

The influence of dynamic capabilities on hospital-supplier collaboration and hospital supply chain performance

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Abstract

Purpose – The purpose of this paper is to explore the influence of hospital's visibility for sensing (VFS), learning, coordinating and integrating on hospital-supplier collaboration. Second, it explored the influence of hospital-supplier collaboration on hospital supply chain performance. The author also explored how the technology orientation of the medical chain units influences the above linkages.

Design/methodology/approach – The study adopted a multi-unit study of different hospital supply chains. Consequently, perceptual data were gathered from seven dominant entities in a typical medical/hospital supply chain: hospitals and clinics, accommodation (i.e. hotels), chemistry and pharmaceutical, marketing/public relations/promotion, medical equipment manufacturers, food and beverage and insurance. The responses were gathered using e-mail survey and were analyzed using structural equation modeling.

Findings – Based on 192 completed responses, the author found positive influences of VFS, learning and integrating on hospital-supplier collaboration and a positive impact of hospital-supplier collaboration on hospital supply chain performance. An insignificant influence of hospital's visibility for coordinating was noted on hospital-supplier collaboration. The study argued hospitals to invest more for enriching their dynamic capabilities to diagnose the changes in the environment so as to sustain their collaborative relationships leading to positive performance implications.

Originality/value – The study is the foremost to investigate the effects of hospital's dynamic capabilities on its collaborative efforts with its key supplier and their influence on hospital supply chain performance. Also the study is foremost in exploring the importance of technology orientation on hospital dynamic capabilities and hospital-supplier collaboration. An important contribution of the research is the conceptualization of supply chain visibility core components (visibility of sensing, visibility of learning, visibility of coordinating and visibility of integrating) in the context of hospital supply chains.

Keywords Hospital, Collaboration, Dynamic capabilities, Hospital performance, Medical supply chain

Paper type Research paper

Introduction

The health care initiatives by the Indian Government coupled with increasing demand for medical care by the public have urged health care firms and hospitals to improvise processes for optimum efficiency and reducing costs. Such initiatives, e.g., e-health initiative targeted to provide economical medical services to patients; National Deworming initiative for safeguarding 24 crore children from intestinal worms; developing 3,000 new medical stores in the country; GI Digital Dispensary for extending medical facilities to rural people and providing additional health care cover of INR30,000 to senior citizens, were the prominent ones to boost medical services in the country (IBEF Sectoral Report, 2016). However, there is an urgent need for hospitals to address financial challenges posed by increased operating costs and costs of hospital supplies (Chen *et al.*, 2013). Previously, costs of hospital supply and associated materials attributed for around 45 percent of a hospital's operating budget (Kowalski, 2016). Based on forecasted trends, health care firms might be required to invest in their supply chain development (Vähätaalo and Kallio, 2015). Consequently, supply chain management in health care administration also has gained due importance (Lee and Fernando, 2015). While the initial literature on supply chain management concentrated on manufacturing and retail, there has been a paradigm shift to



incorporate hospital supply chains in recent times (Dobrzykowski and Tarafdar, 2015). Studies have urged to develop theories focusing on hospital supply chains and associated service environments (Akkermans and Voss, 2013; Prajogo and Oke, 2016). Certain unique characteristics differentiate hospital supply chain management from traditional manufacturing ones.

First, the quality of hospitals supplies is more critical than manufacturing supplies as any failure in the former can have direct fatal effects, e.g., any mistake in patient treatment can be more fatal compared to accidents in manufacturing, although exceptions do exist (Akkermans and Voss, 2013). Second, hospitals are yet to develop a specific universal product number classification system that helps identify functionally equivalent products, resulting in a lack of data standards and synchronization in hospital supply chain management practices (Chen *et al.*, 2013). Third, key decisions in hospital supplies, e.g., medicine selections, are executed mainly by doctors, whereas in manufacturing, e.g., requirement of tires and tools in an automotive firm, they are typically driven by demand forecasts based on past sales (Vähätalo and Kallio, 2015; Lee and Fernando, 2015). Fourth, owing to extensive complexity in operations and diversity in medical requirements, hospital supply chain management is more complex and knowledge intensive compared to manufacturing supply chains. Hospital supply chains are considered to be more complex than service supply chains. This is owing to the health care criticality and life-death situations for patients in medical supply chains compared to other service supply chains like tourism that are normally utilized for leisure and entertainment (Wang *et al.*, 2015). As a result, hospitals need to focus on developing their information exchange systems for managing their supply chains and associated routine and strategic operations.

Extending on the supply chain and information system (IS) literature, information exchange in hospital supply chains is defined as accurate and timely information interchange among those involved in the associated processes (Wei and Wang, 2010). This information exchange forms the very basis for effective coordination that forms the core of efficient and effective hospital supply chain management. Coordination, or the information exchange relationship among providers in health-care delivery, is necessary to achieve desirable patient outcomes (Blome *et al.*, 2014). The current study contributes to the development of this much-needed coordination and the capability of hospitals to identify changes in external environment so as to develop improved coordination in times of emergencies. Vähätalo and Kallio (2015) urge health care services must understand the growing changes in the environment and should have adequate mechanisms to address the same. Similar calls were made in related research works regarding the importance of environmental sensing, learning and responding to threats and uncertainties (Malik *et al.*, 2016; Almeida and Cima, 2015). The importance of dynamic capabilities for executing hospitals day-to-day operations and long-term sustenance is well documented (Singh *et al.*, 2011). Drawing from the dynamic capability theory (Teece *et al.*, 1997) and later works of Pavlou and El Sawy (2011) and integrating the importance of information exchange in hospitals, we argue that modern hospitals require the much-needed visibility for sensing (VFS), learning and understanding their supply chain environments. We extend the notion of visibility in supply chains adopted by Wei and Wang (2010) and complemented it with the dynamic capabilities view in the case of hospitals. Hospital supply chain visibility is the extent to which dominant entities in a hospital (i.e. medical) supply chain, e.g., surgical suppliers, accommodation providers, insurance agents and hospital managers, have relevant information for efficient execution of hospital supply chain operations (Barratt and Oke, 2007). It is an extension of the definition of visibility proposed by extant studies (Barratt and Oke, 2007; Wei and Wang, 2010) for hospital supply chains. Accordingly, the study proposes four essential constituents of hospital dynamic capabilities (Caridi *et al.*, 2014; Drupsteen *et al.*, 2016; Wei and Wang, 2010): hospital's VFS, hospital's visibility for



learning (VFL), hospital's visibility for integrating (VFI) and hospital's visibility for coordinating (VFC). These are standard constituents of dynamic capabilities (Wei and Wang, 2010; Caridi *et al.*, 2014), and our study extends these to hospitals. This extension was based on the premise that hospitals are focal units of medical supply chains and hence must possess these capabilities for suitable adaptation to changing medical requirements (Teece *et al.*, 1997).

Accordingly, the current study explores the contribution of hospital dynamic capabilities in enhancing the much-needed coordination through developing effective hospital-supplier collaboration. The literature suggests likely presence of a linkage (preferably antecedent-consequence) between collaboration and visibility (Hohenstein *et al.*, 2015; Scholten and Schilder, 2015). We explore the importance of each of the four constituents of hospital dynamic capabilities in developing effective hospital-supplier collaboration. The study extends the collaboration literature from generic supply chain management to hospital supply chains. Furthermore, it explores the importance of this hospital-supplier collaboration in generating enhanced hospital supply chain performance. We further explore the influence of technology orientation of the medical chain units on the above linkages. Hence, the current study addresses the following global research question:



RQ1. What are the chief hospital dynamic capabilities that contribute toward effective hospital supply chain performance through enhancing hospital-supplier collaboration in presence of technology orientation?

Theoretical background and hypotheses development

Hospital supply chain visibility – the dynamic capabilities view

Hospital supply chain visibility is the extent to which dominant entities in a medical supply chain, e.g., surgical suppliers, accommodation providers, insurance agents and hospital managers, have relevant information for efficient execution of hospital supply chain operations (Barratt and Oke, 2007). It is an extension of the definition of visibility proposed by extant studies (Barratt and Oke, 2007; Wei and Wang, 2010) to hospital supply chains. The dynamic capabilities exploit a firm's internal and external resources in the best possible manner to suitably respond to environmental uncertainties (Teece *et al.*, 1997). Aligning resources appropriately for developing competencies is the prime requisites for gaining competitive advantage. Dynamic capabilities are the critical processes for sensing, integrating, learning and reconfiguring resources and capabilities (Teece *et al.*, 1997; Birkinshaw *et al.*, 2016).

We conceptualize hospital supply chain visibility as an important dynamic capability predominantly as it provides the much-needed real-time information based on which hospital supply chain entities can arrive at crucial decisions and helps in the integration of hospital's resources through availability of real-time information and hence further helps in the appropriate modification of hospital's operating routines and procedures. Hence, through appropriate information sharing for critical decision making and consequently modifying hospital's operating routines, hospital supply chain visibility helps hospitals to adapt to their environment and respond positively to market needs. Hence, hospital supply chain visibility satisfies the essential characteristics of a dynamic capability and helps the focal firm, i.e., hospitals, to perform better in a dynamic environment and sustain profitably in the competition.

Research has indicated the complexity and associated difficulties with dynamic capabilities, which makes their contemplation and execution rather difficult (Birkinshaw *et al.*, 2016); however, their recognition as a specific process has been done (Birkinshaw *et al.*, 2016; Pavlou and El Sawy, 2011). Research on dynamic capabilities suggests that the dynamic capabilities can be described into sensing capability, learning capability,

integrating capability and coordinating capability (Pavlou and El Sawy, 2011). These are the basic processes that aid the firms to respond toward and address proactively their environmental changes. This research contends that such processes aid the hospital to respond to its environmental changes, namely, failure of surgical supplies and shortage of doctors or nurses, through real-time information exchange and hence satisfy the basic tenets of dynamic capabilities. Thus, this research proposes that a hospital's SC visibility and certain other processes, e.g., sensing, learning, coordinating and integrating, basically satisfy the requirements of being posited as dynamic capabilities. Following the works of Pavlou and El Sawy (2011) and assuming hospitals focal units of medical supply chains, this research recognizes four important constructs of hospital's dynamic capabilities: hospital's VFS hospital's VFL hospital's VFI and hospital's VFC.

Supply chain collaboration in hospital supply chains

Supply chain collaboration has been denoted essentially a business activity where two or more parties execute operations together toward mutual objectives (Sheu *et al.*, 2006; Cao and Zhang, 2011). It can result in incremental benefits and advantages for involved entities over time. Firms such as Hewlett-Packard, IBM, Dell and Procter & Gamble have forged long-term collaborative relationships with their suppliers to reduce transaction costs and achieve a stronger competitive position (Sheu *et al.*, 2006). Collaborative relationships can help firms share risks, access complementary resources, reduce transaction costs and enhance productivity, profit performance and competitive advantage over time (Blome *et al.*, 2014; Cao and Zhang, 2011; Romano, 2016). Furthermore, collaboration in supply chains urges all entities to actively engage in planning, forecasting, replenishment, information sharing, resource sharing and incentive sharing (Blome *et al.*, 2014). The benefits of supply chain collaboration have been proven in many companies (e.g. West-Marine, Procter & Gamble and Hewlett-Packard) in terms of decreased cost, improved sales and increased forecasting accuracy. The current research extends the concept of collaboration to medical supply chains and focuses on the collaborative efforts of hospitals and their key suppliers.

Based on the precedent literature, we extend the concept of collaboration to hospitals by considering how hospitals work in close association with their key suppliers for meeting their short-term and long-term mutual objectives (i.e. hospital-supplier collaboration). Using a dynamic capabilities view on hospital supply chain visibility, the current research examines the influence of hospital's dynamic capabilities of VFS, VFL, VFI and VFC on the development of hospital-supplier collaboration. We further develop the antecedents of hospital-supplier collaboration, a first-order measurement scale of hospital-supplier collaboration and its impact on hospital supply chain performance.

Hospital dynamic capabilities

The current study proposes four important constructs as hospital dynamic capabilities (Agarwal and Selen, 2015): hospital's VFS, hospital's VFL, hospital's VFI and hospital's VFC. Extending the notion of sensing from Pavlou and El Sawy (2011), hospital's VFS denotes the degree to which a hospital can gain relevant and real-time information regarding its business environment and can record environmental changes, e.g., patient's medical history, upcoming medicines and emerging treatment procedures. Hospitals need to sense these changes in their business environment so as to react in a positive manner. Dominant entities in hospital supply chains therefore must be able to sense information relating to their external environment as well as supply chain operations in order to react positively to changes. For example, hospitals should be able to sense environmental changes in terms of patients inbound and outbound and all the aspects of a hospital's operation, such as medical, administrative and financial (Ahmadi *et al.*, 2015). Furthermore, such sensing capability aids in retrieving any desired information relating to a patient's health

and treatments provided. Another important competitive dimension driving hospitals to sense information pertaining to customers is market intelligence. This intelligence relating to patients' satisfaction and their dynamic requirements is important for responding to market changes and developing new opportunities (Liang *et al.*, 2017). Exchanging information is a prerequisite for entities in medical supply chains for communicating and sensing each other's requirements (Edena *et al.*, 2016). Hospitals that indulge in extensive information exchange with their supply chain partners are comparatively more equipped for sensing threats and opportunities. The basic aim of efficient hospital supply chain management is to reduce cost of operations while providing quality health care services. This is possible through a collaborative effort of hospitals with their key suppliers. Hospital-supplier collaboration through their coordinated approach will be able to attain optimal supply chain configuration for enhanced health care services (Rycroft-Malone *et al.*, 2016). Such coordinated approach through hospital-supplier collaboration can be positively aided though enhanced hospital VFS capabilities. The more the hospitals can sense external changes through appropriate information gathering, e.g., patient's medical history, patient satisfaction, upcoming medicines and emerging treatment techniques (Pavlou and El Sawy, 2011; Liang *et al.*, 2017), the higher the chances of success for these collaborative efforts. This gives our first hypothesis:

H1. Hospital's VFS is positively related with hospital-supplier collaboration.

Extending the notion of learning from Pavlou and El Sawy (2011), hospital's VFL represents the degree to which a hospital can learn and acquire new insights and knowledge from its supply chain partners. Because environmental knowledge is critical for the development of capabilities, hospitals as focal firms in the medical supply chains can expand their experiences through supply chain relationships to gain superior performance (Teece *et al.*, 1997; Birkinshaw *et al.*, 2016). Acquiring information about market changes through working with suppliers and customers (i.e. patients) is important for innovation and newer product and services development, because hospital managers are required to understand external information for identifying and developing opportunities (Teece, 2012). Dynamic capabilities develop from three critical learning processes: experience accumulation, knowledge articulation and knowledge codification. For building capabilities so as to address environmental challenges, hospitals as focal firms need to communicate with their supply chain partners, exchange real-time information and share their domain-specific knowledge and viewpoints aimed at overall performance improvement. Supporting information and insights obtained from external sources may lead to new ideas and performance improvement (Lee and Fernando, 2015). Occasional meetings and contacts among the medical supply chain entities can ensure the correct interpretability of complex knowledge transferred. With these meetings, entities are motivated to realize the way they comprehend their work and convert their implicit knowledge into explicit ones, which can be combined later to develop more advanced knowledge (Romano, 2016). As hospitals meet frequently with their key suppliers, real-time and complex information is exchanged, ensuring accurate interpretability of the knowledge shared. With exact and accurate information interchange, medical supply chain partners are more willing to collaborate with their focal partners, i.e., the hospitals. This gives us our next hypothesis:

H2. Hospital's VFL is positively related with hospital-supplier collaboration.

Hospital's VFC is the core of every decision-making process in medical supply chains (Heyland *et al.*, 2015). Availability of complete information supporting decision making in supply chain processes can also aid in synchronizing the decisions for achieving overall hospital supply chain objectives and building effective coordination for overall supply chain improvement. Sallnäs (2016) argued that firms in a supply chain must stress on sharing

relevant information for efficient coordination. According to Malone and Crowston (1994), coordination is “managing dependencies.” Furthermore, Malone and Crowston (1994) argued that management of three different forms of dependencies are required in a supply chain: prerequisite constraints, transfer and usability. Synchronizing the prerequisite dependency is the basic coordination in a hospital supply chain. Therefore, hospital's VFC should provide important information for management of critical activities and dependencies in hospital supply chain relationships (Cucciniello *et al.*, 2015). Malone and Crowston (1994) stressed on information sharing regarding the timings of item delivery and usage as an effective mechanism to manage transfer dependency. Furthermore, having an adequate buffer aided with material requirement planning, forecasting and optimal production schedules will effectively help to manage transfer dependency. Moreover, for effectively managing usability dependency, hospitals must understand the prime requirements of their patients, and this can be executed through careful market research (Sallnäs, 2016; Cucciniello *et al.*, 2015). For designing effective health care services, hospitals must take into consideration the feedback and suggestions given by their outbound patients and their key suppliers (Joon Choi and Sik Kim, 2013). Through this joint participation, both hospitals and their focal suppliers would accumulate much knowledge that will help them to coordinate better through improved idea interchange (Cucciniello *et al.*, 2015). With the exchange of know-how and efforts of increased coordination, the focal entities in a medical supply chain, i.e., hospitals, surgical suppliers and pharmacists, are brought together with the aim of improved collaboration. Thus, we can argue that hospital's VFC will eventually lead to enhanced collaboration between hospitals and their key suppliers. This gives our next hypothesis:

H3. Hospital's VFC is positively related with hospital-supplier collaboration.

Hospital's VFI stresses on the information that can provide unanimity to arrive at joint goals and develop a collective recognition for a medical supply chain. The amalgamation of external activities and technologies is vital for achieving competitive advantage for hospitals (Teece *et al.*, 1997). Every supply chain should have collective recognition (Blome *et al.*, 2014). Hence, developing a strategic orientation regarding medical supply chain partners and possessing a collective recognition of the chain are dominant attributes of supply chain integration. The development of a collective identity in a medical supply chain can occur provided the key partners share their valuable experiences and educate the rest (Cao and Zhang, 2011). Higher sharing of information allows the development of collective meanings and unanimity on the actions with partners (Kitto *et al.*, 2015). This provides the accurate comprehension of each partnering firm's capabilities and strengths and aids the achievement of goal congruence in a medical supply chain (Yan and Dooley, 2013). With overall objectives becoming more clarified and synchronized, the anticipated conclusion of common objectives is a dominant criterion to gain strategic outcomes (Nyaga *et al.*, 2010). Therefore, hospital's visibility for integration can aid in developing a collective identity or recognition for the medical supply chains, and therefore, it positively contributes to hospital-supplier collaboration. Nyaga *et al.* (2010) differentiated between integration and collaboration. While the former is more process focused, the latter includes governance mechanisms through relational means. Accordingly, we argue that in a medical supply chain, VFI can enhance the collaborative efforts of hospitals with their key suppliers because the process-focused orientation will definitely improve the governance through relational means. Accordingly, we argue the following:

H4. Hospital's VFI is positively related with hospital-supplier collaboration.

Hospital-supplier collaboration is a business process where hospitals work in close association with their key suppliers for meeting their short-term and long-term mutual

objectives (Cao and Zhang, 2011). Hence, there are clear indications of performance improvement through collaborative efforts in supply chain contexts (Cao and Zhang, 2011; Wang *et al.*, 2015; Arvitrida *et al.*, 2015). However, we posit in this empirical exploration that a hospital's essential dynamic capabilities, namely, VFS, VFL, VFC and VFI, contribute positively toward hospital-supplier collaboration, which may enhance hospital supply chain performance (Teece *et al.*, 1997). Furthermore, hospital-supplier collaboration will aid in the attainment of much-needed coordination in the medical supply chain by involving other entities (Arvitrida *et al.*, 2015). Thereby, significant improvement in hospital supply chain performance through effective relational governance mechanisms can be expected (Chen *et al.*, 2013). Accordingly, we frame our next hypothesis:

H5. Hospital-supplier collaboration has a positive influence on hospital-supplier performance.

Moderating role of technology orientation

Technology orientation incorporates product, service (for service-oriented firms), production and innovation orientations and is "the ability and the will to acquire a substantial technological background and use it in the development of new products" (Gatignon and Xuereb, 1997, p. 78). Due to the paper aim, a technology-oriented hospital is considered as the one that is dedicated to adopt newer and emerging technologies for exchanging real-time information with its supply chain partners so as to improve coordination and provide improved health care services to its patients (Lee *et al.*, 2013; Ho *et al.*, 2016).

Extant studies suggest that discovery, variation and innovation strongly influence technology-oriented organizations (Lee *et al.*, 2013), hence technology-driven firms must focus on these processes (Ho *et al.*, 2016). Hospitals as focal firms in medical supply chains have to be more vigilant of environmental changes and must be ready to adapt to changing situations (Ozkaya *et al.*, 2015; Ho *et al.*, 2016). Technology orientation suggests modern hospitals to focus more on providing health care services produced with the newer technologies to provide enhanced customer value and greater strategic performance (Gatignon and Xuereb, 1997; Ozkaya *et al.*, 2015). A hospital that is ready to develop and adapt to new technologies stands a better chance of attaining service differentiation and enjoying cost advantages. Similarly, technology orientation can allow a hospital to become a technology leader, which can impart positive innovation performance (Ho *et al.*, 2016). Service innovation initiatives aided by technology orientation enable such hospitals to develop exploratory and exploitative innovation competencies (Vähätalo and Kallio, 2015). Therefore, hospitals with a technology-orientated approach stand in a better position to enjoy success of service innovation (Lichtenthaler, 2016). It is the contention of this study that technology orientation will enable hospitals to be vigilant enough for sensing, learning, coordinating and integrating so as to improve coordination through enhanced hospital-supplier collaboration. Accordingly, we posit that technology orientation will moderate the linkages between hospital dynamic capabilities and hospital-supplier collaboration. This also follows from the rationale that technology-oriented firms are better prepared for adopting newer technologies so as to meet the growing dynamic requirements of the market (Lichtenthaler, 2016). So we argue in this study that hospitals without a technology-oriented approach may not be able to develop effective collaboration through their dynamic capabilities of VFS, learning, coordinating and integrating. This gives us the following hypotheses:

H6a. Technology orientation positively moderates the relationship between hospital's VFS and hospital-supplier collaboration.

H6b. Technology orientation positively moderates the relationship between hospital's VFL and hospital-supplier collaboration.

H6c. Technology orientation positively moderates the relationship between hospital's VFC and hospital-supplier collaboration.

H6d. Technology orientation positively moderates the relationship between hospital's VFI and hospital-supplier collaboration.

Figure 1 shows the proposed theoretical model.

671

Research methodology

Subjects and procedure

The study utilized stratified random sampling for collecting data from a sample of organizations that were directly or indirectly involved in hospital supply chains in India. These organizations comprise health care entities, manufacturers, marketing/promotion and services. The study includes marketing/promotion/public relations as an integral part to account for foreign patients coming to the country for treatment. Hospital supply chains are quite diverse in their composition as they mainly comprise the following units, e.g., hospitals, accommodation providers (i.e. hotels), chemistry and pharmaceutical, marketing/public relations/promotion, medical equipment manufacturers, food and beverage and insurance (Chen *et al.*, 2013; Lee and Fernando, 2015). Consequently, the targeted strata in our study consisted of the following: hospitals and clinics, accommodation (i.e. hotels), chemistry and pharmaceutical, marketing/public relations/promotion, medical equipment manufacturers, food and beverage and insurance (Lee and Fernando, 2015). Instead of relying on one respondent from the focal unit of the hospital supply chains, i.e., hospitals, the study attempted to gather perceptual responses from multiple entities in a supply chain. This is done with the objective of getting a more accurate picture of the operational scenario (Chen *et al.*, 2013; Lee and Fernando, 2015; Dobrzykowski *et al.*, 2016). The study planned to select firms belonging to the above sector and directly or indirectly are a part of hospital supply chains. The data were collected through a web-based survey. Based on the extant literature (Lee and Fernando, 2015; Dobrzykowski *et al.*, 2016; Dobrzykowski and Tarafdar, 2015), the study targeted to collect perceptual data from senior professionals (e.g. manager – operations, senior manager – operations and manager – procurement) working in these firms for at least five years or more. Data were collected from

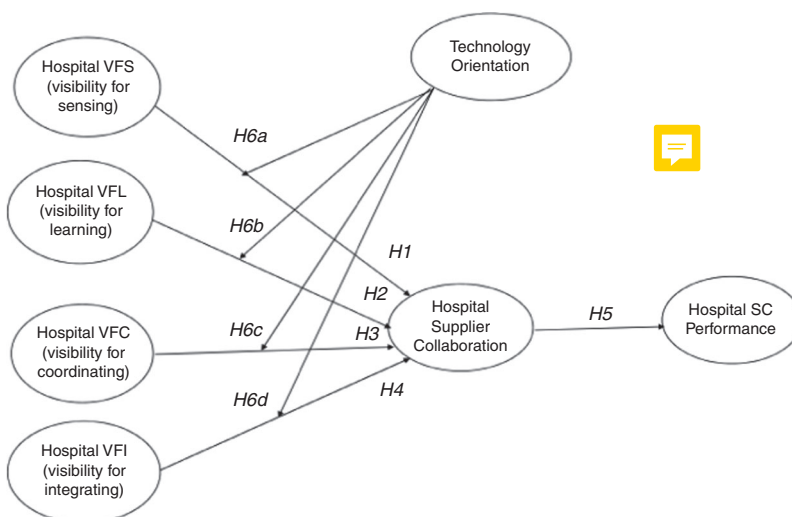


Figure 1.
Theoretical model

two premier metros in the country that are well known for their medical facilities and services. However, many of the respondents wanted to remain anonymous. Hence, the study labeled the two metros as health hub-I and health hub-II. Using the information given for list of hospitals in each of these hubs in Medicards.in (www.medicards.in/hospitals/), an estimate was developed regarding the total number of hospitals and clinics available in these hubs. For accommodation (i.e. hotels), several relevant sites like yatra.com and goibibo.com were utilized using appropriate filters of budget hotels (between USD3 and 15 per night for hub-I). This resulted in 96 hotels for hub-I and 30 hotels in hub-II (between USD6 and 15 per night). These were all approximate rates based on the visited online portals. The above thresholds were set based on consultation with few experts like doctors, practitioners and economists. Considering a developing nation like India, the above thresholds were deemed adequate and reasonable in practice. The main rationale behind the above thresholds was that majority of the patients and their relatives in this country prefer cheap accommodation (Dogra and Dogra, 2015).

However, there were other hotels also without websites or online presence. Hotel Association of India database suggests more than 90 percent of the hotels have online presence. Hotel Association of India is the prominent organization of the Indian hospitality industry (www.hotelassociationofindia.com/). Moreover, hotels that have premium accommodation facilities usually maintain their respective online portals and spend heavily for advertisements and promotions. Therefore, during data collection, the authors searched for other non-listed hotels also. At the same time, the authors also contend that certain patients would prefer premium accommodation facilities (i.e. more than USD15). However, the proportion of such people is comparatively much less in a developing country like India. For chemistry and pharmaceuticals, the study utilized the list given in Medindia online portal (www.medindia.net/) for an estimate of chemist and pharmaceutical companies in the two hubs. Using justdial.com in combination with Indiacom.com yellow page services, the study obtained an estimate of the total number of marketing/promotion/public relation companies in these hubs. The strata of marketing/public relations basically indicate those companies that organize and operate tours and travels. As people also travel for medical needs to distant places, the study contends that tour and travel operators are also dominant participants in hospital supply chains. Using the same Medindia online portal, an estimate of medical equipment manufacturers and surgical suppliers was obtained. Furthermore, an estimate of restaurants in these metros was obtained using both tripadvisor.com and justdial.com. As patients vary in their capacity and preferences for restaurant selection and dining, we have not applied any specific filter at this stage. Finally, again using Medindia online portal, the authors obtained 22 companies that provide life insurance policies for clients. The practice of obtaining such data from web resources is well recognized (Ramanathan and Ramanathan, 2011; Mohammed *et al.*, 2016) (Table I).

The study chose one participant per organization for participating in the survey. However, contacts of all these population members were not available. E-mail addresses of

Table I.
Description of strata

Strata	Health hub-I	Health hub-II
Hospitals and clinics	325	149
Accommodation (hotels)	96	30
Chemistry and pharmaceuticals	673	1,049
Marketing/public relations	2,782	708
Medical equipment manufacturers+surgical suppliers	158	215
Food and beverage	5,192	3,697
Insurance	22	22
Total	9,248	5,870

respondents were collected through organization visit (wherever possible), phone contact and an e-mail list purchased from a consultancy firm. A check for repeated records resulted in 270 cases, which were subsequently corrected. These steps resulted in a database containing over 3,000 e-mail addresses of professionals working in various sectors involved with hospital supply chains. Applying our filtering criteria, a list of 1,359 valid e-mails was obtained. The authors utilized proportionate sampling for estimating the number of responses that should be obtained from each city. With an estimation of around 1,000 complete responses (at least aimed to be collected) from these two cities, using proportionate sampling, the expected responses were 611 and 389, respectively.

Survey instrument and pretesting

The seven theoretical constructs of our research model constitute latent variables requiring indirect measurement. As such, following the paradigm for creating effective measures forwarded by Churchill (1979), we started off by defining the domain specification of each construct supported by the collection of relevant measurement items from literature and established sources. We used the established scales as starting point instead of blindly adopting them and used an expert panel for improving the same based on the feedback obtained from the panel. The panel consisted of a total of 15 members, with five researchers and ten practitioners. The expert panel members knew the scope and purpose of our study and as such were able to tailor the measurement items with their feedback. The expert panel had extensive experience in the Indian Medical Industry and medical supply chains and hence deemed appropriate for helping in developing the measurement items using established scales as starting points. The expert panel members were asked to critique the measurement items for the underlying constructs, resulting in slight modifications related to structure, clarity and expression. As such, commencing with established measurement items, we utilized a grounded approach to develop the items to be as accurate as possible, given our study context. This rigorous approach to develop the final items provides for a very high level of face and content validity, also increasing the practical relevance and applicability of our research. Following the feedback of the expert panel, we specifically had to accommodate changes in all the constructs employed in the study. Using a grounded approach, the measures for hospitals' sensing, learning, coordinating and integrating were thus deductively and inductively developed with the help of practitioners. Once the set of measures had been finalized, the complete survey instrument underwent additional pretesting with 63 contacts chosen randomly from the database developed earlier. Of these 63 respondents, four were restaurant managers having an experience of more than five years, 24 were hospital operations manager with over ten years of experience, six were managers working in the pharmaceutical sector, nine were managers involved in providing health insurances, six were hotel managers with more than ten years of experience, five were senior managers involved in marketing/promotion/public relation companies with more than seven years of experience and remaining nine were managers involved in the manufacturing of medical equipment and surgical products. Such an extensive set was chosen for the pretest for ensuring further face validity and content validity of the measures. The pretesting phase ensured that the items (developed from established sources for measuring each construct with the help of the expert panel) seemed to measure the constructs they were intended to measure. Finally, each of the measurement constructs in the survey had three to four items (after deletion of few items based on expert panel feedback following the pretesting) which were measured using a seven-point Likert-type scale ranging from strongly agree (7) to strongly disagree (1). In addition, some demographic information regarding the participant's organizations was also included in the questionnaire. The final survey was created in Google Docs and was mailed to 1,359 contacts with a request for participation in the survey. A gentle reminder was sent after two

weeks for participating and completing the survey. This resulted in 192 complete and usable responses, with a response rate of 14.12 percent, which is decent considering the online survey (Fowler, 2013). Table II shows the distribution of final respondents' sample across different strata and health hubs.

The respondent characteristics are shown in Table II. Around 31 percent of respondents were hospital managers, with an average experience of around nine years; 7.29 percent of respondents were senior operation managers working in hotels, with an average experience of ten years or more; 19.79 percent represented were senior managers from medicine and pharma sector, with a mean experience of seven years; 8.85 percent represented marketing and public relations sector, with a mean experience of 9.5 years; 20.31 percent represented managers employed in the manufacturing of medical equipment and surgical supplies, with a mean experience of 6.5 years; 4.69 percent represented restaurant managers, with an average experience of 7.7 years and finally 8.85 percent represented managers involved in providing life insurance services, with a mean experience of 8.25 years. Considering the online survey mode of data collection and without an incentive, we feel the different response rates from each sector are decent enough to proceed for hypotheses testing. Furthermore, such response rates are in line with allied studies (Lee and Fernando, 2015). To test the proposed relationships, the study employed SPSS 17 for Windows and Amos 17.0. The SPSS package was used to test the reliability of the measurement model and examine the data on demographics and shopping patterns of the respondents. Meanwhile, Amos was used to perform a confirmatory factor analysis (CFA) of the research model, test the hypotheses, and analyze the path coefficients. Table AI shows the final measurement items.

Non-response bias

We tested for the non-response bias by comparing the early and late respondents (Armstrong and Overton, 1977). There were no significant mean differences between these two groups on key measures such as firm size and industry affiliation.

Measure assessment

Reliability refers to the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects (Hong and Cho, 2011). The reliability of the individual items in the questionnaire has been tested by checking the internal consistency, which was measured by reliability coefficients called Cronbach's α . As shown in Table III, the Cronbach's α for all constructs were found to exceed the 0.70 threshold suggested by Kline (2013). In addition, composite reliability coefficients in Table III are all higher than the Nunnally's threshold (Kline, 2013). Therefore, our measures are deemed reliable. A measurement model should have construct validity as well as reliability if it is to be validated. Construct validity can be thought of as the degree of correspondence between a construct and its operationalization (Hong and Cho, 2011). Construct validity can

Table II.
Respondents
profile across
strata and hubs

Strata	Health hub-I	Health hub-II	Total	Percentage
Hospitals and clinics	37	21	58	30.21
Accommodation (hotels)	8	6	14	7.29
Chemistry and pharmaceuticals	20	18	38	19.79
Marketing/public relations	12	5	17	8.85
Medical equipment manufacturers+surgical suppliers	23	16	39	20.31
Food and beverage (restaurants)	6	3	9	4.69
Insurance	12	5	17	8.85
Total	118	74	192	100

Construct	Variable	Std. loadings	t-Value	SMC	CR α	Composite reliability	AVE
Hospital's VF sensing No. of items = 5	VFS1	0.787	9.253	0.619	0.891	0.921	0.701
	VFS2	0.883	12.347	0.780			
	VFS3	0.848	14.014	0.719			
	VFS4	0.852	16.225	0.726			
	VFS5	0.811	9.315	0.658			
Hospital's VF learning No. of items = 5	VFL1	0.829	12.346	0.687	0.871	0.908	0.665
	VFL2	0.778	10.437	0.605			
	VFL3	0.883	14.208	0.780			
	VFL4	0.721	13.437	0.520			
	VFL5	0.856	15.204	0.733			
Hospital's VF coordinating No. of items = 5	VFC1	0.897	11.492	0.805	0.892	0.928	0.721
	VFC2	0.853	19.903	0.728			
	VFC3	0.827	11.059	0.684			
	VFC4	0.875	10.703	0.766			
	VFC5	0.789	8.234	0.623			
Hospital's VF integrating No. of items = 5	VFI1	0.764	11.304	0.584	0.887	0.911	0.671
	VFI2	0.828	19.356	0.686			
	VFI3	0.829	11.271	0.687			
	VFI4	0.817	15.203	0.667			
	VFI5	0.855	9.065	0.731			
Hospital-supplier Collaboration No. of items = 5	HSC1	0.853	11.557	0.728	0.904	0.941	0.762
	HSC2	0.867	18.234	0.752			
	HSC3	0.884	9.368	0.781			
	HSC4	0.889	14.971	0.790			
	HSC5	0.871	11.388	0.759			
Hospital SC performance No. of items = 4	SCP1	0.779	10.267	0.607	0.863	0.899	0.691
	SCP2	0.884	16.347	0.781			
	SCP3	0.852	9.001	0.726			
	SCP4	0.806	15.762	0.650			
Technology orientation No. of items = 5	TO1	0.793	13.739	0.629	0.895	0.914	0.679
	TO2	0.827	18.745	0.684			
	TO3	0.831	11.053	0.691			
	TO4	0.822	13.558	0.676			
	TO5	0.847	10.416	0.717			

Influence
of dynamic
capabilities

675

Table III.
Reliability and
unidimensionality

be evaluated by assessing unidimensionality, convergent validity, discriminant validity and nomological validity (Selles, 1993). First, unidimensionality of the measurement model was tested using the CFA technique. Unidimensionality means the degree to which the assessment measures the same construct and only that construct, and CFA is often used to test whether measures of a construct are consistent with a researcher's understanding of the nature of that construct (or factor) (Hong and Cho, 2011). We assessed unidimensionality for the measurement scales to refine and improve the measurement items. We found all the items were loaded on their respective constructs with standardized loadings greater than 0.70.

Next, convergent validity refers to the degree of agreement observed when two attempts are made to measure the same construct through maximally different methods. In general, convergent validity can be claimed when critical ratios are 2 or above, standardized factor loadings are 0.5 or above and averaged variances expected are 0.5 or above (Fornell and Larcker, 1981; Hair *et al.*, 2006). As we can see in Table III, the minimum critical ratio (= 8.234) was much higher than the "2" threshold, the minimum standardized factor loading (= 0.721) exceeded the "0.5" threshold and the lowest average variance extracted calculated (= 0.665) was well above the 0.50 threshold (Hair *et al.*, 2006). Thus, convergent validity for the measurement model is acceptable.



Table IV.
Correlation matrix
of the constructs

Then we assessed discriminant validity by examining the correlation coefficients among the constructs under investigation, as shown in Table IV. Hair *et al.* (2006) suggest that a model has discriminant validity provided that the minimum of average variance extracted is larger than the squares of between-construct correlation coefficients. Table IV shows that the largest coefficient is 0.573, a coefficient of correlation between hospital's VFL and hospital's VFI, and that the square of this number, 0.328, is not as large as 0.665, the minimum AVE for hospital's VFL. Therefore, our measurement model is presumed to have discriminant validity.

Finally, nomological validity refers the extent to which structural relationships among measured constructs are consistent with other studies. This is examined through checking correlation coefficients among the constructs in Table IV. Some of the correlation coefficients were moderate, e.g., 0.573 between hospital's VFL and hospital's VFI, and thus, we performed a multicollinearity test. If variance inflation factors calculated are 10 or less, no threat of multicollinearity exists (Hair *et al.*, 2006). Results demonstrated that variance inflation factors ranged from 2.934 to 4.785 suggesting that multicollinearity is not an issue in this study. Hence, we argue that nomological validity is present.

Next, the study assessed the goodness-of-fit of the measurement model (Table V). First, the absolute fit indices were examined as per the guidelines based on Hu and Bentler (1999) and Hair *et al.* (2006). Standardized χ^2 test result was obtained to be 2.205, which in general is regarded as a modest fit (Hu and Bentler, 1999). Standardized root-mean-square residual is well within the threshold, while goodness-of-fit index is slightly near threshold (Hu and Bentler, 1999). The incremental fit indices indicate to be well within the prescribed limits. Furthermore, parsimonious normed fit index and root-mean-square error of approximation were found to be within the acceptable range (Hair *et al.*, 2006). Hence, it is inferred that the measurement model was a reasonable fit for the data set (Hu and Bentler, 1999).

Construct	Mean	SD	x1	x2	x3	x4	x5	x6	x7	AVE
Hospital's VFS (x1)	3.83	0.98	1							0.701
Hospital's VFL (x2)	4.02	1.06	0.452	1						0.665
Hospital's VFC (x3)	4.56	0.82	0.523	0.447	1					0.721
Hospital's VFI (x4)	4.81	0.73	0.509	0.573	0.476	1				0.671
Hospital-supplier collaboration (x5)	3.97	1.14	0.256	0.349	0.383	0.493	1			0.762
Hospital SC performance (x6)	4.05	0.69	0.394	0.431	0.451	0.372	0.243	1		0.691
Technology orientation (x7)	3.85	1.02	0.428	0.297	0.377	0.344	0.211	0.416	1	0.679

Table V.
Goodness-of-fit test

Category	Goodness-of-fit test		Value
	Measure	Acceptable values	
Absolute fit indices	χ^2		1,115.73
	df		506
	χ^2/df	1 to 3	2.205
	GFI	0.90 or above	0.872
Incremental fit indices	SRMR	0.080 or below	0.0571
	NFI	0.90 or above	0.924
	RFI	0.90 or above	0.893
	IFI	0.90 or above	0.937
	TLI	0.90 or above	0.923
	CFI	0.90 or above	0.929
Other fit indices	PNFI	0.60-0.90	0.755
	RMSEA	0.050-0.080	0.059

Structural model results

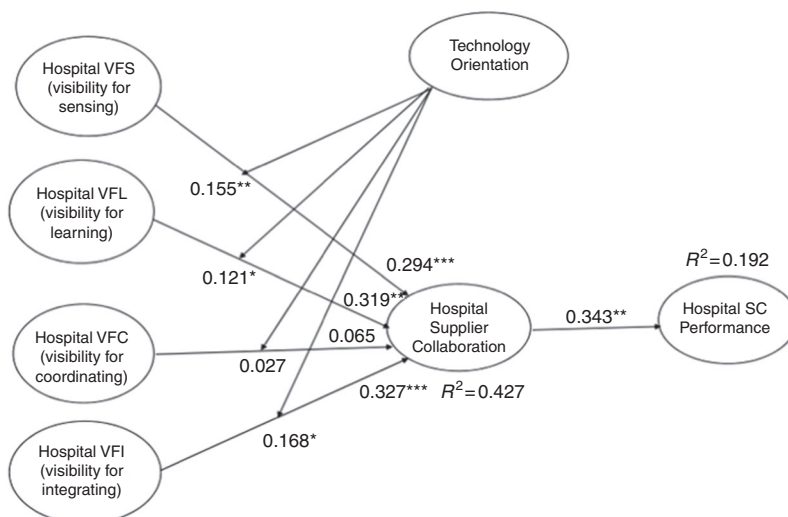
We utilized structural equation modeling using AMOS 17 to test the significance of the proposed paths based on the collected data. Table VI summarizes the results of hypotheses testing. Except *H4*, all the remaining hypotheses were supported (among the direct paths). *H6a*, *H6b*, *H6c* and *H6d* discussed a positive moderation of technology orientation on each of hospital's visibility capabilities (namely sensing, learning, coordinating and integrating) with hospital-supplier collaboration. For testing the above proposed moderation effects, we created the following interaction terms: sensing×technology orientation, learning×technology orientation, coordinating×technology orientation and integrating×technology orientation, and regressed on hospital-supplier collaboration. Most of the corresponding coefficients were found to be positive and significant as shown (ref. Table VI) in the summary of hypotheses testing below. Figure 2 summarizes the hypotheses testing results in a structural model.

The moderation tests showed that technology orientation had a negligible moderating effect on hospital VFC→hospital-supplier collaboration linkages. However, the moderation

Hypotheses	Path	Std. coefficient	CR (<i>t</i> -value)	Result
<i>H1</i>	VF sensing→hospital-supplier collaboration (HSC)	0.294***	5.108	Accepted
<i>H2</i>	VF learning→hospital-supplier collaboration (HSC)	0.319**	4.783	Accepted
<i>H3</i>	VF coordinating→hospital-supplier collaboration (HSC)	0.065	0.914	Rejected
<i>H4</i>	VF integrating→hospital-supplier collaboration (HSC)	0.327***	4.922	Accepted
<i>H5</i>	Hospital-supplier collaboration→hospital SC performance	0.343**	5.821	Accepted
<i>H6a</i>	VFS*tech. orientation→hospital-supplier collaboration	0.155**	3.045	Accepted
<i>H6b</i>	VFL*tech. orientation→hospital-supplier collaboration	0.121*	2.557	Accepted
<i>H6c</i>	VFC*tech. orientation→hospital-supplier collaboration	0.027	0.73	Rejected
<i>H6d</i>	VFI*tech. orientation→hospital-supplier collaboration	0.168*	2.139	Accepted

Notes: * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

Table VI.
Results of
hypotheses testing



Notes: * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

Figure 2.
Results of hypotheses
testing

effect of technology orientation was most pronounced on hospital VFI→hospital-supplier collaboration linkage (0.168*). Subsequent pronounced effects were on hospital VFS→hospital-supplier collaboration (0.155**) and on hospital VFL→hospital-supplier collaboration linkages (0.121*).

Discussion and implications

The study is one of the foremost to investigate the effects of hospital's dynamic capabilities on their collaborative efforts with their key supplier and their influence on hospital supply chain performance. Also the study is foremost in exploring the importance of technology orientation on hospital's dynamic capabilities and hospital-supplier collaboration. An important contribution of our research is the conceptualization of supply chain visibility core components (Pavlou and El Sawy, 2011), i.e., VFS, VFL, VFC and VFI in the context of hospital supply chains. Furthermore, our study has extended the resource-based view (Barney, 1991) and its dynamic capability extension (Teece *et al.*, 1997) in the context of medical supply chains. This is the main theoretical contribution of our empirical exploration. Our study has investigated the much-needed importance of information sharing in hospital supply chains for important performance management (Dobrzykowski and Tarafdar, 2015). To fulfill this need, the study has theorized hospital's VFS, VFL, VFI and VFC (Pavlou and El Sawy, 2011) as dominant dynamic capabilities having positive influences on hospital-supplier collaboration. An indirect contribution of this study therefore is the development of measurement instrument for the hospital dynamic capabilities of VFS, learning, coordinating and integrating and hospital-supplier collaboration. Our study is the foremost in exploring the development of hospital-supplier collaboration – a much-needed research call (Chen *et al.*, 2013). Hence, our study has important implications for practitioners and managers across dominant entities in a medical supply chain. First, the study has empirically established that a hospital's supply chain visibility does contribute in the development of its collaborative efforts in the supply chain (Hohenstein *et al.*, 2015; Scholten and Schilder, 2015). The study has explored the importance of core components of a hospital's visibility, e.g., VFS, learning, coordinating and integrating (Pavlou and El Sawy, 2011), on hospital-supplier collaboration. As shown by the findings, VFS, VFL and VFI do enhance hospital-supplier collaboration, while VFC has no positive effects. The dynamic capability view suggests that firms in competitive world must adapt to their changing environment in order to survive (Helfat and Peteraf, 2015). Hospitals are the focal units of medical supply chains (hence are also known as hospital supply chains) (Chen *et al.*, 2013). Research suggests that first they must be able to sense the emerging changes in its environment (Chithambaranathan *et al.*, 2015) and accumulate knowledge from their experiences. Focus consequently has been more on learning so that firms can prepare well for forthcoming changes (Scholten and Schilder, 2015). Hence hospitals must have adequate infrastructure in terms of ISs so that efficient information interchange can take place with their core partners. This is an important implication for hospital managers. Furthermore, the other core entities in a medical supply chain, e.g., medical equipment manufacturers, surgical suppliers and hotels, must focus on aligning their ISs in sync with their focal units, i.e., hospitals, so that accurate and relevant information can be shared. This will enhance environmental sensing capabilities for the medical supply chain members and their focal units, i.e., hospitals (Pavlou and El Sawy, 2011). Dynamic capabilities do suggest that firms in competitive surroundings must be ready to learn and accumulate knowledge through experience (Birkinshaw *et al.*, 2016). As shown by our study, hospitals must be ready to learn from their supply chain entities, e.g., medical equipment manufacturers, insurance agents and pharmaceuticals. Partners in such medical chains must be ready to learn and help in the growth and sustenance of each other (Ahmadi *et al.*, 2015). Teece (2012) suggests that in a complex network, learning from experiences becomes

all the more important for gaining competitive advantage. As shown in our study, hospital managers therefore put more reliance on inculcating VFL capabilities so as to enhance their collaborative efforts in the medical supply chain. Managers belonging to different entities of the medical supply chain therefore focus more on arranging meetings frequently so as to exchange and share their experiences and gain from the same. **With enhanced capabilities of sensing and learning, hospitals along with other core entities in a medical supply chain will be successful in their collaborative efforts** (Pavlou and El Sawy, 2011; Heyland *et al.*, 2015). Dynamic capabilities suggest that unification of efforts in networks is compulsory for successful adaptation to change (Teece, 2012). As shown in our study, hospital's VFI has a positive effect on hospital-supplier collaboration. Therefore, hospital managers urge their supply chain members to work cohesively so that they can unite their individual efforts. Effective integration has positive performance implications (Prajogo and Olhager, 2012). Therefore, the finding of our study is in line with extant literature. Also, medical chain entities must comprehend the diversity in their operations (being a service supply chain) and hence must collaborate with each other (Wang *et al.*, 2015). Furthermore, hospital-supplier collaboration was found to have a positive influence on hospital supply chain performance (Dobrzykowski *et al.*, 2016). This in line with other allied studies in production and supply chain management (Cao and Zhang, 2011; Fawcett *et al.*, 2015; Prajogo and Oke, 2016). Hence it is compulsory for the diverse entities in a medical supply chain to unite their efforts and must collaborate. With appropriate information sharing, hospitals will be in a better position to sense the changes in their surroundings, learn from experiences and able to unify (i.e. integrate) their efforts (Arvitrida *et al.*, 2015), resulting in enhanced and effective collaboration in the medical supply chain (Cao and Zhang, 2011). This will effectively enhance the medical supply chain performance. While the above three dynamic capabilities were found to have positive effects, the influence of VFC was not significant. This might be due to the fact that coordination may be perceived as not that much important for achieving collaboration, although our empirical findings have successfully established that these two are different constructs. However, further research is needed to explore the causes. Our study has established that technology orientation plays a significant role in enhancing the linkage between the proposed dynamic capabilities and hospital-supplier collaboration (Leng *et al.*, 2015). As shown by the study, technology orientation acts as a positive moderator on the linkages between VFS, learning and integrating with hospital-supplier collaboration. However, its influence on the VFC with hospital-supplier collaboration was not significant. For technology-oriented firms, influence of their integration efforts on collaboration was most pronounced followed by their sensing and learning capabilities, respectively (Ho *et al.*, 2016). This highlighted the dire need among firms to be technology-oriented for successful assimilation of their integration efforts into effective collaboration with their medical chain partners. Also sensing and learning efforts could result in improved collaboration in the medical chain provided the dominant entities have a positive technology orientation (Ho *et al.*, 2016; Lichtenthaler, 2016). Accordingly, this suggests that managers in medical supply chains should focus on developing and investing more on newer technologies for information sharing (Ozkaya *et al.*, 2015). This will strengthen the relation between each of the dynamic capabilities of hospital, i.e., sensing, learning and integrating, with hospital-supplier collaboration. Furthermore, managers should also focus on updating their other relevant machines and technologies required for efficient execution of business activities.

Limitations and future research

Our study has empirically established that hospital's VFS, VFL and VFI are dominant factors for the development of hospital-supplier collaboration. This further enhances hospital supply chain performance. However, the study has its own limitations. As the study

selected one respondent per firm, the ultimate findings may not be extended to all contexts. Furthermore, our sample size of 192 is relatively small considering the depth of this investigation. Considering the existing diversity and complexity in medical supply chain operations, future studies must adopt a case-study approach for analyzing in depth every medical supply chain operations and associated issues. Another problem is that every unit in the medical supply chain, e.g., medical equipment manufacturer, may be in turn core supplier of multiple other hospitals. Hence, exclusivity was difficult to maintain while collecting the perceptual responses. Future studies should focus more on exploring the influence of hospital's dynamic capabilities of VFS, learning, coordinating and integrating on the relational resources such as hospital-supplier trust and how the same influences supplier performance and hospital performance individually. Future studies should also explore if other dynamic capabilities can act as active antecedents to hospital-supplier collaboration. Research should also explore the direct and indirect influences on technology orientation on hospital supply chain operations through other relevant supply chain capabilities.

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(The Appendix follows overleaf.)

Appendix

Construct	Items
Hospital's VFS (visibility for sensing) (Wei and Wang, 2010)	You share complete information relating to an upcoming technology with your key supplier You share complete information regarding an upcoming new medicine with your key supplier You share complete information regarding new surgical equipments with your key supplier You share complete information regarding emerging medical trends with your key supplier You share complete information regarding upcoming market demands with your key supplier
Hospital's VFL (visibility for learning) (Wei and Wang, 2010)	You frequently seek performance feedback from your key supplier You frequently exchange new ideas targeted at improving performance with your key supplier You normally discuss different perspectives regarding your operations with your key supplier in meetings You generally gain new knowledge and perspective through joint decision making with your key supplier You exchange critical knowledge targeted at improving supply chain performance with your key supplier
Hospital's VFC (visibility for coordinating) (Wei and Wang, 2010)	You share ordering information with your key supplier You share shipping information with your key supplier You share payment processing information with your key supplier You share transportation schedule with your key supplier You share order forecasting with your key supplier
Hospital's VFI (visibility for integrating) (Wei and Wang, 2010)	You share information with your key supplier that helps in efficient business functioning You occasionally discuss routine operational issues with your key supplier You frequently discuss long-term planning with your key supplier You have sufficient expertise for understanding the competency of your key supplier You frequently share information relating to your key business processes with your key supplier
Hospital-supplier collaboration (Cao and Zhang, 2011)	Incentives for optimal performance are shared appropriately in your supply chain You can easily synchronize your operational decisions with those of your key supplier Your key supplier regularly communicates with you before taking important decisions You and your key supplier share strong agreement on operational goals of the supply chain You develop demand forecasts jointly with your key supplier
Hospital supply chain performance (Chen <i>et al.</i> , 2013)	The order fulfillment process in your allied hospital supply chain is improving considerably over time The cost associated with the order fulfillment process in your allied hospital supply chain is becoming all the more better with time You have observed that there is sufficient buffer in the order fulfillment process of your allied hospital supply chain which is getting better day by day Based on your existing knowledge of your allied hospital supply chain, you think the associated order fulfillment process is short and efficient
Technology orientation (Leng <i>et al.</i> , 2015)	You use advanced technologies in your every day-to-day operation You use updated technologies in your strategic operation You normally refrain from using technologies that are outdated You design your product/services always with the latest technologies You readily accept proven technological innovation in your organization

Table AI.
Final measurement
items

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