its past (Eisenhardt and Martin 2000, Ambrosini et al. 2009). Resources are combined to develop capabilities (Grant, 1996) and such a combination of capabilities in turn can create competences or capabilities that can span across people, functions and organizational boundaries (Day, 1994). In this study, we conceptualize supply chain innovation as such a dynamic capability formed by a culmination of several logistic capabilities to match the context and will give birth to other capability based outcomes.

Hypotheses Development

Using the theoretical foundation and extant literature on supply chain innovation discussed above, we commence to develop our research model. In a first set of hypotheses, we link the five widely discussed logistic capabilities (Esper et al., 2007; Gligor and Holcomb, 2012) viz. demand management capability (also known as customer focus capability), supply-management capability, integration capability, measurement capability and information exchange capabilities. Our next section discusses the outcomes: SC agility, SC resilience and SC continuity. The final section discusses the moderating role of environmental uncertainty and research model.

Linking the capabilities (antecedents) to supply chain innovation

Demand-Management Capability

This was originally known as customer focus capability (Esper et al., 2007, Morash et al., 1996; Bowersox et al.1999) but later Gligor and Holcomb (2012) adapted it to demand management capability as in the original classification it was referring activities aimed at fulfilling customer demands. Such a capability aims at providing differentiated products or services to a target set of customers aimed at exceeding their expectations. It also provides certain other value added activities (Morash et al., 1996). Now a firm has to devise new and better ways to differentiate its products and services and in doing so it leads to better, improved products and services. Thus we can hypothesize:

H1: A greater level of demand-management capability is positively associated with supply chain innovation.

Supply-Management Capability

Such a capability aims at multiple aspects like 1) minimizing total cost without significant tradeoffs in the cross functional sections 2) concentrates on time management minimizing waste 3) to meet dynamic demand patterns with reduced distortion of the order cycle process 4) using resources optimally for postponement speculation, modularization and standardization (Morash et al., 1996; Lowson, 2003). New products and services can evolve not all of a sudden, rather, by gradual development, improvement and transition. Therefore, as supply –management capability focusses on improving various aspects of relevant processes; we argue that it is indeed relevant for supply chain innovation. Accordingly, we hypothesize that:

H2: A greater level of supply-management capability is positively associated with supply chain innovation.
Integration Capability

This capability actually refers to “……a state that exists among internal organizational elements that are necessary to achieve unity of effort to meet organizational goals. Includes internal component (communication aspects associated with interdepartmental activities the willingness of departments to work together), and an external component (two or more firms voluntarily agree to integrate human, financial, and/or technical resources in an effort to create a new, more efficient, effective or relevant business model)”(Esper et al., 2007). Thus according to the above, the notion implies in attainment of unity among various set of diverse yet related activities for optimal performance. This is required for utilizing skills and knowledge for better products and services. Without efficient integration, supply chain innovation can never happen. Accordingly, the study hypothesizes that:

H3: A greater level of integration capability is positively associated with supply chain innovation.

Measurement Capability

These types of capabilities actually refer to the extent an organization monitors it internal and external operations (Esper et al., 2007; Gligor and Holcomb, 2012). Also focusses on making accurate and relevant information available that can aid decision making .Thus it enables the transforming business objectives into operational and financial targets for supply chain elements. Such a capability will definitely aid in innovation as it quantifies targets across all levels of a firm and its supply chain. Without objectives being translated into measurable items, innovation is not possible. Improvement or modification in existing products or services must be quantified. Accordingly, we hypothesize that:

H4: A greater level of measurement capability is positively associated with supply chain innovation.

Information Exchange Capabilities

This type of capabilities aim to gather, analyze and then distribute routine to strategic information both in and out of the organization through the application of relevant supporting infrastructure and technologies for enhancing information flow and better decision making (Zhao et al., 2001; Mentzer et al., 2004).Earlier studies in supply chain have repeatedly acknowledged the importance of sharing timely and relevant information in aiding better decision making. Without efficient and effective information exchange taking place between supply chain partners, the execution of new ideas and a better product or service will not materialize for a focal firm. Thus, it is agreed that information exchange capabilities are a positive antecedent for successful supply chain innovation. Accordingly, we hypothesize that:

H5: Greater levels of information exchange capabilities are positively associated with supply chain innovation.
Linking the Outcomes to Supply Chain Innovation

Supply Chain Agility

Supply chain agility aims to increase the speed and response of the chain subjected to dynamic requirements of the customer. Swafford et al. (2006) empirically found that sourcing and manufacturing flexibility serves as important antecedents of supply chain agility. Chiang et al. (2012) defined a firm’s supply chain agility as: “the capability of the firm, internally, and in conjunction with its key suppliers and customers, to adapt or respond in a speedy manner to a changing marketplace, contributing to agility of the extended supply chain”. According to the definition of supply chain innovation, significant improvement in existing supply chain processes due to enhanced skills and knowledge are expected. This improvement implies better speed and responsiveness in the supply chain. Accordingly, we hypothesize that:

H6: A greater level of supply chain innovation is positively associated with supply chain agility.

Supply Chain Resilience

Supply chain resilience is defined as the “adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function” (Ponomaroy and Holcomb, 2009). Sheffi (2003) argued that to build a resilient supply chain, firms must focus on designing agility in it. One of the earlier definitions of supply chain resilience (Christopher and Peck, 2004) states it as: “the ability of a system to return to its original state or move to a new, more desirable state after being disturbed”. Therefore when faced with disruptions, supply chains will be required advanced tools, technologies and procedures to restore operations to normal level. As supply chain innovation aims to innovating tools and technologies for better processes along the chain, hence it seems that supply chain innovation can result in a better resilient supply chain. Accordingly, the next hypothesis stood as:

H7: A greater level of supply chain innovation is positively associated with supply chain resilience.

Supply Chain Continuity

Firms are adopting an approach to manage these unpredictable disruptions that have an immediate and significant impact on the ability of supply chains in meeting customer requirements. This approach is known as business continuity planning (BCP) in supply chains (Zsidisin et al., 2005) and without it, business continuity in supply chains can never be achieved. Managing risk is a key aspect of any business continuity plan. According to Elliot et al. (1999) BCP is:

“..planning which identifies the organization’s exposure to internal and external threats and synthesizes hard and soft assets to provide effective prevention and recovery for the organization, whilst maintaining competitive advantage and value system integrity.”

However, business continuity is the activity performed by an organization to ensure that critical business functions will be available to customers, suppliers, regulators, and other entities that must have access to those functions (Coombs, 2012). Accordingly, the notion of supply chain continuity borrows is adapted from business continuity management in supply chains. Now
supply chain innovation would result in the production of better products and procedures resulting in efficient management of relevant processes and ensuring sustenance of the various activities even after facing disruption. Therefore, supply chain continuity might be a viable outcome of supply chain innovation. Accordingly, we hypothesize:

**H8:** A greater level of supply chain innovation is positively associated with supply chain continuity.

Now, innovation results in improved processes resulting in new product or services to the customers. These improved processes, skills and knowledge generated as a result of supply chain innovation will help in restoring operations when faced with disruption and hence bears the notion of continuity in that it assures sustainability of necessary operations even after disruption. Thus, it seems that supply chain resilience also implies continuity in the strategic sense. Accordingly, we posit supply chain continuity as an outcome of supply chain resilience too. Thus,

**H9:** A greater level of supply chain resilience is positively associated with supply chain continuity.

Therefore, it seems that supply chain resilience might act as a mediating variable between supply chain innovation and supply chain continuity. But future empirical research will prove the validity of these claims.

**Moderating Role of Environmental Uncertainty**

Environmental uncertainty refers to the degree to which firm’s external environment in terms of its competitors actions, technology, and consumer tastes and preferences, is characterized by an absence of pattern, unpredictability, and unexpected change (Fynes et al., 2004). A firm’s strategies will be successful or not is mostly determined by the environmental conditions in which the firm operate (Holweg et al., 2005). However, a firm cannot produce all the essential inputs that it requires and hence have to dependent on other firms for procuring the same. This suggests that firms therefore are encouraged to form close relationships with other firms. Hence, the presence of strong relationships will not only help in procuring essential inputs; but will enable both partners to an exchange to perform better under normal circumstances and recover effectively when encountered with environment uncertainties. Also capabilities develop as firms interact and exchange skills and knowledge during environmental uncertainties (Powell, 1998).

Accordingly, the study posits that:

**H 10a:** The greater the environmental uncertainty, greater the association between SC innovation and supply chain agility.

**H 10b:** The greater the environmental uncertainty, greater the association between SC innovation and supply chain resilience.

**H 10c:** The greater the environmental uncertainty, greater the association between SC innovation and supply chain continuity.

The below mentioned research model summarizes the proposed hypotheses.
Fig. 1 Research Model

Conclusion

Future studies must address if other capabilities are relevant for the proposed model. Secondly, empirical validation of the above framework is needed for generalization purposes. Thirdly, future research should address the specific importance of each of the included capabilities according to industry sector. All capabilities may not be equally relevant in all industry settings. Fourth, future studies should investigate for other possible consequences.

References:


***************