Complexity and supply chain management practices in healthcare: a value co-creation view

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Abstract
'Complexity' management is a key area of managerial consideration. Conceptualizing complexity dimensions as relationship-quality, volume and frequency of interactions in the network, number of elements, and degree of differentiation among the actors in the network, this paper investigates the influence of hospital supply-base and customer-base complexity on key supply chain management practices (SCPs) using Prahalad and Ramaswamy's (2004) DART (Dialogue-Access-Risk Benefits-Transparency) framework, linking it to Dynamic Capabilities literature.

Keywords: Complexity, Supply chain practices, Capabilities.

Introduction
'Complexity' has become a dominant feature of the lexicon of today's supply chain management field. Complexity no more remains a novel stumbling block as the SC managers, irrespective of their sectors, are facing it increasingly. So understanding the nature and source of the complexity have become very important for the managers, so as to aptly find means to manage and contain complexity. With the enhancement in technology and sector competitiveness, complexity seems to be ever spiraling up across sectors and healthcare happens to be one of the foremost (Schneller and Smeltzer, 2006). Christopher and Lee (2004) have indicated the intensifying scenario and highlighted that demand patterns across nearly every industrial and services sector is on a rise associated with increasing volatility and vulnerability of supply chains due to various aspects including disturbances or disruptions, changing pattern of business models, adoption of stringent practices, move towards prevalence of more outsourcing, trend towards reduced supplier base and last but most importantly lacking in visibility and supply chain confidence. Multiple
interrelated firms and supply chain actors exhibiting inherent complex interconnections are the characteristics of most buyer-supply networks across industries (Choi & Hong, 2002). Hospital supply network happens to be one of the most crowded and complex with hundreds or even thousands of actors from both up and downstream networks. Such networks often exhibit shift in strategies and objectives within a dynamic environment which complicates the scenario (Pathak et al. 2007). Thus for a focal firm in a business to business (B-2-B) scenario, with upstream multiple suppliers and downstream customers, the role of focal firm in managing complications and adapting to the network conditions becomes immensely important which can be rationally linked to buyer-supplier network decisions and optimization (Pathak et al. 2007).

However under the said presence of complexity, decisions if and when taken with non-complex assumptions poses threat to business and thus re-iterates the need for understanding the nature and source of complexity for assuring streamlined operations. On the other hand the benefits gained from adapting to the dynamicity of the environment are increased efficiency, rapid flexibility, preparedness for uncertainties, increased market awareness and overall superior decisions (Brown & Eisenhardt, 1998; Abell, Serra, & Wood, 1999). Pathak et al. (2007) have justified through evidences and rational arguments regarding supply networks being complex adaptive systems (CAS) and exhibiting adaptive aspects while existing in complex environment with myriad relationships and interactions. This article does not focus deep into CAS aspects of supply networks, as it is already well established in literature. However certain characteristics of CAS appear rationally linked to the co-creation viewpoint of this paper, that of co-evolution (reacting to and creating the unique environment) and self-organization (properties emerging without any external imposition on the system), which are the manifestations of the evolving dynamic interactions in complex systems.

The conceptualization of this paper is done in the perspective of the hospital supply chain with the healthcare service provider i.e. the hospital as the focal entity and its upstream suppliers representing the supply base and downstream customer base represented by the physicians who are representatives of the patients and having immense role in the medication related orders and deciding patient needs. The hospitals engage into supply relationships with varied number of suppliers for different hospital supplies (devices, pharmaceutical drugs and products, medical-surgical items, etc) and thus often induce different working relationships with and among the suppliers. Thus the healthcare (hospital) supply network offers a plethora complex inter-connections with suppliers and the physicians. Moreover there has been an increasing trend in the outsourcing activities across sectors and healthcare is no exception where outsourcing activities are gaining prevalence. From the perspective of the focal firm, this has enhanced the need for more orchestration of activities with the suppliers in the supply-base on one hand and also coordinating with the customers or users of services on the other hand positing it as a strategic issue (Dyer, 1996; Agrawal and Nahmias, 1997; Fine, 1998). With the hospitals, though the output is service, but this service delivery depends largely on the achievement of sync between the supply side and the customer side. The service delivery rests much on the availability of products and transactions between network actors. Dobler and Burt (1996) indicated that higher the proportion of items purchased, larger is the significance of managing the supply-base. In case of hospitals very high percentage of the goods are purchased and the service is highly dependent on those, thereby justifying the need of probing further and understanding the role complexity plays in a hospital supply chain perspective.

The objective of this paper is firstly conceptualizing the complexity dimensions which describes and represents the hospital network environment and is common to both its upstream
and downstream segments involving its supplier-base (portion of the supply network within managerial purview of the focal firm) and customer-base (portion of the upstream network within managerial purview). Secondly, the paper aims at understanding how the conceptualized complexity in the healthcare environment (hospital) influences or rather drives the DART supply chain practices (DART-SCPs). These DART-SCPs are the generic key upstream and downstream SCPs that fit the connotations of DART framework proposed by Prahalad and Ramaswamy (2004). Thirdly, the paper aims at rationally arguing through the existing literature, leading to establishing the proposition linking DART-SCPs to the firm’s dynamic capability. Finally, the ultimate overarching goal is to view complexity as an antecedent to DART-SCP, in a value co-creating environment viewed through a service dominant logic (SDL) lens.

Understanding Complexity
The concept of complexity bears its root to the systems concepts that are difficult to understand, analyze and hence difficult to predict or control (Thompson, 1967; Gottinger, 1983). So Scricini (1987, p. 96) indicated that precisely defining complexity is a challenge in itself and stated that due to the very subjective nature, the meaning and value of complexity evolve and change as per the scope of the system in consideration. In short, the definition of complexity can be said to be tied deeply and inherently to the details and boundary of the system in discussion. So at the very first instance specifying the system boundaries and justifying it as a complex system becomes the priority before conceptualizing complexity in that perspective. Various studies have highlighted supply chain (SC) complexity as key managerial issue and a primary construct linked to performance, justifying it’s immense relevance in SC management (Kaufman, 1993; Waldrop, 1992; Vachon and Klassen, 2002; Choi and Krause, 2006).

Conceptualization of complexity in this paper
Although various studies in the SC complexity literature have conceptualized complexity in terms of various parameters from a generic viewpoint, however the choice of parameters in this paper has been done with specific objective, based on the common relevance of parameters between the supplier-base and the customer-base, relevant to the hospital scenario. In the hospital perspective, the hospital supply network managers have to deal with various suppliers supporting various relationship patterns (characterized by different levels of information sharing, frequency of interaction and collaborative linkages) on one hand and on the other side also have to deal with the customers (physicians who represent the patient needs) with different levels of attachment to the specific hospital (may be an in-house physician dedicated to that hospital or a visiting physician) and with different levels of involvement (highly involved in the hospitals purchase and quality planning or may be working as an independent physician as per the available hospital resources). Thus the relationship with these distinct yet integral set of network actors poses a dynamic and challenging situation which contributes to the understanding and conceptualization of complexity in the hospital’s network environment.

There is a vast literature on complexity in general and it appears but natural as the complexity of a system can be described and inter-twined in terms of various interconnected aspects of a system. In a nutshell, based on selected and relevant studies on SC systems and networks, the prominent parameters that surface are number of elements or sub-systems in the scenario, the degree of interaction or connectivity between the sub-systems or parts, level of variety of the elements, uncertainty or degree of predictability associated with the system, etc
among others (Ashby, 1958; Calinescu et al., 2000; Frizelle, 1998; Scuricini, 1987; Simon, 1962; Wiendahl and Scholtissek, 1994). Some of the literature evidences have broadly classified complexity in terms of structural and operational aspects (Calinescu et al., 2000; Deshmukh, 1993; Deshmukh et al., 1998; Frizelle and Woodcock, 1995; Scuricini, 1987; Wiendahl and Scholtissek, 1994). While structural complexity dealt with static variety characteristics of a system (Frizelle and Woodcock, 1995; Deshmukh et al., 1998), operational complexity has been shown to be linked with dynamic system’s uncertainty (Frizelle and Woodcock, 1995; Frizelle, 1998; Sivadasan et al., 2002). In this section we however focus at highlighting and relevantly linking those parameters, essential to justify our standpoint and support our propositions.

**Number of elements or sub-systems** have been indicated to be profoundly acknowledged as one of the mandatory complexity parameters (Milgate, 2001; Prater et al., 2001; Choi and Hong, 2002; Guide et al., 2003; Oke, 2003; Choi and Krause, 2006; Stonebraker and Liao, 2006; Meepetchdee and Shah, 2007; Jonsson et al., 2007; Masson et al., 2007; Wycisk et al., 2008; Bozarth et al., 2009; Hofer & Knemeyer, 2009). Handfield and Nichols (1999) indicated that fewer suppliers was indicative of less complexity and thus prescribed supply base reduction. However that is not always feasible in networks, especially in the healthcare scenario where assurance and back-up aspects are more relevant than cost containment. Relevance of this parameter in the hospital scenario depends on the fact that hospitals in general use several thousand items (stock keeping units) that are procured from equally high number of suppliers and even have backup supply partners for key items in their systems. In a similar note on the customer side various departments have various physicians who may be attached to the hospital or may be external and patient-preferred. Thus the number of elements or actors in typical upstream and downstream hospital network environment is quite high and involving this parameter appears to be extremely necessary to truly reflect the hospital network’s complexity.

Another set of studies have indicated that the extent of **inter-relationships among the network elements or sub-systems** is a vital complexity parameter (Milgate, 2001; Prater et al., 2001; Choi and Krause, 2006; Meepetchdee and Shah, 2007; Jonsson et al., 2007; Wycisk et al., 2008). In the context of hospital supply network this parameter is highly relevant as the hospitals fall in that specific service sector which depend completely on buying the necessary items and utilities or services, essential for creating the unique value proposition of patient care, from myriad suppliers. Under these circumstances the hospitals often have a purchase relationship on the supply side with several suppliers of same and/or different items and also on the customer side there are various physicians, who may be in-house, contracted or external patient-preferred physicians using the hospital facilities. So, obviously the hospitals interaction and nature of relationship with these elements in the network are instrumental. But more interestingly, the way these elements are linked with each other and connected through business tie-ups and interact among themselves in sub-groups, possess significant importance when analyzed from the operational complexity standpoint.

Another aspect which might be considered as rather indirect approach or parameter to understand complexity, as discussed by some studies, is that of **frequency and volume of interaction between the focal firm and the elements in the network**. Studies from collaborative communication literature in the healthcare domain by VanVactor (2011) and also supply chain communication and information sharing literature bear testimony to that (Noorderhaven and Harzing, 2009; Strader et al., 1999; Lee et al., 2000). Communication literature highlights that with increase in the number of interaction the complexity and uncertainty reduces and enhances responsiveness (Simon, 1962; Noorderhaven and Harzing, 2009). Evidences of complexity from
other domain indicate that rich face-to-face communication, informal interaction, and teamwork reduces "transmission losses" in the knowledge transfer context (Mudambi, 2002, Bjorkman et al., 2004; Tsai, 2001; Tsai and Ghoshal, 1998). The relevance of this in the hospital context can be well imagined depending on the nature and number of actors both up and down the network and the various demand patterns for different SKUs and different physician preference articles (PFAs). Thus frequency and volume of interaction should be considered as a vital parameter that defines hospital SC complexity.

However one of the parameters that have not generally been looked at in the healthcare sector particularly interests this conceptualization and that is quality and nature of relationship. There is a rich literature that claims and establishes that healthcare purchasing is dominated by relationships and networks (Ferlie and Pettigrew, 1996; Laing and Cotton, 1997; Lian and Liang, 2004). Also studies by Shin et al. (2000) have drawn the attention towards the conceptualization of supplier management orientation (SMO) and customer management orientation (CMO) which happens to consider most of the aspects of relationship, trust, quality and number of elements in the base. Many focal firms conduct various improvement and reorganization activities and developmental programs with their supplier and customer base with aims of streamlining operations and removing sudden hiccups. Thus it can be rationally deduced that there is a need to have a deep understanding about the nature and quality of the relationship: term of contract, level of linkage and trust. In the healthcare sector where the supplies are often critical and coordination of the physicians is vital for optimized service delivery, this quality aspect of complexity becomes relevant.

One of the parameters, which is less discussed in complexity literature yet important and relevant for understanding SC complexity, is the degree of differentiation among the suppliers and customers. Differentiation entails various connotations starting from the different organizational structure and culture of the elements to that of operational practices and technology levels and expertise (Choi and Krause, 2006). Differentiation may also be thought of in terms of their product offer. Suppliers or customer elements that belong to and use similar patterns of practices, or belong to similar organizational culture are easier to manage (Burt and Doyle, 1993; Dooley, 2001) and reduces complications. However in case of the healthcare perspective, the supplier and customer elements vary along all the characteristics of the differentiation parameter, thereby necessitating an in depth consideration of this aspect while understanding complexity. Thus this study proposes:

**Proposition 1:** Complexity in the healthcare context is defined by four dimensions: relationship-quality, volume and frequency of interactions in the network, number of elements, and degree of differentiation among the actors in the network.

**Complexity and the Supply Chain Practices along the DART framework**

Increase in uncertainty of information and material flow in the supplier–customer system and large number of firms operating simultaneously with many supply partners are often the prerequisites that define supply chain complexity (Sivadasan et al., 1999, 2002, 2006). Looked from such perspective hospital supply network well qualifies as a complex system. Another viewpoint that explains similar scenario is what Choi et al. (2001) and other complex adaptive systems (CAS) literature explained. Hospital supply network also appears as a CAS with suppliers and customers (physicians) as autonomous actors (Dooley, 1997; Goldstein, 1994;
Holland, 1995; Kauffman, 1993, 1995; Waldrop, 1992). Thus studying the evolving system from the complexity dimension becomes meaningful.

Supply chains are ideal examples of complex interactions as many SC entities operate and interact simultaneously through information and material flows and the involved environment is often uncertain (Beamon, 1998, 1999; Christopher, 2000; Harland, 1996; Wikner et al., 1992; Wilding, 1998). Thus rationally interpreting the operational complexity of supplier–customer systems to be the associated uncertainty at that level of control and monitoring becomes obvious. Studies represented supplier-customer operational complexity to be associated with “uncertainty of information and material flows within and across organizations” (Sivadasan et al., 1999; Sivadasan, 2001; Sivadasan et al., 2002). Thus the volatility of demand, reliability of material, predictability of performance and effectiveness leads to the variation of the operational complexity of supplier–customer system. However these information flow and transactional processes depend on a series of established practices between the network actors called SCPs.

Very few studies have tried to link supply chain practices (SCPs) and complexity. One of the rare instances is that by Gimenez et al. (2012) who have empirically investigated the role of supply chain integration (SCI) in varying network contexts and attempted at addressing its effectiveness. In their survey-based empirical study, they showed SCI to be effective in specific buyer-supplier relationships which are characterized by high level of complexity in the supply network. Thus how complexity influences the SCPs (the generic sets of practices) and the contextual influences offers a scope of probing because it can be rationally extended that complexity in the dynamic context might not influence the practices in similar manner in both the directions. Moreover Gimenez et al (2012) analyzed supply chain integration in a dyadic relationship from the perspective of the supplier. In a B-2-B hospital scenario with suppliers on one side and the customers on the other, in the face of complexity and dynamism, how the SCPs are influenced might be worth investigating. Moreover studies on complexity have often been carried out in dynamic environment with static assumptions. Gimenez et al. (2012) attempted at understanding the role of context in moderating the interaction between the integration practices and the performance. This has strengthened the indications to study the other way round keeping the context indifferent and examining how the SCPs on two sides of the focal firm behave under similar context and complexity level, for gaining a comprehensive understanding.

Now SCPs are myriad and if not the conceptualization is coherent, the analysis becomes meaningless. When viewed from the value co-creation perspective, the understanding of how the complexity dimensions influence SCPs need to fall along a particular framework which can be rationally linked to the SDL principles. Taking all these into consideration, the DART framework is chosen and the DART components have been rationally conceptualized as the value co-creation enablers (Callaway and Dobrzykowski, 2009; Vargo and Lusch, 2004; Lusch and Vargo, 2006). Prahalad and Ramaswamy (2004) proposed the DART framework (D-A-R-T is the acronym for dialogue, access, transparency, and understanding of risk-benefits) which enables the co-creation and co-extraction of value (Callaway and Dobrzykowski, 2009).

**DART-Supply Chain Practices**
The four components of DART are defined to fit the scope and objective of the study. First, ‘Dialogue’ referred to as Supply Chain Dialogue is defined as the extent to which network actors demonstrate a manifested willingness to communicate (Prahalad and Ramaswamy, 2004; VanVactor, 2011; Levine et al., 2001). The communication practices in the hospital network with the suppliers and also the physicians constitute it. Until and unless the actors show signs of
willingness to communicate (which might be initiated by either party) it does not create the ambience for the subsequent value creation platform to be setup. However the complexity parameters like the number of network elements (suppliers or customers), the differentiation among them, the type of relationship they share with the focal firm (whether they are used to clearly communicating each others position and needs) and how frequently they communicate and what type of complexity level drives such actions, can be rationally linked to the successful implementation of communication practices in the SC.

Second, ‘Access’ referred to as Supply Chain Information Access is defined as the extent to which network actors effectively share information that is necessary in the creation of value (Viswanathan et al., 2007; Arshinder and Desmukh, 2007; Davenport and Glaser, 2002; Prahalad and Ramaswamy, 2004; Ford and Scanlon, 2007). Thus it indicates an approach towards provision of timely, accurate and relevant information, more precisely having inclusions of the previously hidden or unavailable information to be used by the organizational decision makers. In the hospital’s perspective the type of relationship between the firm and the network elements have much to contribute. The SCPs involving information sharing, cooperation, coordination and collaboration are thus largely extent dependent on the complexity dimensions.

Third, ‘Risk’ referred to as Supply Chain Risk is defined as the extent to which network actors possess the information necessary to adequately assess the consequences of their decisions to interact (Hu et al., 2012; Tummala and Schoenherr, 2011; Chen and Paulraj, 2004; Berger et al. 2004; de Boer and van der Wegen, 2003). The level of communication and access thus creates the necessary platform for analyzing the risk-benefit scenario between the actors and the focal firm. In the hospital scenario, this should be of particular importance because until and unless the network elements have a precise understanding of the risk and benefits in the decision making loop and transactional practices involving outsourcing decisions, participation in group purchasing consortiums, etc., the true value co-creation process gets hampered. All the complexity dimensions involving interaction frequency and volume, differentiation, relationship quality and most importantly the inter-relationships across sub-groups of elements in the focal network can be rationally linked to it and also from the practitioners’ literature perspective.

Fourth, ‘Transparency’ referred to as Supply Chain Transparency is defined as the extent to which network actors exhibit trust, and reveal their true motivations, goals, and agenda (Schneller and Smeltzer, 2006; Handfield and Bechtel, 2002; Prahalad and Ramaswamy, 2004; Powell, 1995; Frohlich and Westbrook, 2001; Drickhamer, 2002; Rosenweig et al., 2003). SCPs like integration largely contribute to this particular DART dimension. In the healthcare perspective in particular the supplier and customer relationship quality and inter-relationship among the network elements affects this aspect. The clarity and coherence of decisions and transactions among the actors, has much to do with creation of the necessary ambience that foster value co-creation and optimized performance. The indirect role of complexity on performance has been indicated by Perona and Miragliotta (2004). Value co-creation is defined as the extent to which network actors exchange specialized competencies to develop desirable capabilities (Zhang et al., 2002; Vargo and Lusch, 2004; 2006; Vargo and Akaka, 2009; Callaway and Dobrzykowski, 2009). However the ever increasing complexity situation in a dynamic and constantly evolving supply environment in absence of transparency might loose the value creation focus. Thus the literature and logic discussed establish that complexity parameters influence all of the DART dimensions, collectively enhancing value co-creation, interaction among actors and leading to higher-level capability development; in line with SDL principles. So:

Proposition 2: Complexity in the healthcare environment drives DART SCM practices.
**Dynamic capabilities environment**

Current business environment across sectors can well be marked as dynamic markets characterized by ever increasing variability and complexity of operations, involving multiple actors, plethora of sophisticated and high-end complex technologies, immense competitive pressure, besides ever increasing concern for cost reduction and superior streamlined operations with higher efficiency. The concept of dynamic capabilities has been highlighted by management researchers focused at the processes in existence at the firm level for renewing the organizational capabilities (Teece and Pisano, 1994; Teece et al., 1997; Wheeler, 2002).

The literature on dynamic capabilities indicate that firms benefit from having dynamic capabilities in variety of ways and which might be perceived as rewarding and value enhancing. Literature evidences indicate such role of dynamic capabilities in the formulation of new business and corporate strategies (Bowman and Ambrosini, 2003), new market entry (King and Tucci, 2002), carrying out successful mergers and development of unique skill-set (Bowman and Ambrosini, 2003; Zollo and Winter, 2002), overcoming the inertia and stumbling blocks of development (King and Tucci, 2002; Repenning and Sterman, 2002) and most importantly fine-tuning the ability to leverage their other resources which under static conditions often go unnoticed (Bowman and Ambrosini, 2003). Dynamic capability literature derives itself from the source of evolutionary theory of firm (Nelson and Winter, 1982; Alchian, 1950 and March and Simon, 1958; 1993) which was premised on the understanding that often under uncertain environmental conditions the managers make decisions. Such decisions are characterized by bounded rationality and often try to satisfy the necessity rather than optimizing problem solutions. Thus it becomes imperative that such solutions should not be considered as ultimate and once and for all, but rather need to be dynamic and evolving to the situational needs (Zahra, 2006). Dynamic capabilities concept implies that continual reconfiguration to be essential so as to transform the ability of solving problem (a substantive capability) into ability to change the problem solving pattern of the firm (dynamic capability that helps alter capabilities).

For getting a comprehensive understanding about the role and relevance of dynamic capabilities in the firms’ business perspective, a close look at few arguments and definitions might be helpful. While Anand (2001) argued that dynamic alliance capability might be a way of forming stable and reliable partner relationships so as to improve performance, Helfat (1997) defined it to be a subset of the competences/capabilities, thereby allowing the firm in their pursuit of creating suitable processes for responding to the changing market situations. Teece et al. (1997) on the other hand described it as: firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Eisenhardt and Martin (2000) put forth their understanding of dynamic capabilities (DC) in a very comprehensive manner and described it as firm’s processes using resources to match or create the market change especially in terms of the processes linked to integration, reconfiguration, gain and release resources. The definition by Griffith and Harvey (2001) happens to be much more comprehensive and describes DC as difficult to imitate combinations of resources which is highly effective in coordinating inter-organizational relationships, providing a firm with its desired competitive advantage. Thus a close look at DC literature emphasizes its role in dealing with various processes and relationships in the network among the actors and towards achieving superior competitive advantage and allow actors to evolve their competencies as per the evolving circumstances. The role of DC capabilities becomes pronounces and meaningful especially in volatile and unpredictable business environment as if provides the necessary preparedness (Helfat, 1997; Teece et al., 1997; Eisenhardt and Martin, 2000; Griffith and Harvey, 2001) which
can be linked with the specific operational performance parameters. But Zahra et al. (2006) warned that it should not be implied that volatility or changing environment is a resultant of dynamic capability.

**Dynamic Capabilities and Value Co-creation environment in Hospital perspective**

Key implications linked to the concept of dynamic capabilities have been that firms are competing not just to exploit existing resources and capabilities, but are in a constant pursuit to renew and develop capabilities (Teece et al., 1997). Based on these premises, the rational linking of this concept to the hospital supply network perspective as described in this paper appears apt and meaningful. Drawing parallel from the generic perspective in which this concept was developed and proposed, healthcare sector is equally dynamic like any other sector (Schneller and Smeltzer, 2006) and the key to successful gaining of competitive advantage rest on the ability to constantly evolve and develop better and newer capabilities, instrumental for achieving successful service offering by the focal firm. This especially holds true in scenarios where the firm competes in dynamic markets (Wheeler, 2002; D’Aveni, 1994) as such capabilities help firms to be more reactive to the evolving conditions, thereby providing them with sustainable competitive advantage (Winter, 2003). Dynamic capabilities conceptualization in the hospital's network appears rational and relevant not only from volatile environment perspective, but also the conceptualization of the complexity parameters affecting the transactional environment between the hospital and its network environment. Dynamic Capability (DC) conceptualization also premises that such capabilities under conditions of uncertainty and volatility helps transform existing substantive capabilities (capabilities under static environmental situations) into the ability to change the way the firm solves its problems (a higher-order dynamic capability to alter capabilities). Thus the role of dynamic capability in value creation environment appears commendable. This argument finds support in the value chain flexibility literature involving competence-capability transformation where Zhang et al. (2002) highlights that the transformation of the inward facing competences into outward manifestation of capability leads to gaining of competitive advantage, vital for value creation. Hamel and Prahalad (1994) have indicated that competences are intangible non-physical processes, acting as bundles of skills and technologies. As such, competencies can be thought of as operand resources extant in the supply network. In other words, competencies must be acted upon in order to facilitate value creation (Vargo and Akaka, 2009). Capabilities, on the other hand, are outward facing resources that can be exploited by actors in the network for value creation (Zhang et al., 2002). Thus parallels can be drawn between the value literature and the DC arguments.

The role of SDL comes into picture while portraying the Value Co-creation (VCC) environment. While the traditional outlook of value-creation championed the principle of value addition and creation at subsequent stages along the value-chain (Porter, 1985), SDL supported the need to create a platform where the actors co-existed and co-create value by leveraging each others resources, thereby leading to mutual benefits (Vargo and Lusch, 2004; Lusch and Vargo, 2006). The understanding of such transaction network plays a pivotal role in deciding the outcome and effectiveness of SCPs aimed at complexity management. Viewed through a SDL lens, the network and co-creation platform aspects foresee the vitality of the synergistic efforts and mutually beneficial approaches undertaken by the co-creating actors, thereby ensuring growth and mutually beneficial moves.

Different SC practices have gained prominence as effective tools for managers for gaining favorable and superior operational performances, manifested through enhanced
flexibility, responsiveness, cost-savings and quality aspects (Miguel and Brito, 2011). There is a need to look at those same SCPs manifested as DART from the perspective of value co-creation, through the dynamic capabilities lens. While taking the standpoint of dynamic capabilities, things are not static but explained in a dynamic environment. Thus rationally it can be conceptualized that DART-SCPs itself under dynamic setup becomes dynamic when implemented with respect to the focal hospital supply network in both the up and down-stream directions. SDL explains that the network is constantly evolving. Thus the actor composition is in constant flux. Therefore, DART-SCPs must also be dynamic in response to the changes in the network. Thus the study proposes:

**Proposition 3:** DART SCPs make up a dynamic capability for the firm.

**Study Relevance and Scope**

The parameters used for conceptualization of complexity form the inevitable aspects of a dynamic hospital supply network and as evident from practitioners’ literature, the complexity parameters considered in this paper ought to be along the incremental path. This is however not unexpected, rather unavoidable considering the success and growth aspect of the network itself. The incremental trajectory of complexity when viewed in terms of those parameters, gives the true essence of the constantly evolving nature of the sector. The network dynamicity, manifested through the conceptualized complexity parameters, might be rationally visualized as the drivers influencing the implementation (intensity of application, choice of practice and the destined actor to be impacted upon) of SCPs for the overall success of the focal firm and its network. This offers scope for new avenues of probing and further research.

**References (Selected):**

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