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**Supply Chain Integration, Supplier Commercial Relationships, and
Order Fulfilment Practices in Public Hospitals**

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Abstract

Supply chain integration (SCI), supplier commercial relationships (SCR), and order fulfilment (OF) have been acknowledged by academics and practitioners as key areas for reducing operational costs and improving service level to meet customers' requirements. Nevertheless, little is known concerning factors influencing SCI, SCR, and OF in public hospitals. This paper reports the critical factors influencing SCI, SCR, and OF identified in a pilot study conducted in New Zealand public hospitals. A survey methodology was used to collect data. The findings and suggestions to improve SCI in public hospitals are discussed.

Keywords: supply chain integration, supplier commercial relationships, order fulfilment, public hospitals, New Zealand.

1.0 Introduction

Many people, including academics and practitioners have developed an interest in supply chain management (SCM) and supply chain integration (SCI). The practitioners are using SCM and SCI knowledge in order to reduce operational costs and to improve customer service in a global competitive environment. In addition, practitioners have been using SCM and SCI to reduce inefficiencies in their current management processes.

Lambert, Cooper, and Pagh, (1998, p. 1) define SCM as the “integration of business processes from end user through original suppliers that provides products, services, and information that add value for customers.” Handfield and

Nichols (2002, p. 8) define SCM as “the integration and management of supply chain organizations and activities through cooperative organizational relationships, effective business processes, and high levels of information sharing to create high – performing value systems that provide member organizations a sustainable competitive advantage.”

The National Research Council in the U.S. (2000, p. 27) defines an integrated supply chain as an association of customers and suppliers (supply chain stakeholders) who, in using management techniques, work together to optimize their collective performance in the creation, distribution, and support of an end product manufacturer.

Kim and Narasimhan (2002) argue that supply chain integration links an organisation with its customers, suppliers, and other channel members by integrating their relationships, activities, functions, processes and locations. Supply chain integration is a good approach for improving business performance in a highly competitive market (Narasimhan, Jayaram, & Carter, 2001). Although there is general understanding on the strategic importance of supply chain integration (Cooper, Lambert, & Pagh, 1997; Handfield & Nichols, 1999), Frohlich and Westbrook (2001) claim that little is known regarding the relationship between SCI and its impact on performance.

Lambert (2004) states that executives in many companies face problems to achieve the required integration because they don't fully understand the supply chain business processes and linkages needed to integrate eight key SCM processes identified by members of The Global Supply Chain Forum. The eight processes being: customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, supplier relationships management, product development and commercialization, and returns management (Lambert, 2004).

A supply chain (SC) is a network of members and links between the members (Lambert, Cooper, & Pagh, 1998). Handfield and Nichols (2002, p. 8) state that the SC involves activities associated with the flow and transformation of goods from the raw materials stage (extraction), through to the end user, as well as the associated information flows. However, Mentzer, DeWitt, Keebler, Min, Nix, Smith and Zacharia (2001) limit their definition of a supply chain to the flow of products, services, finances, and/or information from a source to a customer, whereas Lambert et al. see a two way flow of information. Basu and Wright (2008) add to physical flow of goods and flow of information the flow of funds to certain types of supply chains such as those found with point of sale retail operations. Management of the SC is, therefore, basically the management of the relationships and activities among the members of organisations (system).

Supply chain management (SCM) links a firm with its customers, suppliers and other members of the supply chain system, including logistics and warehousing companies. The goal of SCM is for members in the organisations to integrate, work together, and build a partnership with each other to increase the competitive advantage of the supply chain as a whole (Mentzer et al. 2001).

Bowersox, Closs and Stank (1999) have classified integration in the supply chain context into six different types: customer integration, internal integration, material and service supplier integration, technology and planning integration, measurement integration, and relationship integration. Recent SCM literature has emphasized the importance of SCI in creating value and reducing costs (e.g., Lee, 2000; Lee & Wolfe, 2000, 2003) and the cost of logistics in the supply chain (Delaney, 2000).

1.2 Rationale of the study

Studies of SCM/SCI issues in the health sector are scarce in the literature, but include e.g., Task Force Report on Supply Chain Management, a joint initiative of

the Ontario Hospital Association of Canada (November, 2001) which found that an efficient SC could reduce cost; Breen and Crawford (2005) state that e-commerce is an important aspect of SCM; Towill and Christopher (2005) emphasize the use of principles of SC design in healthcare; and Okoroh, Gombera and Ilozor (2002) stress that healthcare facilities management is part of the service chain process.

Furthermore, in the context of New Zealand (NZ) there is little research on SCI in general (Campbell, 2002; Campbell & Sankaran, 2005) and the work that has been published does not address the SCI factors and their impact on supplier commercial relationships and order fulfilment are not addressed.

1.3 Background information: supply chain in the public hospital sector in NEW ZEALAND

The Public Health and Disability Act 2000, implemented in 2001 established the District Health Boards (DHB) in NZ. There are 21 DHBs and 41 public hospitals in NZ providing health services to 4.2 million people. DHBs are “responsible for providing, or funding the provision of health and disability services in their district” (Ministry of Health in NZ, 2008). A high level of operating deficit across the sector (e.g., NZ \$185 million in mid 2003) creates difficulties for DHBs as they try to manage and reduce these deficits, to increase the funding of a wider range of community services (Dew and Davis, 2005), and to lower operational costs, especially the cost of procurement in the public hospitals and other health service providers. More specifically, DHBs had deficits in 2005 of up to NZ \$58,110,000 (down from \$185, 000, 000 in 2003), and all had high levels of inventory (DHBs annual reports).

High levels of inventory indicate that money is tied up in inventory and they contribute to the deficits, which reduce money available to meet other obligations. Furthermore, high levels of inventory show that the supply is not well integrated

to reduce inventory and costs. Though the problem is recognisable, no research on supply in public hospitals exists in NZ.

The initial investigation on supply chain in public hospitals reveals three types of supply chain networks (Figure 1.1):

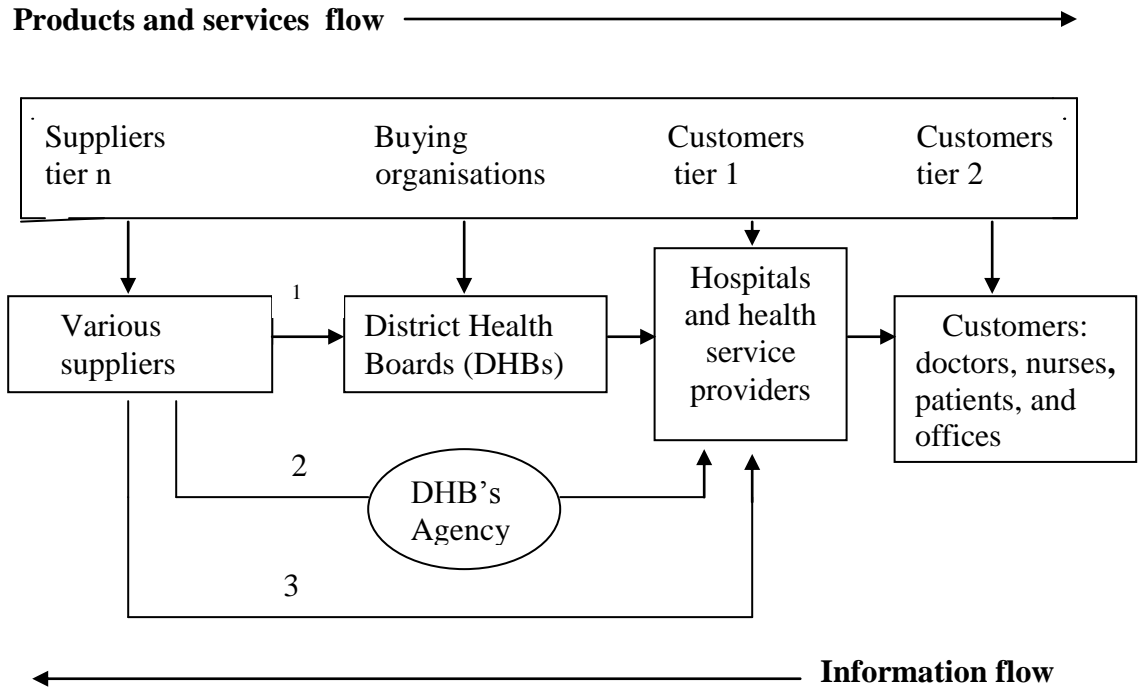
- (1) DHBs buy products and services from various suppliers in order to fulfil the requirements of the hospitals and health service providers (customers tier 1), and doctors, nurses, patients, and offices (customers tier 2);
- (2) DHB's Agency buys products and services from various suppliers in order to meet the requirements of the customers tier 1; and
- (3) Hospitals and health service providers buy products and services direct from various suppliers in order to meet the requirements of the customers tier 2.

The model of supply chain for buying products and services in the public health sector in NZ is indicated in Figure 2 (Middlemore hospital, 13 September 2006, personal (communication)).

After reviewing the existing SC in NZ public health sector, it shows that SC is not standardised, and hospitals have different ways of meeting their procurement needs. Hospitals get their requirements through an agency or direct from the suppliers.

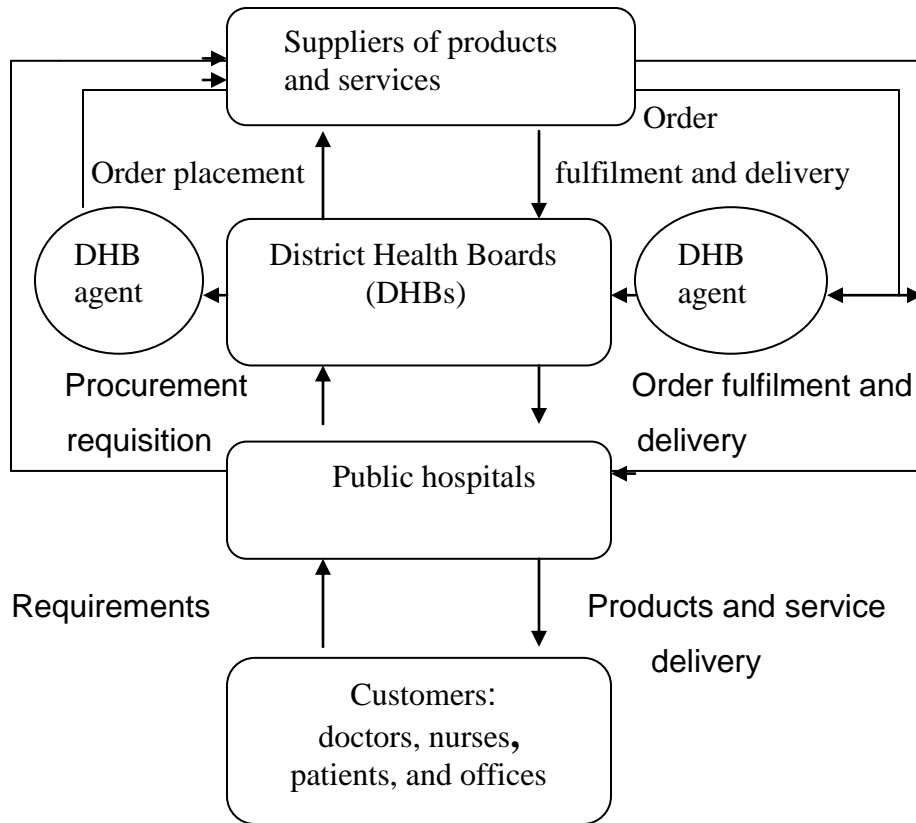
In summary, the literature on critical factors influencing SCI is limited for the health care sector, and does not focus on the supplier commercial relationships and order fulfilment. This study attempts to fill that gap by conducting an empirical study which examines the critical factors influencing supply chain integration in the NZ public hospital sector.

Figure 1.1: Products and services supply chain network in public health sector in New Zealand



Source: Author

Figure 1.2: Model of the supply chain for products and services in the public health sector of New Zealand



Source: Author

1.4 Objectives of the study

The primary objective of this research is to develop an empirical understanding of the critical operational factors influencing the supply chain integration, supplier commercial relationships and order fulfilment in the NZ public hospital sector. It deals primarily with the following constructs indicated in the research model (Figure 1.3): supply chain integration initiatives, organisation strategy and SCI drivers, performance improvement and SCI, organisation environmental forces,

barriers to SCI, supplier commercial relationships, focused SCI (all these are independent variables) and order fulfilment (dependent variable).

SCI operational issues

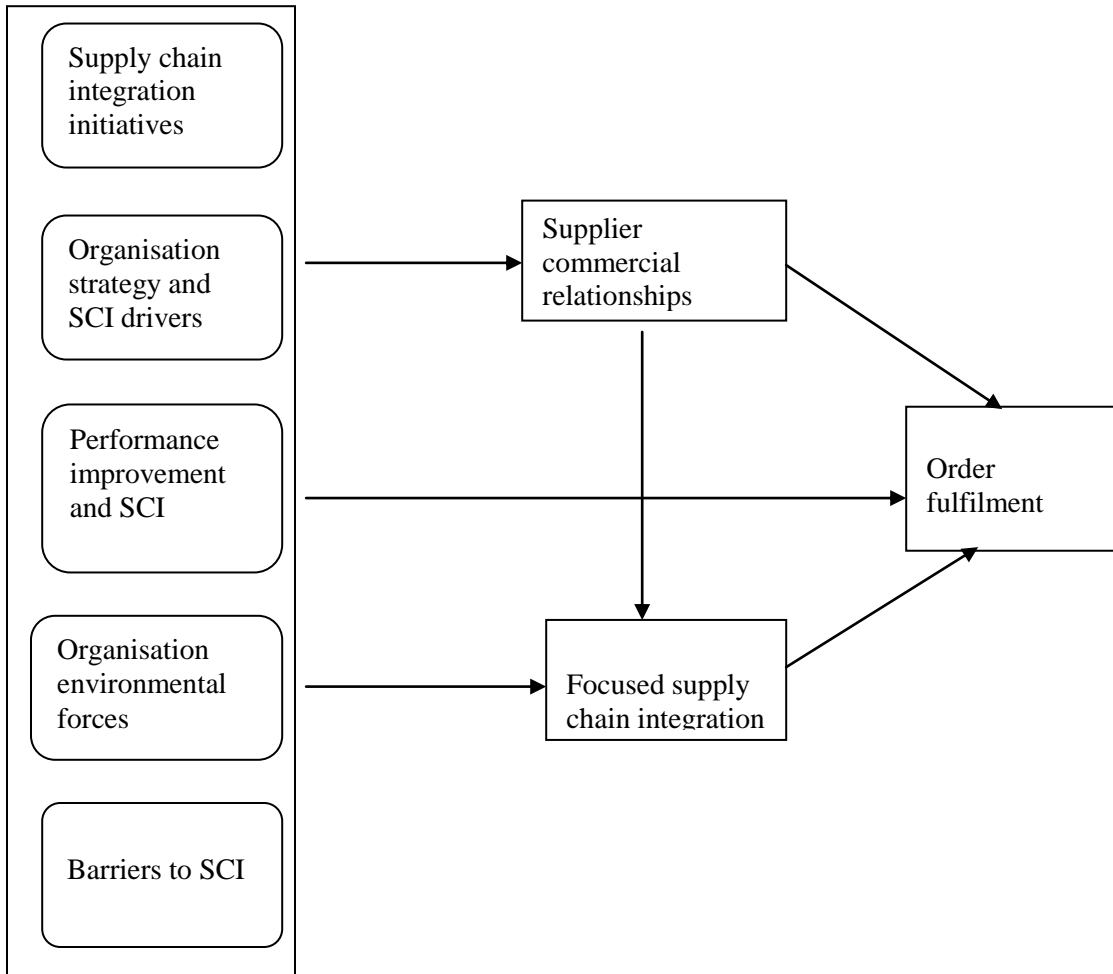


Figure 1.3: Conceptual Research Model: Factors influencing supply chain integration in New Zealand health public sector

The key question is: What are the critical operational factors influencing supply chain integration, supplier commercial relationships, and order fulfilment in NZ public hospital sector?

1.5 Significance of the study

It is evident that SCI has been considered as a means to reduce operations costs and supply chain inefficiencies, and improve the service level in an organisation. Lack of integration between members of a supply chain results in operational inefficiencies and hinders the performance of the supply chain (Lambert, 2004).

Early SCI research has focused mostly on the management process integration issues related to the manufacturing sector and part of the service sector. Little is known concerning how public hospitals attain SCI. It is thus evident that there are still gaps in SCI knowledge in determining the factors which influence order fulfilment in public hospitals. A review of the literature indicates that SCI influences and their impact on supplier commercial relationships and order fulfilment in public hospitals are not known.

This research seeks to identify critical factors or operational issues that affect SCI in the New Zealand public hospitals. The SCI influences and their impact on supplier commercial relationships and order fulfilment will be examined critically in the next stage of the research.

The objective of this paper is to report the critical factors influencing SCI, SCR, and OF identified in a pilot study conducted in New Zealand public hospitals.

2.0 Literature Review

2.1 Supply chain integration

2.1.1 Integration

Lambert (2004) emphasises that successful supply chain management needs cross-functional integration of key business processes within the firm and across the network of companies that consist of the supply chain. Furthermore, Lambert (2004, 2008) states that executives in many companies struggle to accomplish the required integration because they don't fully understand the supply chain business processes and the linkages required to integrate eight key SCM processes identified by members of The Global Supply Chain Forum:

- Customer relationship management
- Customer service management
- Demand management
- Order fulfilment
- Manufacturing flow management
- Supplier relationship management
- Product development and commercialization
- Returns management (Lambert, 2004).

2.1.2 Supply chain integration

Many definitions of SCI provided in the literature create confusion to the practitioners and academics. For the purpose of this study, the definition used is that of the National Research Council in the U.S.

The National Research Council (2000, p. 27) defines an integrated supply chain as an association of customers and suppliers (supply chain stakeholders) who, using management techniques, work together to optimize their collective performance in the creation, distribution, and support of an end product manufacturer. Thus, SCI is a continuous process that can be optimized only when the original equipment manufacturers (OEMs), customers, and suppliers work together in partnership to improve their relationships and when all participants are aware of key activities at all levels in the chain (National Research Council, 2000). Supply chain integration is the level to which all activities in an organisation and that of

its suppliers, customers, and other supply chain members are integrated (Stock & Tatikonda, 2000; Narasimhan and Jayaram, 1998; Li, 2002; Marquez, Bianchi & Gupta, 2004). Kim and Narasimhan (2002) state that supply chain integration links an organisation with its customers, suppliers, and other channel members by integrating their relationships, activities functions, processes and locations.

Hill and Scudder (2002) emphasise on inter-organisational coordination in the supply chain to integrate activities. Organisations must integrate their operations with trading partners in order to sustain competitive advantage for the whole supply chain (Cox, 1999; Lambert and Cooper, 2000). The literature on supply chain integration is composed of three types of integration: integration with suppliers, integration with customers, and internal integration across supply chain (Frohlich & Westbrook, 2002; Frohlich, 2002; Narasimhan & Kim, 2002).

Supply chain integration is considered a suitable approach for improving business performance in highly competitive market (Narasimhan, Jayaram & Carter, 2001). Furthermore, Yusuf, Gunasekaran, Adele and Sivayoganathan (2004) stress that SCI is a vital tool for competitive advantage, and they support Lee and Whang (1999) on the importance of SCI.

The importance of SCI has been recognized in the literature (e.g., Lee & Whang, 1999). Integration is emphasised by the Supply Chain Council's supply chain operations reference (SCOR) model. SCOR is a management tool that "enables users to address, improve, and communicate supply chain management practices within and between all interested parties. It is a process reference model for supply chain management, spanning from the supplier's supplier to the customer's customer" (Supply Chain Council, n.d., 2001). The SCOR Model is a cross industry framework for the evaluation and improvement of supply chain management and performance (Stewart, 1997). The model have five major supply chain processes: plan, source, make, deliver and return. The source process of the SCOR model comprises managing incoming raw materials, supplier

selection and certification, supplier relationships and agreements (Stephens, 2001; Stewart, 1997). The deliver process deals with all warehousing, distribution and logistics processes and decisions that impact the delivery of product to the customer, including customer order entry and management, warehouse picking and distribution, invoicing and selection of carriers (Stephens, 2001 & Stewart, 1997).

Frohlich and Westbrook (2001) found that the highest levels of integration with both suppliers and customers had the highest correlation with high levels of an organisation's performance. Furthermore, Frohlich and Westbrook (2002) reported that firms that embrace high levels of internet-based supply integration and demand integration experience the highest levels of performance.

Rosenzweig, Roth & Dean (2003) support the findings of Frohlich and Westbrook (2001) that supply chain intensity leads to improved business performance.

Zailani and Rajagopal (2005, p. 379) add that the potential benefits of integrating the supply chain "will be realised only if the interrelationships among different parts of the supply chain are recognized, and proper alignment is ensured between the design and execution of the company's competitive strategy." Lack of integration between members of supply chain results in operational inefficiencies and hinders the performance of the supply chain.

Estimates of European companies' supply chains highlighted that only 10% of supply chains are well integrated (Towill, Childerhouse & Disney, 2000).

Simchi-Levi et al. (2003, p. 10) provide three examples of companies implementing supply chain and state that "the National Semiconductor, Wal-Mart, and Procter & Gamble success stories demonstrate not only that integrating the supply chain is possible, but it can have a huge impact on the company's performance and market share." Lee (2000) argues that a truly integrated supply chain contributes more than reduced costs, and emphasizes the added value (e.g., sharing information resulting in savings, higher profit margins, improved customer service performance, and shareholder values are multiplied) for the

company, supply chain partners and shareholders. In a study of the performance benefits of supply chain logistical integration, Stank, Keller, and Closs (2001) found that SCI creates value through improved customer service levels and reduced costs. The National Research Council (2000, p.33) state that “the most sought-after benefit, or return on investment, in supply chain integration is the cost savings that result from reductions in inventory. Inventories can be reduced by increasing the speed at which materials move through the supply chain and by reducing safety stocks.”

Hammer (2001) presents examples of Geon, Hewlett-Packard (HP), and General Mills that have successfully integrated their operations with those of their suppliers. For example, the Geon’s processes integrated are: Geon’s customer’s procurement process, Geon’s order fulfilment and procurement processes, and Geon’s supplier’s order fulfilment process.

2.1.3 SCI Operational issues

The success of an organisation regarding SCI depends on how management critically examines the SCI operational issues, which are likely to affect an organisation’s ability to successfully implement SCI.

SCI operational issues are concerned with the organisation’s activities that can have impact on enhancing SCI in an organisation. Barki and Pinsonneault (2005, p. 165) propose the concept of organisational integration, which is defined as “the extent to which distinct and interdependent organisational components constitute a unified whole” and they identified two intraorganisational integration: (1) internal-operational (integration of successive stages within the primary process chain (workflow) of an organisation) and (2) internal-functional (integration of administrative or support activities of the process chain of an organisation). Akkermans, Bogerd, Yucesan, and Wassenhove (2003) found that the executives

expected further integration of activities between suppliers and customers across the entire supply.

The operational SCI issues, such as SCI initiatives, organisation strategy and SCI drivers, performance improvement and SCI, organisational environmental forces, and barriers to SCI, are discussed in the following sections.

2.1.4 Supply chain integration initiatives

Braganza (2002) argues that enterprise integration initiatives are not equally important and they differ by their purpose. Enterprise integration initiatives are based on the capabilities developed for an organisation. Filippini, Forza, and Vinelli (1996; 1998) stress that external competitive pressure appears to influence the number of initiatives that companies implement. They found that there is a relationship between the level of competitiveness in the external situation and the more about innovation. Corbett and Van Wassenhove (1993) also argue that a company should start the initiatives with the aim of achieving a certain level of performance “compatible with qualifying and order winning criteria in the competitive context” (Corbett & Van Wassenhove, 1993, p. 107).

Lack of external fit acts as a cause for companies to implement SCM/SCI initiatives (Danese, Romano, & Vinelli, 2006). They found that “external fit influences the type of SCM initiatives to be launched as companies select them on the basis of those performance dimensions to be improved.” For example, “if managers believe that the company performance level fitted the performance conditions for competitiveness there is no plans to implement any new SCM initiative” (Danese, et al., 2006, p. 1210). Donk and Akkerman (2008) support the results of Danese et al. (2006). They claim that “uncertainties and complex business conditions increase the need for integration” (Donk & Akkerman, 2008, p. 218).

Rai, Patnayakuni, and Seth (2006) found that integrated information technology infrastructures enable a firm to develop the higher-order capacity of supply chain process integration. In addition, they emphasised that “managerial initiatives should be directed at developing an integrated IT infrastructure and leveraging it to create process capabilities for the integration of resource flows between a firm and its supply chain partners.” (Rai et al., 2006, p. 225).

In order to understand the nature of SCM as it is practices, Fawcett and Magnan (2002) sought experience and insight of industry managers engaged in SCI initiatives. They found that supply chain integration practice does not always resemble the theoretical principle and emphasised that “managers must recognize the tension that exists between SCM’s competitive potential and inherent difficulty of collaboration” (Fawcett & Magnan, 2002, p. 339). Fawcett and Magnan (2001, p. 11) found a strong functional bias in the data. “Each functional area viewed itself as very supportive of SCM while identifying the other functional areas as less engaged or even obstructive.”

2.1.5 Organisation strategy and SCI drivers

Strategy is “concerned with the long-term direction of an organisation” (Johnson & Scholes, 2002, p. 4). Raps (2005, p. 141) claim that “the key to success is an integrative view of the implementation process” of the strategy. Researchers have emphasised the strategic importance of integrating suppliers, manufacturers, and customers (e.g., Lummus, Krumwiede, & Vokurka, 2001; Van Hoek, Harrison, & Christopher, 2001; Lawson, 2003; Barratt & Oliveira, 2001; & Barratt, 2004). Furthermore, Martensen and Dahlgaard (1999) stress on the importance of linking an innovative strategy to the company’s vision and overall business strategy. Briscoe (2004, p. 193) found that “clients are shown to be key drivers of performance improvement and innovation and are the most significant factor in achieving integration in the supply chain.” Briscoe’s findings are similar to that

of Fawcett and Magnan (2001) who found improving customer satisfaction as the dominant motivation to SCI.

Morash (2001) reports that supply chain capabilities are the building blocks for supply chain strategy and a source of competitive capability for an organisation's success. Dangayach and Deshmukh (2001) also assert that those organisations that can manage their capabilities and resources related to SCM more efficiently are likely to gain competitive capabilities and superior performance leading to increased competitiveness. "The role and benefit of SCI as a strategic lever for the interactive relationship between corporate competitive capability and SC operational capability can be different depending on the developmental stage of SC integration" (Stevens, 1990; Narasimhan and Jayaram, 1998). Stevens (1990) points out that "as the stage of integration moves from independent operation and functional integration to internal and external integration, the focus of corporate capabilities would shift from operational and tactical to strategic aspects" (Stevens, 1990, p. 1085).

2.1.6 Performance improvement and SCI

Kim (2006, p. 241) conducted a study on effects of SCM practices, integration, and competition capability on performance, found that "in small firms, efficient SC integration may play a more critical role for sustainable performance improvement, while, in large firms, the close interrelationship between the level of SCM practices and competition capability may have more significant effect on performance improvement. In addition, "once SCI has been implemented, it may be advisable to focus on SCM practice and competition capability" (Kim, 2006, p. 241). In the empirical study on the effect of SCI on alignment between corporate competitive capability and SC operational capability, it was found that "the effect of integration between corporate competitive capability and SC operational capability on performance improvement becomes insignificant as the developmental stage of SC integration increases" (Kim, 2006, p. 1084).

Briscoe, Dainty, Millett, and Neale (2004) found that clients are key drivers of performance improvement and innovation, and they are the most significant factor in attaining integration in the SC. However, Frohlich and Westbrook (2001, p. 185) concluded that “there was consistent evidence that the widest degree of arc of integration with both suppliers and customers had the strongest association with performance improvement.” Stratman (2007, p. 203) propose that organisations that are “seeking external market and supply chain performance improvements must first establish a foundation of internal operational performance improvement before customer satisfaction and supply chain benefits can be realized.” Sundarraj and Talluri (2003) stress that sharing and coordination of information across the SC at the right time, are major factors to improving the performance of an organisation. Fawcett and Magnan (2001) identified four highest-ranked benefits: responsiveness to customer requests, on-time delivery, overall customer satisfaction, and order fulfilment lead times, which are key to performance improvement.

2.1.7 Organisation environmental forces

Daft (2000, p. 73) defines organisational environment as “all elements existing outside the organization’s boundaries that have the potential to affect the organisation.” The external organisational environment is composed of competitors, resources, technology, and economic conditions that have an impact on the organisation (Daft 2000). Mullins (2002) explains further the environmental influences on the organisation, for example, competitors, suppliers, economic activity, social attitudes, customers, culture, shareholders or providers of finance, and technological innovations that are constantly changing. “In order to understand the operations of organisations, and to improve organisational performance, it is necessary to consider how they achieve an internal and external balance and how they are able to adopt to changes in their environment and the demand placed upon them (Mullins, 2002, p. 110).

Fawcett and Magnan (2001) found that the desire to improve customer satisfaction is the key factor among the environmental forces to SCI followed by improving SC productivity, intensifying competition, an opportunity to build the best team of SC partners, compete against global supply chains, focus on competence in services, customers initiated integration, access to global markets, shifting channel power, and suppliers initiated integration.

2.1.8 Barriers to SCI

The benefits of SCI have been known to practitioners and academics but the implementation of SCI in practice has been difficult. SCI provides vital competitive advantage, such as ability to ‘outperform’ rivals on both price and delivery (Lee & Billington, 1992). The higher the level of integration the greater the benefits (Narasimhan & Jayaram, 1998; Frohlich & Westbrook, 2001; Ahmad & Schroeder, 2001). However, researchers have found barriers to SCI. For example, Christopher and Ryals (1999) found that the key barriers to time shortening in the supply chain are the long replenishment lead-times often experienced with suppliers.

Members of supply chain (e.g., suppliers, manufacturers, and customers) can be a barrier to change operations, and they frequently compete for the power to control the supply chain (Cox, Sanderson, & Watson, 2001). Frohlich (2002, p. 550) found that “managers interesting in improving their company’s supply chain using e-integration should first focus on internal barriers” and concludes that internal barriers hinder “e-integration more than either upstream suppliers or downstream customer barriers” (Frohlich, 2002, p. 537). Halldorsson, Larson, and Poist (2008) also found that internal resistance is more of a barrier than external (customer or supplier) resistance to SCM.

Barratt (2004) found that lack of visibility of demand and inventory holding status across the supply chain, together with adversarial relationships between trading

partners are critical barriers to SCI. Daintly, Briscoe, and Millett (2001, p. 163) revealed that barriers to supplier integration are due to “skepticism over the motives behind supply chain management practices.” Vaart and Donk (2004, p. 21) claim that “the goal of integrated supply chains is to remove barriers to ease the flow of materials and information.” Shared resources is a key barrier to supply chain integration (Vaart & Donk, 2004). Donk, Akkerman, and Vaart (2008) also argue that there are limits to integrating supplier’s operations to that of customers.

Frohlich (2002) classifies supply chain integration barriers in three categories: (1) supplier barriers, (2) internal barriers, and (3) customer barriers on technology costs/benefits not demonstrated; existing business model/current practice; and lack of technical/e-business skills. Fawcett, Magnan, and McCarter (2008) identified the following top ten barriers to strategic supply chain management, which are also reflected in SCI in the literature (e.g., Fawcett & Magnan, 2001; Fawcett et al., 2002):

(a) Interfirm rivalry

- Inadequate information sharing
- Inconsistent operating goals
- Lack of willingness shared risks and rewards
- Lack of willingness to share information

(b) Managerial complexity

- Lack of alliance guidelines
- Processes poorly appraised in terms of costs
- Non-aligned measures
- Organizational boundaries
- Measuring supply chain contribution
- Measuring customer demand (Fawcett et al., 2008, p. 44).

2.2 Supply chain integration studies in New Zealand

Campbell (2002, p.120) and Campbell and Sankaran (2005) studied two SMEs organisations (NZ Com and Build Com) in NZ with reference to SCI, and a major finding was that SCI has three distinct dimensions (internal integration, backward or external integration with suppliers, and forward or external integration with customers). However, the study did not identify critical factors influencing the SCI and their impact on supplier commercial relationships and order fulfilment. The aim of the research was to develop a framework for assessing the extent of SCI in the supply chain. The validity of their framework can be challenged as it was developed from experience with only two organisations.

A comprehensive study conducted by Basnet, Corner, Wisner and Tan (2003) highlighted that the situation regarding SCI is no better in New Zealand and confirms that NZ is lagging behind the U.S. and Europe. Basnet et al. (2003, p. 63) noted that in NZ, "... there has not been much progress when it comes to more advanced ideas such as supply chain teams, or information sharing, or use of EDI, etc." They concluded from their survey data that future research opportunities existed in the identification and validation of SCM techniques and practices that are particularly suited to manufacturing industries in NZ.

The results of a recent online survey of the panel of experts conducted by Childerhouse (2007) indicate that the two key barriers for achieving supply chain excellence in New Zealand are: lack of understanding of supply chain integration and lack of internal buy-in to supply chain concepts. The results support the findings of Basnet et al. (2003). In addition, Childerhouse (2007) identified secondary barriers: staff's resistance to change and a significant lack of human resource expertise, and concluded that there is a need for a dynamic workforce that supports new concepts and is willing to learn modern management concepts.

2.3 Focused supply chain integration

SCI has many definitions in the literature but they are less focused on management behavioural issues. For this reason, the focused supply chain integration (focused SCI) construct has been created for this study. Focused SCI refers to the targeted management behavioural issues which can have impact on organisation's ability to integrate management processes and corporate culture practices in the hospitals.

Literature furnishes different dimensions of measuring SCI (e.g., benefits, barriers, and bridges (Fawcett et al., 2008); integration of eight key SCM processes (Lambert, 2008); content integration at the point of sale (Loebbecke, 2007); supplier integration activities (Wagner, 2003); integration with suppliers, integration with customers (Frohlich, 2002); supply chain alignment: benefits, barriers, and bridges (Fawcett, & Magnan, 2001); and integration of eight key SCM processes (Lambert et al., 1998).

It is evident from the literature that there are different dimensions of measuring SCI. This study will measure SCI using focused SCI measurements based on organisational management behavioural aspects. Focused SCI will be measured to determine critical management behavioural factors that enhance SCI in the hospitals.

The assumption is that improved focused SCI lead to improved operational SCI issues, commercial supplier relationships, and order fulfilment.

2.4 Health care supply chain integration

2.4.1 Health care supply chain

A recent study by Bagchi and Chun (2005) found that SCI influences operational performance, and the extent of integration also has a positive impact on cost and

efficiency. Despite this, little evidence is found in the literature regarding the major operational issues which have an impact on SCI, supplier commercial relationships, and order fulfilment in the hospital sector. The recent conference of Production and Operations Management Society (2006, April 28 – 1 May) noted negative publicity regarding the perceived inefficiencies within the health care industry and recommended that supply chain in the health care sector was not well researched.

Health care organisations in all countries are looking for the ways to improve operational efficiencies and reduce costs without affecting patient care services. The study conducted by Byrnes (2004, April, p. 1) concerning inefficiencies in the health care supply chain in the U.S. revealed that " the healthcare industry has developed some of the most important supply chain innovations. In the mid-1980s, Federal regulations severely crimped hospital budgets. In response, a particular innovative hospital supply company developed one of the first powerful vendor managed inventory systems, which greatly reduced costs and increased service at the same time." Health care budgets are very tight generally, and that is why health providers worldwide are striving to improve processes and reduce costs. Savings in the health care supply chain are reported in a study by the Ontario Hospital Association Task Force (2001, November). Their study revealed that the potential value of SCM improvement in the Ontario hospital sector is estimated at more than Canadian \$ 300 million a year.

Although information technology has been seen as a catalyst for cost savings, Novelli (2004, p. 32) cautions that technology is a means, not an end in itself, and he provides the example of health care in the U.S. He states that information technology is not effectively or routinely applied to the practice of medicine, noting that "more than 90% of the 30 billion annual medical transactions are conducted by phone, fax or stamped mail ... Only one third of hospitals have computerized order-entry systems and fewer than 55 require their use. Only 5%

of clinicians and 195 of provider organizations use electronic medical records ... fewer than 5% of physicians write electronic prescriptions.”

The cost of managing the health sector in developed countries has also been growing. There is a wide range of supplies purchased for health care, which involve many different relationships of different types being formed in complex networks of supply from the supplier to end customer. The National Health Service (NHS) in England spends Pounds 15 billion per year on purchased goods and services (NHS, 2004). The NHS Purchasing and Supply Agency (PASA) was established in year 2000 to act as a strategic adviser to the NHS on all supply issues. PASA (April 2002 and February 2004) achieved savings for NHS totalling Pounds 580 million over the three year period between April 2000 and April 2003. Another example of benefits of group buying is that of the Voluntary Hospital of America Inc. (VHA) (April 29, 2004), a U.S. not-for-profit hospital co-operative with 2200 members, which estimated its members saved U.S.\$ 813.5 million using group buying on purchases of U.S.\$ 17.7 billion in 2003. All of this is evidence of the importance of SCM in the health care system.

2.4.2 Supply chain integration in the health sector

The situation in the health sector regarding SCI lags behind that of manufacturing and other service sectors. Byrnes (2004, April, p. 1) states that "25 percent of hospital costs are supply related. The opportunity costs of this inefficiency are enormous. With limited hospital budgets, supply chain inefficiencies consume resources that could be used to bring important therapies into more wide spread availability." Hersch and Pettigrew (2002, p. 41) also emphasize that "with hospital budgets stretched and margins flat, a more efficient supply chain not only can add to the financial bottom line, it also can reduce the time health care workers spend in administrative duties, allowing them to focus on delivering quality patient care." In addition, Hersch and Pettigrew (2002) claim that hospitals group effort can cut 5% to 15% off their present supply chain expenses.

Harland's (1996, p. 187) research on supply network strategies in the health sector revealed that "there is a wide variety of supplies purchased for healthcare, which involve many different relationships of different types being formed in complex networks of supply from original source to end customer." McGrath and More (2001) stated that poorly integrated information systems, certainly comprise a main problem within the Australian healthcare sector. They reported on some outcomes of a recent study of a major Australian e-commerce project designed to improve pharmaceutical supply chain efficiency within the healthcare sector and revealed that "the standards that underpinned the project seem to have resulted in improved levels of data and systems integration - both within and between organisations" (p.1). The importance of integration was also emphasized by Brennan (1998, Jan. p. 31) who commented that "healthcare organisations should include the whole supply chain in their integrated delivery systems (IDS). Managing the supply chain process with the aid of IDSs will help healthcare providers achieve service efficiencies that will translate into long-term success." McGrath and More's (2001) study of the use of e-commerce to improve Australian pharmaceutical supply chain efficiency within the healthcare sector reveals that e-commerce improved levels of data and systems integration. They warned that poorly integrated information systems can worsen the inter-organisational e-commerce applications.

An integrated healthcare system is provided by Oracle (n.d.). In order to reduce costs and improve services, Oracle offers SCM for healthcare, and its benefits include: procurement costs reduced by as much as 20 percent, increased efficiencies in the healthcare supply chain and shortened lead times, etc. It reduces cost through improved decision-making about product costs, terms and choice of vendors. "Thousands of healthcare organizations around the world rely on Oracle to help them increase clinical performance and integrate business processes across the entire healthcare continuum:

- 10 of the top 12 of Fortune Magazine's global 500 healthcare organizations run Oracle Applications
- 70 percent of the top multi-hospital systems in the United States run Oracle technology." (Oracle, 2008).

Nevertheless, Zheng et al. (2006) in their study of e-adoption in healthcare supply chains in the English National Health Service (NHS), revealed that there is limited use of e-commerce in supply chains in this sector.

2.4.3 Outsourcing in public hospitals

Most studies of supply chain integration in health care sector have concentrated on outsourcing, and information regarding supply chain integration in public hospitals is limited. In order to reduce health care costs, providers are shifting to outsourcing in an attempt to maintain high standards of health care (Sarpin & Weideman, 1999). A study by Moschuris and Kondylis (2006, p. 4) on outsourcing in public hospitals in Greece revealed that cost savings and customer satisfaction are the key factors affecting the outsourcing decision. In addition, they found that the collaboration/cooperation with a contract service provider had significant improvement in service quality (Moschuris & Kondylis, 2006). Moreover, Homburg, Hoyer and Fassnacht (2002), and Lytle and Timmerman (2006) suggest that organisations focusing their activities on the requirements of their customers perform better, and achieve long-term goals and improve finance performance.

The usage of outsourcing in health care has been widely investigated in the U.S.A (Gardner, 1991; Solovy, 1996; Hensley, 1997; Triulzi, 1997; Hensley, 1998; Ngeo, 1998; Smyth, 1998; Sunseri, 1998; Blouin & Brent, 1999; Katzman, 1999; Morrissey, 1999; Wholey, Padman, Hamer, & Schwartz, 2001; Lorence & Spink, 2004; Nicholson, Vakharia, Erenguc, 2004). They found six factors that influence managers' information system outsourcing decisions: improved patient care, cost

savings, regulations, competition, trained staff availability, and space considerations (Lorence & Spink, 2004). Nicholson et al. (2004) found not only outsourcing results in inventory cost savings but also does not compromise the quality of care as reflected in service levels.

Studies which examine the usage of contract service providers in health care in other countries have been conducted by many researchers, including for example in U.K. (Mark, 1994; Smyth, 1998; Heavisides & Price, 2001; Riley, 2001), in New Zealand (Cameron, 1998; Renner & Palmer, 1999), and in Canada (Chow & Heaver, 1994; Rivard-Royer, Landry, & Beaulieu, 2002). All these studies concluded that: health care organisations outsource different types of activities (e.g., pre-packed products, packing formats, re-arrangement of storage areas, stockless agreements, and logistics activities), and key benefits from using outsourcing services are improved performance, cost savings, and increased management time spent on core business. Rivard-Royer et al. (2002) highlighted the disadvantage of outsourcing. They found that the labour union in Quebec due to fear of losing jobs did not accept the Canada's government - controlled healthcare system, using the hybrid version of stockless system.

2.4.4 Group purchasing in hospitals

Nollet and Beaulieu (2005, p.12) define a purchasing group “as a formal or virtual structure that facilitates the consolidation of purchases for many organisations. Consolidation is a procurement practice used to transfer to a central entity activities such as: bidding, supplier evaluation, negotiation, and contract management.” Furthermore, Rozemeijer (2000) emphasise that a purchasing group normally provides extra power to the members of the group in their negotiations with suppliers. As a result, members get more favourable conditions than those which they would have gained individually. Young (1989) says that a purchasing group is an additional link in the supply chain. Fenstermacher and

Zeng (2000) argue that a purchasing group increases the distance between buyers and sellers.

A study by Nollet and Beaulieu (2005, p.11) on “Should an organisation join a purchasing group?” found that “a purchasing group increases volume consolidation, making it possible to have only one negotiation, in order to increase purchasing group members’ power vis-à-vis that of its suppliers. However, a purchasing group also constitutes an additional link in the supply chain and its objectives could go contrary to those of some of its members.”

Anderson and Katz (1998) highlight three types of cost reduction for which purchasing can generate benefits: price, administrative costs, and assets utilisation costs. Purchasing groups create savings of between 10 per cent and 15 per cent (Hendrick, 1997; Schneller, 2000). However, (Scanlon, 2000, p. 2) found that prices negotiated by purchasing groups “were not always lower and were often higher than prices paid by hospitals negotiating with vendors directly.”

Chapman, Gupta, and Mango (1998) state that the real savings in the health care sector come from product standardisation, and they warn there is a need to be careful as to how far purchasing groups can create savings. Although purchasing groups are gaining importance in the health sector in the world, the majority of purchasing groups, between 600 and 700, are in the U.S. health-care industry (Burns, 2002).

In recent years, group purchasing in hospitals has been developing. For example, seven hospitals in the Pittsburgh, PA, area in the U.S. merged to create a purchasing cooperative/group in order to keep prices cost effective (Foodservice Director, 1998, p.18). The value of group purchasing in the health care supply chain has been emphasized by Scheller and Patton (n.d.). The result from their study indicates that most of the leading hospitals perceive outsourcing the contracting and supplier negotiation process using group purchasing order (GPO)

as a major strategic SCM choice. The findings are supported by the U.K. Department of Health (DH), which has recently selected as its preferred outsource bidder DHL/Novation, a consortium made up of German logistics company and a U.S. health care contractor (Ellinor, 2006, May, p. 7).

2.4.5 Organisational culture

Schein (1980, p.111) defines culture as “a pattern of basic assumptions that a group has invented, discovered or developed in learning to cope with its problems of external adaptation and internal integration, and that have worked well enough to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.” O’Reilly, Chatman, and Caldwell (1991, p. 491) define culture as “a set of cognitions shared by members of a social unit.” Lysons and Farrington (2006, p. 50) define culture as “the system of shared values, beliefs and habits within an organisation that interacts with the formal structure to produce behavioural norms.” They also refer to culture as an ingredient of SCM.

The literature suggests that there are variations between employee’s perceptions concerning the required form of organisational culture, based on whether they hold a managerial or non-managerial position (Schneider, White, & Paul, 1998). Employees’ different role within the organisation can cause variations in perceptions. A study conducted by Bellou (2007, p. 514) in the health-care sector regarding achieving long-term customer satisfaction through organisational culture found that there “is still a lot that needs to be done in order to meet customer needs.” This result confirms the finding of Jakubowski and Busse (1998) who stated that hospitals in the European Union face serious challenges due to lack of capability to provide services of high quality. Furthermore, Bellou (2007) revealed that there is a positive correlation between organisational culture and customer service orientation.

IMTI, Inc. (2007, n. p.) found that “a culture of trust and innovation enables corporations to achieve breakthrough levels of business performance. This performance achievement is realised through a shared vision of success in which everyone has a defined role and clear incentives and rewards. The supply chain is a partnership with common objectives, including management of total cost and risks.” Trkman and Groznik (2006) state that different organisational cultures and leadership styles be aligned to suit the SC and that “organizational culture importance must be emphasized” (Trkman & Groznik, 2006, p. 42). Corporate culture and the management techniques of each organisation in a supply chain should be compatible for successful SCM (Cooper et al., 1997a; Cooper et al., 1997b; Lambert, Stock, & Ellram, 1998).

2.5 Supplier commercial relationships

2.5.1 Commercial relationships

Lambert (2004, p. 21) define supplier relationship management (SRM) as the process that “provides the structure for how relationships with suppliers are developed and maintained.” Lambert emphasise that the firm should negotiate a product and service agreement (PSA) that defines the terms of the relationship for every key supplier and managing the PSAS (Lambert, 2004). There are two main extremes of commercial relationships described in the literature: the adversarial relationship (an extreme form of 'arms length') and partnerships (Baily, Farmer, Jessop & Jones, 1998). The study conducted by Quayle (2003) revealed that a lack of effective change from traditional adversarial relationships to the modern collaborative “e” – supply chain in the organisations. There are many types of supplier relationships, but little is known regarding the critical supplier commercial relationships which affect SCI. Kwon and Suh (2005, p. 26) state that "Effective supply chain planning based on shared information and trust between and among partners is an essential element for successful supply chain implementation." Bowersox et al. (2000) also found in their study that effective

information sharing is greatly dependent on trust in the SC members' relationships initially within the firm and finally extending to supply chain partners. La Londe (2002, p.10) further emphasizes that "issues of trust and risk can be significantly more important in supply chain relationships, because supply chain relationships often involve a higher degree of interdependency between companies."

Given the importance of trust discussed above, a study conducted by Golicic, Davis, McCarthy and Mentzer (2002, p. 851) revealed that "a stronger emphasis on relationship management as part of business strategy enables managers to manage uncertainty better." They also discovered that "increased information does not decrease the perception of uncertainty."

Therefore, when the business environment becomes more complex, organisations realise that benefits can be achieved from closer, long-term relationships (Ganesan, 1994). Burt, Dobler and Starling (2003, pp. 86 - 87) stress that there is a need to establish the strategic essentials of a relationship, such as a collaborative relationship, trust, and flexibility and speed of responsiveness. Carr and Pearson (1999) expressed that buyer-supplier relationships have a positive impact on an organisations financial performance. The results of the study conducted by Cannon and Homburg (2001, p. 29) to investigate buyers-supplier relationships and customer firm costs show that "increased communication frequency, different firms of supplier accommodation and the geographic closeness of the supplier's facilities to the customer's buying location lower customer firm costs. In addition, customer firms intend to increase purchases from suppliers that provide value by lowering each of these costs." It is important to maintain business relationship with key suppliers.

Uлага and Eggent (2006) in their study found that a key supplier status offers several advantages to vendors, for example, key suppliers normally gain larger share of a customer's business than other suppliers. Their study revealed that key

suppliers secured 73.3 % of customers' order volumes while secondary suppliers gained only 19.5% of customers' requirements. Although the literature shows that there is a need to strengthen buyers and supplier relationships, a study conducted by Pan and Pokharel (2007, p. 195) in Singapore found that "hospitals do not see alliances with suppliers as a strategic option; rather they focus on outsourcing of logistics services."

2.5.2 Long-term relationships with key suppliers

According to Ragatz, Handfield, and Scannel (1997), effective integration of suppliers into supply chain will be a major factor for some manufacturers in attaining competitive advantage. Higher level of integration with suppliers and customers in supply chain, the greater the potential benefits (Frohlich & Westbrook, 2001; Narasimhan & Jayaram, 1998; Tan, Kannan, & Handfield, 1998). The study conducted by Tan, et al., (1998) on supplier performance and firm performance, confirms that a company's customer relations and purchasing practices can impact its financial and market performance. Lau and Goh (2005) propose that technological, social, time and actual distances, other than the quality of the relationships can affect relationship development. They suggest that buyers must consider cautiously the influence of the geographical proximity of suppliers. Buyers should use the services of people who understand the supplier's local culture (Lau & Goh, 2005). In addition, Jonsson and Zineldin (2003, p. 224) stress that "a good reputation, close relationship and positive relationship benefits are key variables for the achievement of high satisfaction in a 'high-trust and commitment relationship'."

Integration with suppliers emphasize on a long-term commitment among the collaborators, openness of communication, and common trust. Supplier partnering attempts to involve supplier's early in the product life cycle in activities, such as product design and acquisition of technological capabilities (Narasimhan & Das, 1999).

2.6 Order fulfilment

2.5.1 Order fulfilment process

The dependent variable for this study is order fulfilment.

The literature provides different dimensions of measuring order fulfilment. Lambert (2004, p. 21) defines order fulfilment as the supply chain process that “involves more than just filling orders. It also encompasses all activities necessary to define customer requirements, design a network, and enable a firm to meet customer requests while minimizing the total delivered cost. While much of the actual order fulfilment work will be performed by the logistics function, the process needs to be implemented cross-functionally and coordinated with key suppliers and customers.”

Order fulfilment is one of supply chain activities in an organisation involving the supplier in meeting customer demand. The supplier capability in meeting the customer order requirement has an impact on customer service level. Palmatier (1988) emphasises the need for establishing closer links with customers in order to improve demand planning. The cost benefits obtained through such closer collaboration and information transparency are well documented in literature. Duffy and Dale (2002) state that order fulfilment is a major consideration for business to consumer (B2C) operations and it is one of the foremost critical success factors.

A study conducted by Kritchanai and MacCarthy (1999, p. 830) to investigate the responsiveness of the order fulfilment process in a number of companies revealed that "it is clear that companies tend to be responsive with respect to their strategic directions and the key issues are then to determine the appropriate ways to respond and appropriate levels of responsiveness." They also indicated that there are few sources in the literature discussing the details of the order fulfilment process clearly, and recommended that the grouping of companies based on the

characteristics of their order fulfilment processes be investigated more widely. A study conducted by Thirumalai and Sinha (2005) supports the findings of Kritchanchai and McCarthy (1999). They found that “customers tend to have higher satisfaction levels with the order fulfilment process of convenience and shopping goods than with the order fulfilment process of specialty goods” (Thirumalai & Sinha, 2005, p. 291). Similar results may be obtained in the health sector. Therefore, the differences in order fulfilment processes for various goods need to be studied.

2.6.2 Demand management - collaborative planning

Lambert (2004, p. 21) defines demand management as “the process that balances customer requirements with supply chain capabilities. With the right process in place, management can match supply with demand proactively and execute the plan with minimal disruptions.” A major cause of supply chain inefficiency mentioned in the literature is the bullwhip effect. Demand variability increases when it moves from downstream to upstream in a supply chain and the bullwhip effect causes unnecessary inventory increase in the supply chain (Balan, Vrat & Kumar, 2007).

Balan et al. (2007) emphasize that there is a need to reduce “errors associated with forecasted demand between the nodes of a supply chain” and allow “a smooth information flow by reducing the vagueness in the chain” (Balan et al., 2007, p. 261). In addition, they argue that managers can forecast the demand with less distortion and improve the supply chain effectiveness, using human judgement on the errors and change in errors associated with forecasted demand (Balan et al., 2007). Lee, Padmanabhan and Whang (2004, p. 1875) state that “the information transferred in the form of “orders” tends to be distorted and can misguide upstream members in their inventory and production decisions.”

The recognition of the value of information sharing between supply chain members has made many firms develop interest in jointly forecasting customer demand and co-managing business functions (Min & Yu, 2008). The implementation of collaborative planning, forecasting and replenishment (CPFR) aimed at improving collaboration between buyer and supplier has been successful in minimising safety stocks, improving order fill rates, increasing sales, and reducing customer response time (Min & Yu, 2008). However, they claim that regardless of increasing popularity of CPFR, key drivers for the successful development and implementation of CPFR are not well grasped by practitioners and academicians (Min & Yu, 2008). “If demand information can be communicated throughout the entire supply chain each trading partner would know how much product to have available and when” (Crum & Palmatier, 2004). Crum and Palmatier (2004) identified the common reasons why demand collaboration has not realized its potential:

- The pace of adopting new ways of doing business is slow
- Demand information supplied by customers is not put to use in trading partners’ own demand, supply, logistics, and corporate planning in an integrated manner
- Demand management and supply management processes are not integrated, and sales and operating planning is not utilized to synchronize demand and supply
- Lack of trust among trading partners to share pertinent information and collaborate on decision making.
- The desire to partner but not commit to executing the communicated plans
- A common view that demand collaboration is a technology solution and that the current technology is too complex (Crum and Palmatier, 2004).

2.6.3 Inventory management in supply chain

Managing inventory in the supply chain is essential to secure higher customer service levels. Inventory is a very costly asset to keep because of the the following costs: e.g., storage facilities, handling, insurance, pilferage, breakage, obsolescence - used by date, interest, wastage, and cost of capital. Having the right amount of inventory to meet customer requirements is critical (Logistics Bureau, 2007). Many researchers in the literature assert that the focus point of successful supply chain management is inventories and inventory control (Dooley, 2005). Food manufacturers and grocers in 1992 created efficient consumer response to shift their focus from controlling logistical costs to examining supply chains (King & Phumpiu, 1996). The general understanding and experience is that supply chain management leads to cost savings, largely through reductions in inventory. Inventory costs decreased by about 60% since 1982, while transportation costs have decreased by 20% (Wilson, 2004). Dooley (2005) argue that cost savings motivated many organisations to engage in inventory-reduction strategies in the supply chain. However, in order to develop the most effective logistical strategy, an organisation must understand the nature of product demand, inventory costs, and supply chain capabilities (Dooley, 2005).

Furthermore, Dooley (2005) emphasise that supply chain coordination can reduce the uncertainty of product demand, and hence, decrease inventory costs. Hanna, Groot, Loo, and Ypenburg (2003); Viswanathan and Piplani (2001) stress that SCM involves the cooperation and coordination of activities of all partners for the production and distribution of products to the final consumer using a system to optimize inventories across the entire supply chain. Inventories are considered important to build up reserve seasonal demands or promotional sales (Shapiro, 2001).

2.6.4 Cross - functional teams

Cross-functional team involves two or more functions working together simultaneously on order fulfilment activities. The organisational practices that encourage team work, cross-functional communication and cooperation or collaboration organisational culture (Davenport & Prusak, 1998; Smith & Farquhar, 2000) is required in order to have an effective plan for order fulfilment in an organisation. Furthermore, Mollenkopf, et al. (2007) stress that cross-functional integration helps to handle external factors affecting the returns management process. Additionally, if an organisation has an integrated cross-functional team, it can solve more easily order fulfilment problems. Chen (2007, p. 687) state that the level of “investment and training on information technology is positively related to cross-functional team interaction; that when organisational structure is more decentralized and less formalized, cross-functional team interaction is more favourable; and that cross-functional team interaction is positively related to the performance.”

A study conducted by Alexander, Lichtenstein, Jinnett, Wells, Zazzali, and Liu (2005) on cross-functional team processes in relation to improved patient outcomes revealed that patients treated in teams with higher levels of staff observed more improvement in activities of daily living. The results indicated that team process has important implications for patient outcomes. Therefore, we can conclude that cross-functional teams can have impact on order fulfilment to meet customers (e.g., patients) requirements. Sethi, Smith, and Park (2001) reported that innovativeness is positively related to the strength of the team. In addition, they found that social cohesion between team members can result in a negative effect on innovativeness because of groupthink (Sethi et al., 2001).

The literature indicates that there are different dimensions of measuring order fulfilment. This study will determine the critical factors that enhance order fulfilment in the public hospitals. The assumption is that SCI operational issues

have impact on commercial supplier relationships, focused SCI, and order fulfilment. Therefore, order fulfilment is dependent on improved SCI operational issues, commercial supplier relationships, and focused SCI.

The main observation from the literature is that there is a need to study SCI in different sectors in order to understand the nature of SCI initiatives and its implementation. Bagchi and Chun (2005) found that SCI influences operational performance, and the extent of integration also has a positive impact on cost and efficiency. Apart from the benefits of SCI in organisations, the research on SCI operational issues, supplier commercial relationships, focused SCI, and order fulfilment in the public health sector is nonexistent. This research is aimed to fill this gap in the literature.

3.0 Research Methodology

3.1 Introduction

Survey methodology is used in this study. A survey involves the collection of information from individuals (through mailed questionnaire, personal interviews, etc.) about themselves or concerning the social units to which they belong (Rossi, Wright, & Anderson, 1983). Surveys are useful to test hypotheses and to generalise findings.

- Data collection based on the procedures suggested by Fowler (2002); Alreck and Settle (2004), such as information needs, sampling design, instrumentation, data collection, data processing, and report generation. In addition, Marston and Straker (2001) procedures were used for both personal interviews and mail surveys. Surveys are the widely used data collection methods for organisational research (Zikmund, 2000). Forza (2002) also stresses that survey research is important and widely used in operations management.

3.2 Development of survey questionnaire

In order to effectively design and validate the survey questionnaire, a comprehensive review of the literature was conducted to identify scales that have been used in past studies to measure the constructs of the research model. In addition, interviews with senior purchasing and supply executives were carried out, and provided additional scale items related to the operations of the public hospitals. However, SCI operational issues (factors) were adopted from Fawcett and Magnan (2001) because they were similar to the responses from the interviews. The scales were validated using Churchill's paradigm (Churchill, 1979) to ensure that a valid and reliable scale was developed for the purpose of this study.

The initial survey questionnaire was reviewed by the academics and practitioners in purchasing and supply area for content, clarity and easy understanding. The review was conducted by three academics. In addition, the review of the survey was carried out by two senior purchasing and supply executives in the public hospitals.

The survey questionnaire was revised after considering the comments from the academics and purchasing and supply executives. Useful comments were obtained from the purchasing and supply executives during the interviews. The purchasing and supply executives reviewed the survey questionnaire which was already refined and ready for completion by the practitioners, for testing purposes.

The steps used in designing and validating the survey are discussed in the following sections. The initial step in designing the survey was to generate a comprehensive list of measurement items and survey questions from the literature that were used in previous studies on each construct, and from the interviews. This part is discussed in 4.6.

3.2.1 Scale Development

In order to gather reliable data, it was important to design a valid and reliable survey questionnaire for this research and future studies. Initially, an extensive review of the

literature was conducted to identify scales that have been used in previous studies, and they are valid and reliable. The items used in the previous research related to the constructs of this study were determined, especially the measurement items concerning the SCI operational issues most were adapted from the past study on achieving world-class supply chain alignment conducted by Fawcett and Magnan (2001). Other items originated from the interviews. The pool of items identified in the literature and interviews for each construct were evaluated by academics and purchasing and supply personnel to make sure that questionnaire items were suitable for this study on public hospitals. The items for all constructs for this study were measured according to existing theory in the literature. The questions that were used in the initial survey (pilot study) are indicated in Appendix I.

SCI operational issues are composed of the following constructs: (1) supply chain integration (SCI) initiatives; (2) organisation strategy and SCI drivers; (3) performance improvement and SCI; (4) organisation environmental forces; and (5) barriers to SCI.

The construct supplier commercial relationship was defined in section 2.5. The items that have been developed for this study are from the interviews and past general literature on supplier relationships. The items are indicated in Appendix 1.

The initial search for the measurements identified forty six different common items from the literature, some of which overlap in meanings. Therefore, after removing duplicate items, the remaining measurements were selected for this study. In addition, some of the items from the interviews were similar to those from the literature.

Focused supply chain integration was defined in section 2.3, and it is composed of behavioural factors for this study. The items that have been developed from the interviews with purchasing and supply executives are indicated in Appendix 1.

The construct order fulfilment was defined in section 2.6. The items that have been developed for this study are from the interviews and past general literature on order fulfilment. The items are indicated in Appendix 1.

The initial search for the measurements identified twenty five different common items from the literature, some of which overlap in meanings. Therefore, after removing duplicate items, the remaining measurements were selected for this study. In addition, some of the items from the interviews were similar to those from the literature.

3.2.1 Scale Validation

All items are measured on a scale ranging from 1 to 5 in order to make it easier for the respondents to select the right answers. Although the literature supports the use of a large range in the Likert scale (e.g., 1 – 7), Gupta and Somers (1992) argue that respondents will not be able to differentiate the differences in a range of scale in a short time.

The response categories for the scales range from ‘strongly agree’ for the nature of supply chain in the hospital, supplier commercial relationships, order fulfilment, and focused supply chain integration. The range is from ‘not engaged’ to ‘totally engaged’ for supply chain integration initiatives. The range is from ‘not improved’ to ‘greatly improved’ for supply chain performance improvement. The range is from ‘not a factor’ to ‘critical factor’ for importance of environmental factors. Finally, the response category for the scales range from ‘not a barrier’ to ‘serious barrier’ for barriers to supply chain integration in the hospital.

In order to minimize response bias, it was necessary to reverse some items, especially the items influenced by positive or negative responses (Alreck & Settle 1985). Sometimes the respondent shows a positive response to all items in scale. Schmitt and Klimoski (1991) suggest that some items must have positive or negative responses to minimize response bias. For example, a five point Likert scale was used with the scale range from 1 (strongly disagree) to 5 (strongly agree).

Initial validation of the item measures was achieved during initial development of the survey. The initial development of the survey questionnaire was based on an interview with a key person in charge of purchasing and supply in a public hospital. Then further interviews were conducted with two key purchasing and personnel in two public hospitals. The interviews lasted for one hour. One senior and one lower level purchasing and supply personnel were interviewed in order to minimize (or remove) status bias (Heiskanen & Newman, 1997). The interviews were conducted using the interview questionnaire, and also the participants were asked to contribute additional measures they thought were important in the survey.

The contact was made to the NZDHBs coordinator regarding this project, and the coordinator provided necessary support by providing a mailing list of key purchasing and supply managers in the DHBs. The mailing list was used for pre-testing and pilot testing. Public hospitals were contacted directly using addresses from the Ministry of Health and the DHBs websites.

The next step was to revise/edit the survey questionnaire for the pilot study. The sample for the pilot study was selected randomly from purchasing and supply personnel in public hospitals.

3.3 Identification of sample

This study applies survey methodology for data collection. The sampling frame for the survey is composed of the 41 public hospitals and 21 DHBs with purchasing and supply personnel directly involved in purchasing goods and services for the public hospitals. A list of purchasing and supply managers was obtained from the NZDHBs with contact email addresses. Postal addresses were obtained from the Ministry of Health website which provides the DHBs' and public hospitals' addresses. The sample size for the pilot study was 150.

3.4 Data collection process

3.4.1 Interview

In order to gather information necessary for developing and/or improving the survey questionnaire (first developed using the information from the literature review), it was important to interview the purchasing and supply chain executives in the public hospitals. Initially, seven purchasing and supply executives were invited to participate in the study, but only two respondents (28.6% response rate) accepted to be interviewed. It was fortunate that the executives who agreed to participate in the study composed of senior and lower purchasing and supply personnel, to reduce bias in responses. Interviewing only people of high status (key informants) can result in lack of understanding of the broader picture of the existing situation and can create elite bias. Miles and Huberman (1994) discuss the bias introduced in qualitative research by interviewing the stars in an organisation. In addition, Heiskanen and Newman (1997) state that elite bias concerns overweighting data from high-status informants and under-representing data from lower-status ones.

The interviews were done effectively because structured questionnaires were e-mailed to all participating purchasing and supply executives before the interview, and this shortened the time to respond to the questions during the interview.

Participants completed the interview questionnaire before the interview. Therefore, it was easy for the respondent to follow the questionnaire during the interview. All the interviews were completed between one and two hours, and there was no evidence of either interviewer or respondent fatigue. Interviewee enjoyed the interview because the study centres on crucial issues related to the purchasing and supply operations in the public hospitals in NZ.

The interviewer followed the guidelines provided by Fowler (2002, p. 117 -118) regarding three primary roles to play in the collection of survey data:

- To locate and enlist the cooperation of selected respondents
- To train and motivate respondents to do a good job of being a respondent.
For example, interviewers who read the questions slowly to respondents, in a nonverbal way, their willingness to take the time to obtain thoughtful, accurate answers; consequently, they do obtain more accurate answers.
- To ask questions, record answers, and probe incomplete answers to ensure that answers meet the question objectives.

Furthermore, interviewees were asked to add some measures on the survey questionnaire that they considered important in the pilot survey. Also, the interviewees were asked to comment on the clarity and understanding of the questions in the survey questionnaire. The response was that the questionnaire was clear and easy to understand.

In addition, in order to make sure that interview procedures were properly followed and reduce interview bias, only one interviewer conducted the interviews.

The literature review and the two in-depth interviews with purchasing and supply executives led to the identification of the scale items for the pilot mail survey questionnaire.

3.4.2 Pilot study

The pilot study was divided into two parts. First, interviews with the purchasing and supply executives and used the result to improve the questionnaire. In addition, purchasing and supply executives, and academics were asked to comment on the clarity of the instructions and validity of the questionnaire. Secondly, the survey was sent to 150 purchasing and supply personnel in the DHBs and public hospitals. A reminder e-mail was sent to the respondents, after two weeks. To my surprise only six usable responses were returned. Two additional reminder e-mails were sent out to the potential respondents, and resulted in nine extra responses. The sample is too small for rigorous statistical testing, but the responses are enough to determine good items for the main survey.

3.4.3 Results of the pilot study

The response to the pilot study was not good. Out of 15 responses, only 12 were usable (response rate of 8 %). Three questionnaires were not completed due to outsourcing of the procurement function in the hospitals, and the respondents were new to the hospitals. The low rate was due to the length of the questionnaire and purchasing and supply executives were engaged in another internal survey. Appendix 1 indicates the results of factor analysis using extraction method: Principal Component Analysis and the internal consistency reliability of the scales using Cronbach's alpha for each scale used in this research.

The measurement items with less than one initial Eigenvalue will not be included in the main study. However, due to low response rate for valid factor analysis, some of the useful items with less than one Eigenvalue will be included in the main study. The Cronbach's alpha value range is from 0.752 to 0.897 (for all items used in the pilot study). The generally accepted lower limit for Cronbach's alpha is 0.70 (Hair, Black, Babin, Anderson, & Tatham, 2006; Robinson, 1991).

The findings regarding the critical factors for supply chain integration, supplier commercial relationships, and order fulfilment support the literature. The following sections provide the critical factors identified in each construct with eigenvalues greater than one.

3.4.3.1 Supply Chain integration operational issues

(a) SCI initiatives

- V1. Cross-functional process integration within the hospital (2.502)
- V2. Integration with valued first-tier customers (1.075).

(b) Organisation strategy and SCI

- V5. Our organisation's corporate strategy includes supply chain integration (3.001)

V6. We have a centralised purchasing department (1.461).

(c) Performance improvement and SCI drivers

V10. Ability to handle expected challenges (4.877)

V11. Lowering cost of purchased items (2.551)

V12. Hospital profitability (1.819)

V13. Inventory costs (1.464).

(d) Organisational environmental forces

V23. Suppliers have initiated integration effort (4.144).

(e) Barriers to SCI.

V29. Lack of willingness to share information (4.766)

V30. Difficult to establish relationships based on shared risks and rewards
(3.805)

V31. Difficulty to evaluate contribution of each supply chain member
(1.915)

V32. Inappropriate information systems (1.350)

V33. Inconsistent operating goals (1.013).

3.4.3.2 Supplier commercial relationships

V43. We have reliable suppliers (8.878)

V44. We promote partnership with dedicated suppliers (3.466)

V45. We have good process integration between suppliers, customers, and
the District Health Board (DHB) (2.707)

V46. We have joint or collaborative planning (1.716)

V47. We make effective negotiations with suppliers (1.193).

3.4.3.3 Focused Supply chain integration

V62. Our service functions are integrated (7.082)

V63. We follow national procurement policies and procedures (1.946)

V64. We use an Enterprise Resource Planning (ERP) system e.g., SAP, Oracle, JD Edwards (1.468).

3.4.3.4 Order Fulfilment

V74. We classify inventories according to their importance (6.275)

V75. We have collaborative planning, forecasting and replenishment (CPFR) (3.695)

V76. We make an effort to control ordering costs (2.087)

V77. Suppliers have capacity to meet the demand (1.498)

V78. We have capacity to respond to demand (1.231).

3.4.3.5 Non response Bias

The non response bias was assessed by grouping responses into two groups: early responses and late responses, using a two-sample t-test according to Armstrong and Overton (1977). The statistical test indicated no significant difference. Therefore, non-response bias is not a major concern.

4.0 Conclusions and recommendations

This study presents findings of an exploratory study (part of on-going research) on the supply chain integration, supplier commercial relationships, and order fulfilment practices in public hospitals, with particular reference to New Zealand. The findings regarding the critical factors for supply chain integration, supplier commercial relationships, and order fulfilment support the literature: SCI initiatives (e.g., Fawcett & Magnan, 2002; Akkermans et al., 2003; Rai et al., 2006); organisation strategy and SCI (e.g., Stevens, 1990; Narasimhan & Jayaram, 1998; Lowson, 2003; Barratt, 2004; Zailan & Rajagopal, 2005); performance improvement and SCI drivers (e.g., Fawcett and magnan, 2001; Kim, 2006); organisation environmental forces (e.g., Fawcett & Magnan, 2001; Mullins, 2002); barriers to SCI (e.g., Cox et al., 2001; Frohlich, 2002; Fawcett & Magnan, 2002; Halldorsson et al., 2008); supplier commercial relationships (e.g., Tan et

al., 1998; Narasimhan & Das, 1999; Bowersox et al., 2000), and order fulfilment (e.g., Kritchanchai & MacCarthy, 1999).

The findings in this study support few measurement items used by Fawcett and Magnan (2001), which were identified as critical factors. The main reason for the difference is that Fawcett and Magnan studied a cross section of service and manufacturing organisations while this study concentrated on the public health sector. An in depth study of the supply chain integration, supplier commercial relationships, and order fulfilment practices in public hospitals is required to determine hard evidence of the level of supply chain integration (this is the purpose of the next stage of the study). A similar study can be replicated in other sectors of the economy where supply chain management plays a major role.

This study provides the key factors (section 3.4.3.1 – 3.4.3.4) for effective SCI in the public hospitals. The major critical factors identified in this study are: cross-functional process integration within the hospital, organisation's corporate strategy which includes supply chain integration, ability to handle expected challenges, lowering cost of purchased items, suppliers initiate integration effort, lack of willingness to share information, difficult to establish relationships based on shared risks and rewards, reliable suppliers, promote partnerships with dedicated suppliers, good process integration between suppliers, customers, and hospitals, service functions are integrated, inventories are classified according to their importance, collaborative planning, forecasting and replenishment, and an effort to control ordering costs. The factors can help management in making rational decision regarding SCI in their hospitals.

In addition, this study contributes to theory in SCI by providing an instrument to measure SCI operational issues, supplier commercial relationships, focused SCI, and order fulfilment in public hospitals or other organisations. Also, the study furnishes a new construct of focused SCI.

The integrated supply chain can be achieved with the support from top management, and collaborations within and amongst the hospitals. The results will be clear after conducting a main study. The key recommendations are: recognising procurement as a strategic function and the head of procurement reporting to the chief executive; head of procurement must be qualified in supply chain management so that he/she can encourage the subordinates to gain qualification in supply chain management; cement relationships with critical suppliers, and top management must be trained in supply chain management.

The major limitation of this paper is that the data were collected from a small sample of one sector and we cannot generalise the findings.

Appendix 1.0: Pilot Survey Items (Eigenvalues and Cronbach's alpha)

1. Measurement items for the construct SCI initiatives

To what extent is your hospital actively engaged in supply chain integration initiatives?

The items were measured using a Likert scale that ranged from 1 (Strongly disagree) to 5 (Strongly agree).

Construct	Measurement item	Eigenvalues
SCI initiatives	V1.Cross-functional process integration within the hospital (reworded)	2.502
	V2.Integration with valued first-tier customers	1.075
	V3.Integration with important first-tier suppliers	Deleted
	V4.Complete customers and suppliers supply chain integration.	Deleted

Scale reliability: Cronbach's alpha 0.752.

2. Measurement items for the construct organisation strategy and SCI drivers

Please tick the number that best reflects your agreement with the following statements concerning supply chain integration in your hospital.

The items were measured using a Likert scale that ranged from 1 (Strongly disagree) to 5 (Strongly agree).

Construct	Measurement item	Eigenvalues
Organisation strategy and SCI drivers	V5. Our organisation's corporate strategy includes supply chain integration	3.001
	V6. We have a centralised purchasing department	1.461
	V7. Our organisation promotes integration through use of information technology	Deleted
	V8. Lowering costs is a core driver of our supply chain integration	Deleted
	V9. Improving service level is another core driver influencing our supply chain integration in our hospital.	Deleted

Scale reliability: Cronbach's alpha 0.800.

3. Measurement items for the construct performance improvement and SCI

To what extent has supply chain integration improved your hospital's performance in the following areas?

The items were measured using a Likert scale that ranged from 1 (Strongly disagree) to 5 (Strongly agree).

Construct	Measurement item	Eigenvalues
Performance improvement and SCI	V10.Ability to handle expected challenges	4.877
	V11.Lowering cost of purchased items (reworded)	2.551
	V12.Hospital profitability (reworded)	1.819
	V13.Inventory costs	1.464
	V14.On-time delivery/Due-date performance	Deleted
	V15.Order fulfilment lead times	Deleted
	V16.Overall customer satisfaction	Deleted
	V17.Overall product cost	Deleted
	V18.Overall product quality	Deleted
	V19.Total productivity	Deleted
	V20.Responsiveness to customer requests	Deleted
	V21.Transportation costs	Deleted
V22.Planned requirements from customers	Deleted	

Scale reliability: Cronbach's alpha 0.813.

4. Measurement items for the construct organisation environmental forces

To what extent have the following led your hospital to seek greater supply chain integration?

The items were measured using a Likert scale that ranged from 1 (Not a critical factor) to 5 (Is a critical factor).

Construct	Measurement item	Eigenvalues
Organisation environmental forces	V23.Suppliers have initiated integration effort	4.144
	V24.Customers have initiated integration efforts	Deleted
	V25.Desire to improve customer satisfaction	Deleted
	V26.Desire to lower supply chain costs	Deleted
	V27.Desire to focus on core competence in services	Deleted
	V28.Opportunity to build the best team of supply chain partners	Deleted

Scale reliability: Cronbach's alpha 0.888.

5. Measurement items for the construct barriers to SCI

To what extent do the following act as barriers to supply chain integration in your hospital?

The items were measured using a Likert scale that ranged from 1 (Is not a serious barrier) to 5 (Is a serious barrier).

Construct	Measurement item	Eigenvalues
Barriers to SCI	V29. Lack of willingness to share information (reworded)	4.766
	V30. Difficult to establish relationships based on shared risks and rewards	3.805
	V31. Difficulty to evaluate contribution of each supply chain member	1.915
	V32. Inappropriate information systems (reworded)	1.350
	V33. Inconsistent operating goals	1.013
	V34. Lack of clear guidelines for managing supply chain alliances	Deleted
	V35. Lack of employee loyalty, motivation, and empowerment	Deleted
	V36. No systematic approach to measuring customer requirements	Deleted
	V37. Lack of good performance measures	Deleted
	V38. Organisational boundaries prevent integration	Deleted
	V39. Value-added processes are not accurately costed	Deleted
	V40. Budget limitation for supply chain resources	Deleted
	V41. Lack of suppliers to comply with agreed key performance indicators (KPIs)	Deleted
V42. Government procurement policies and procedures	Deleted	

Scale reliability: Cronbach's alpha 0.788.

6. Measurement items for the construct supplier commercial relationships

Please tick the number that best reflects your agreement with the following statements concerning supplier commercial relationships in your hospital. The items were measured using a Likert scale that ranged from 1 (Strongly disagree) to 5 (Strongly agree).

Construct	Measurement item	Eigenvalues
Supplier commercial relationships	V43.We have reliable suppliers	8.878
	V44.We promote partnership with dedicated suppliers	3.466
	V45.We have good process integration between suppliers, customers, and the District Health Board (DHB)	2.707
	V46.We have joint or collaborative planning	1.716
	V47.We make effective negotiations with suppliers	1.193
	V48.We have good level of trust in buyer – supplier relationships	Deleted
	V49.Quality of information shared is good	Deleted
	V50.We have increased level of strategic alliance with suppliers	Deleted
	V51.We have good communication with suppliers	Deleted
	V52.Power of the supplier has impact on relationship	Deleted
	V53.Our suppliers prefer electronic purchasing	Deleted
	V54.We have supplier development programme	Deleted
	V55.We value importance of measuring relationship	Deleted
	V56.We use KPIs in judging our suppliers	Deleted
	V57.We have a service level agreement	Deleted
	V58.We have continuous improvement programmes	Deleted
V59.We have good relationship / trust with our third party buyer	Deleted	
V60.We use a contract to maintain relationship	Deleted	
V61.We have single source relationships	Deleted	

Scale reliability: Cronbach's alpha 0.853.

7. Measurement items for the construct focused SCI

Please circle the number that best reflects your agreement with the following statements concerning supply chain integration in your hospital.

The items were measured using a Likert scale that ranged from 1 (Strongly disagree) to 5 (Strongly agree).

Construct	Measurement item	Eigenvalues
Focused SCI	V62.Our service functions are integrated	7.082
	V63.We follow national procurement policies and procedures	1.946
	V64.We use an Enterprise Resource Planning (ERP) system e.g., SAP, Oracle, JD Edwards	1.468
	V65.We use an ERP system for health sector	Deleted
	V66.We give high priority to consultation with other departments	Deleted
	V67.We have a national supply chain integration policy	Deleted
	V68.We have good service integration	Deleted
	V69.We have good networking and build with supplier	Deleted
	V70.Top management is committed to supply chain integration processes	Deleted
	V71.We have good organisational culture that supports supply chain integration	Deleted
	V72.We value supply chain management	Deleted
	V73. Our organisation structure is good for internal supply chain integration	Deleted

Scale reliability: Cronbach's alpha 0.897.

8. Measurement items for the construct order fulfilment

Please circle the number that best reflects your agreement with the following statements concerning order fulfilment in your hospital. The items were measured using a Likert scale that ranged from 1 (Strongly disagree) to 5 (Strongly agree).

Construct	Measurement item	Eigenvalues
Order fulfilment	V74.We classify inventories according to their importance	6.275
	V75.We have collaborative planning, forecasting and replenishment (CPFR)	3.695
	V76.We make an effort to control ordering costs	2.087
	V77.Suppliers have capacity to meet the demand	1.498
	V78.We have capacity to respond to demand	1.231
	V79.We have reduced order fulfilment lead time	Deleted
	V80.We have an inventory policy of maintaining high level of inventory for critical items only	Deleted
	V81.We have an inventory policy for important items	Deleted
	V82.We have inventory policy for all items	Deleted
	V83.We have supplier – buyer integrated order Planning	Deleted
	V84.Suppliers (vendors) manage our inventory	Deleted
	V85.Our deliveries from suppliers are on time and right quantity	Deleted
	V86.We emphasize to suppliers that accuracy and efficiency of order fulfilment is important	Deleted
	V87.We improve supplier performance using order fulfilment metrics (measures)	Deleted
	V88.We have a high stockturn (products are not spending a long time in storage)	Deleted
	V89.We do maintain high levels of emergency supplies	Deleted

* Importance means: (critical, important, non critical).

Scale reliability: Cronbach's alpha 0.762.

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