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Conceptualizing the relative openness of supply chain and its impact on organizational performance

Kamel A. Fantazy Syed Awais Ahmad Tipu Vinod Kumar

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Kamel A. Fantazy
Department of Business and Administration, The University of Winnipeg, Winnipeg, Canada
Syed Awais Ahmad Tipu
Department of Management, University of Sharjah, Sharjah, United Arab Emirates, and
Vinod Kumar
Sprott School of Business, Carleton University, Ottawa, Canada

Abstract

Purpose – The purpose of this paper is to develop a framework conceptualizing the relative openness of a supply chain and its impact on organizational performance.

Design/methodology/approach – The literature on system theory and the attributes of supply chain management are used to develop a framework describing the relative openness of a supply chain.

Findings – Different supply chain terminologies – such as adaptive supply chain network, best value supply chain, and open inter-organizational system – partially draw upon the basic premises of an open system. The relative openness of a supply chain and, consequently, the dynamics of different supply chain attributes remain understudied. This supports the idea that an open system perspective of the supply chain is imperative to improve the understanding of the influence of supply chain openness on organizational performance.

Originality/value – The conceptual framework posits that different supply chain attributes affect the openness of supply chain to a varying degree which ultimately influences the organizational performance. The proposed framework and research propositions will serve as a springboard for conducting future empirical studies.

Keywords Supply chain, Organizational performance, System theory, Open system, Closed system

Paper type Conceptual paper

1. Introduction

Cavinato (1992) suggests drawing upon system theory in order to develop a holistic view of the supply chain. Organizations operate in a highly dynamic and competitive business environment and constantly need to adapt to external changes in order to survive and remain competitive (Chatterji, 1996). In the context of supply chain management, this quest for survival and competitiveness is pertinent given the fact that the agility and flexibility of business operations result in competitive performance. Increasingly, organizations compete at the supply chain level (Ketchen and Hult, 2007). The need to examine the relationships between organizations and the external environment draws our attention toward employing the lens of open system theory in order to explore the interactions of supply chain partners.

The extant literature explores various dimensions of supply chain and highlights how supply chain partners are interlinked for mutual benefits (Cao and Zhang, 2011;

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Cao *et al.*, 2010; Bagchi *et al.*, 2005; Stavrulaki and Davis, 2010; Simatupang and Sridharan, 2005; Whipple and Russel, 2007). In this context, many of the supply chain dimensions such as collaboration and integration are used interchangeably (Cao and Zhang, 2011). Different attributes such as information sharing, decision synchronization, and incentive alignment are often associated with collaboration among supply chain partners (Cao and Zhang, 2011; Simatupang and Sridharan, 2005). Despite the benefits of supply chain collaboration, many supply chain partners fail to meet their partners' expectations (Barringer and Harrison, 2000). This essentially relates to the partners' willingness to open up their boundaries and develop an exchange relationship. Goffin *et al.* (2006) stress the need to further investigate the mutual collaborative relationship among supply chain partners in order to fully understand the supply chain dynamics. It appears that the supply chain researchers have addressed various dimensions of supply chain but they have not adequately highlighted the relative degree of supply chain openness. The current paper addresses this gap in the literature and initiates the development of a new theory of openness in supply chain.

The relative degree of openness is pertinent in the context of supply chain given the fact that supply chain partners may react differently toward a certain dimension of supply chain. For example, one supply chain partner may be more open in information sharing whereas the other partner may be less open in terms of joint learning and knowledge creation. Supply chain entities may have some consultation with their partners but they may not prefer joint decision making (Bagchi *et al.*, 2005). This kind of mutual arrangement could affect the overall relative degree of supply chain openness. This may also explain one of the possible reasons related to the inability of supply chain partners to truly capitalize on supply chain collaboration (Min *et al.*, 2005). Thus, the present paper posits that the supply chain openness should be assessed on a relative scale in order to improve our understanding of supply chain openness and the associated dynamics of mutual relationship.

In an attempt to develop the conceptual model depicting relative openness of supply chain, the current paper first draws upon the system theory and discusses open system perspective. Then, it highlights how past researchers have applied system perspective in a supply chain context. This essentially reveals that the relative openness of supply chain is not fully explored in the mainstream supply chain literature. This theoretical background is then used for developing the conceptual model of relative supply chain openness. In doing so, the present paper draws upon six supply chain attributes which determine the relative openness of supply chain and influence organizational performance. Extant literature on selected six supply chain attributes is presented in order to underline the role of supply chain attributes and how these attributes impact organizational performance. Based on this discussion, the current paper then proposes a set of research propositions to guide future research.

The remainder of the paper is organized as follows: An open system perspective in the context of the supply chain is discussed followed by the model development and suggested propositions. The practical implications, limitations, and future research directions are set forth followed by the conclusions.

2. Background

2.1 Open system perspective

Open system theory (Barnard, 1938; Boulding, 1956; Katz and Kahn, 1978; Scott, 2003) postulates that organizations interact with the external environment and exchange resources. Kast and Rosenzweig (1972) argue that the openness of a system is a matter

of relative degree and suggest considering the notion of "partially closed" and "partially open" systems. They further explain that "the relatively close[d] system has rigid, impenetrable boundaries, whereas the open system has the permeable boundaries between itself and a broader suprasystem" (p. 450). Table I presents the patterns of relationships between organization types and system variables. According to Kast and Rosenzweig (1972), closed or mechanistic organizations often operate under certain stable market conditions, focus on improving performance, and tend to achieve a single clear-cut goal. On the contrary, open or adaptive organizations face turbulent and uncertain conditions, develop external relationships, innovate, and inspire to achieve growth.

The distinction between open and closed organizations supports the idea that open systems operate under unstable conditions and are not considered self-contained (Hellriegel and Slocum, 1992). The open model treats organizations as a unit in the environment and employs an organizational development perspective (Robbins, 1991).

2.2 System perspective and supply chain

A range of theoretical perspectives have been applied in the supply chain context – such as agency theory, network theory, resource dependence theory, institutional theory, resource-based theory, game theory, and social capital theory (Ketchen and Hult, 2007). One of the previously mentioned theories, namely, network approach, appreciates the need to work with supply chain partners. The network approach delineates the strong and weak ties among supply chain partners and underlines the benefits of reliability and flexibility.

Different supply chain terminologies – such as adaptive supply chain network (Hsiao *et al.*, 2010), best value supply chain (Ketchen and Hult, 2007), and open inter-organizational system (Qu and Wang, 2011) – partially draw upon the basic premises of an open system. Ketchen and Hult (2007) examine the differences between traditional supply chains and best value supply chains and identify the key priorities of best value supply chains as speed, quality, cost, and flexibility. Furthermore, agility, adaptability, and alignment are also regarded as key attributes of best value supply chains (Lee, 2004).

The notion of organizational interdependence highlights the fact that supply chains are made of interrelated components that call for the coordination of various entities (Scott, 1981). This has drawn attention toward employing the system theory

Table I.
Patterns of relationships between organization types and system variables

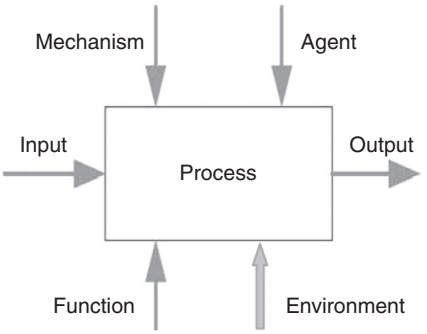
Organizational supra- and subsystems	Continuum of organization types	
	Closed/stable/mechanistic	Open/adaptive/organic
Environmental relationships		
General type	Placid	Turbulent
Predictability	Certain, determine	Uncertain, undetermined
Boundary relationship	Relatively closed, fixed, and well defined	Relatively open; participants have external relationship; varied and not clearly defined
Goals and values		
Organizational goals in general	Efficient performance, stability, maintenance	Effective problem solving, innovation, growth
Goal set	Single, clear-cut	Multiple, determined by necessity to satisfy a set of constraints
Stability	Stable	Unstable

Source: Adapted from Kast and Rosenzweig (1972, p. 461)

perspective in the supply chain context (Chandra and Tumanyan, 2005; Hassan, 2006; Holt and Ghobadian, 2009). Chandra and Tumanyan (2005) offer a system view of the supply chain and postulate that a supply chain is comprised of different components (as shown in Figure 1) – such as input, process, output, mechanism, agent, function, and environment. Figure 1 provides a system-wide view of supply chain. The description of the proposed components of a system is presented in Table II.

Different system components affect the dynamics of the supply chain system. For example, information sharing (Lee *et al.*, 2000) among supply chain partners is a critical input of the system view of a supply chain. The collective flexibility and adaptability of supply chain partners (Vickery *et al.*, 1999) fulfill the resource requirement and make a more conducive environment for effective functioning of a supply chain. Joint learning and knowledge creation underscore the role of supply chain partners as collaborating agents who act with combined skills and experience (Spekman *et al.*, 2002). The function of the supply chain system underpins the mission, aim, or primary concern of the supply chain partners, which are achieved through supply chain integration and alignment (Flynn *et al.*, 2010).

A few supply chain studies partially draw upon the open system perspective (e.g. see, Holt and Ghobadian, 2009; Yin *et al.*, 2005). Goutsos and Karacapilidis (2004) propose an open supply chain system for supporting e-business transactions. This essentially suggests that the mainstream supply chain literature does not fully explore



Source: Adapted from Chandra and Tumanyan (2005, p. 250)

Figure 1.
General system components

Components	Properties
Input	Physical item, information, or service that is necessary to start a process
Output	Physical item, information, or service that results from processing of input. The output is related to the total accomplishment of the function
Environment	Physical or sociological factors within which system elements operate. It relates to resource requirements, both physical and human
Agent	Computational or human resources for carrying the process
Function	Mission, aim, purpose, or primary concern of the system
Mechanism	Physical or logical facilitators in the generation of an output
Process	Flows, transformations, conversions, or order of steps, which transforms an input into an output

Source: Chandra and Tumanyan (2005, p. 252)

Table II.
System components

the openness of a supply chain and its influence on organizational performance. This area needs further exploration given the fact that a range of attributes could affect the degree of supply chain openness.

3. Model development and propositions

3.1 Toward defining the notion of "relative openness of a supply chain"

Supply chain partners interact with each other and open up their boundaries to exchange resources. This exchange could result in agility (Lee, 2004), information sharing (Lee *et al.*, 2000), communication (Akkermans *et al.*, 1999), collaboration (Barratt, 2004), cooperation (Mentzer *et al.*, 2001), flexibility (Kumar *et al.*, 2006; Vickery *et al.*, 1999), integration/alignment (Lee, 2004; Tan *et al.*, 1998), sharing responsibility, and joint learning and knowledge creation (Johnson and Sohi, 2003; Cao and Zhang, 2011).

3.2 Definition

Drawing upon the open system theory and supply chain management literature, we offer the following definition of relative openness of supply chain:

> "The relative openness of a supply chain is the degree to which supply chain partners are willing to show combined agility, collective flexibility, integrate their business operations, communicate and share information bilaterally, cooperate, and jointly learn from each other and create knowledge." This definition includes the attributes which are most commonly mentioned in the supply chain literature in order to underpin the relations among different supply chain entities. Although other dimensions are of great interest, they are not included due to the concerns regarding the model complexity.

Figure 2 presents the proposed conceptual framework depicting the relative openness of a supply chain. As shown in the framework, different supply chain attributes – such as cooperation, integration, communication, flexibility, agility, and learning and knowledge creation – determine the relative openness of the supply chain which

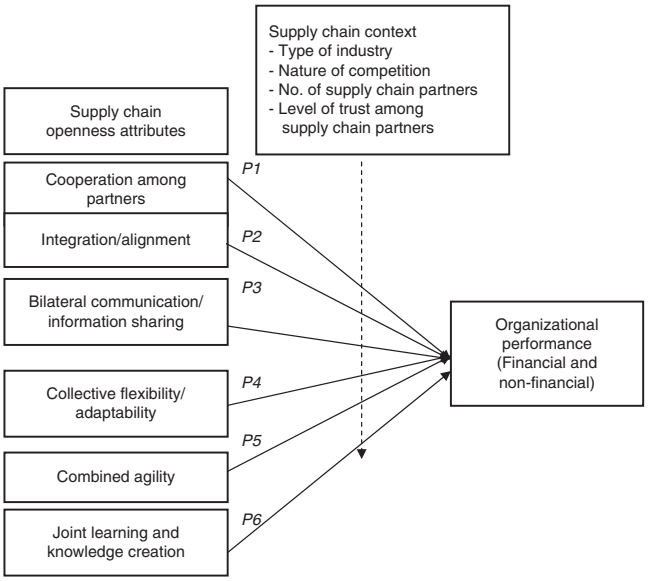


Figure 2.
Conceptual framework – relative openness of supply chain

ultimately affects the organizational performance. Moreover, a variety of contextual factors moderate the effects of supply chain openness on organizational performance. The contextual factors include type of industry, nature of competition, number of supply chain partners, and level of trust among supply chain partners. The lack of trust between trading partners is more likely to result in a lack of collaboration (Barratt, 2004; Jones *et al.*, 2010). Mentzer *et al.* (2001) suggest that the number of supply chain partners should be small in order to ensure increased cooperation.

More intense competition warrants higher degree of collaboration among supply chain partners in order to remain competitive (Koh *et al.*, 2007; Simatupang and Sridharan, 2004). The supply chain structure and management differ across diverse industries given the unique characteristics in terms of value and cost of components (Cohen and Lee, 1988), availability and amount of raw materials (Chikan and Whybark, 1990), and perishability of the products (Picard, 1982). This posits that the type of industry is also likely to affect the interaction among supply chain partners (Vargas and Johnson, 1993).

4. Supply chain attributes and impact on performance

4.1 Cooperation among partners

Cooperation is regarded as a critical factor for effectively managing supply chain networks (Tyndall *et al.*, 1998). Cooperation underpins similar or complementary, coordinated activities of supply chain partners to produce improved mutual outcomes (Anderson and Narus, 1990). Inter-organizational dependencies give rise to the need for coordinated actions of supply chain partners in response to the strategic problems (Xu and Beamon, 2006). Cooperation among supply chain partners underscores cross-functional coordination (Cooper *et al.*, 1997), which encompasses joint planning and control activities (Tyndall *et al.*, 1998). Joint responsibility for problem solving and flexibility in arrangements are important dimensions of cooperative relationship behavior in a supply chain network (Johnston *et al.*, 2004).

Cooper *et al.* (1997) argue that the number of supply chain partners should be small in order to enhance cooperation. Mutual trust and commitment largely determine the level of cooperation between supply chain partners (Morgan and Hunt, 1994). Degree of formality, level of control, decision localization (McCann and Galbraith, 1981), and risk/reward sharing (Xu and Beamon, 2006) affect the degree of mutual coordination in a supply chain network. The degree of formality, level of control, and centrality is higher if one partner increasingly depends on the other partner in a supply chain network (McCann and Galbraith, 1981). Also, the mutual cooperation is unlikely to last if one partner benefits at the expense of the other (Ballou *et al.*, 2000). There is an emphasis on the need for redistributing the rewards of cooperation using appropriate metrics, allocation methods, and information sharing mechanisms. In the absence of formal cooperation, informal mechanisms, such as power and trust, determine the degree of cooperation between supply chain partners (Ballou *et al.*, 2000).

Supply chain partners need to carefully select the coordinated mechanism considering its effects on supply chain performance (Xu and Beamon, 2006). Cooperation results in better performance as it avoids redundancy and overlap of supply chain activities (Lassar and Zinn, 1995). Supply chain partners carry out core business activities in accordance with mutually agreed upon mechanisms (Heide and John, 1990). Some of the activities of mutual cooperation include achieving cost efficiencies and reducing inventories (Cooper *et al.*, 1997), quality control, and delivery system design (Treleven, 1987).

Clark and Lee (2000) empirically explore the relationship between performance, interdependence and coordination of firms involved in inter-organizational relations within the US grocery channel. They find that interdependence, performance, and coordination are closely related for firms engaged in inter-organizational relationships. Drawing upon the survey data and personal interviews, Min *et al.* (2005) assess the level of supply chain collaboration. They report the outcomes of supply chain collaboration such as increase in effectiveness, efficiency, and market position. In the same vein, Soosay *et al.*'s (2008) case study research reveals that working together with supply chain partners affects operations of the firms and improves effectiveness. It also influences innovative capacity of the firms and encourages radical and incremental innovations.

In the light of the extant literature, the present study offers the following proposition:

P1. Cooperation among SC partners as a dimension of relative openness of SC relates positively to organizational performance.

4.2 Supply chain integration/alignment

Flynn *et al.* (2010, p. 59) define supply chain integration as "the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organization processes." A tightly integrated supply chain encompasses a firm's logistics to include suppliers and customers (Christopher, 1992). Supply chain partners rely on inter-organizational networks for quick response to changing customer demands (McAdam and McCormack, 2001). In addition to integrating internal operations, supply chain partners need to have strategic alignment in order to achieve supplier and relationship integration (Bowersox *et al.*, 1999). Material/service supplier integration links externally performed work with internal processes whereas relationship integration develops and maintains a shared mental framework with customers and suppliers. External integration provides various advantages to the supply chain partners – such as enhanced customer capabilities, improved quality standards, and differentiation (Bowersox, 1989; Stevens, 1990).

Supply chain partners need to focus on their core competencies, performing what they do best for achieving virtual vertical integration (Prahalad and Hamel, 1994; Hammer, 2001). The level of integration is determined by various factors such as the degree of competition, the maturity of the industry, the nature of the products, and the balance of power in the supply chain (Bagchi and Skjoett-Larsen, 2002). Zhang *et al.* (2015) contend that total integration of supply chain needs integration of resource flows, processes and organization, strategy, planning and control.

Supply chain integration provides enhanced competitive capability enabling the supply chain partners to significantly improve performance. Childerhouse and Towill (2011) conduct eight-year international field study of 50 products and associated supply chains. They reveal that supply chain integration significantly correlates with increased performance. Saeed *et al.* (2005) draw upon the empirical data from 110 manufacturing firms and reveal that the higher levels of external integration as a result of inter-organizational system enhances process efficiency. Flynn *et al.* (2010) conduct survey of 617 manufacturing companies in China and finds that supply chain integration relates to operational and business performance. Better integration leads toward improving delivery performance and customer satisfaction due to the better

understanding of supply chain partners with regard to products, processes, capabilities, and operations (Flynn *et al.*, 2010).

Taking into account contemporary literature, the current study presents the following proposition:

P2. Supply chain integration/alignment among SC partners as a dimension of relative openness of SC relates positively to organizational performance.

4.3 Bilateral communication/information sharing

Research shows that relationship factors – including understanding, commitment, information sharing, and bilateral communication (Chan and Chan, 2009; Chandra *et al.*, 2007; Grossman, 2004; Kampstra *et al.*, 2006) – are essential in aligning supply chain relationships toward common objectives. The essential ingredient at the center of information sharing is bilateral communication (Spekman *et al.*, 2002). Two important aspects of bilateral communication are the methods of information exchange and sharing among partners and the degree of openness in information exchange between partners (Ogulin *et al.*, 2011). Keeping all members in a relationship informed and focussed happens through regular communication of measurements, objectives, and future changes, and this is essential in changing fully functioning, transactional-oriented relationships to a partnership (House and Stank, 2001). The other side of this is that a lack of bilateral communication between partners causes disagreements and confusion among supply chain partners and is one source of collaboration failure (Paulraj *et al.*, 2008). Mohr and Nevin (1990) suggest that the role of communication in holding supply chain partners together is similar to that of glue, and this function only works through well-defined, two-way relationships that function on different levels. Anderson and Narus (1990, p. 44) define communication as "the formal as well as informal sharing of meaningful and timely information between firm[s]." Frequent and timely communication helps to resolve disagreements and line up partner expectations (Morgan and Hunt, 1994) and it also reduces behavioral uncertainty (Wuyts and Geyskens, 2005).

The level of information sharing could influence organizational performance. Yu *et al.* (2002) study a decentralized supply chain consisting of a single retailer and a single manufacturer in order to explore the benefits of information sharing with supply chain partners. They find that supply chain partners achieve cost savings and reduction in inventory levels through information sharing. Zhou and Benton (2007) cite the positive impact of information sharing on performance in Dell and Cisco. They report that information sharing with suppliers enables Cisco to quickly respond to the demand changes in the supply chain. Dell shares component availability information with its customers on the website and also exchanges information with suppliers. Customers' orders are forwarded directly to appropriate suppliers. This information sharing mechanism makes the supply chain more responsive and improves customer service (Zhou and Benton, 2007). However, the lack of information sharing among supply chain partners can lead to non-transparent demand patterns that may cause demand amplification downstream and results in the bullwhip effect (Cao *et al.*, 2010).

In light of the literature cited above, the present study suggests the following proposition:

P3. Bilateral communication/information sharing among SC partners as a dimension of relative openness of SC relates positively to organizational performance.

4.4 Collective flexibility/adaptability

With the increasing interest in supply chain flexibility over the last few years has come a fairly comprehensive literature review of flexibility from the supply chain perspective by a number of authors (Duclos *et al.*, 2003; Fantazy *et al.*, 2009; Kumar *et al.*, 2006; Lummas *et al.*, 2005; Pujawan, 2004; Seebacher and Winkler, 2013; Stevenson and Spring, 2007; Vickery *et al.*, 1999; Zhang *et al.*, 2003). The flexibility of supply chains is one way to improve company efficiency, and it provides a significant measure of supply chain performance (Fantazy *et al.*, 2009; Wadhwa *et al.*, 2007). A definition of supply chain flexibility includes the flexibility dimensions that directly affect a firm's customers (Sanchez and Perez, 2005; Vickery *et al.*, 1999). However, the responsibility for supply chain flexibility is spread throughout the supply chain and the effective performance depends upon a firm's ability to leverage the capabilities of its supply chain to meet or exceed customer requirements (Sanchez and Perez, 2005).

The description of flexibility by Swafford *et al.* (2006) uses two dimensions: range and adaptability. They go on to define range as the different states (levels, positions, or options) that can be accomplished using the existing resources. The notion of adaptability relates to the ability to change from one condition to another condition in a timely and cost-effective way. Vickery *et al.*'s (1999) study of 65 office and residential furniture manufacturers reveals that the volume flexibility – an ability to increase or decrease production for meeting customer demand – positively relates to a firms' performance and highly relates to market share and market share growth. Chan *et al.* (2009) use a semi-structured interview with a logistics manager of a prominent international company to understand the issues around flexibility and adaptability in supply chain management through the eyes of an industrial practitioner. The results of this study demonstrate that flexibility and adaptability are helpful in practical supply chain applications. Chan and Chan (2009) conduct a comparative study of a network of two-level, multi-product make-to-order supply chains to document how flexibility and adaptability in delivery quantity and due date can improve the network performance. The study shows a positive connection among flexibility and adaptability and performance. However, the authors note that there is a trade-off in selecting the coordination mechanism between adaptability and flexibility subject to capacity utilization.

Based on the current literature, the present study offers the following proposition:

P4. The collective flexibility/adaptability of SC partners as a dimension of relative openness of SC, relates positively to organizational performance.

4.5 Combined agility

Recent research in supply chain management has focussed on the development of agility as a means of coping with the challenges presented by more dynamic market places (Blome *et al.*, 2013; Katayama and Bennett, 1999; Shaw *et al.*, 2005). The agility of a supply chain, the fundamental characteristic of the supply chain market interface (Katayama and Bennett, 1999), is a relatively new concept in operations and supply chain management literature (Braunscheidel and Suresh, 2009). The definition of agility by Swafford *et al.* (2006) is "the supply chain's capability to respond in a speedy manner to a changing marketplace environment." The definition by Braunscheidel and Suresh (2009) is "the capability of the firm, both internally and in conjunction with its key suppliers and customers, to adapt or respond in a speedy manner to marketplace changes as well as to potential and actual disruptions, contributing to the agility of the extended supply chain." Developing agility is seen as a risk management initiative that

allows a firm to respond rapidly to marketplace changes and to anticipated and actual disruptions in the supply chain.

Achieving agility results in different performance-related outcomes. Organizations develop agility so they provide superior value, manage the risk of disruption, and ensure uninterrupted customer service (Christopher, 2000; Christopher and Towill, 2001; Zhang *et al.*, 2002; Chopra and Sodhi, 2004; Kleindorfer and Saad, 2005).

Yusuf *et al.* (2014) draw upon the survey of 137 supply chain managers in the oil and gas industry in UK and explore the relationships among supply chain agility, competitive objectives, and business performance. They find that agility has a significant influence on business performance. More specifically, mastering change and uncertainty – one of the dimensions of supply chain agility – correlates with all aspects of business performance including turnover, net profit, market share, customer loyalty, and performance relative to competitors. They also find strong positive correlation between supply chain agility and competitive objectives of proactivity, quality, innovation, delivery, and speed.

Gligor *et al.* (2013) relates agility to the ability to access relevant data, quickly detect changes, opportunities, and threats, and implement decisions quickly. In this context, Christopher (2000) cites the example of Zara – a Spanish apparel company – and discusses the role of its agile supply chain in a highly competitive business environment. He mentions some of the features of its agile supply chain which enables Zara to develop one of the most effective quick response systems in its industry. Some of these salient features include cross-functional teams that are well informed about latest industry trends, gathering up-to-date data from company stores around the world, providing technological, logistical, and financial support to a network of contractors, and focus on economies of scale.

Aligning with the current literature, this study examines the following proposition:

P5. The combined agility of SC partners as a dimension of relative openness of SC, relates positively to organizational performance.

4.6 Joint learning and knowledge creation

Sharing know-how or resources encourages joint learning between supply chain partners (Akande *et al.*, 2010) which enhances a firm's competitiveness (Bessant *et al.*, 2003). A firm's ability to acquire new insight and knowledge is a basic building block of learning which improve firm's performance (Spekman *et al.*, 2002). In a supply chain network, collaborating partners combine skills, experience, and capabilities for technology and knowledge transfer (Spekman *et al.*, 2002).

Firms can potentially exchange knowledge for encouraging upstream and downstream supply chain learning (Claycomb *et al.*, 2001). Conducive learning environment is needed for process efficiency and improved performance (Spekman *et al.*, 2002). Supply chain partners need to reach a level of trust which is critical in exchanging sensitive information (Spekman *et al.*, 2002). Supply chain partners need to manage knowledge as an intangible asset rather than mere focussing on managing physical goods (Nielsen, 2005).

Joint learning and knowledge creation strengthen the networking and collaboration between supply chain partners. The mechanism of joint learning and knowledge creation facilitates the supply chain partners in better adapting and serving the customers (Shin *et al.*, 2001). Learning and knowledge creation of supply chain partners is essential in developing knowledge creation capabilities which ensures transferring the codified

knowledge (Nielsen, 2005). Samuel *et al.* (2011) conduct study of 144 French manufacturing firms and find that supply chain partners can realize learning across borders through creating knowledge by working together. Cheung *et al.* (2010) examine the learning capabilities between business partners in a cross-border setting for investigating how relationship learning influences relationship value for supplying and buying firms. Relationship learning refers to the joint activity in which supply chain partners strive to create more value together than they would do individually. Relationship value reflects both financial and relational benefits obtained from the mutual relationship. Cheung *et al.*'s (2010) study of 126 cross-border dyads finds that relationship learning is significantly related to relationship value for both buyers and suppliers.

Crone and Roper (2001) highlight the importance of local learning and find that the locally based multinational plants work closely with the suppliers which encourages knowledge transfer activities. This results in improving business performance through enhancing process and operational efficiency (Sambasivan *et al.*, 2009). Spekman *et al.* (2002) report the survey results of companies associated with 22 extended supply chains. They find that learning positively affects performance measures related to end-customer satisfaction and being a more market-focussed supply chain.

In the light of the current literature, the current study suggests the following proposition:

P6. Joint learning and knowledge creation among SC partners as a dimension of relative openness of SC, relates positively to organizational performance.

Table III summarizes the definitions of selected SC attributes and selected performance-related outcomes as revealed in the literature.

4.7 Organizational performance

While many organizations still use the traditional financial measures of performance, it is argued that these measures are not adequate for today's competitive environment (Agami *et al.*, 2012). Typical financial measurement approach includes the examination of such indicators as sales growth, profitability, earnings per share, investment on assets, and so forth. Supply chain companies have realized the importance of financial and non-financial performance measures (Gopal and Thakkar, 2012). However, they fail to understand them in a balanced framework (Gunasekaran *et al.*, 2001). According to Kaplan and Norton (1996), while some managers and researchers concentrate on financial performance measures, others consider operational measures. Such an inequality does not lead to the measures that can present a clear picture of the organizational performance.

Maskell (1991) suggests a balanced approach in which companies may consider financial performance measurements as important for strategic decisions and external reporting, but day-to-day control of manufacturing and distribution operations is better handled with non-financial measures. Furthermore, financial performance measures are more likely to reflect the assessment of a firm by factors outside of the firm's boundaries, operational measures reflect more directly on the efficiency and effectiveness of the operations within the firm. These categories of performance reflect competencies in specific areas of the supply chain, including cost, delivery speed and reliability, quality, and customer satisfaction. Operational performance measures provide a relatively direct indication of the efforts of the various supply chain constructs. Recognizing the importance of financial and non-financial performance, the proposed model incorporates both financial and non-financial performance measurements.

SC attributes	Definition	Source	Performance-related outcome	Source
Cooperation	Similar or complementary, coordinated activities performed by firms in a business relationship to produce superior mutual outcomes	Anderson and Narus (1990)	Achieving cost efficiencies and reducing inventories; quality control	Cooper *et al.* (1997) and Treleven (1987)
Integration/ alignment	The degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organization processes	Flynn *et al.* (2010)	Enhanced customer capabilities, improved quality standards, and differentiation; enhanced competitive capability; process efficiency; improved delivery performance and customer satisfaction	Stevens (1990), Kim, 2006, Saeed *et al.* (2005) and Flynn *et al.* (2010)
Collective flexibility/ adaptability	Encompasses those flexibility dimensions that directly impact a firm's customers and are the shared responsibility of two or more functions along the supply chain, whether internal (marketing, manufacturing) or external (suppliers, channel members) to the firm	Vickery *et al.* (1999)	Positive association between flexibility and adaptability and performance	Chan and Chan (2009)
Combined agility	The supply chain's capability to respond in a speedy manner to a changing marketplace environment	Swafford *et al.* (2006)	Ensuring uninterrupted service; risk mitigation and ability to respond to uncertainty	Christopher (2000), Zhang *et al.* (2002), Swafford *et al.* (2006) and Braunscheidel and Suresh (2009)
Bilateral communication/ information sharing	Includes the ways in which information is exchanged and shared among partners and the openness between partners in their exchanges of information	Ogulin *et al.* (2011)	Resolving disagreements	Morgan and Hunt (1994)
Joint learning and knowledge creation	Combining skills, experience, and capabilities for technology and knowledge transfer	Spekman *et al.* (2002)	Process efficiency; better adapting and serving the customer; cost saving advantage; foster innovation	Spekman *et al.* (2002) and Shin *et al.* (2001)

Table III. Supply chain attributes, definitions, and outcomes

5. Implication, limitation, and scope for future research

5.1 Practical implications

Interaction among supply chain partners is increasingly important to survive and remain competitive in the marketplace (Ketchen and Hult, 2007). The relative degree of supply chain openness largely depends on the willingness of supply chain partners to open up their boundaries for sharing information and resources. Supply chain managers need to decide what information and resources they are willing to share with their supply chain partners. This eventually determines the relative openness of the supply chain. The proposed conceptual framework highlights the critical attributes which should be considered when managing supply chain performance and making decisions regarding the relative openness of supply chains.

As noted earlier, past studies have empirically shown the influence of supply chain attributes on organizational performance. Moreover, literature also reveals that the selected supply chain attributes, such as information sharing and combined agility, mentioned in the model positively impact performance in leading business organizations such as Cisco, Dell, and Zara. These empirical studies and practical real world examples potentially show that the links between supply chain attributes and firm performance, as proposed in the model, are well established. The proposed framework will facilitate the supply chain practitioners to develop the holistic view and assess the relative openness of their supply chains considering the empirical underpinnings of the linkages between supply chain attributes and organizational performance. Having supply chain attributes linked with performance, the framework will potentially help supply chain managers to be more sensitive to the importance and challenges of managing these attributes.

5.2 Limitations

It is also pertinent to consider the possible limitations of the proposed framework. Given the fact that the selected supply chain attributes are not exhaustive, additional attributes can be considered in future research. Moreover, the present study attempts to set the initial theoretical foundations for mapping the influence of relative openness of the supply chain on organizational performance. Future work is needed to empirically test the proposed framework and further refine the attributes of supply chain relative openness.

5.3 Future research directions and implications

For conducting future empirical research, the authors of the current paper aim to draw upon the proposed conceptual model and go to the next stage of empirical study. This includes the development of an instrument measuring relative degree of supply chain openness, gathering field data from supply chain or logistics managers, and performing hypotheses testing. Advanced statistical techniques such as SEM will be applied to identify which attribute has more impact on organizational performance. Detailed discussion on supply chain attributes as shown in the model will potentially facilitate in identifying possible measures of supply chain constructs. Given the absence of studies measuring relative openness of supply chain, future researchers can also consider the proposed framework as a springboard for conducting empirical research so they can get deeper insights into the relative openness of the supply chain and its impact on organizational performance.

Selected supply chain attributes are not mutually exclusive, which also highlights the potential interdependence among the selected attributes. Clearly defining the attributes will improve the meanings of the selected variables. Moreover, researchers use supply chain

attributes interchangeably; for example, flexibility and agility, flexibility and adaptability, and cooperation and bilateral information sharing and communication. Future researchers should consider the implications of this potential overlap among supply chain attributes.

The present study posits that some dimensions, such as sharing responsibility, cut across the selected supply chain attributes. For example, the supply chain partners share responsibility while cooperating and integrating their supply chain operations (Anderson and Narus, 1990; Flynn *et al.*, 2010). Organizations that have strategic partnerships with suppliers are able to work more effectively with the few important suppliers who have demonstrated their willingness to share responsibility for product success (Rao *et al.*, 2006). Additional research is needed to improve our understanding with regard to the level of responsibility that each partner has within the supply chain system.

Different contextual factors could moderate the relationship between supply chain openness and organizational performance. In this context, the proposed framework should be applied to explore the relative openness of global supply chains (Bhatnagar and Viswanathan, 2000). This is pertinent to investigate as global supply chains transcend national borders and managers operating in different cultural settings could have different attitudes toward sharing information and resources with supply chain partners.

The framework proposed in this paper allows a supply chain manager to evaluate among several supply chain openness attributes that directly impact financial and non-financial performance. The framework also encompasses those supply chain attributes which may directly impact a firm's customers (i.e. the attributes that deliver added value to customers). These attributes include cooperation among partners, integration/alignment, bilateral communication/information sharing, collective flexibility/adaptability, combined agility, and joint learning and knowledge creation. Each of these supply chain openness attributes could be applied to the supply chain system. However, each attribute may not be appropriate for every supply chain. The framework is useful in helping managers to identify which attribute of supply chain should be given emphasis in an attempt to increase supply chain performance. In addition, the framework emphasizes that the supply chain partners may consider both measures – financial and non-financial – for assessing the supply chain performance.

Given the organizational quest to improve performance, employing an open system theory in the supply chain context is a potential area of future research. There are several research questions that can be raised to advance the understanding of the relative openness of the supply chain and its impact on organizational performance. The following are some of the potential research questions:

RQ1. What are the characteristics of partially close and partially open supply chains?

RQ2. Which of the attributes of the supply chain interaction is most likely to have a strong effect on the degree of supply chain openness?

RQ3. Under what conditions are partially closed and open supply chains appropriate for organizations?

Performance measures must be identified that measure supply chain performance across supply chain nodes to determine if real change in customer value has been added:

RQ4. How does the relative degree of openness of the supply chain affect organizational performance?

It is hoped that continued research efforts will potentially lead to a better understanding of the nature of supply chain openness.

6. Conclusions

A comprehensive framework conceptualizing the relative openness of a supply chain and its impact on organizational performance (financial and non-financial) is presented in this paper. The paper extends the current supply chain literature on collaboration among supply chain partners and stresses the need to study the relative openness of a supply chain. This extension is important with the advent of supply chain management concepts in the last two decades. A range of theoretical perspectives have been applied in the supply chain context (Ketchen and Hult, 2007). According to the interdependence theory, supply chains are made of interrelated components and require the coordination of various entities (Scott, 1981). This has triggered an interest in applying the system perspective in exploring the dynamics of supply chains (Holt and Ghobadian, 2009; Yin *et al.*, 2005). Most of the studies present a descriptive account of a supply chain as a system describing the flow of activities and components of the system. Consequently, the relative degree of supply chain openness and associated dynamics remain underexplored. In order to address this gap in the literature, the current paper considers the notion of openness in supply chain context. The proposed conceptual framework highlights different supply chain attributes and future researchers can operationalize this to investigate the relative degree of supply chain openness and its impact on organizational performance.

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Further reading

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About the authors

Kamel A. Fantazy received his PhD in Operations Management from the Sprott School of Business at the Carleton University, Ottawa, Canada. He worked as Research Fellow and taught in Canada. His research interests include supply chain management, improving performance of production and operation systems, international technology transfer and supply chain sustainability. He has 14 years of industrial experience in various managerial positions. He is currently an Assistant Professor in the Faculty of Business and Economics, the University of Winnipeg, Canada. He has several research papers and he was the recipient of the Best Research Paper Award in the POM division at the ASAC Conferences held in Halifax, Canada, 2008, Memorial University, 2012, and Nipissing University, 2014. He received the Best Paper Award in the Seventh Annual Supply Chain Symposium in Toronto, Canada, October 28-30, 2009. Kamel A. Fantazy is the corresponding author and can be contacted at: k.fantazy@uwinnipeg.ca

Dr Syed Awais Ahmad Tipu holds Doctor of Science and Master of Science Degrees from the George Washington University, USA. He is working as an Associate Professor in the College of Business Administration, University of Sharjah, United Arab Emirates. He has published in leading journals such as *Journal of Business Research, Journal of Business Ethics*, and *International Journal of Entrepreneurial Behavior & Research*. His research interests include entrepreneurial cognition, work values of aspiring entrepreneurs, and necessity drive entrepreneurship.

Professor Vinod Kumar, the winner of the two Scholarly Achievement and three Research Achievement Awards of the Carleton University, received his graduate education from the University of California, Berkeley and the University of Manitoba. He has just completed ten years as the Director of the Sprott School of Business – Carleton University. Vinod has also served for several years on the Board of Governors and the Senate for Carleton University and on the Board of

the Ontario Network of e-Commerce. Vinod is a well-known expert sought in the field of technology and operations management. He has consulted DND, CIDA, Canada Post, Industry Canada, CHEO, Federal Partners of Technology Transfer and Canadian Association of Business Incubator to name a few. Before joining academia in the early 1980s, Vinod worked for five electronics and manufacturing firms for over 15 years in Canada, India and the USA in various line and staff management positions. Vinod has given invited lectures to professional and academic organizations in Australia, Brazil, China, Iran, and India among others. He has taught in Executive MBA programs in Canada and Hong Kong and in Sprott MBA in Ottawa, Iran and China where he enjoys connecting his industry and research experience with management theories.