DEVELOPING A CONCEPTUAL FRAMEWORK TO ANALYSE SUPPLY CHAIN DESIGN PRACTICES

by

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I, Jacobus Daniel Nel, declare that "*DEVELOPING A CONCEPTUAL FRAMEWORK TO ANALYSE SUPPLY CHAIN DESIGN PRACTICES*" is my own work and that all sources that I have used or quoted have been indicated and acknowledged by means of complete references.

31/05/2011

JD Nel **Date**

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ABSTRACT

Analysis of the supply chain is necessary to improve performance. For this reason, supply chain management (SCM) has received a lot of attention recently and supply chain design (SCD) is a concept that forms an integral part of the adoption and implementation of SCM. Effective SCD contributes towards better supply chain integration (SCI) which, in turn, contributes towards improved supply chain performance. The focus of this study is on the analysis of SCD practices. Designing the supply chain structure is a complex and demanding undertaking that needs to be aligned with the needs of the supply chain's end customers, because their needs ultimately have to be satisfied. This study proposes a conceptual framework that has been developed from literature to assist organisations in the analysis of their SCD practices, with the aim of improving supply chain performance. The conceptual framework was exploratively tested by means of empirical research to determine whether it can be used as an assessment tool to assess the SCD practices of organisations. The study concluded that the conceptual framework that was developed in this study can be used as an assessment tool with which organisations can analyse their SCD practices.

Key terms: supply chain, supply chain management, supply chain design, supply chain strategy, supply chain integration, supply chain drivers, supply chain performance

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CHAPTER 1
INTRODUCTION TO THE STUDY

This study was conducted in the supply chain management (SCM) discipline. It focuses specifically on the topic of supply chain design (SCD) in the context of supply chain integration (SCI). The study was undertaken as an effort to develop a conceptual framework to help organisations analyse their SCD and SCI practices with the aim of improving these practices to ultimately improve customer satisfaction and supply chain performance. This chapter begins by providing the background to the study, which is followed by the formulation of the research problem and the reason for the study. Following this, the objectives of the study and the research methodology are presented. The chapter concludes with an orientation towards the main components of the study. To put the study into perspective, this chapter starts by providing a brief overview of the origin of SCM and why SCM has become an important topic for organisations. The complex nature of SCM will become evident through this background sketch.

1.1 BACKGROUND: THE DEVELOPMENT OF SUPPLY CHAIN MANAGEMENT

SCM has become increasingly important for organisations in recent times (Kumar, Ozdamar & Zhang, 2008:95; Persson & Olhager, 2002:231; Matopoulos, Vlachopoulou, Manthou & Manos, 2007:177). SCM philosophy has developed in response to changes in the business environment to address new challenges which result from integrating all the linkages between organisations, their suppliers and their customers into a seamless unit (Hugo, Badenhorst-Weiss & Van Biljon, 2004:10). SCM thus is the result of dramatic changes occurring in the nature of business competition (Ross, 1998:16) and has become increasingly important in the turbulent business environment of today (Wisner, Tan & Leong, 2009:28). These changes include increased competition, increased demand variability, increased product variety, increased amounts of customer-specific products, and shortening product life cycles (Hilletofth, 2009:16).

1.1.1 Competition and the demands on the internal capabilities of organisations

As already mentioned, the nature of business competition is constantly changing and is also becoming more complex (Handfield, Monczka, Giunipero & Patterson, 2009:5). Competition is expanding rapidly in all industries and in all markets around the world (Wisner *et al*., 2009:6). In fact, today's marketplace is more competitive than ever, due to globalisation, technological change and more demanding customers (Fawcett, Ellram & Ogden, 2007:1; Bowersox, Closs & Cooper, 2010:3; Christopher, 2005:37; Handfield & Nichols, 2002:2) and these trends will continue to develop in the foreseeable future (Bowersox *et al*., 2010:3). Organisations have been forced to improve their internal processes in order to stay competitive (Handfield *et al.*, 2009:6) and to become more effective and/or efficient (Harland, Lamming & Cousins, 1999:650).

To achieve this, organisations have started placing more emphasis on their own competencies and capabilities and on what they do well, as these qualities allow them to compete (Fawcett *et al*., 2007:1; Christopher, 2005:29). Success depends on building processes that can deliver products and services that customers demand (Fawcett *et al.*, 2007:6) and organisations essentially have to create value for customers by managing their core processes better than competitors manage theirs in a highly competitive business environment (Christopher, 2005:29).

1.1.2 Managing beyond organisational boundaries

However, due to the pace and complexity of the changing business environment, organisations often find that they lack the necessary resources and skills to try to meet customer needs on their own (Fawcett *et al*., 2007:6). It has become increasingly important for organisations to be aware of the suppliers and customers they work with and to understand the roles they play to be successful in today's business environment (Hugos, 2006:2; Fawcett *et al.*, 2007:1; Wisner *et al*., 2009:5). Organisations are therefore beginning to look more proactively beyond their own organisational walls or boundaries to consider how the resources of suppliers and customers can be used to create value (Fawcett *et al.*, 2007:6). There is a need to focus on techniques to manage operations beyond their own organisational boundaries (Harland *et al.*, 1999:650). This means that organisations are focussing more on their own core capabilities while trying to create alliances or strategic partnerships with suppliers and customers who possess essential complementary capabilities and are also good at what they do (Fawcett *et al*., 2007:1; Wisner *et al*., 2009:5). All organisations form part of a chain that begins with the source of original materials and ends with consumption (Lambert, 2006:8; Hines, 2004:xi). Hence the concept of a supply chain.

1.2 KEY CONCEPTS IN THE STUDY

Several key concepts that form part of the focus of this study need to be explained. These concepts are supply chain, supply chain management (SCM), supply chain design (SCD) and supply chain integration (SCI).

1.2.1 Supply chains

Supply chains are not new (Bozarth & Handfield, 2006:8) and are (and always were) omnipresent (Gattorna, 2006:2; Mentzer, 2001:7). All organisations form part of a chain of organisations that begins with a source of materials (suppliers) being supplied and ends with consumption of a product by customers (buyers) (Lambert, 2006:8; Fawcett *et al*., 2007:11; Hines, 2004:xi; Handfield & Nichols, 1999:5) and each organisation has a role to play in each supply chain (Hugos, 2006:2; Hines, 2004:xi). Therefore, all products reach customers via some type of supply chain,[1] some larger and more complicated than others (Wisner *et al*., 2009:6).

The supply chain extends from the raw material extraction or raw concept origination through many processes to the ultimate sale to the consumer of the final product, whether goods or services (Quayle & Jones, 1999:5). In this study, the extractor of raw materials will be referred to as the initial supplier and the consumer of the final product will be referred to as the end customer.[2] From this brief introduction to supply

[1] The concept supply chain is preferred to other concepts such as demand chain or supply network. It is not the focus of this study to distinguish between these concepts.
[2] The concept customer includes all customers and consumers on the downstream side of the supply chain until the final product reaches the end customer in the supply chain.

chains it can be derived that a supply chain is a network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products[3] in the hands of the end customer. As implied, these linkages refer to the coordination of supply chain processes and relationships (Lysons & Farrington, 2006:91, 92), which will be discussed later.

Upstream relates to the relationship between an organisation and its suppliers and suppliers' suppliers while downstream relates to the relationship with its customers and customers' customers (Lysons & Farrington, 2006:92). Suppliers lie upstream because their activities or organisations are positioned earlier in the supply chain while downstream is a term used to describe activities or organisations that are positioned later in the supply chain (Bozarth & Handfield, 2006:7; Waters, 2009:9). The upstream side is thus part of the procurement function while the downstream side is the domain of distribution, marketing and sales (Ayers, 2006:9).

Thus, the supply chain includes all those direct and indirect parties involved in bringing forth products through all the various input, conversion and output stages (Baily, Farmer, Crocker, Jessop & Jones, 2008:66; Chopra & Meindl, 2010:20). These parties will be referred to as supply chain members. Each input provides added value to the output which the ultimate customer receives in the form of a product as the aggregate of values at the end of the supply chain (Lysons, 2000:68).

1.2.1.1 The three supply chain flows

Three primary flows can be identified in any supply chain, namely information flows, product flows and finance flows. Information flows can also be termed demand flows and product flows, similarly, can be termed supply flows (Lambert, 2006:14; Taylor, 2004:26). Demand provides the impetus for the other two flows, which means that supply chains are customer driven (Halldórsson, Kotzab, Mikkola & Skjøtt-Larsen, 2005:37; Hines, 2004:123). The flow of finances provides the motivation for the supply chain. The key to managing the flow of products lies in synchronising all three

[3] The term product will also be used to include all goods and services, because the focus of this study is on supply chains in general and not on the distinction between goods and services involved in SCM.

supply chain flows (Taylor, 2004:26) so that the entire chain of business activities from raw material through to the final point of consumption should be effectively managed to deliver the end customer's value requirements (Zokaei & Hines, 2007:223). Therefore, to match demand with supply, organisations form supply chains to share competencies with other organisations to meet demand (Canever, Van Trijp & Van der Lans, 2007:511).

The basic operation of a supply chain can hardly be simpler and supply chains are relatively easy to describe and visualise (Burt, Dobler & Starling, 2003:9). Demand flows up the chain in the form of orders and triggers the movement of supply through shipments back down the chain. As products reach customers, finances flow up the supply chain through payments and compensate suppliers for their products (Taylor, 2004:26). From this it can be derived that supply chain flows are both forward towards the customer and backward towards the supplier (Stonebraker & Liao, 2006:35). This is illustrated in Figure 1.1 by means of a simplified linear example of a basic supply chain. For the purposes of this study, the organisation from which the supply chain is viewed or analysed will be referred to as the focal organisation.

1.2.1.2 The focal organisation

According to Lambert (2006:9), the management in each organisation in a supply chain views its organisation as the focal organisation. The focal organisation is the organisation that is depicting the relationships among its suppliers and customers (Fawcett *et al*., 2007:7). The concept of focal organisation is therefore relative with regard to the organisation viewing the supply chain and it can be any of the organisations involved in the supply chain, depending on the frame of reference of the organisation viewing the supply chain (Wisner *et al.*, 2009:7). For example, in Figure 1.1 the focal organisation is positioned in the centre of a supply chain consisting of three organisations. Depending on the position of the focal organisation, customers (or buyers) and suppliers (or sellers) can be positioned anywhere along the supply chain.

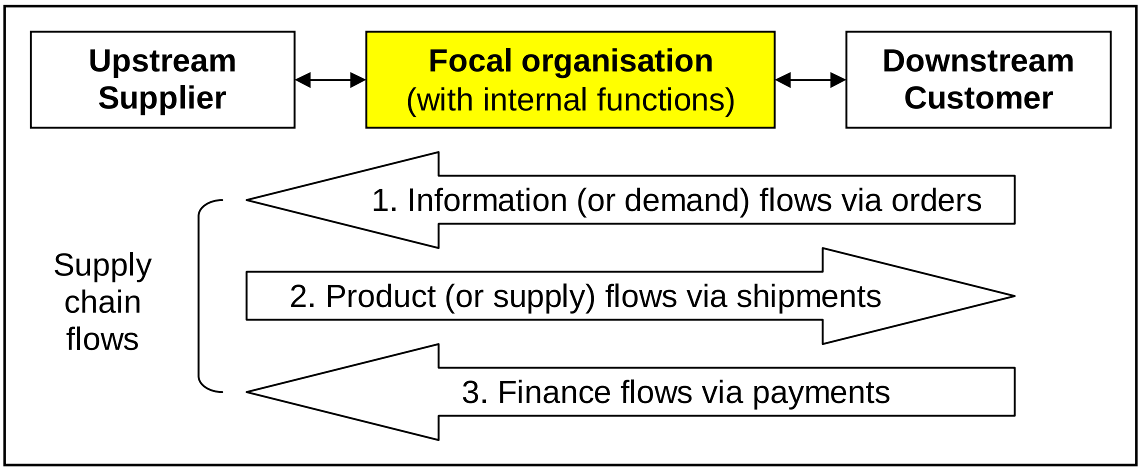

Figure 1.1: A basic linear supply chain model
Source: Adapted from Taylor (2004:26, 27).

1.2.1.3 The complexity of supply chains

Thus far, a supply chain can be defined as consisting of a set of at least three organisations directly linked by the necessary supply chain flows of information, products and finances between an organisation, an upstream supplier and a downstream customer (Handfield *et al.*, 2009:10; Mentzer, 2004:4; Taylor, 2004:26). In looking at Figure 1.1, the term supply chain may imply that only one organisation is involved in each stage of the supply chain. In a simple supply chain this may be the case, for example, when a cook buys potatoes directly from a farmer. In reality, an organisation may have several suppliers providing input on different levels to different stages of the operational processes and then also become a supplier to many customers. A huge number of different configurations occur (Waters, 2009:10). This becomes evident later in the study.

Real world supply chains therefore are usually more complex than the one illustrated in Figure 1.1 (Wu & O' Grady, 2005:444), because they may be nonlinear and may have more supply chain participants (Coyle, Bardi & Langley, 2003:18; Taylor, 2004:26; Hines, 2004:83). In fact, the linear representation of a supply chain (as illustrated in Figure 1.1) has received a lot of criticism because an organisation in the supply chain is usually related to a variety of suppliers and customers (Albers, Delfmann, Gehring & Heuermann, 2005:64; Waters, 2009:10). Each manufacturer, for example, may be actively producing several hundreds of end products, each requiring their own supply chain (Wu & O'Grady, 2005:445). It would be rare for an organisation to participate in only one supply chain and have one supplier and one customer (Lambert, 2006:8). Thus, most supply chains are actually networks (Chopra & Meindl, 2010:21; Lysons & Farrington, 2006:92) that are dynamic and difficult to manage (Taylor, 2004:36).

The complexity of supply chains is determined amongst others things in the way the constant flow of information, products and finances between different stages relate to one another. In principle, orders trigger shipments that, in turn, trigger payments. Yet, in practice, the relationship of orders to shipments and payments quickly becomes tortuous (Taylor, 2004:36). The complexity of supply chains is also determined by several other factors such as the complexity of the product, the number of available suppliers and the availability of raw materials. Dimensions to consider include the length of the supply chain and the number of customers at each tier (Lambert, 2006:8). A typical supply chain can be complex due to (Wu & O' Grady, 2005:444):

- the large mesh of interlinked supply chain members such as suppliers, manufacturers and distributors;
- the fact that each participant may be a member of a large number of other supply chains; and
- the dynamic nature of the supply chain.

These issues are discussed at length in Chapter 4, which covers the scope of the supply chain structure. To conclude, supply chains are complex systems (Childerhouse & Towill, 2004:586). An effect of this complexity is the excessive time taken to respond to changes in customer demand. It is thus hard to overestimate the importance of the management of the supply chain (Wu & O' Grady, 2005:445).

1.2.2 Supply chain management

In this section, the role benefits, focus and dimensions of SCM will become clear. Decisions made within supply chains play a significant role in the success or failure of an organisation (Chopra & Meindl, 2010:25; Jacobs, Chase & Aquilano, 2009:355). Therefore, managing the supply chain cannot be left to chance (Stock & Lambert, 2001:709). In fact, the management of the supply chain has become one of the key issues for many organisations (Cagliano, Caniato & Spina, 2006:282; Mentzer, 2001:8; Ittman, 2004:10). SCM provides for a strategic view of the supply chain (Ross, 1998:11) and therefore SCM has taken on an increasingly important role from an organisation's strategic point of view (Burt, Petcavage & Pinkerton, 2010:13; Nunlee, Qualls & Rosa, 2000:354; Storey, Emberson, Godsell & Harrison, 2006:769). In fact, Gattorna (1998:18) even predicted that SCM would emerge as the main driving force in the strategies of many organisations.

SCM offers organisations the opportunity to become more competitive and maintain competitiveness amidst the changing business environment (Wisner *et al*., 2009:28) which is shifting towards supply chain versus supply chain and is becoming less about organisation versus organisation (Lambert, 2006:1; Handfield *et al.*, 2009:6; Christopher, 2005:18, 28; Gough, 2003:78; Wilding, 1998:599). SCM is thus most certainly strategic in nature (Fawcett, Magnan & McCarter, 2008:35). Managerial attention should also not be on the individual organisation only, but on the interactions between the series of organisations which constitute the supply chain (Baily *et al.*, 2008:69; Cagliano *et al.*, 2006:283). Effectively managing the supply chain can yield significant benefits (Fawcett *et al*., 2008:35; Stock & Lambert, 2001:67).

Individual organisations are no longer the sole source of creating value for end customers; they are now part of a team of organisations actively contributing towards satisfying end customer needs (Childerhouse & Towill, 2003:109). With SCM allowing organisations to focus on their core capabilities and allowing other supply chain members to focus on the other activities in the supply chain, relationships are formed amongst supply chain members to form an integrated supply chain which competes against other supply chains (Fawcett & Magnan, 2002: 339, 340). The goal of SCM is the creation of value for the supply chain's end customers, as well as all the supply chain member organisations (Handfield & Nichols, 2002:5; Bozarth & Handfield, 2006:8) by meeting the needs of the supply chain's end customers (Fawcett *et al*., 2007:8; Wisner *et al.*, 2009:8). In so doing, organisations will achieve a sustainable competitive advantage (Bozarth & Handfield, 2006:8). SCM is thus a source of competitive advantage (Cagliano *et al.*, 2006:283; Stonebraker & Liao, 2006:34; Christopher, 2005:6; Mentzer, 2004:1; Quayle, 2006:106). In fact, many organisations have turned to SCM to give them a competitive advantage (Sridharan, Caines &

Patterson, 2005:313).

SCM can be seen as the strategic management of all the traditional business functions that are involved in any supply chain flow, upstream or downstream, across any aspect of the supply chain (Mentzer, 2004:5). SCM is the *design* and management of value-added processes (or activities) and relationships within organisations and across the network of organisations that form the supply chain to meet the real needs of the end customer and to increase efficiency and value to gain a sustainable competitive advantage (Fawcett *et al*., 2007:8; Wisner *et al*., 2009:8; Bozarth & Handfield, 2006:8; Ayers, 2006:10) for all the organisations that form part of the supply chain (Mentzer, 2004:7). SCM thus *coordinates* and *integrates* all the supply chain activities into a seamless process, thereby linking all of the supply chain partners in the supply chain (Lam & Postle, 2006:267; Mouritsen, Skjøtt-Larsen & Kotzab, 2003:686). SCM therefore represents a conscious effort by the supply chain members to develop and run supply chains in the most effective and efficient ways possible (Bozarth & Handfield, 2006:8).

From this description of SCM it is clear that the design of the supply chain forms an integral part of SCM, hence, the concept of supply chain design (SCD). In fact, organisations are integrating design into SCM. Organisations have begun to look beyond their own organisation's boundaries and have started considering the overall design of their supply chains to be more efficient while maintaining high levels of customer service (Kirkwood, Slaven & Maltz, 2005:460; Baiman, Fischer & Rajan, 2001:173). It thus becomes evident that a supply chain has to be consciously designed (Bagchi, Ha, Skjoett-Larsen & Soerensen, 2005:276; Persson & Olhager, 2002:231). Organisations that learn how to design and participate in strong supply chains will have a substantial competitive advantage in their markets (Hugos, 2006:2; Reeve & Srinivasan, 2005:50). SCD is the key focus in this study and is discussed in the next section.

1.2.3 Supply chain design

The practice of designing supply chains is relatively new because, historically, the design of supply chains evolved in response to changes in the business environment

(Fawcett *et al*., 2007:222). SCD will, however, become a key source of competitive advantage with the shift from competition between organisations towards competition between supply chains (Reeve & Srinivasan, 2005:50). It not only is a critical factor in determining the efficiency and effectiveness of a supply chain (Sezen, 2008:234), but is also extremely important due to the commitment of resources over long periods of time (Santoso, Ahmed, Goetschalckx & Shapiro, 2004:96). The role of SCD in providing an optimal platform for efficient and effective SCM and acting as a bridge to connect supply chain strategy and the supply chain flows (Sharifi, Ismail & Reid, 2006:1083, 1084) is strategic and the importance of effective SCD has been well recognised by both academics and practitioners (Pangburn & Stavrulaki, 2005:209).

SCD can be regarded as the determination of how to structure a supply chain (Saxton, 2006:244; Persson & Olhager, 2002:231). It involves planning and developing supply chains to support the value proposition and goals of the organisation and it is a proactive approach to serving the customer rather than chasing after changing needs (Fawcett *et al*., 2007:222). From a strategic point of view, SCD thus refers to the process of determining all required components of the supply chain, including its structure and operations aligned to customer requirements and supply chain strategy (Sharifi *et al.*, 2006:1083, 1084). SCD is a complex task. It involves aligning customer needs with supply chain capabilities. It determines the right supply chain members and tasks that each should perform. It involves coordinating the three supply chain flows to improve responsiveness and efficiency. In doing this, SCD ensures that all these activities create value for the end customer and profitability for all supply chain partners (Fawcett *et al*., 2007:216).

Through SCD, organisations structure their supply chain and decide what the supply chain's configuration will be, how resources will be allocated and what processes will be performed at each stage (Chopra & Meindl, 2010:25). From this, it can thus be derived that SCD decisions ultimately determine the capabilities and limitations of the supply chain (Taylor, 2004:259) and find the best structure for the supply chain. This includes deciding on the number of supply chain members, its length, breadth, locations, systems used and relationships (Waters, 2007a:44).

The goal of SCD is thus to create supply chain capabilities to ensure that the supply chain meets its customers' needs (Fawcett *et al*., 2007:21) through either a cost advantage or a value advantage, or a combination of the two (Christopher, 2005:7). By identifying and bringing together a group of organisations with complementary competencies (Fawcett *et al.*, 2007:493) SCD can be said to seek a sustainable and defensible competitive advantage (Christopher, 2005:7).

In general, the idea that supply chain performance is influenced by the supply chain's structure is accepted (Moon, 2004:20) and changes in the structural design of the supply chain may improve the chain's performance (Persson & Olhager, 2002:231). The lack of a formal supply chain design can lead to a dysfunctional supply chain when it comes to reaching goals for growth and profits (Ayers, 2006:56). If organisations do not design their supply chains and merely allow their supply chains to evolve through a series of processes and choices that are made independently, the organisations can expect (Fawcett *et al*., 2007:216, 217), amongst others problems, to have to deal with:

- poor coordination of efforts;
- incompatible information systems;
- long time cycles;
- communication problems;
- customer service issues;
- excessive waste and environmental degradation;
- relatively high inventory for the level of customer service achieved; and
- lower than optimal profit.

These problems occur because a supply chain that is not designed lacks transparency. Decisions have to be made independently to optimise organisational results without considering the effects on the rest of the supply chain. It can be argued that an organisation's key to success is its ability to design and manage the supply chain in a nimble way, assembling the 'right' supply chain of capabilities as the operating environment changes (Fawcett *et al*., 2007:217).

SCD thus includes the identification and bringing together of a group of organisations with complementary competencies (Fawcett *et al*., 2007:494). The basic principle is to match the supply chain to its requirements. This match does not just happen, but there are many analyses that can help (Waters, 2007a:200). From literature it can be concluded that SCD essentially consists of the three basic phases that are illustrated in Figure 1.2. In phase one it is necessary for the supply chain to gain understanding of the nature of the needs of its end customers (Taylor, 2004:259) and how these needs can be met by some value proposition (Christopher, 2005:57). Organisations must know how they can contribute value to meet the demands of their supply chain's end customers (Fawcett *et al*., 2007:222; Christopher, 2005:57). In phase two, organisations must select a supply chain strategy to be able to deliver value to their end customers (Taylor, 2004:279). In phase three the supply chain structure needs to be configured (Sharifi *et al*., 2006:1078; Fawcett *et al*., 2007:222). This includes deciding which supply chain partners to partner with, assigning roles and responsibilities to each of the supply chain members and establishing key performance indicators. This third phase will be referred to as scoping the supply chain structure (Fawcett *et al*., 2007:335; Taylor, 2004:284). Phases two and three have to be aligned towards meeting the first phase, which is meeting the end customers' needs (Sharifi *et al.*, 2006:1078). SCD and supply chain configuration imply the same concept, because configuration is generally defined as the harmonic interaction of organisational variables focusing on strategy, structure, process and environmental aspects which all form part of SCD (Klaas & Delfmann, 2005:12).

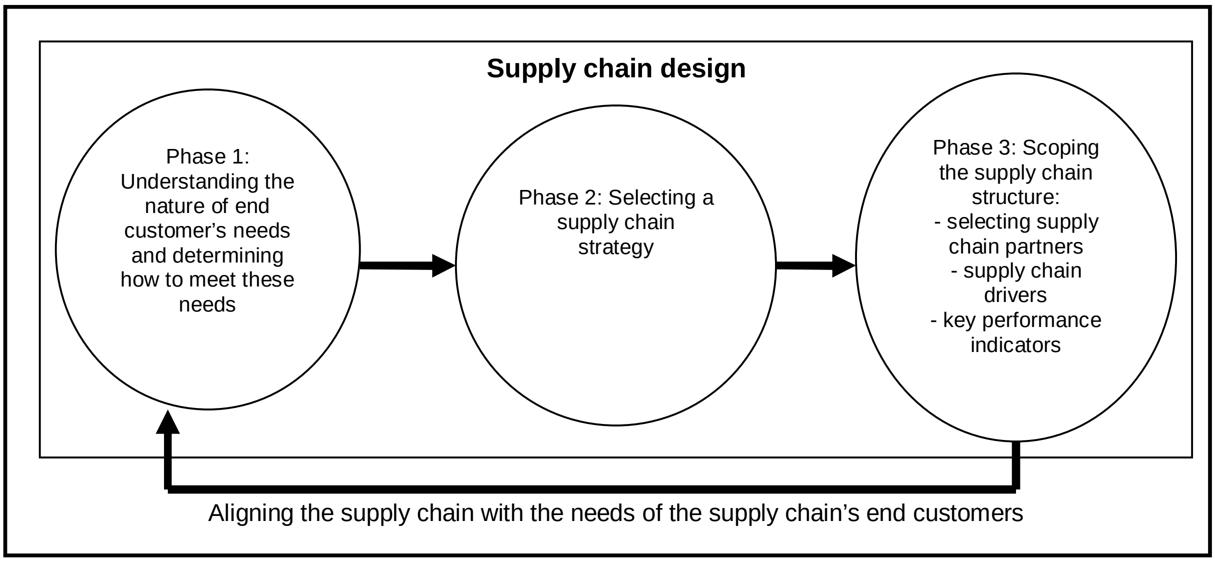

Figure 1.2: The three phases of supply chain design
Source: Compiled from Taylor (2004:259, 279, 284), Fawcett *et al.*, (2007:20) and Christopher (2005:57).

It is important for organisations to respond to the turbulent business environment and the success of an organisation's supply chains will be defined by the ability of organisations to adapt to the changes by reconfiguring existing supply chains or assembling (or designing) new ones (Carter, Slaight & Blascovich, 2007:44,45). Organisations that have aligned the needs of their end customers with their SCD have had exceptional results. However, this alignment is too often overlooked as a source of competitive advantage (Carter *et al.*, 2007:46). This alignment is illustrated in Figure 1.2, above, and discussed in the following paragraphs.

1.2.3.1 Understanding end customer needs and how to meet them

Most traditional supply chains were designed to optimise the internal operations of the organisation (Christopher, 2005:56). The focus was on optimising operations from the organisation towards the end customer. However, due to the changing nature of business discussed earlier in this chapter, this philosophy has become less and less appropriate. The challenge is now to design supply chains with the end customer's needs in mind (Christopher, 2005:56). The supply chain's end customer is the person at the end of the supply chain who makes the decision whether or not to buy the product or service offered by the supply chain (Harrison, 2001:1). The customer is the ultimate judge of supply chain performance (Jeong & Hong, 2007:578). The end customer should thus be the starting point of any supply chain design (Christopher, 2005:56). In fact, the need to align the supply chain to the demands of its end customers is imperative (McCullen, Saw, Christopher & Towill, 2006:14). Sadler (2007:179) states that supply chains operate most effectively if they have been designed for specific products for the supply chain's end customers.

Therefore, to design a world-class supply chain, organisations need to understand their end customers. They have to know who their end customers are and they have to understand their real needs (Fawcett *et al*., 2007:19). To understand the customer there must be some direct link with the customer. Getting closer to the end customer and compiling information about the end customer's needs will provide the inputs necessary for designing the value proposition that will meet their needs. Knowing what matters to the customer will help align the supply chain towards meeting and exceeding customer expectations (Harrison, 2001:2) efficiently and better than competing supply chains (Fawcett *et al.*, 2007:19). The *value proposition* is quite simply a statement of how, where and when value is to be created for specific customers or market segments. The value proposition should form the guiding principles around which all the activities of the organisation are based (Christopher, 2004:32). Core competencies will also be developed. However, the value proposition will require specific market winners. Market winners differentiate an organisation's products from competition (Bozarth & Handfield, 2006:31) and can, for example, be low cost or high service levels (Mason-Jones, Naylor & Towill, 2000:4064). Understanding the end customer's needs and determining the value proposition to meet these needs on the basis of core competencies and identified market winners amidst supply uncertainties will be discussed further in Chapter 2.

1.2.3.2 Selecting a supply chain strategy

Selecting a supply chain strategy is the second phase of SCD. Once organisations understand the nature of their end customers' needs and have determined the value proposition necessary to meet these needs (phase one of SCD), they can select a supply chain strategy (phase two of SCD) (Christopher, 2004:32; Taylor, 2004:279; Raturi & Evans, 2005:207). The supply chain strategy thus starts with the business value proposition to customers on the basis of core competencies and identified market winners (which was identified in the first phase of SCD) and shows how the supply chain can contribute to achieving business goals (Tang & Gattorna, 2003:25,26) by aligning the needs of the supply chain's customers and the supply chain's capabilities (Chopra & Meindl, 2010:40, 41).

It has already been mentioned that competition today is moving towards supply chain versus supply chain (Lambert, 2006:1; Handfield *et al.,* 2009:6; Christopher, 2005:18, 28; Gough, 2003:78). Success thus depends upon formulating and executing clear supply chain strategies (Taylor, 2004:279). Supply chain strategies can be defined as strategies required for managing the integration of all the supply chain activities through improved supply chain relationships to achieve a competitive advantage for the supply chain (Hines, 2004:5). Basically, there are three different supply chain strategies. They are lean, agile and leagile supply chain strategies (Raturi & Evans, 2005:208; Towill & Christopher, 2002:300). Supply chain strategies are discussed in

Chapter 3.

Supply chain strategies should form part of the organisation's business strategy. Organisations have to have strategies in place if they wish to survive in today's competitive business environment. Competitive strategies are driven by a need to find a unique position in the market that will give the organisation a competitive edge. This competitive position is sustained by the development of appropriate business strategies (Hugo *et al.,* 2004:23). Business strategies are strategies that identify the organisation's targeted customers and set time frames and performance objectives for the organisation that can be used to track the organisation's progress towards fulfilling its business strategy. Business strategies are translated into functional strategies which are specific actions for the functional areas of an organisation that should be aligned with the overall business strategy and with each other. Supply chain strategies are functional strategies (Bozarth & Handfield, 2006:25) and define how operations in the supply chain will support overall business strategies (Ayers, 2004:163).

Unfortunately, having supply chain strategies is a very uncommon practice for organisations (Taylor, 2004:279) in spite of the poor performance of many supply chains (Fisher, 1997:1) and the fact that very few organisations rated their supply chains as excellent (Taylor, 2004:280). Many organisations ranked SCM as vital to their organisation's success, yet had no supply chain strategy in place for improving the supply chain (Taylor, 2004:280). To add to the insult, many organisations also select the incorrect supply chain strategy for their supply chains, which results in poor supply chain performance (Fisher, 1997:1).

1.2.3.3 Scoping the supply chain structure

The supply chain structure must support the supply chain strategy (Defee & Stank, 2005:34). Scoping the supply chain structure is the third phase of SCD. Once organisations have decided on a core supply chain strategy, they need to determine the scope of the design effort. Supply chain scope embodies the configuration of the supply chain's structure, processes and operations (Taylor, 2004:284). SCD thus determines strategic decisions such as the location of facilities, flow of products, information and finances throughout the supply chain (Mo & Harrison, 2005:243). Organisations have to identify the supply chain partners with whom they would want to build collaborative relationships through supply chain integration (Taylor, 2004:284; Raturi & Evans, 2005:208). The supply chain structure thus implies the integration of the focal organisation and the links between supply chain members (Defee & Stank, 2005:34); the supply chain structure may depend on, for example, the maturity of the supply chain's markets, products and supply chain relationships (Kumar & Zander, 2007:16). Specific supply chain partners who can contribute best to the value proposition must be identified (Taylor, 2004:284; Raturi & Evans, 2005:208).

An important part of SCD thus concerns deciding which type of partnership is most appropriate for a particular relationship (Sadler, 2007:170). The opportunity to build a competitive supply chain will be greater if more supply chain members can be integrated under the supply chain design (Taylor, 2004:284). Specific roles and responsibilities of individual supply chain members can then be defined (Fawcett *et al.,* 2007:335). Managing specific drivers of supply chain performance and establishing the right supply chain key performance indicators (KPIs) is also an important aspect of SCD (Raturi & Evans, 2005:203; Rafele, 2004:281). Due to the length of the section dealing with the scope of the supply chain structure, this topic will be discussed in Chapters 4 and 5.

1.2.4 Supply chain design and supply chain integration

From the discussion about the importance of managing supply chains (refer to section 1.2.2) it also became evident that integration is central in SCM. Integration is an integral part of SCM (Mouritsen *et al.,* 2003:689). Organisations pursuing effective SCM need to pay attention to supply chain integration (SCI). Effective SCM requires internal cross-functional integration within organisations and external integration with suppliers and customers (Kim, 2006a:241). To get full benefit from a supply chain, it is necessary to link all the supply chain partners involved to meet the needs of the supply chain's end customers (Sadler, 2007:18).

SCM seeks to enhance competitive performance by closely integrating the internal functions within an organisation and effectively linking them with the external operations of suppliers, customers, and other supply chain members (Kim, 2006a:241). SCM as source of competitive advantage can thus be attained by integrating efficiently with other supply chain members to implement various supply chain capabilities (Kim, 2006a:241). In its core, SCM thus implies integration (Magnan & Fawcett, 2006:346; Fabbe-Costes & Jahre, 2007:836). The challenge is to determine how to successfully accomplish the integration (Lambert, 2006:1).

SCI can be defined as *supply chain members using techniques enabling them to work together to optimise their collective performance in the creation, distribution, and support of the end product* (Sundaram & Mehta, 2002:537). SCI occurs when all supply chain partners act together at all levels to determine objectives based on their end customers' needs, to ultimately maximise supply chain profits (Wisner *et al.,* 2009:23). It is often described as the seamless supply chain of close collaborative relationships with integrated processes to ensure the flow of products and information from supplier on to customer. Integration thus includes the integration of all the *key business processes* and *relationships* between all the organisations that form part of the supply chain. (Cagliano *et al.,* 2006:283; Lambert, 2006:1; Fawcett *et al.,* 2007:8; Wisner *et al.,* 2009:8; Bozarth & Handfield, 2006:8; Handfield & Nichols, 2002:4; Kim, 2006b:1087). These business processes and relationships are determined during the scoping of the supply chain design, as discussed in the previous section.

Supply chain integration is thus the mutual coordination within and across organisational boundaries (Van Donk, Akkerman & Van der Vaart, 2008:218, 219; McCormack & Johnson, 2003:204). It is the alignment of organisations that form the supply chain and their processes to achieve an advanced form of competitive advantage (Green, McGaughey & Casey, 2006:407). The development of collaborative supply chain relationships within which decision making is integrated, invariably involves the development of inter-organisational relationships (Leat & Revoredo-Giha, 2008:398).

SCI not only involves working together, but necessitates collaboration and close long-term relationships between supply chain partners (Hertz, 2006:210; Mouritsen *et al.,* 2003:689) once they have been selected as part three of the SCD. Therefore, supply chain partners must be selected to improve collaboration, because collaboration improves supply chain performance. Integration is seen as an important change process in supply chain networks, which actually means a transformation from loose cooperation to a higher degree of synchronisation between the partners in a supply chain. This process makes it possible to act collectively in the supply chain (Hertz, 2006:210). Increasing the level of integration among the members of a supply chain has become a necessity for improving the effectiveness of supply chains (Sezen, 2008:234). SCI will be discussed in Chapter 4.

A link between SCD and SCI is implied. It can be assumed intuitively that SCI thus follows or develops from the SCD stage where specific supply chain partners are selected. Cagliano *et al.* (2006:283) affirms this link and states that supply chain integration certainly requires design links. However, the link between SCD and SCI needs to be justified further. SCD displays a conceptual model of a supply chain in a graphic form, which enables supply chain designers to understand and alter the structure of the supply chain, if necessary. SCD therefore is an exercise in modelling (Taylor, 2004:120). Supply chains need to be modelled, to be managed effectively. Supply chain modelling thus is the basis for SCI (Li, Kumar & Lim, 2002:551) and SCI can be the actual utilisation of techniques (refer to definition in section 1.2.4) to implement the model (or blueprint) that is developed for the supply chain during SCD. It can thus be derived that SCD provides direction to SCI efforts, or SCI is the ‘implementation’ of SCD.

SCD cannot be applied in a single universal manner to varying business situations (Tellarini, Pellandini, Battezzati, Fascina & Ferrozzi, 2007:179). Managers face numerous alternatives in designing supply chains (Evans & Collier, 2007:368). However, as will become evident in the chapters to follow, the basic design of a supply chain can be one of two broad designs. A supply chain can be designed to be *physically efficient* or *market responsive* (Fisher, 1997:1).[4] (These supply chain approaches will be discussed in Chapter 3.) For now, it is sufficient to distinguish between the two supply chains as follows. An *efficient* supply chain attempts to minimise the overall supply chain *costs* and a *responsive* supply chain focuses on *speed*, *responsiveness* and *flexibility* of the supply chain (Tellarini *et al.,* 2007:181;

[4] Fisher (1997) was the pioneer in distinguishing between efficient and responsive supply chain designs. His work was used as foundation by many academics, as will become evident in this study.

Evans & Collier, 2007:368, 369; Raturi & Evans, 2005:208). Even though these supply chain design approaches will be discussed in a later chapter, it is important to note that SCD decisions will vary for each approach (Raturi & Evans, 2005:208) and that each approach also requires a distinctly different kind of SCI (Jespersen & Skjøtt-Larsen, 2005:28). A study in SCD should therefore include SCI, which can be regarded as the practical implementation of the design (specifically in phase three where supply chain partners are identified, selected and managed). This is illustrated in Figure 1.3.

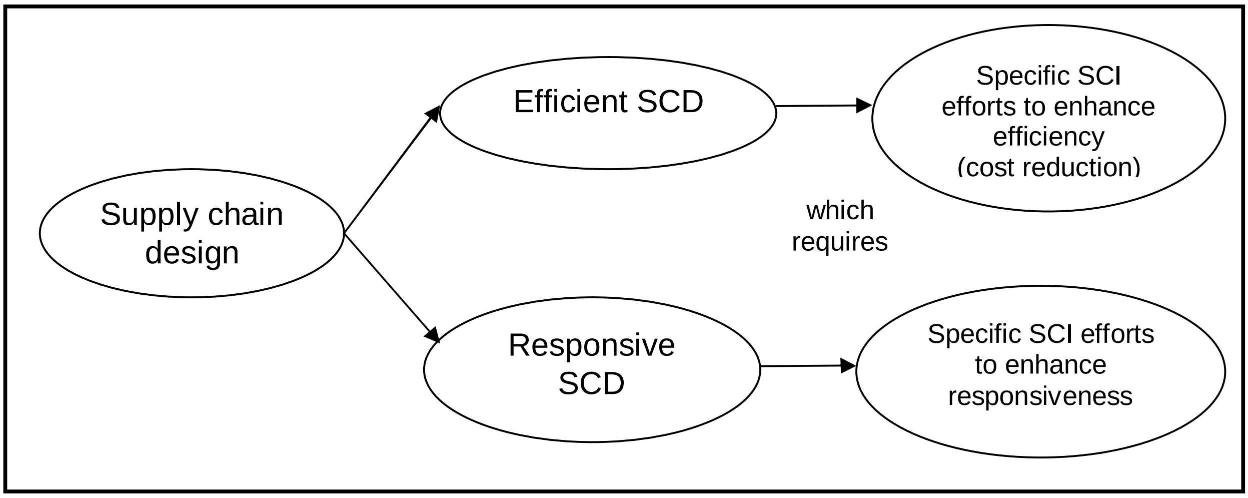

Figure 1.3: The need to align SCI efforts to the correct SCD
Source: Researcher's own.

1.2.5 Supply chain performance measurement

Supply chain performance and supply chain performance measurement have become increasingly important (Gough, 2003:78; Nunlee *et al.,* 2000:354). Organisations have realised that aligning and integrating their supply chains are essential for improving their performance (Nunlee *et al.,* 2000:354). The level of SCI has a positive influence on performance outcomes of the supply chain and there is a strong positive correlation between the level (or degree) of SCI and supply chain performance (Cohen & Roussel, 2005:230; Kim, 2006a:241, 242; Trkman, Štemberger, Jaklič & Groznik, 2007:118; Cagliano *et al.,* 2006:284; Bagchi *et al.,* 2005:275; Gattorna, 2003:xii; Lee, Kwon & Severance, 2007:444). These statements point to the fact that SCI results in improved supply chain performance.

Organisations have to measure their supply chains and monitor them to determine whether they achieve the performance they want (Hugos, 2006:133). However, unless the right KPIs are established to support the organisation's strategy, the supply chain may be poorly designed and managed (Raturi & Evans, 2005:203; Holmberg, 2000:851). In fact, the manner in which supply chain performance measures are incorporated in the supply chain design plays an important role in determining the effectiveness of the supply chain (Sadler, 2007:179). Performance measurement thus supports SCM and provides useful information about long-term decisions regarding SCD (Wang, Heng & Chau, 2007:333). This implies that supply chain performance measurement indicates whether SCD is successful. However, it is essential to establish the right KPIs during the SCD stage.

Performance measurement thus also makes an indispensable contribution to decision making in SCM (Chan & Qi, 2003:210). This study does not, however, focus on performance measurement systems, but rather on the focus of aligning measurement efforts (as measured through specific KPIs) and specific SCDs. To conclude, supply chain performance measurement evaluates organisations' SCI efforts if the correct measures are identified during SCD and, as SCI improves, so does supply chain performance. This interdependence of the concepts is highlighted in Figure 1.4.

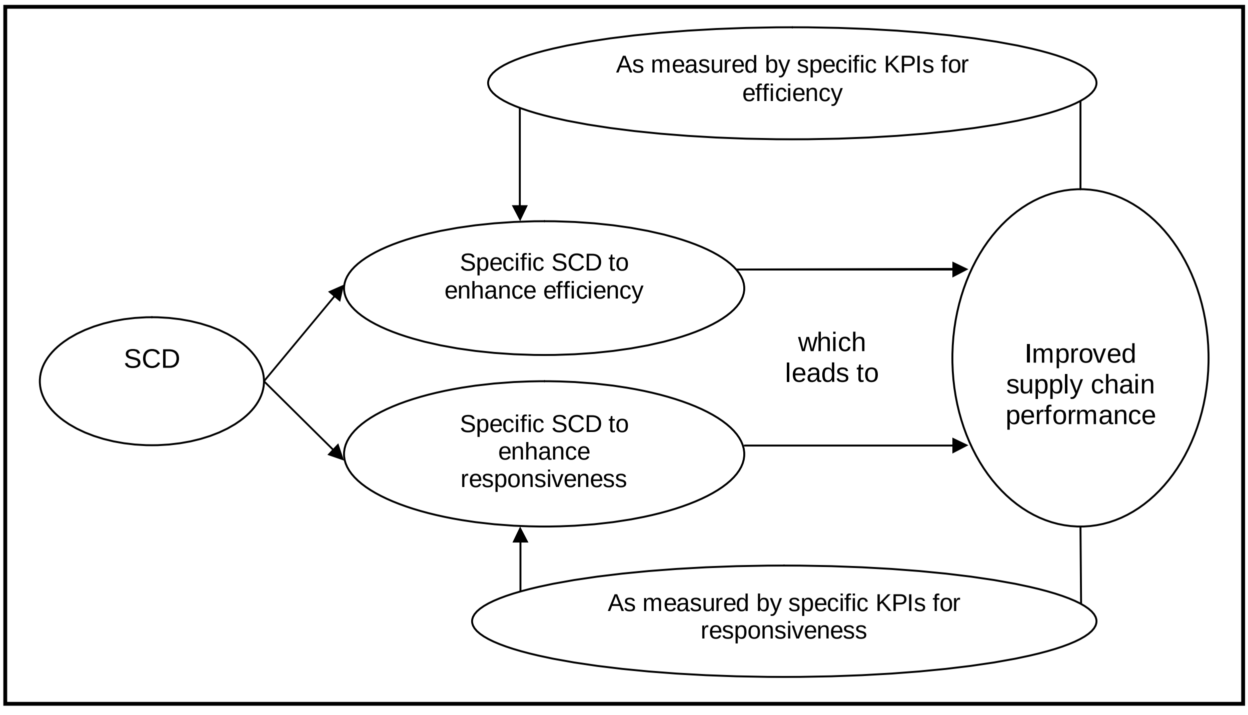

Figure 1.4: The link between SCI and supply chain performance
Source: Researcher's own.

1.3 PROBLEM STATEMENT

From the previous section it is clear that one of the greatest opportunities for organisations is SCM, as it has the potential ability to ensure continued growth and success (Timme, 2004:5). However, SCM is also one of the biggest challenges facing organisations (Hugos, 2006:ix) and it is difficult to master (Taylor, 2004:21) because of its complex nature (Wu & O'Grady, 2005:444; Childerhouse & Towill, 2004:586). In the previous section, it became evident that SCD forms an integral part of SCM (refer to section 1.2) and that SCD is an important decision (Santoso *et al.,* 2004:96). The design (or structure) of a supply chain is an important core capability of an organisation because it enables or limits the organisation's competitiveness. However, SCD is a demanding and complex process (Fawcett *et al.,* 2007: 337) and it has become a major challenge for organisations (Shen & Daskin, 2005:188). In fact, the big challenge in evaluating possible improvements in the supply chain lies in the complex structure of the supply chain (Reiner & Trcka, 2003:219).

As already mentioned, SCI can be regarded as the implementation of SCD and is central to successful SCM (Magnan & Fawcett, 2006:346; Fabbe-Costes & Jahre, 2007:836). However, one of the biggest challenges for organisations is to integrate supply chains for the benefit of the supply chain's end customers (Sadler, 2007:12) because many supply chain partners never learn to work together (Fawcettt *et al.,* 2007:339). Very few organisations are actively integrating their supply chains (Fawcett & Magnan, 2002:340). A majority of organisations unfortunately are still preoccupied only with the internal integration of functional activities and supply chain flows and not with externally integrating with other supply chain partners (Burt *et al.,* 2010:529). The integration efforts in these organisations still are focused mainly on their own functional levels and they seldom take into account the overall supply chain decisions, or fully understand how their decisions will impact on other members in the supply chain (Yee & Tan, 2004:355).

Although literature emphasises that different SCDs need different SCI efforts (Raturi & Evans, 2005:208; Jespersen & Skjøtt-Larsen, 2005:28) very little attention is given in the literature to what exactly this entails. Ismail and Sharifi (2006:436, 437) also point out that the manner in which SCD is used to manage supply chain strategy and implement (or incorporate) SCI issues (such as supply chain relationships and processes) has not been fully resolved. The problem statement of this study was therefore formulated in the main research question, which was:

What are the elements of SCD and how can these elements be included in a framework to analyse organisations' SCD practices with the aim of improving supply chain performance?

Based on the problem statement of this study, the following research questions (RQ) were asked:

RQ 1: Which elements (or characteristics) can be identified to design supply chains?

RQ 2: Can the elements of SCD be used to develop a conceptual framework with which organisations can analyse their SCD practices?

RQ 3: Will the conceptual framework help organisations to determine:

3.1 the extent to which they understand the needs of the end customers in their supply chain and show them how to improve these practices if necessary?
3.2 the extent to which they know how to meet the needs of their customers and show them how to improve these practices if necessary?
3.3 the supply chain strategy on which they are focusing and whether the supply chain strategy is aligned towards meeting the needs of the end customers in their supply chain?
3.4 the extent to which they are managing their supply chain partners and show them how to improve these practices if necessary?
3.5 how they are managing their supply chain drivers and whether it is aligned with their supply chain strategy, and make recommendations if necessary?
3.6 if they are focusing on the correct supply chain KPIs to measure supply chain performance based on their supply chain strategy and make recommendations if necessary?

1.4 OBJECTIVES OF THE STUDY

From the above-mentioned, the objectives of the study can now be formulated. The main objective of this study was to *develop a conceptual framework from the literature that organisations can use to analyse their SCD practices with the aim of improving performance*. To achieve the main objective, the study also comprised several secondary objectives. The secondary objectives of the study therefore were to:

- determine the elements of SCD by means of an extensive literature study about SCD; and
- exploratively test the conceptual framework to determine whether it is a usable assessment instrument in terms of helping organisations to determine:

- the extent to which they understand the needs of their supply chain's end customers;
- the extent to which they know how to meet the needs of their customers;
- the supply chain strategy on which they are focused;
- whether their supply chain strategy is aligned towards meeting the needs of their supply chain's end customers;
- the extent to which supply chain partners are managed;
- how supply chain drivers are managed and whether it is aligned with their supply chain strategy;
- whether their focus is on the correct supply chain KPI categories for their supply chain strategy; and
- whether the conceptual framework contributes to improvement of these practices by offering recommendations, if necessary, within each component of the framework.

A literature study and empirical research was conducted to reach the objectives. The literature study was conducted to cover the topic of SCD. This discussion comprises three main topics which present the three phases of SCD. These topics are (1) understanding the needs of the supply chain's end customers and determining how to meet these needs, (2) supply chain strategies and (3) scoping the supply chain structure. Scoping the supply chain also touches on the topics of supply chain partners, (and thus SCI), supply chain drivers and supply chain key performance indicators (KPIs).

From the literature study, several SCD elements were identified with which a conceptual framework was developed to assist organisations in analysing their SCD practices. Empirical research was to be conducted to determine answers to the above-mentioned research questions and to exploratively test the conceptual framework for SCD analysis. The problem statement and main objectives of this study can be illustrated as follows.

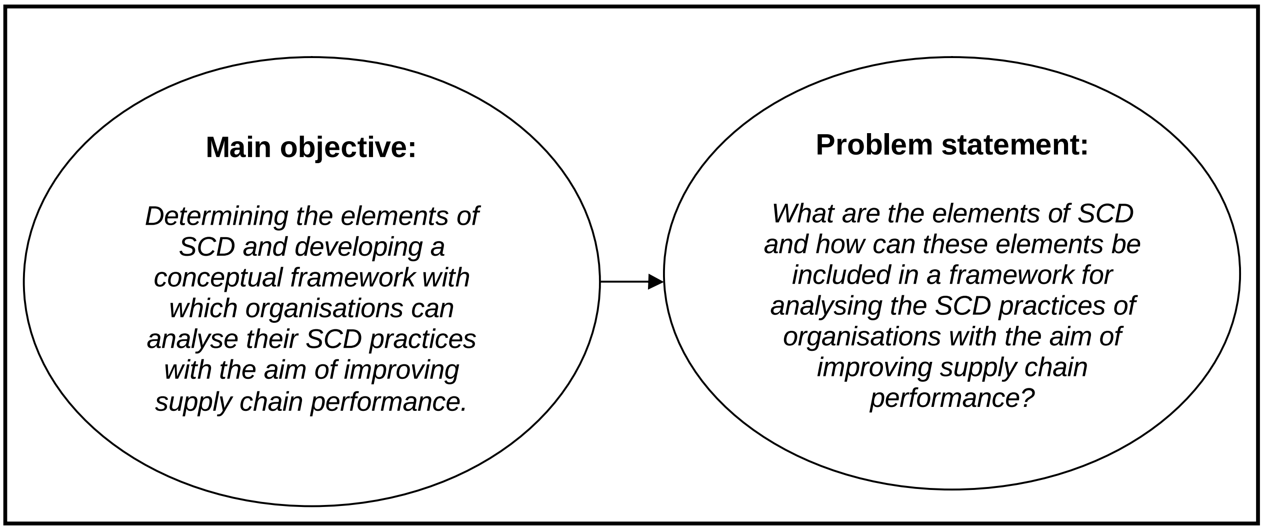

Figure 1.5: Problem statement and main objective of the study
Source: Researcher's own.

1.5 RESEARCH METHODOLOGY

In order to address the objectives of this research, the study consisted of a literature study on the topic of SCD as well as empirical research to exploratively test the conceptual framework. The conceptual framework was developed from the literature study. Empirical research was used to exploratively test the conceptual framework to see whether it provided a usable instrument to analyse the SCD practices of organisations. This study thus combined research from literature with empirical research to answer the research questions. The research comprised two phases which are illustrated in Figure 1.6.

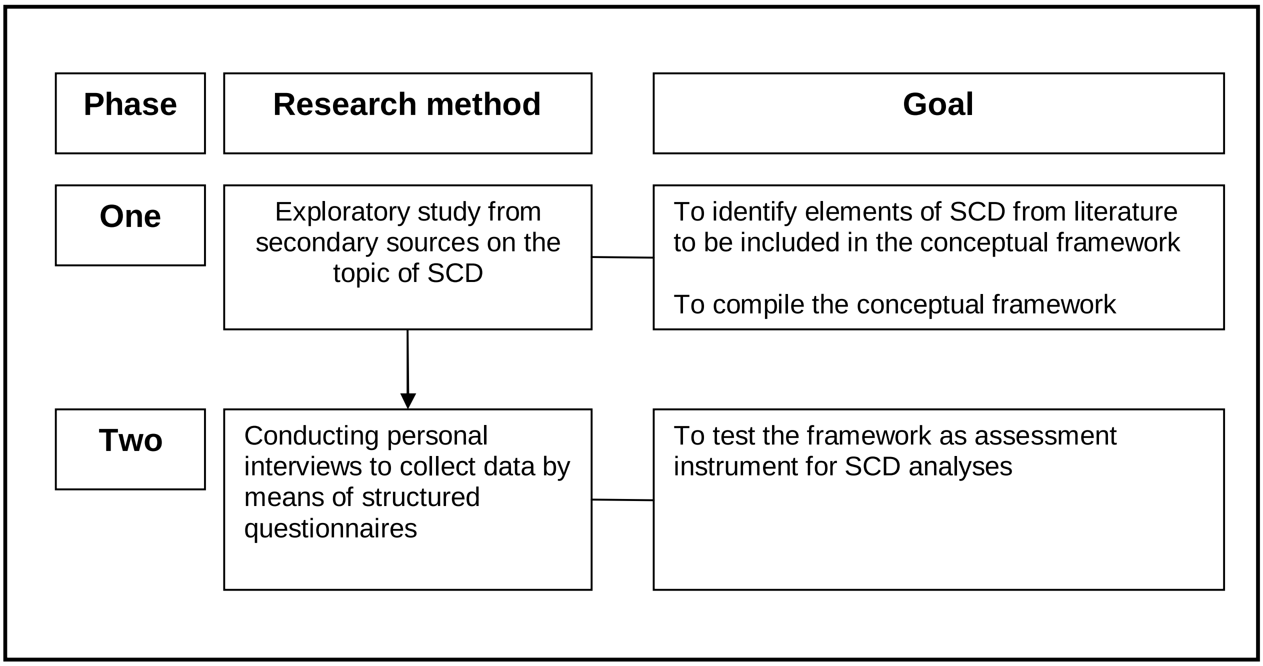

Figure 1.6: The broad phases of research conducted in this study
Source: Researcher's own.

1.5.1 Phase one: Literature study

The secondary objectives of this research clearly necessitated a thorough literature study on the topic of SCD. The topic of SCD is discussed in three sections. These sections are: (1) understanding the needs of the supply chain's end customers and determining how to meet them with a value proposition, (2) selecting a supply chain strategy and (3) scoping the supply chain structure. From the literature study a conceptual framework could be compiled and proposed to assist organisations in analysing their SCD practices.

Numerous sources were used in the literature exposition. The main sources included books written by authors specifically about these topics; relevant articles in journals or accessed from the Internet; as well as supply chain focused papers delivered at conferences. Other sources included talks and meetings with supply chain practitioners and academics. The main objective of the literature study was to identify SCD elements to be included in the proposed conceptual framework with which SCD practices could be analysed and also to compile the conceptual framework.

1.5.2 Phase two: Personal interviews

During phase two of the research, exploratory and descriptive empirical research were conducted by means of personal interviews with the aid of a structured questionnaire. The questionnaire was structured around the conceptual framework developed in phase one of the research. Data were gathered from organisations with the structured questionnaire to exploratively test the conceptual framework to see whether it could be used to analyse the SCD practices of organisations. The conceptual framework became an instrument for communicating by means of the questionnaire. This is illustrated in Figure 1.7. The purpose of the empirical research therefore was to test the conceptual framework to see whether it provided a practical and sound instrument for SCD analysis. In doing so, the research questions (refer to section 1.3) were answered to achieve the primary and secondary goals of the study. The goal was not to validate the conceptual framework. This will have to be done through further research.

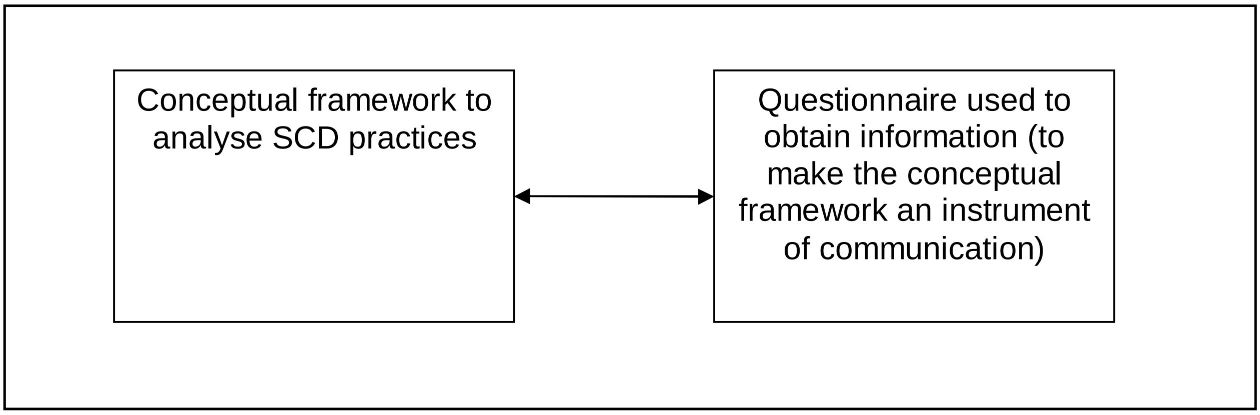

Figure 1.7: The link between the questionnaire and the conceptual framework
Source: Researcher's own.

1.5.3 Research frame and sample

The Sunday Times Top Brands survey of 2009 was used to design the sample frame. Industries had to be included in the framework to ensure that the supply chains of different products across the three different types of supply chain strategies, namely lean, agile and leagile, were tested in the research. It was essential that the conceptual framework had to be tested for each of the three supply chain strategies. The framework was tested with thirteen respondents across the following categories, as demonstrated in Chapter 7:

- food kept on the shelf;
- drinks; and
- automobiles.

The respondents were from the manufacturing, assembling, wholesale and retail sectors. Purposive and judgmental sampling was used to select the respondents in phase one, but time and availability constraints made it necessary to use convenience sampling in the second stage of the sampling process to finalise the sample. Three respondents used a lean supply chain strategy, three respondents used an agile supply chain strategy and seven respondents used a leagile supply chain strategy. These aspects are discussed in detail in Chapter 7.

1.6 REASONS FOR AND CONTRIBUTION OF THE STUDY

According to Reid and Sanders (2007:124), an organisation's first step to improving performance is to analyse the supply chain. Supply chain decisions play a significant role in the success or failure of an organisation (Chopra & Meindl, 2010:25). A concept that forms an integral part of SCM is SCD. The title of this study is: Developing a conceptual framework to analyse SCD practices. The focus of this study therefore is on the concept of SCD. The greater challenge in evaluating the possible improvements of supply chain results lies in the complex structure of the supply chain (Reiner & Trcka, 2003:219). This structure is embodied in the SCD and the importance of aligning SCD to SCI efforts to improve performance has been emphasised earlier (refer to section 1.2). This study will make a contribution in the field of SCM. *The reason and contribution of this study comprise the development of a conceptual framework with which organisations can analyse their SCD practices, with the aim of improving supply chain performance.* The conceptual framework is based on the different phases of SCD as identified from an extensive literature study (refer to section 1.2) and includes the relevant SCD elements that are necessary to analyse SCD efforts.

The study may therefore contribute to improving SCD practices in supply chains by providing relevant answers to the research questions raised in the previous section. This information was used to finalise the conceptual framework, which is seen as the main contribution of the study, in providing organisations with a conceptual framework with which they can analyse their SCD practices. SCD is equally important for the survival of the organisation as for providing a competitive advantage in the marketplace (Dekker, 2009:27, 28). Organisations will be able to use the conceptual framework to analyse their SCD practices and to see whether their SCD practices are aligned. The broad outline and aim of the conceptual framework that has been developed in this study are illustrated in Figure 1.8.

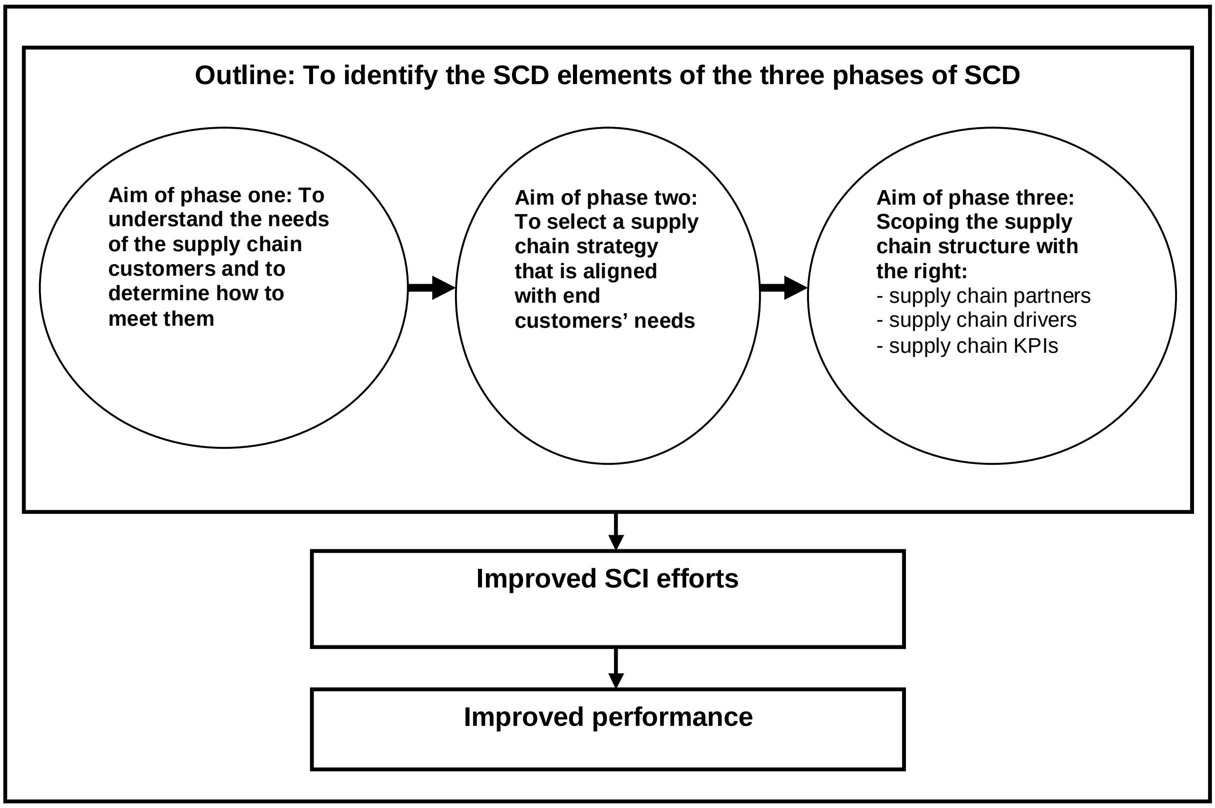

Figure 1.8: Broad outline and aim of the proposed conceptual framework
Source: Researcher's own.

Research into the field of SCD is justified by the fact that insufficient attention seems to be devoted to this in the academic literature, despite the significance of design issues in the supply chain (Sezen, 2008:234). The fact that it seems that organisations do not consciously design their supply chains (Fawcett *et al.,* 2007:15), as well as the fact that many managers involved in SCM may not be all that familiar with the notion of SCD (Quinn, 2004:7), also necessitate some research in this field because the effectiveness of SCD correlates directly with how effectively the supply chain will operate (Quinn, 2004:7). The same author states that poorly designed supply chains may lead to substandard results. The fact that very few organisations were found to have strategies to improve their supply chains (Taylor, 2004:15) justifies research into the use of SCD and supply chain strategies in South African organisations, since supply chain strategies form an important part of SCD (phase two). Thirdly, due to the preoccupation of many organisations at the internal integration phase, research is also necessary to determine whether and, if so, how SCD can help achieve more effective SCI at an external level. Secondary sources comprehensively address the first two parts (or phases) of SCD, albeit with different and compartmentalised approaches, and the literature, as already mentioned, states that SCD should be used for SCI efforts. It is lacking in providing a comprehensive overview, however, of how to design the supply chain. This study aims to address this and will therefore contribute to academics as well as practitioners.

1.7 STUDY OUTLINE

This study consists of nine chapters. Before giving a brief outline of each chapter, it is necessary to revisit the current chapter. In this chapter, a background sketch, problem statement and the reason for the study has been provided. This led to the formulation of the objectives of the study. Chapter 1 also presents a brief introduction to the research methodology (which is explained in depth in Chapter 7) that was followed in this study.

The literature study comprises four chapters, from Chapters 2 to 5 and covers the topic of SCD. There are three phases of SCD. Chapter 2 covers the first phase of SCD, namely: Understanding the needs of the end customers in the supply chain and determining how to meet them. Chapter 3 discusses the selection of an appropriate supply chain strategy. This is the second phase of SCD. Ultimately, organisations have to select a supply chain strategy that is aligned to the needs of the end customers. There are three broad supply chain strategies that organisations may select for implementation and these strategies form the backbone of Chapter 3. Chapters 4 and 5 look at the third phase of SCD, which is the scoping of the supply chain structure. During the scoping of the supply chain structure, organisations must decide what the structure of their supply chains will look like. Scoping the supply chain structure is divided into two parts. Organisations have to determine which supply chain members warrant supply chain partnerships. Supply chain partners are discussed in Chapter 4. Organisations have to develop relationships with their most important supply chain members across supply chain processes. Organisations also have to manage specific supply chain drivers and it is also important to determine the right KPIs. Chapter 5 covers these issues.

Chapter 6 proposes a conceptual framework that is compiled from the literature study (Chapters 2 to 5). The conceptual framework includes all the different SCD elements that were identified from the literature and which may have an effect on an organisation's SCD practices. Chapter 7 discusses the research methodology used in the study. Various research design decisions are considered in Chapter 7, which justifies the research methods used.

In Chapter 8, the findings of the empirical research are highlighted. The findings provide a clear insight into the SCD practices of a limited number of supply chains. In Chapter 9, conclusions are drawn and recommendations are made. The study reached a highlight when the conceptual framework with which organisations can analyse their SCD practices was finalised. The research questions are answered and the research objectives are met. The study closes in referring to some limitations of the study and suggestions about potential areas for further research.

CHAPTER 2

END CUSTOMER NEEDS

2.1 INTRODUCTION

In Chapter 1, it became evident that supply chain design (SCD) is an important element of supply chain management (SCM). SCD is the determination of how to structure a supply chain (Saxton, 2006:244) and decide what the supply chain's configuration will be, how resources will be allocated and what processes will be performed in each stage in the supply chain (Chopra & Meindl, 2010:25). SCD thus is concerned with determining the supply chain's strategy, designing its structure, processes and operations and aligning its main constituents (Sharifi *et al.,* 2006:1078). SCD is the transition to the highest level of SCM because it ultimately determines the capabilities and limitations of the supply chain (Taylor, 2004:259). SCD will become a key source of competitive advantage (Reeve & Srinivasan, 2005:50) and organisations have begun to consider the overall design of their supply chains (Baiman *et al*., 2001:173). These issues were touched on in Chapter 1.

SCD is a critical factor determining the efficiency and effectiveness of a supply chain (Sezen, 2008:234) and has become a major challenge for organisations as they simultaneously try to improve customer service and reduce operating costs (Shen & Daskin, 2005:188). SCD thus involves planning and developing supply chains to support the value proposition and goals of the organisation and is a proactive approach to serving the supply chain's customer (Fawcett *et al.,* 2007:222). It is essential that supply chain members need to understand their customers (Taylor, 2004:259). This is the first phase of SCD. Effective SCD requires from organisations that they understand how the supply chains in which they are members really operate and how they meet the needs of their customers.

In Chapter 1 a distinction was made between three phases of SCD. Phase one embodies understanding the needs of the supply chain's end customers, as well as the capabilities of the supply chain to meet these needs (Fawcett *et al.,* 2007:19). This phase comprises two major steps. The first step is to understand the needs of the supply chain's end customers and the second step is determining how to meet these needs. Once this has been determined, organisations can formulate a supply chain strategy aimed at meeting the needs of the supply chain's customers (Taylor, 2004:279) in phase two of SCD. These issues are discussed at length in Chapter 3. After selecting a supply chain strategy, organisations can scope their supply chain structure (Taylor, 2005:284) as phase three of SCD. The scoping of the supply chain structure and what it entails is discussed at length in Chapters 4 and 5. These three phases of SCD are illustrated in Figure 2.1.

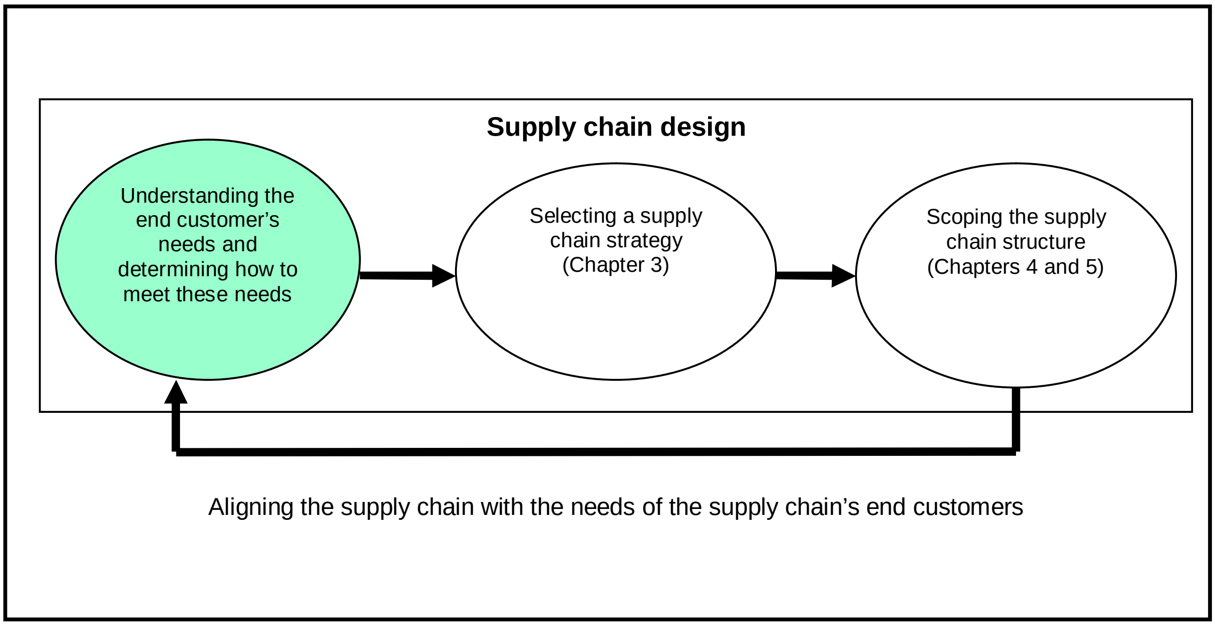

Figure 2.1: The three phases of supply chain design
Source: Compiled from Taylor (2004:259, 279, 284), Fawcett *et al.* (2007:20) and Christopher (2005:57).

The focus of this chapter is on phase one, which is highlighted in Figure 2.1 as the shaded area. The value proposition must be defined from the customer's viewpoint (Christopher, 2004:32). The challenge thus is to design supply chains from the customer's point of view (Christopher, 2005:56) because supply chains are customer driven. Therefore, SCD starts with an understanding of customers' needs in the market in which the organisation competes. This will enable the identification of the real market segments that share the same value preferences (Christopher, 2005:57). It is important to recognise that, in any given market, there will probably be a number of customer segments that are quite different in their perceptions of value. Organisations will benefit by focusing on aspects to which the customer attaches most value (Christopher, 2004:31). Therefore the first phase in SCD is to understand the needs of the supply chain's end customers by identifying market segments

(Christopher, 2005:57).

The second step in the first phase of SCD is to determine how to meet the needs of the supply chain's end customers. Once organisations have identified their end customers' needs, they have to define a value proposition. The value proposition is simply stated in how, where and when value is to be created for specific customers or market segments (Christopher, 2004:32). After defining the value proposition, organisations must develop their core competencies to be able to deliver the value proposition. These have to be aligned with market winners that differentiate an organisation's products and services from those of its competitors (Bozarth & Handfield, 2006:31). This chapter will cover these topics. The chapter layout is illustrated in Figure 2.2.

2.2 UNDERSTANDING END CUSTOMERS' NEEDS

In Chapter 1, three supply chain flows were distinguished. These three supply chain flows are information flows, product flows and finance flows. It was also mentioned that information flows can be termed demand flows (Lambert, 2006:14; Taylor, 2004:26). Customer demand information provides the impetus for the other two flows, which means that supply chains are customer driven (Halldórsson *et al.,* 2005:37; Hines, 2004:123). Demand refers to the overall market demand for a group of related products (Hugos, 2006:16). In today's competitive environment, organisations are moving towards a more effective demand-driven supply chain to enable them to respond quickly to shifting customer requirements (Wisner *et al.,* 2009:139). Customer demand for the product thus activates the flows in the supply chain (Taylor, 2004:26), which accentuates the need for organisations to understand the market's demand for their product. The end customer therefore is the focus of SCM and organisations need to know what their customers' needs are (Rudansky-Kloppers, 2008:259). The organisation must therefore know who the end customers are.

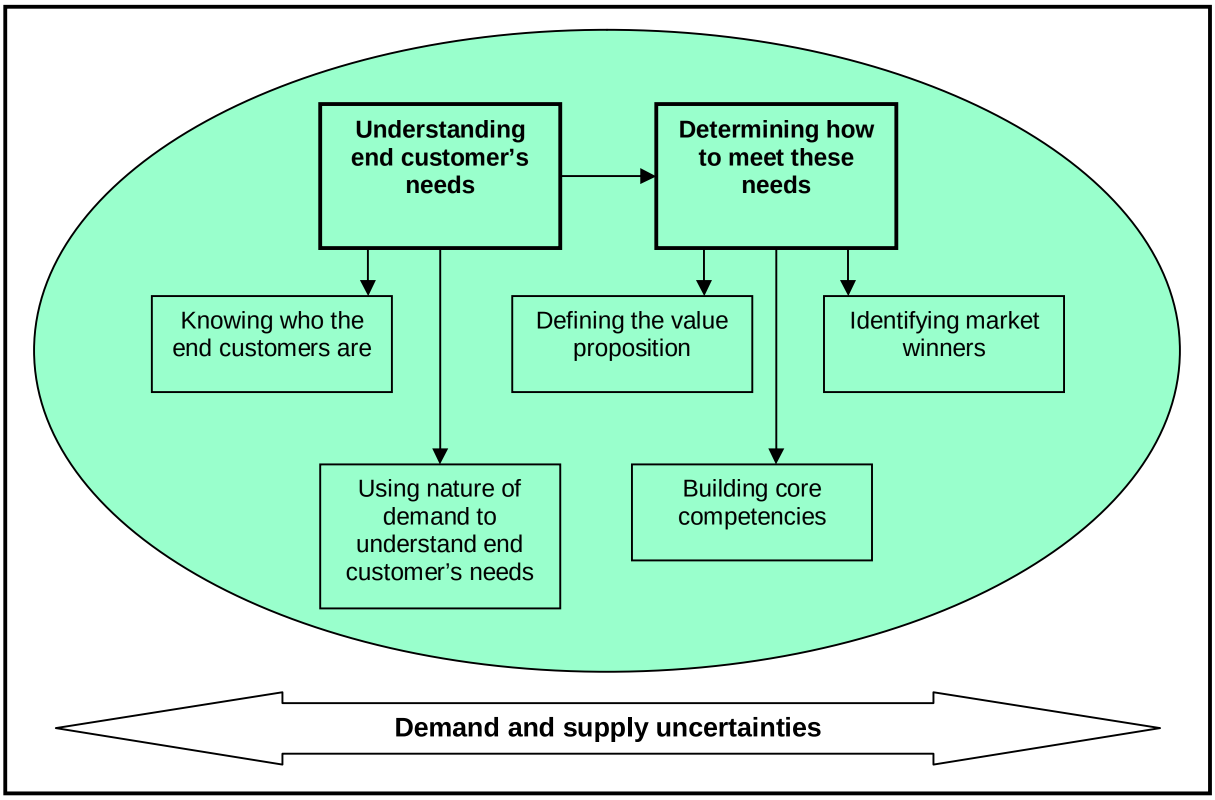

Figure 2.2: Phase one of supply chain design
Source: Researcher's own.

2.2.1 Knowing who the end customers are

Earlier in this chapter the end customer was defined as the person at the end of the supply chain who makes the decision whether or not to buy the product offered through the supply chain (Harrison, 2001:1). Effective supply chains have to be developed with respect to the product that is going to be supplied to the end customer through the supply chain (Selldin & Olhager, 2007:42). Depending on the range of the customers that the organisation and its supply chains serve, there will be a range of desired products, along with the various quantities and delivery needs; product availability and response time needs; product quality demanded; and prices that customers are willing to pay (Wisner *et al.,* 2009:479). Therefore, in general, customer demand varies along several attributes, namely (Chopra & Meindl, 2010:41; Hines, 2004:58, Hugos, 2006:33, 34):

- the volume quantities demanded by the customer;
- the response time related to the customer's willingness to wait for fulfilment of the order;

- the variety of products needed;
- the service level required;
- the price of the product; and
- the desired rate of innovation in the product (including new product development).

Organisations should thus conduct market research about their customers. Broadly defined, market research is a means of getting more information about current and potential customers and their needs (Nieuwenhuizen, 2008:323). Organisations should ask questions about their customers. They must know what kind of customers their organisation serves. By answering the question, organisations will be able to get answers to the above issues (Hugos, 2006:32). Information can be obtained by using existing information or obtaining the information from outside sources. Sources of existing information include (Plantes & Finfrock, 2009:88-89):

- past proprietary market research reports;
- multiclient market research reports;
- other published material pertinent to the organisation's industry, customer base, technology gathered from publications, the Web, seminars and so on;
- competitors' websites, press releases, media references, and annual and quarterly reports and stock analyst reports (if available);
- websites of companies selling complementary products and services;
- the organisation's financial statements overall, by business unit, by product category, by market, by channel, and in B2B markets and by customer; and
- any tracking information on market size, market share, penetration rates, repeat purchase rates, win rates, and any other variable that measures outcome of the organisation's selling process.

Information can also be obtained from outside sources. Outside resources will depend on the organisation, its industry, and the amount that can be invested in information collection. Sources of qualitative information about customers include (Plantes & Finfrock, 2009:90):

- current, lost and potential customers;

- potential customer groups not using the organisation's offerings due to particular features;
- end users of the industry's offering (including those who are using competitors' offerings);
- key suppliers;
- organisations selling complementary offerings; and
- experts in any area.

There is no single market for any given product. All markets are composed of different segments, each of which has somewhat different requirements (Bowersox *et al.,* 2010:49). Organisations usually cannot appeal to all buyers because they are too numerous and too varied in their needs and wants. Additionally, no organisation is able to serve all buyers in the market because of limits on the skills and resources to execute all activities associated with producing and delivering the demanded products. This forces organisations to use market segmentation (Canever *et al.,* 2007:511). Market segmentation occurs when organisations divide the heterogeneous market into fairly homogeneous subsets of customers (Cant, 2010:127).

2.2.1.1 Explaining market segments

Market segments are customer groups with common characteristics (Ayers, 2004:43; Hutt & Speh, 2004:174). Customer segmentation can be defined as the identification of unique groups of customers who possess similar needs. Customer segmentation helps organisations to develop the products and establish the systems needed to fulfil the needs of the different customer groups (Fawcett *et al.,* 2007:42).

Effective market segmentation requires that organisations identify segments clearly and select specific targets (Bowersox *et al.,* 2010:49). Methods that aggregate customers into markets consider grouping customers in a specific geographic region with similar demand characteristics into a market (Shapiro, 2007:263). Therefore, organisations have to investigate their customers' needs and then segment the customers into groups with similar needs before finally targeting them with differentiated products (Canever *et al.,* 2007:512; Cohen and Roussel, 2005:28). The awareness of market segments is fundamental to effective SCM (Ayers, 2004:43).

Organisations must know who their customers are, how their customers can be reached and how competitive advantage can be reached with their customers (Mentzer, 2004:91). They must therefore understand the value that their customers seek (Christopher, 2005:57).

2.2.1.2 Identifying market segments to target

Once the market has been segmented into smaller homogeneous segments, organisations can target certain segments (Rudansky-Kloppers, 2008:269). An organisation's target market defines which customer groups are strategic in terms of how they deliver a product offering to meet their customers' needs. When deciding which market segments to target, organisations have to decide for which groups they can deliver the greatest differentiated benefits and highest value (Plantes & Finfrock, 2009:114). Customer segmentation can occur on the basis of sales territory or region, preferred sales channel, profitability, products purchased, sales history, demographic information, desired product features, and service preferences, to name a few (Wisner *et al.,* 2009:351). The purpose of identifying market segments is to identify similarities between groups of customers so that their needs can be satisfied efficiently (Hines, 2004:58). The fact that SCM is market-focused means that deliberate decisions can be made about where organisations compete. This includes the market segments they serve, as well as the products they offer. It makes some customers, market segments, and products more strategic than others because organisations can meet their needs better (Plantes & Finfrock, 2009:39).

Customers in different segments may have similar needs to other segments, but most of the time the differences will be greater than the similarities observed. Where similarities are observed, the supply chain structures and strategies may be similar and economies may be achieved by sharing costs across the target segments. Where differences are identified, there is less room to develop standard services across the target groups and supply chains costs may be higher, as a consequence (Hines, 2004:58). When organisations analyse the percentages of revenue they receive from individual customers or market segments, they realise that not all customers or market segments are equally profitable. Usually, a small percentage of customers represent the majority of an organisation's profits (Plantes & Finfrock, 2009:39). For this reason, the Pareto analysis (or 80:20 rule) applies to customer aggregation. If, for example, sales volume is used as criteria, it can be expected that eighty percent of an organisation's sales will be made to twenty percent of its customers (Shapiro, 2007:264) and that these customers have to be targeted.

2.2.1.3 The role of market segmentation in supply chain design

Market segmentation is a major way to match organisations' strategies to meet customers' needs (Canever *et al.,* 2007:512). Fully understanding segmentation thus is an important input to the designing of appropriate supply chain strategies (Saxton, 2006:59). For market segmentation to be effective in the design and development of supply chain strategy, it needs to be responsive and also needs to translate the segment requirements into practical supply chain initiatives (Canever *et al.,* 2007:512). Therefore, understanding the market and the value that customers seek is a critical aspect of developing an effective strategy (Tang & Gattorna, 2003:29; Christopher, 2005:57), which is the next phase in SCD. The effectiveness of market segment identification is therefore crucial in creating value for customers and competitive advantage for supply chain members (Canever *et al.,* 2007:514).

It follows that market segmentation requires organisations to make choices about their SCD (Ayers, 2004:44) and that supply chains should be designed with the differing needs of multiple segments in mind (Ayers, 2006:550). However, no matter how well organisations design their supply chains, it can't meet the needs of every kind of customer (Taylor, 2004:270). Organisations have to know which segments of the market they want to target (Saunders, 1997:58), because it is unlikely that an organisation can operate in every market (Bowersox *et al.,* 2010:49). Every organisation wants to target profitable customers (Fawcett *et al.,* 2007:44) and therefore one of the most important things organisations can do is make sure they are serving the right customers (Taylor, 2004:270). It is essential to be aware of the market segments that want or need an organisation's products. In fact, as has already become evident, fundamental to effective SCM is awareness of market segments needs (Tang & Gattorna, 2003:29). Different customer groups attach different degrees of importance to different benefits. The importance of such benefit segmentation lies in the fact that there often are substantial opportunities for creating differentiated appeals for specific segments (Christopher, 2005:9).

2.2.2 Demand uncertainty levels as key measure of end customer needs

End customer needs can be diverse and vary substantially along these above-mentioned attributes. A common determinant is necessary to determine the nature of end customer needs. This determinant is the level of demand uncertainty (Chopra & Meindl, 2010:41). It is evident that supply chains will most certainly need to be designed for and operated in uncertain environments (Simchi-Levi, Kaminsky & Simchi-Levi, 2008:5; Geary, Childerhouse & Towill, 2002:52). Many organisations ignore this fact and treat their markets as if they were predictable. These organisations will have to realise that it is difficult to match supply with demand (Simchi-Levi *et al.,* 2008:35). Due to uncertainty, demand typically exceeds or falls short of what is planned (Bowersox *et al.,* 2010:168). Uncertainty cannot be eliminated, but the effect thereof can be minimised by using the right approach (Simchi-Levi *et al.,* 2008:6).

Broadly defined, uncertainty is the absence of information to make decisions (Brindley & Ritchie, 2004:7). Demand uncertainty can be defined as the risk of significant and unpredictable fluctuations in downstream demand (Bozarth & Handfield, 2006:417; Koh & Tan, 2006:473). Thus it is the difference between the actual end-marketplace demand (or that section of the market the organisation feels they can capture) and the orders placed with an organisation by its customers (Geary *et al.,* 2002:55). It follows that demand uncertainty is compounded by a lack of marketplace transparency (Childerhouse & Towill, 2004:586) and demand uncertainty is linked to the predictability of the demand for the product (Lee, 2002:106).

Various factors influence demand uncertainty. It will increase when the range of products increases, because a wider range implies greater variances in demand. Similarly, demand uncertainty will also increase when lead times decrease, because there is less time in which to react to orders. When the variety of products required by customers increases, demand uncertainty will increase because the demand per product becomes more disaggregated. Demand uncertainty will also increase when the number of channels through which the product may be acquired increases (because the total customer demand is now disaggregated over more channels); or when the rate of innovation increases (because new products tend to have more uncertain demand). Another example of when demand uncertainty may increase is when the required service level increases, because the organisation now has to handle additional requirements concerning service attributes in demand (Chopra & Meindl, 2010:42).

To conclude, end customer needs may vary significantly along attributes as mentioned above, which results in different levels of demand uncertainty. The level of demand uncertainty therefore is a key determinant in determining the nature of end customer needs (Chopra & Meindl, 2010:41) and will vary depending on the nature of the product offering that has to satisfy end customer needs (Appelqvist, 2003:201).

2.2.3 Demand uncertainty according to the nature of the product

Customers' demands will be met through the supply chain product offerings. For this reason, organisations must understand the nature of their products and be able to devise a supply chain strategy that best fits their customers' demands (Fisher, 1997:1; Seuring, 2003:183) by also taking the associated demand uncertainties into account. If products are classified according to their demand patterns in terms of characteristics such as life cycle length, demand predictability, product variety and market standards for lead time and service (Selldin & Olhager, 2007:43), they fall into one of two clearly distinguishable categories, namely primarily functional or primarily innovative products. Each category requires a distinctly different kind of supply chain (Fisher, 1997:1, 2).

2.2.3.1 Functional products

Functional products satisfy the basic needs of customers. These needs do not change much over time, which, in turn, means that the demand for these products is stable and predictable (Fisher, 1997:2). Therefore, functional products have longer life cycles and lower demand variability (Lee, 2002:106; Seuring, 2003:183; Appelqvist, 2003:199). It is likely that functional products would be in mature or declining phases of the product life cycle model (Ayers, 2006:62). As the product matures, the basis for competitiveness shifts from the product to the supply chain as the product becomes more functional (Ayers, 2004:44, 45). In these phases of the product life cycle, there is more direct competition because the stability of demand of functional products makes it easier for competitors to enter and compete in the market. Competition is fierce (Ayers, 2006:61). This often results in low profit margins (Lee, 2002:106; Chopra & Meindl, 2010:42). These product life cycle characteristics are illustrated in Figure 2.3.

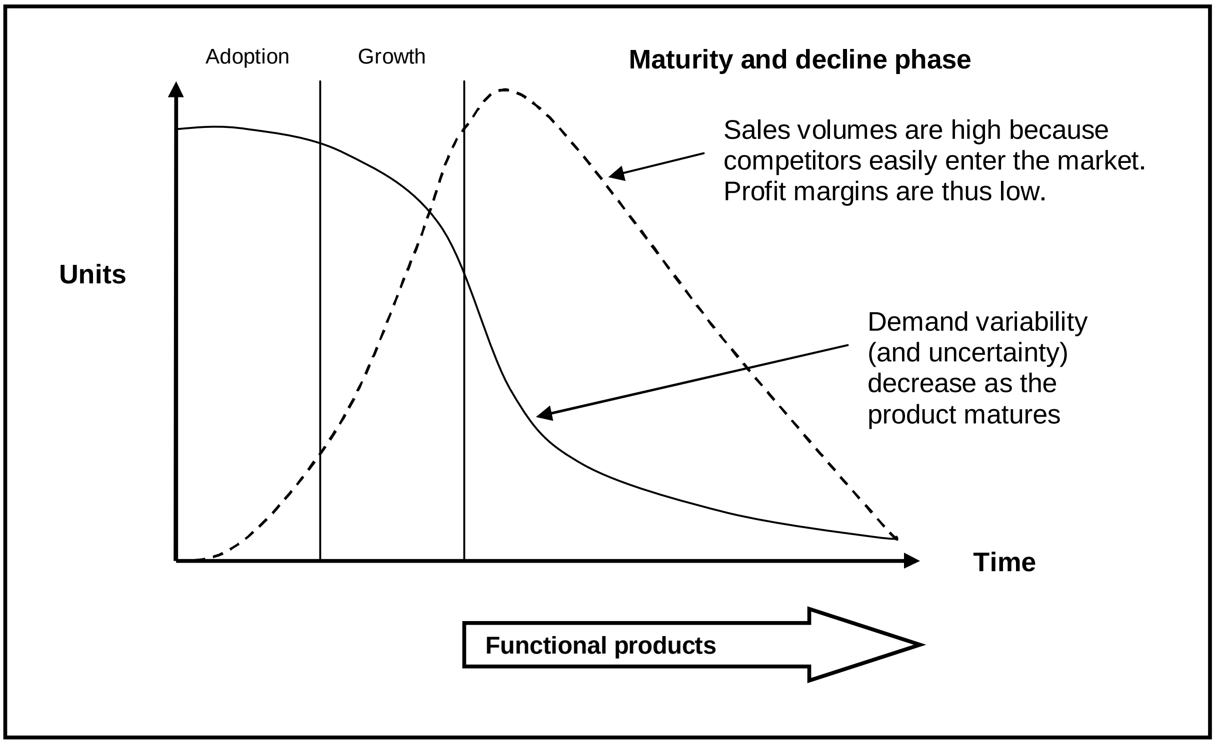

Figure 2.3: Product life cycle characteristics of functional products
Source: Adapted from Taylor (2004:268) and Ayers (2006:64).

Demand is constant and is easy to forecast (Ayers, 2006:61, 62). The predictable demand of functional products makes market mediation easy because a nearly perfect match between supply and demand can be achieved (Fisher, 1997:2, 3). Therefore, stock-out costs are low because higher volumes of a product are kept because of the predictable demand (Lee, 2002:106). Similarly, markdowns (and therefore obsolescence) will be less because of more accurate forecasts and the ability to match supply with demand (Chopra & Meindl, 2010:42; Hines, 2004:60) (refer to Figure 2.5).

Because of the predictable demand, organisations can use level scheduling and create a schedule for assembling finished goods well into the future. This means that organisations that provide functional products can focus on minimising the physical costs of these products. Physical costs typically include production costs, transportation costs, inventory storage costs, and so on. This is a crucial goal due to the price sensitivity of functional products. Organisations can optimise production efficiency whilst minimising costs. The flow of information occurs between all the supply chain members and, in turn, allows them all to coordinate their activities in order to meet predictable demand at the lowest cost (Fisher, 1997:2, 3).

Examples of functional products include the staples that customers buy at a wide range of retail outlets, such as grocery stores and fuel stations (Fisher, 1997:2, 3) as well as maintenance, repair and operating (MRO) items (Wisner *et al.,* 2009:106).

2.2.3.2 Innovative products

Customers also have a need for innovative products. Supply chains will introduce new innovations to try and gain competitive advantage by means of differentiation (Ayers, 2004:44, 45). Innovative products are new or modified products that organisations create to achieve higher margins (Raturi & Evans, 2005:208). Innovative products are the hardest to manage (Taylor, 2004:267). They are characterised by high levels of change in demand over short times and thus have a volatile demand (Lee, 2002:106; Seuring, 2003:183).

They are therefore also characterised by short life cycles and have high profit margins (Lee, 2002:106; Seuring, 2003:183). The life cycles usually just range over a few months, because competition learns and erodes the competitive advantage by introducing similar, yet newer innovative competing product offerings later in the product life cycle (Fisher, 1997:2; Lee, 2002:106). Products therefore will tend to be innovative during the introduction and growth phases of a product’s life cycle (Ayers, 2006:64). Product life cycle characteristics of innovative products are illustrated in Figures 2.4.

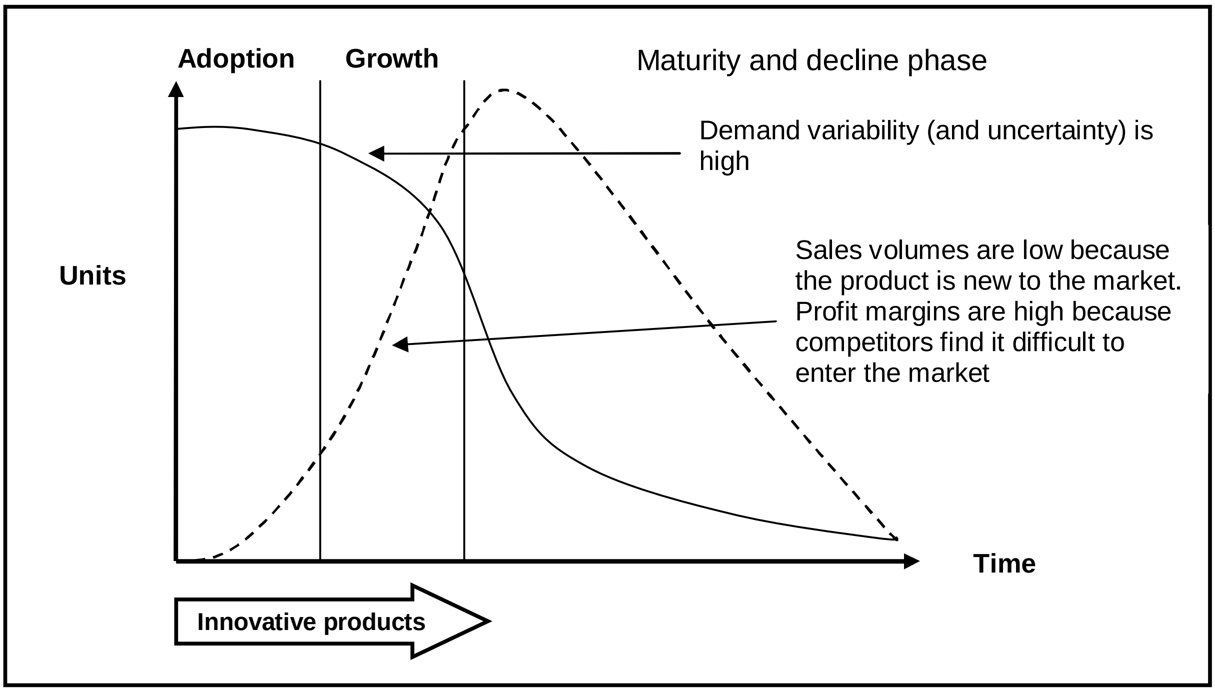

Figure 2.4: Product life cycle characteristics of innovative products
Source: Adapted from Taylor (2004:268) and Ayers (2006:64).

Due to the brief life cycles of innovative products, organisations have to establish market share with early sales (Fisher, 1997:3) and although innovation can enable an organisation to achieve higher profit margins, the very newness of innovative products makes demand for them unpredictable and thus difficult to forecast. This, in turn, increases demand uncertainty (Taylor, 2004:207), which, in turn, increases the risk of shortages or excess supplies (Fisher, 1997:3). Hence the high levels of uncertainty for innovative products as illustrated in Figure 2.4.

Increased demand uncertainty leads to increased difficulty in matching supply with demand (Chopra & Meindl, 2010:42). The forecast error is therefore higher. For a given product, this dynamic can lead to either a stock-out (when demand exceeds the forecast) or an oversupply situation, which may result in markdowns (and even obsolescence) (Chopra & Meindl, 2010:42; Hines, 2004:60). The difficulty in forecasting innovative products lies in predicting how soon a product will enter its growth phase, how quickly sales will take off and to what level sales will eventually rise (Taylor, 2004:207). Forecasting characteristics are illustrated in Figure 2.5.

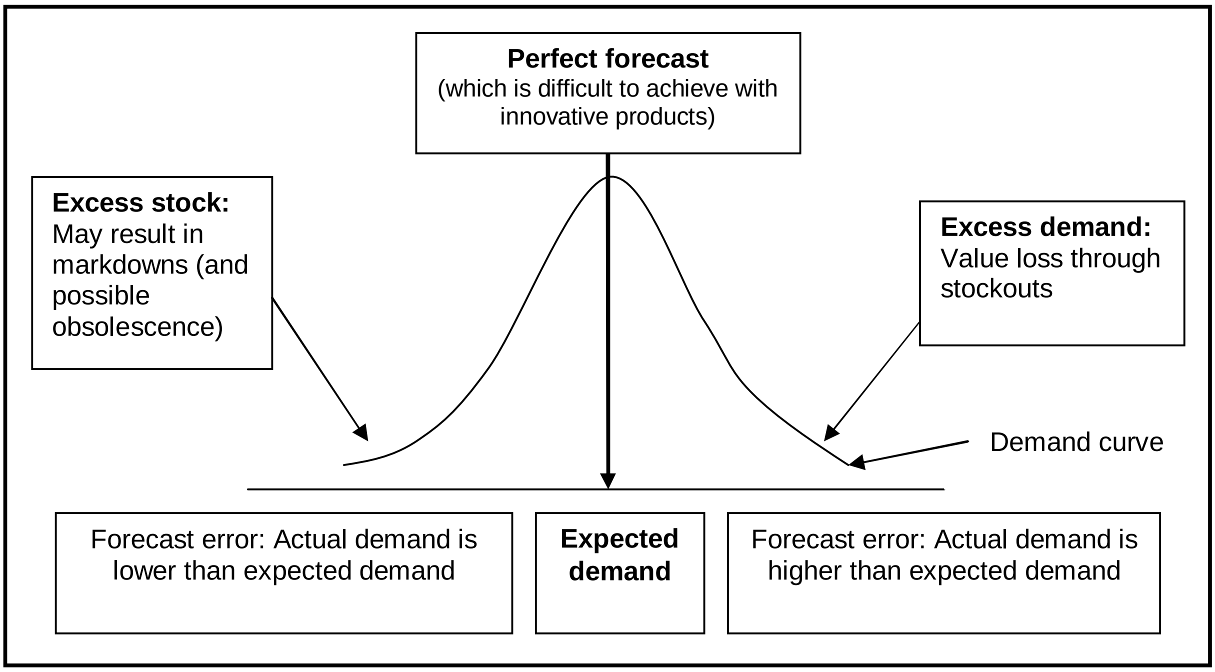

Figure 2.5: The effect of forecast errors on markdowns and stockouts
Source: Adapted from Hines (2004:60).

Figure 2.5 illustrates that the organisation will have excess stock when the market demand is lower than the forecasted demand, which may result in markdowns (and possible obsolescence). On the other hand, if market demand is higher than the forecasted demand, the organisation will have an excess demand, which means that the organisation does not have enough stock. Value may be lost because of stockouts.

With innovative products, the flow of information starts with the customer. The critical decisions to be made about inventory and capacity are not about minimising costs, but about where in the chain to position inventory and available production capacity in order to hedge against uncertain demand. Suppliers should be selected for their speed and flexibility and not for their low cost (Fisher, 1997:3; Lee, 2002:106). Therefore innovative products require a different supply chain (Seuring, 2003:183), which will be discussed in Chapter 3. Examples of innovative products are new fashion products (Hines, 2004:60), technologies (Raturi and Evans, 2005:208) and automobiles with novel features (Ayers, 2006:62).

To conclude, by now it is evident that functional products have a predictable demand with low levels of uncertainty. Innovative products have a more unpredictable demand with higher levels of uncertainty. Demand uncertainty as a key determinant of end customer needs according to the nature of the product, albeit functional or innovative, can therefore be illustrated on a continuum (or spectrum). This is illustrated in Figure 2.6.

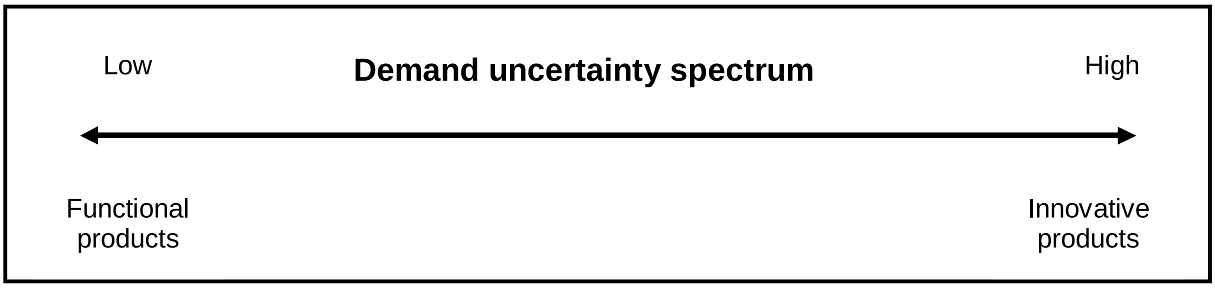

Figure 2.6: Demand uncertainty and the nature of the product
Source: Adapted from Hines (2004:60).

In determining the nature of the needs of the supply chain's end customers, organisations must therefore determine whether the nature of the products that will satisfy these needs are functional or innovative (Fisher, 1997:4). From the foregoing discussion, several basic differences between innovative and functional products can be identified. These differences are summarised in Table 2.1.

From this discussion, it can be concluded that functional and innovative products require fundamentally different supply chains (Ayers, 2006:62). A supply chain cannot respond to all customer demands in the same manner. Trade-offs have to be made to design the supply chain appropriately (Seuring, 2003:184).

Table 2.1: Basic differences between innovative and functional products

	Functional products	**Innovative products**
Demand	Stable, predictable	Variable, difficult to forecast
Length of product life cycle	Long	Short
Profitability	Low	High
Forecast error	Low	High
Stock-out rates	Low	High
Markdown	Low	Potentially high
Obsolescence	Low	High
Lead time	Long	Short
Product variety	Low	High
End result: Demand uncertainty	***Low***	***High***

Source: Adapted from Fisher (1997:1, 2); Ayers (2006:63) and Jacobs *et al.* (2009:363).

2.3 DETERMINING HOW TO MEET THE NEEDS OF END CUSTOMERS

Once organisations understand their end customer demands and the nature of their markets and products, they have to also meet demand by focusing on the supply side of the supply chain and focus on their role in these supply chains (Hugos, 2006:34; Wisner *et al.,* 2009:480). They have to determine how they can meet these needs. They can define a value proposition based on what their customers value; build core competencies to achieve this; and identify market winners (Christopher, 2004:32). This is illustrated in Figure 2.7. What must be understood, is that it is necessary for organisations to understand their capabilities and how they can contribute towards meeting the needs of their end customers (Hugos, 2006:34; Wisner *et al.,* 2009:480).

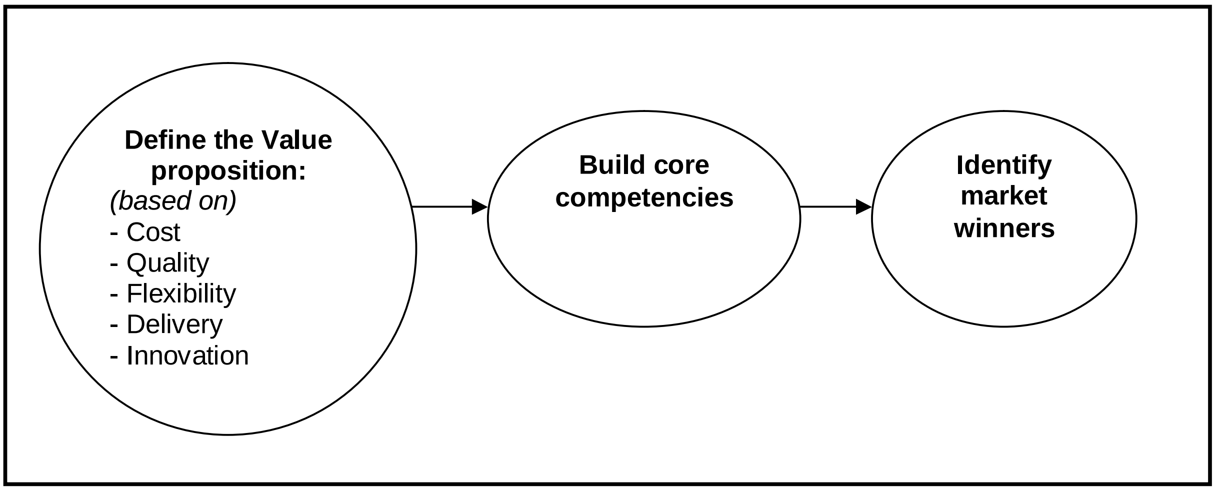

Figure 2.7: Creating value to meet end customer's needs
Source: Adapted from Fawcett *et al.,* (2007:81).

2.3.1 Explaining customer value

The final decision to purchase a product is based on value (Plantes & Finfrock, 2009:17). Value is that which gives a product worth in the eyes of the customer (Dolcemascolo, 2006:32). Value can be a very elusive concept and can vary from one organisation to the next. As already mentioned, supply chains are customer (or demand) driven. Products do not have value until they are in the hands of the customer (Christopher, 2005:37). Therefore, customer value needs to be considered from the customer's point of view.

With customers placing demands on suppliers for more value-added benefits, it is becoming increasingly important to be able to measure the value of these attributes in terms that are meaningful to the customer. Value can be described as what customers are willing to pay for the benefits they receive from the product (Lysons & Farrington, 2006:92; Christopher, 2005:8). Customer satisfaction is achieved when a customer's experience concerning something, for example buying a product, meets or exceeds the customer's expectation about that product. When expectations are exceeded, the experience is favourable and the customer may become a repeat customer. Dissatisfaction is the result when the expectation exceeds the experience (Fawcett *et al.,* 2007:36; Zhang, Vonderembse & Lim, 2006:392). This is illustrated in Figure 2.8.

The key to satisfying customers is to understand their needs so that unique products and services can be developed to meet those needs (Fawcett *et al.,* 2007:36, 37). Greater customer satisfaction (and even competitive advantage, which is discussed in Chapter 3) can be achieved by creating value for customers that is superior to that created by competition. This may even influence customers to behave in ways that improve the performance of the supply chain as a whole (Mentzer, 2004:15).

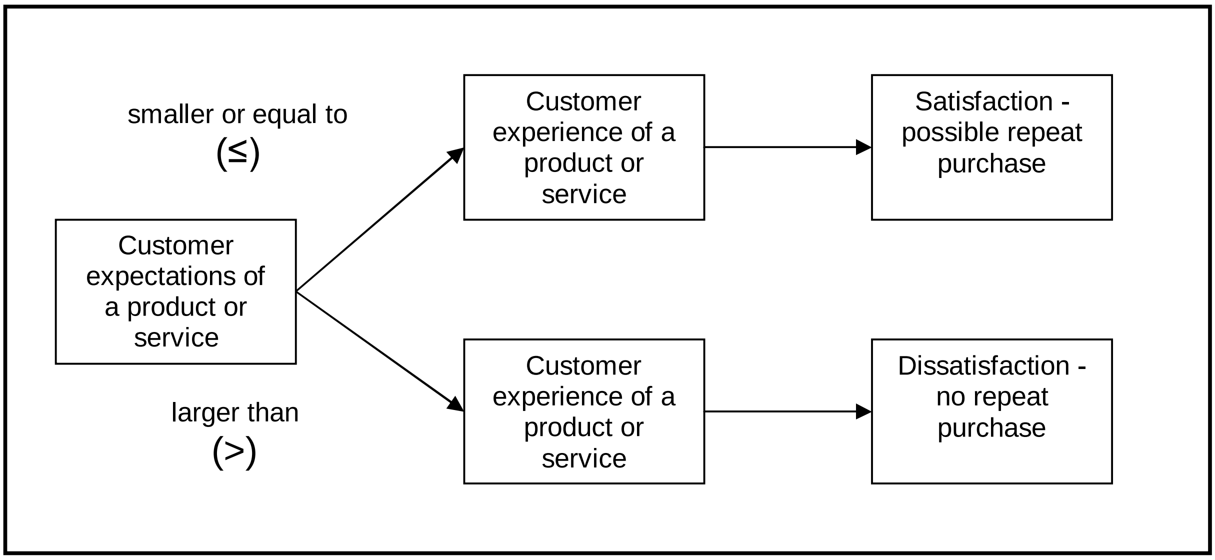

Figure 2.8: Customer satisfaction and dissatisfaction in fulfilling needs
Source: Adapted from Fawcett *et al.* (2007:36).

Customer value can thus be defined simply as the difference between the perceived benefits that flow from a purchase or relationship and the total costs incurred (Christopher, 2005:46). It can be expressed in the following equation (Plantes &

Finfrock, 2009:18):

Value = Customer's perception of benefits of a product – total costs that the customer incurs to acquire those benefits.

According to Handfield *et al.,* (2009:443), value is the relationship between the function of a product and its cost. The function of a product includes the benefits expected or received from the product and can also be seen as the performance of the product (Hugo *et al.,* 2004:12). Stated differently, customer value can be expressed as a ratio. The ratio is (Christopher, 2004:28):

Customer value = [Perception of benefits / Total cost of ownership]

Value is expressed differently in the two equations. In the first equation, value is expressed as the difference between two variables and in the second equation it is expressed as a ratio between the same variables. The variables are perceived benefits and total costs to acquire the benefits. In the first equation, the difference has to be greater than zero to indicate that value has been created, while the ratio has to be greater than one to indicate that value has been created. The elements of customer value are illustrated in Figure 2.9.

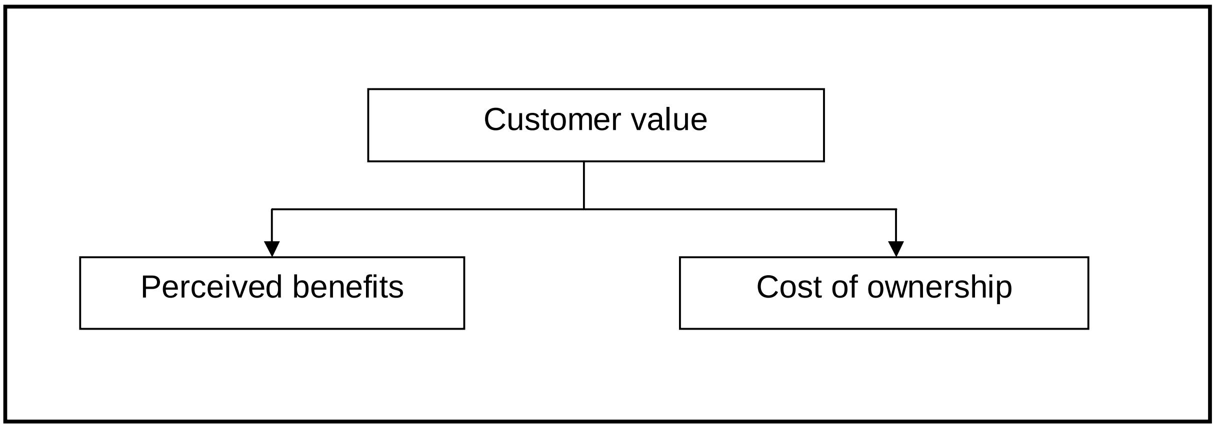

Figure 2.9: Elements of customer value
Source: Adapted from Christopher (2004:29).

The perceived benefits include aspects such as quality, speed and flexibility (Hugo *et al.,* 2004:12), while total cost of ownership is used instead of price because in most transactions costs other than price will also be involved (Christopher, 2004:28). Total cost of ownership thus includes all the costs of acquisition, ownership and use of a product (Hugo *et al.,* 2004:12). When looking at these calculations of customer value, organisations have opportunities to create value that could be classified into one of five basic areas of customer value. These areas are *quality, cost, innovation, flexibility and delivery* (Swink, Melnyk, Cooper & Hartley, 2011:31-33; Fawcett *et al.,* 2007:32; Zhang *et al.,* 2006:393).

Value must thus be created for the end customer in one or more of these areas. *Quality* is determined by how well the products meet the customer's expectations (Hugo *et al.,* 2004:12; Fawcett *et al.,* 2007:32). Organisations are constantly facing pressures to reduce *costs*, because customers always value low prices. To make this possible, the entire supply chain from raw materials to the end customer must be designed for efficiency (Fawcett *et al.,* 2007:33). *Innovation* helps create new markets and changes industry standards (Fawcett *et al.,* 2007:35). *Flexibility* indicates how easily products may be adapted or changed to meet changing customer demands (Hugo *et al.,* 2004:12; Bozarth & Handfield, 2006:29). A flexible organisation operates with short lead times, is responsive to special customer requests and can adjust rapidly to unexpected events (Fawcett *et al.,* 2007:33). *Responsiveness* is the ability of a supplier to respond to the needs of the customer quickly and concisely lets the customer know that their time and costs are important (Ross, 1998:268). Here competence is the supplier's ability to support customers with the required skills and knowledge when a product issue arises, while credibility includes aspects such as honesty and trustworthiness (Ross, 1998:268). *Time* refers to the time needed to deliver the products to the customer (Hugo *et al.,* 2004:12). Time has two basic characteristics, namely speed and reliability. *Delivery speed* generally refers to how quickly a need can be fulfilled by the supply chain once the need has been identified. *Reliability* refers to the ability to live up to a commitment to a specific level of service (Ross, 1998:268). Due to uncertainty, organisations, for example, carry safety stock to enable them to be reliable (Christopher, 2005:38). *Delivery reliability* refers to the ability to deliver products or services when promised. An organisation can have long lead times and still be reliable. Typical measures of delivery reliability include the percentage of orders that are delivered on time. Delivery reliability is especially important to supply chain members that are linked together in a supply chain (Bozarth

& Handfield, 2006:28, 29). Fast, reliable delivery requires the reduction of order cycle time and the elimination of variability (Fawcett *et al.,* 2007:34). The key word in ever-shorter time frames is agility. Agility implies the ability to move quickly and to meet customer demand sooner (Christopher, 2005:38).

From this discussion it is clear that customer value has several tangible and intangible elements. Tangible elements include such measurements as product characteristics, and quality, level and value of services, flexibility, availability of technology, ease of ordering, timeliness, accuracy, and completeness of delivery. Intangible elements relate to how the customer feels about doing business with the supplier and includes ease of conducting transactions, friendliness, and responsive attitude, together with a feeling of dealing with a supplier who is looking out for the customer's well-being (Ross, 1998:266). Customer value is therefore derived from the entire relationship with the supplying organisation. Providing customer service through SCM is therefore just one of the elements contributing to customer value (Hugo *et al.,* 2004:118, 119).

2.3.2 Defining the value proposition

As already mentioned, a value proposition is the value an organisation promises to deliver to customers (Fawcett *et al.,* 2007:81). A value proposition comprises the programme of products, services, ideas and solutions that an organisation offers its customers (Hutt & Speh, 2004:7) and is the reason why customers will choose one organisation over other alternatives (Plantes & Finfrock, 2009:5). To match promised value to customer desires, supply chain managers should therefore know what their customers are looking for, as well as how the organisation's products meet those desires (Fawcett *et al.,* 2007:38). The value proposition should thus be defined in terms of benefits that the target market will value or costs and risk reductions it will value (Plantes & Finfrock, 2009:106). The value proposition is quite simply a statement of how, where and when value is to be created for specific customers or market segments. This should guide all the activities of the organisation (Christopher, 2004:32).

Therefore, an analysis of the value proposition considers how an organisation competes and is an essential element of corporate strategy. Organisations must know what attracts customers to them. They must know what advantage they have to offer their customers above competition (Fawcett *et al.,* 2007:250). The value proposition must, however, be defined from the customer's view point (Christopher, 2004:32; Plantes & Finfrock, 2009:73). Some generic value propositions include being a cost leader (or being the low cost provider) or being an innovator (Fawcett *et al.,* 2007:250).

2.3.3 Building core competencies

Value is created when core competencies are built (Fawcett *et al.,* 2007:81). To develop a value proposition, organisations must know what their core competencies are (Reid & Sanders, 2007:33). Core competencies are defined as a set of skills, systems, technologies and capabilities that enable an organisation to provide a particular benefit to customers (Hines, 2004:49; Hutt & Speh, 2004:176; Handfield & Nichols, 2002:123). Core competencies create a value proposition which, in turn, is the value an organisation promises to deliver to its end customers (Fawcett *et al.,* 2007:81). They are usually described in terms of one of the areas of customer value (refer to previous section). Therefore core competencies are described in terms of *quality, cost, innovation, flexibility and delivery.* Core competencies will come from the following areas: processes, planning systems, technology, people and culture and supply chain relationships (Swink *et al*., 2011:36). Other examples are provided in Table 2.2. Core competencies are not an attribute of a material, or an asset or an individual or even a market requirement (Plantes & Finfrock, 2009:67).

Table 2.2: Examples of organisational core competencies

Workforce	Highly trained Responsive in meeting customer needs Flexible in performing a variety of tasks Strong technical capability Creative in product design
Facilities	Flexible in producing a variety of products Technologically advanced An efficient distribution system
Market understanding	Skilled in understanding customer wants and predicting market trends
Financial know-how	Skilled in attracting and raising capital
Technology	Use of latest production technology Use of information technology Quality control techniques

Source: Adapted from Reid and Sanders (2007:33).

Core competencies are internal organisational strengths or capabilities (Bozarth & Handfield, 2006:24; Cohen & Roussel, 2005:119). It is something the organisation is so good at, that it provides the organisation a competitive advantage (Fawcett *et al.,* 2007:81; Saunders, 1997:103; Plantes & Finfrock, 2009:66). Core competencies are essential for achieving strategic objectives (Cohen & Roussel, 2005:119). For this reason, they are rare and hard for competitors to follow (Fawcett *et al.,* 2007:81). It distinguishes an organisation from other organisations (Handfield & Nichols, 2002:123). To fulfil their roles in supply chains effectively, organisations have to determine what their core competencies are (Hugos, 2006:34) and compete in markets where their core competencies will have value (Reid & Sanders, 2007:33). Organisations can determine their core competencies by reviewing their basis for competition and asking whether the process elements (or activities) that support it are critical to gaining competitive advantage, business growth, customer service or superior offerings (Cohen & Roussel, 2005:120, 121). A core competency satisfies three criteria. These criteria are that the core competency (Plantes & Finfrock, 2009:66; Hines, 2004:50; Handfield & Nichols, 2002:122):

(1) must make a disproportionate contribution to customers' perceived value,
(2) must be competitively unique, that is, not unique to the organisation as such but in some differentiate the organisation's offering in a unique way, and
(3) must be extendible, meaning that the competence may be applied to new product areas or to new product developments and not just to existing product groups or existing markets.

It can be concluded that an organisation must focus on its core competencies (Hines, 2004:49) because core competencies (or capabilities) differentiate an organisation or supply chain from its competitors, thereby leading to a competitive advantage (Hines, 2004:51). Core competencies will therefore enhance customer value or reduce cost. It would seem that a core competency must either give a cost advantage or differentiate the organisation from its competitors (Hines, 2004:50). By that, these competencies help organisations to decide on a competitive strategy (Plantes & Finfrock, 2009:67). This is discussed later under the topic of competitive advantage. Successful organisations develop a business strategy that takes advantage of their core competencies or strengths (Reid & Sanders, 2007:33). Organisations must be aware that they can serve multiple markets and participate in multiple supply chains. If this is the case, the organisation will need to look for ways to leverage its core competencies (Hugos, 2006:34). To repeat: to identify core competencies, organisations must know what makes them uniquely good and what they do better than other organisations (Fawcett *et al.,* 2007:44).

2.3.4 Using the value proposition to identify market winners

The concepts of market winners (and market qualifiers) were derived from order winners and order qualifiers. Market winners differentiate an organisation's products and services from those of its competitors (Bozarth & Handfield, 2006:31). Market winners are means to win the orders of customers. Once market winners are understood, appropriate supply chain solutions can be designed and implemented (Quesada, Rachamadugu, Gonzalez & Martinez, 2008:297). These solutions are encompassed in phases two and three of SCD and will be dealt with in later chapters. It is to identify those key determinants that drive the choice of products (Christopher, 2004:32). Market qualifiers are those elements from which customers expect a minimum level of performance (Bozarth & Handfield, 2006:31).

The supply chain must excel at market winners metrics and be highly competitive at market qualifier metrics (Mason-Jones *et al.,* 2000:4063). Sometimes market winners can be product performance or price. In other scenarios, availability may be a market winner (Christopher, 2004:32). Mason-Jones *et al.* (2000:4064) distinguish between different market winners and market qualifiers for functional and innovative products. The authors state that service levels generally are market winners for innovative products and price is a market winner for functional products. This is illustrated in Figure 2.10. Understanding the nature of these success factors is an important prerequisite for successful SCD because the SCD must be aligned with an organisation's market winners (Christopher, 2004:32).

	Market qualifiers	Market winners
Innovative products	Quality Price Lead time	Service level
Functional products	Quality Lead time Service level	Price

Figure 2.10: Market winners and qualifiers for functional and innovative products

Source: Adapted from Mason-Jones *et al.* (2000:4064).

Determining how to meet the needs of end customers as the second part of phase one of SCD can be summarised as follows: Organisations will meet these needs with a value proposition based on core competencies and identified market winners. An organisation's supply chain networks will therefore have to include certain characteristics depending on the nature of the products they intend providing to their customers. These characteristics are illustrated in Table 2.3.

Table 2.3: Characteristics of supply chain networks to meet end customer demands

Supply chain network of innovative products	Supply chain network of functional products
- Speed and flexibility - Innovation - Quality supremacy	- Cost reduction - Quality sustainability

Source: Adapted from Lyons, Coleman, Kehoe and Coronado (2004:659).

Earlier in this chapter, a lot of emphasis was placed on demand uncertainty. However, supply uncertainties that will affect the supply chain also most certainly exist (Jacobs *et al*., 2009:363). Supply chain strategies therefore have to take supply and demand uncertainties that exist in the organisation's supply chain into consideration (Croxton, Lambert, García-Dastugue & Rogers, 2006:66).

2.3.5 Supply uncertainties in delivering the value proposition

As organisations focus on their capabilities, it becomes clear that uncertainties inherent to the supply side are important drivers for the right supply chain strategy (Jacobs *et al*., 2009:363, 364; Lee, 2002:106). Supply uncertainty can be defined as unpredictable events that occur in the upstream supply chain (Koh & Tan, 2006:473). Various supply source capabilities will affect supply uncertainty differently. The impact of supply source capabilities on supply uncertainty are illustrated in Table 2.4.

Table 2.4: Impact of supply source capability on supply uncertainty

Supply source capability	Supply uncertainty
Frequent breakdowns	Increase
Unpredictable and low yields	Increase
Poor quality	Increase
Limited supply capacity	Increase
Inflexible supply capacity	Increase
Evolving production process	Increase

Source: Adapted from Lee (2002:107) and cited from Chopra and Meindl (2010:43).

Therefore, when analysing supply uncertainty, a distinction can be made between a stable supply process (capability) and an evolving supply process (capability) (Jacobs *et al*., 2009:363, 364).

2.3.5.1 Stable supply process capability

A stable supply process is one where the manufacturing process and the underlying technology are mature and the supply base is well established. Products are in the maturity phase of their product life cycle and have less supply uncertainty. In a stable supply process, manufacturing complexity tends to be low and manageable. Stable manufacturing processes tend to be highly automated, and long-term supply contracts are prevalent. Supply uncertainty is thus lower with stable supply processes (Lee, 2002:107; Jacobs *et al*., 2009:363, 364; Chopra & Meindl, 2010:43).

2.3.5.2 Evolving supply process capability

In contrast, an evolving supply process occurs when the manufacturing process and the underlying technology are still under early development and are rapidly changing. New products being introduced to the market have higher supply uncertainty because design and production processes are still evolving. As a result, the supply base may be limited in both size and experience. In an evolving supply process, the manufacturing process requires a lot of fine tuning and is often subject to breakdowns and uncertain yields. The supply base may not be reliable, as the suppliers themselves are going through process innovations. Supply uncertainty is thus higher with evolving supply processes (Lee, 2002:107; Jacobs *et al*., 2009:363, 364; Chopra & Meindl, 2010:43).

Upon revisiting Table 2.4, some differences between stable and evolving supply processes can be identified. Table 2.5 summarises these differences.

Table 2.5: Supply uncertainty characteristics

Stable supply process	Evolving supply process
Fewer breakdowns	Vulnerable to breakdowns
Stable and higher yields	Variable and lower yields
Fewer quality problems	Potential quality problems
More supply sources	Limited supply sources
Reliable suppliers	Unreliable suppliers
Fewer process changes	More process changes
Fewer capacity constraints	Potential capacity constraints
Easier to change over	Difficult to change over
Flexible	Inflexible
Dependable lead times	Variable lead times

Source: Adapted from Lee (2002:107) and Jacobs *et al*. (2009:363).

From Table 2.5 and the preceding discussion, it is clear that, when a supply process stabilises, organisations are able to follow a fixed delivery schedule resulting in low supply uncertainty (Chopra & Meindl, 2010:42, 43).

Supply uncertainty is also strongly affected by product life cycle (PLC) characteristics. Products in the early stages of their PLC have higher supply uncertainties because design and production processes are still evolving. Mature products have less supply uncertainty (Chopra & Meindl, 2010:42). Free exchange of information, starting with the product development stage and continuing with the mature and end-of-life phases of the product life cycle, has been found to be highly effective in reducing the risks of supply failures (Lee, 2002:110).

2.3.6 Demand and supply uncertainty spectrum

An uncertainty spectrum can be created once end customer needs have been identified by means of the level of demand uncertainty (refer to paragraph 2.2.2 and 2.2.3) and once supply uncertainties surrounding the supply chain's capabilities to present the promised value proposition have been determined (refer to paragraph 2.3.5). The uncertainty spectrum combines demand and supply uncertainty characteristics and is illustrated in Figure 2.11.

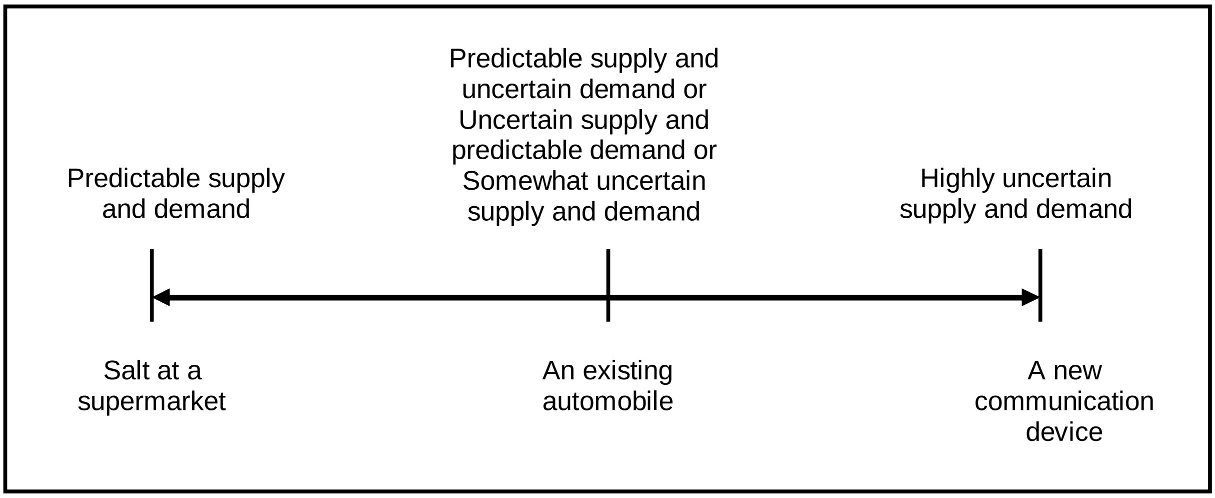

Figure 2.11: The uncertainty spectrum
Source: Adapted from Chopra and Meindl (2010:43).

Understanding both supply uncertainty and demand uncertainty is important for two reasons. Firstly, two different products may both be innovative products, yet have different supply uncertainty. For example, high technology electronics gear and fashion apparel could both be examples of innovative products. However, fashion apparel may come from relatively stable suppliers, which reduces supply uncertainty, while the electronic components for the high technology products could be short in supply, which, in turn, increases supply uncertainty (Ayers, 2006:62, 63).

Secondly, functional and innovative products may both have low supply uncertainties. Examples of this may include canned soup (functional product) and fashion goods (innovative products). Both these product types fall into the low supply uncertainty category. For the fashion goods, there is low uncertainty around supplying the products. The concern is whether customers will buy the products, which means that demand uncertainty is high (Appelqvist, 2003:201).

2.4 CONCLUSION

SCD involves three phases. This chapter covered the first phase of SCD, which entails understanding the needs of the supply chain's end customers. To achieve this, organisations must know who their end customers are and what their needs are. Organisations use market segmentation to target their end customers and must also be aware of the nature of their end customers' needs or demands. When looking at customers' demand patterns, their needs can be categorised as a demand for functional or innovative products. The characteristics of each type were discussed in this chapter. There are also many uncertainties that can be associated with demand. Chapter two looked at how organisations can understand the needs of their end customers by using aspects such as demand uncertainty and product life cycle characteristics to determine whether their end customers' demands are for functional or innovative products.

The second step of the first phase of SCD is to determine a value proposition to meet these needs. Organisations must know what their end customers value to be able to determine a value proposition to meet their end customer's needs. Organisations can then identify and build on their core competencies on the basis of market winners to be able to deliver their value proposition to their end customers and, in so doing, try to gain some sort of competitive advantage over other organisations and supply chains, by means of a low cost or differentiation strategy.

Once organisations understand the needs of their end customers and have determined a value proposition that is necessary to meet these needs, a supply chain strategy can be selected as phase two of SCD. It can be derived intuitively that, for functional products, a supply chain strategy will be selected that aims to gain a competitive advantage by means of minimising costs. For innovative products, a supply chain strategy will be selected that aims to optimise value. This will become clear in Chapter 3, because selecting a supply chain strategy is the topic of Chapter 3.

CHAPTER 3
SELECTING SUPPLY CHAIN STRATEGIES

3.1 INTRODUCTION

In Chapter 2, the first phase of SCD was discussed. The first phase of SCD entails understanding the needs of the supply chain's end customers and determining how to meet these needs. Once organisations understand their end customers' demand and have determined how to meet these needs, they can start thinking about selecting a supply chain strategy. In Chapter 3 the second phase of SCD is discussed. This involves selecting a supply chain strategy. This is illustrated in Figure 3.1.

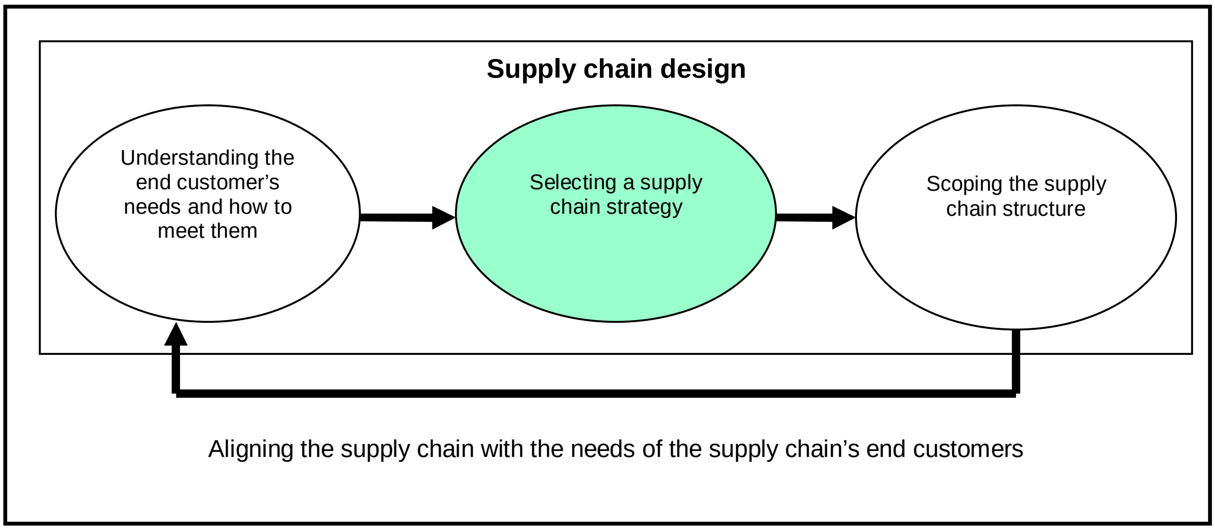

Figure 3.1: The three phases of supply chain design
Source: Compiled from Taylor (2004:259, 279, 284), Fawcett *et al.* (2007:20) and Christopher (2005:57).

Currently, the emphasis is on competition between supply chains and not between organisations. It is essential to reach the end customer with the right product at the right time with the right price. Therefore, customer satisfaction and understanding the needs of the end customers are crucial towards selecting a supply chain strategy. Developing a supply chain strategy to meet the end customer's needs can only be attempted when the markets are understood (Towill & Christopher, 2002:299; Mason-Jones *et al.*, 2000:4061).

In Chapter 2 it was determined that the nature of the product that end customers want is a good indication of what their needs entail. It was also concluded that there essentially were two types of products. A distinction was made between functional and innovative products. Chapter 2 concluded that organisations need to meet the needs of end customers with a value proposition based on developed core competencies and identified market winners. Chapter 3 looks at supply chain strategies. The chapter starts by looking at how organisations can gain a competitive advantage based on their core competencies by either minimising costs or optimising value. This also forms the backbone when selecting a supply chain strategy, because organisations must now select a supply chain strategy on the basis of their product offerings and the way they intend to gain a competitive advantage. In this chapter, three broad supply chain strategies are discussed.

3.2 EXPLAINING SUPPLY CHAIN STRATEGIES

A supply chain strategy can be defined as a strategy required for managing the integration of all the supply chain activities through improved supply chain relationships to achieve a competitive advantage for the supply chain (Hines, 2004:5). Effective supply chain strategies provide organisations with radically new opportunities to create competitive advantage (Ross, 1998:334). Such strategies have to be defined to achieve the elusive goal of obtaining a sustainable competitive advantage by either optimising customer value or minimising cost (Hines, 2004:5; Wilding, 2002:12). Organisations thus want to select supply chain strategies that can achieve high levels of effectiveness by creating value and efficiency by minimising cost (Hines, 2004:105). Appropriate supply chain strategies are based on market characteristics and seek to achieve simultaneous higher levels of customer responsiveness at a lower total cost (Towill & Christopher, 2002:301).

A supply chain strategy determines the nature of procurement of raw materials; transportation of materials to and from the organisation; manufacture of the product or operation to provide the service; and distribution of the product to the end customer, along with any follow-up service and a specification of whether these processes will be performed in-house or outsourced. Given that organisations are rarely completely vertically integrated, it is important to recognise that the supply chain strategy defines not only what processes within the organisation should do well, but also what the role played by each supply chain member is (Chopra & Meindl, 2010:38). These processes and the role to be played by each supply chain member are discussed in Chapters 4 and 5 as part of the scoping of the supply chain structure. Supply chain strategies have to be revised constantly because competing supply chains learn of competitive advantages and, in their turn, try to improve on them (Wilding, 2002:12).

3.3 GENERIC STRATEGIES FOR GAINING COMPETITIVE ADVANTAGE

Supply chains must be designed for strategic advantage (Ayers, 2004:42). Competitive advantage is a special edge that enables an organisation to deal better with market and environmental forces than its competitors do (Lysons & Farrington, 2006:9). Since the previous millennium already, organisations have become increasingly interested in exploring the opportunities for competitive advantage that can be gained by leveraging the core competencies and innovative capabilities to be found among supply chain partners (Ross, 1998:ix). As noted, the flow of information, products and finances forms the backbone of SCM. The link between these flows is essential and competitive advantage can be obtained through the way in which organisations manage the flows in their supply chains (Mentzer, 2004:22). Basically, organisations can choose between one of three main generic competitive strategies to gain a competitive advantage. They are *low cost*, *differentiation* or *focus* strategies. A focused strategy may also employ cost or differentiation as its main strategy (Porter, 1985:11; Hines, 2004:121; Lysons & Farrington, 2006:42).

3.3.1 Low cost

Organisations can have a competitive advantage due to cost advantages (Christopher, 2005:14). A strategy based on low cost essentially stresses offering a product in the market at a price or cost lower than that of competitors (Porter, 1985:12; Coyle *et al.*, 2003:575, 576). Keeping the cost of products low allows organisations to offer their customers better value for money through competitive pricing. Focus on costs will be particularly important when organisations are in competition with low-price competitors (Hines, 2004:38). This, however, is easier said than done because there will typically be one competitor who will be the low-cost producer and often that competitor will have the greatest sales volume in the sector in many industries (Christopher, 2005:7). The main focus of this strategy is to continually work at reducing the cost price of the end product (Van Weele, 2010:185). Organisations that have this competitive advantage are known as cost leaders. Cost leadership strategies have traditionally been based upon the economies of scale gained through sales volume. If volume is to be the basis for cost leadership, then it is preferable for that volume to be gained early in the market life cycle (Christopher, 2005:10). There can be no doubt about the close linkage between relative market share and relative costs. Real costs per unit would decline at a given rate as volume increases (Christopher, 2005:7).

This strategy often requires a large capital investment in automated state-of-the art equipment and significant efforts in the areas of controlling and reducing costs, for example, by standardising services and aiming marketing efforts at low-cost consumers (Wisner *et al.*, 2009:406). Organisations will put considerable effort into controlling, for example, production costs; increasing their capacity utilisation; controlling materials supply or product distribution; and minimising other costs, such as maintaining low levels of inventories, advertising and research and development (Prajogo, 2007:70; Rushton, Croucher & Baker, 2006:28). Price and costs are thus central in the negotiation process (Van Weele, 2010:185, 186). Striving to achieve a competitive advantage by means of a low cost strategy is effective when (Lysons & Farrington, 2006:42; Van Weele, 2010:185):

- the market comprises many price-sensitive buyers;
- a large market share can be obtained. This makes it possible to manufacture in large volumes, on streamlined production lines, with specialised production equipment;
- there are few ways to achieve product differentiation; and
- buyers are indifferent regarding brands.

Some potential threats to this strategy are that (Lysons & Farrington, 2006:42):

- competitors may imitate this strategy, thus driving profits down;
- competitors may discover technological breakthroughs; and
- buyer preferences may be influenced by differentiating factors other than price.

3.3.2 Differentiation (optimising value)

Organisations that apply a differentiation strategy operate in a completely different way to those with a low-cost strategy. There is far less attention to costs, although they are not completely ignored (Van Weele, 2010:186). The approach underlying a differentiation strategy is to make a product offering that is unique along some dimensions that are valued by customers (Porter, 1985:14) so that customers will be willing to pay a premium price. Typically, it means offering a product to the customer that is more valuable than those of competitors (Coyle *et al.*, 2003:575, 576). The uniqueness can take many forms including customer service excellence, brand image, variety and use of technology (Wisner *et al.*, 2009:407, 408). It can also be characterised by valuable features such as quality and innovation. Differentiation can be based on the product itself, the delivery system and a broad range of other factors (Prajogo, 2007:70). Therefore, a differentiation strategy aims at creating customer loyalty and brand preferences, thereby reducing the importance of price (Van Weele, 2010:186). A differentiation strategy thus aims to gain a competitive advantage by means of some form of value advantage (Christopher, 2005:37).

Organisations that have value as competitive advantage may be seen as service leaders (Christopher, 2005:11). Differentiation is created many times as the result of organisations listening to their customers (Wisner *et al.*, 2009:408). The emphasis with this strategy is on close co-operation with other supply chain partners. This co-operation can be in the area of new product development, process and product improvement, quality control, lead time reduction and exchange of information (Van Weele, 2010:186). This may include the provision of a specially tailored service or the use of several different channels of distribution to ensure that the product is available in the marketplace in a number of different ways. It may also include a guaranteed service level (Rushton *et al.*, 2006:28).

3.3.3 Focus

The focus strategy is based on identifying a specific smaller segment of the market or a market niche in which to utilise either the lower price or the differentiation approach. Because of their narrow market focus, organisations adopting a focus strategy have lower volumes and therefore less bargaining power with their suppliers (Coyle *et al.*, 2003:575, 576; Lysons & Farrington, 2006:42). Organisations that adopt a focus strategy can serve a smaller segment of the market better than other organisations that are trying to serve a broad market. These organisations provide customised services and expertise to suit the needs of their customers (Wisner *et al.*, 2009:408). The focus strategy is thus based on either a low cost or a differentiation strategy.

Therefore, competitive advantage is found either in the ability of the organisation to differentiate itself in the eyes of the customer from its competition, thus creating customer value or by operating at lower cost as opposed to other supply chains and hence at greater profit. The low-cost and differentiation strategies signify two fundamentally different approaches to achieve competitive advantage. These two strategies will be the base from which supply chain strategies will be discussed.

Although low-cost and differentiation strategies do support each other to some extent, organisations must thus make a choice between the strategies. For example, to achieve a competitive advantage with a low-cost strategy through efficiency, an organisation still has to provide customers with an acceptable level of value that meets their expectations. Similarly, being responsive through a differentiation strategy can only achieve a competitive advantage if the premium price paid by customers is not offset by the additional cost of funding the differentiation features. All in all, though, there is a trade-off between these two strategies (Prajogo, 2007:70; Wilding, 2002:121, 122; Christopher, 2005:11), because, in reality, there is no middle ground between cost leadership and service excellence (Christopher, 2005:11).

3.3.4 Trade-offs between minimising costs and optimising value

Adding value, for example, through relatively good service is associated with relative high costs while minimising costs may mean reduced customer service levels. If high service positions are selected, it will require higher investments, albeit in inventory, warehouses, use of transportation and so on. Conversely, organisations may select low service levels. The trade-off levels between cost and value (or, in this case, service as subset of value) are illustrated along a function of cost related to service such as the one indicated in Figure 3.2. High service levels generally require high cost and low costs are generally associated with lower levels of service. Organisations need to decide where along this function they reside or wish to position themselves (Copacino, 1997:28).

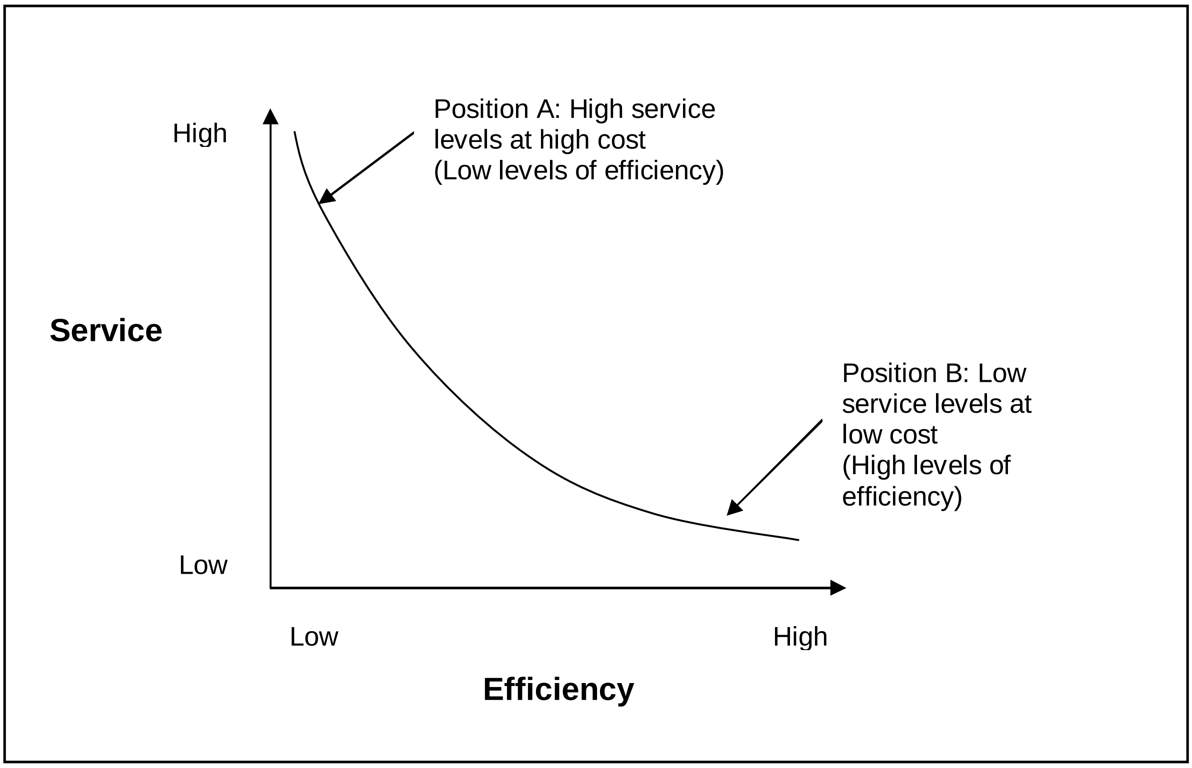

Figure 3.2: Cost-service trade-off curve
Source: Adapted from Copacino (1997:28).

An organisation in position A will use a differentiation strategy to optimise value by offering high service levels. The emphasis is not on minimising cost. On the contrary, an organisation in position B will use a low cost strategy. The emphasis is on minimising cost and not to optimise value by means of, for example, high service levels, which will increase costs. To conclude, increasing customer value generally requires an organisation to be more responsive and to, for example, increase safety stock, and maintain reserve capacity to meet unexpected demand, while increasing efficiency requires driving both of these reserves as low as possible (Taylor, 2004:280).

The trade-off between differentiated supply chains and low-cost supply chains can also be illustrated by observing the effect of each strategy on the organisation's return on investment (ROI). This is illustrated in Figure 3.3 which illustrates the high returns on investment that may be achieved through either adding value by means of a differentiation strategy or minimising cost through a low-cost strategy. As already mentioned, low-cost strategies rely on high volumes and low unit profitability which, when combined, achieve a higher than normal return on investment. Organisations that try to pursue a mixed strategy of low cost and differentiation often find that their returns on investment are unsatisfactory (Hines, 2004:57; Porter, 1985:16; Prajogo, 2007:70) and they find themselves stuck between a differentiated strategy and a low-cost strategy, yielding a less than optimal ROI.

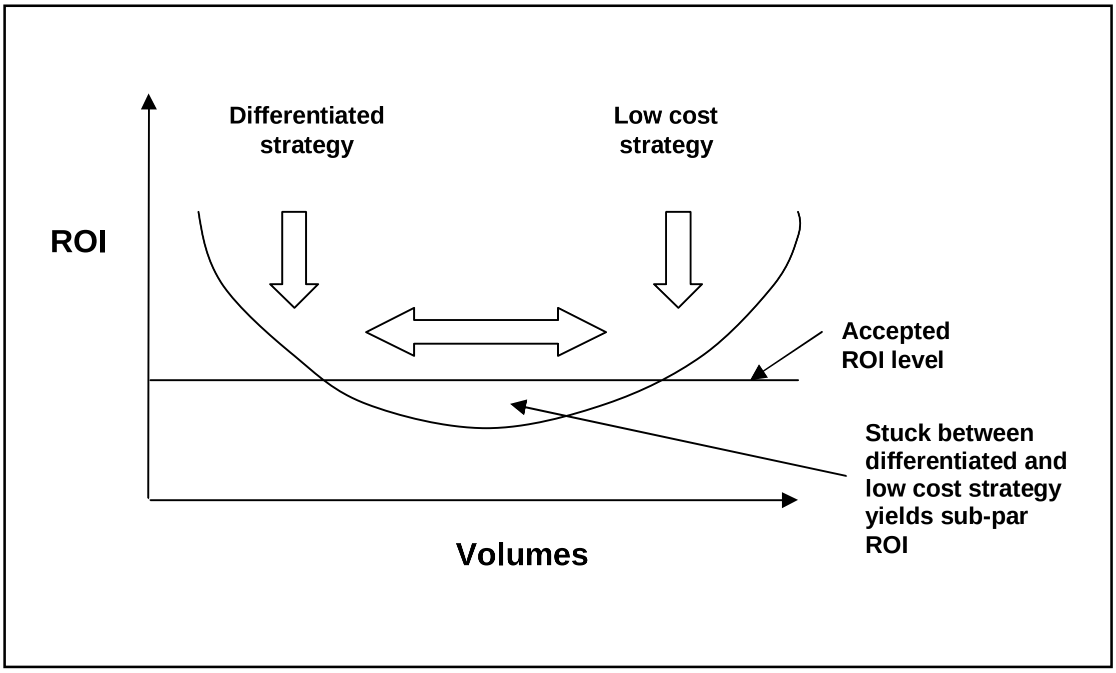

Figure 3.3: Sources of competitive advantage and return on investment
Source: Adapted from Hines (2004:57).

As already mentioned, organisations thus aim to become cost leaders (by means of a low-cost strategy) or service leaders (by means of a differentiation strategy) (Christopher, 2005:10; Hines, 2004:57). Gaining competitive advantage by means of a differentiation strategy (value advantage) or by means of a low-cost strategy can be illustrated by means of what Christopher (2005:10) terms a '*competitive advantage positioning matrix*' with value advantage on its vertical axis and cost advantage on its horizontal axis. This is illustrated in Figure 3.4.

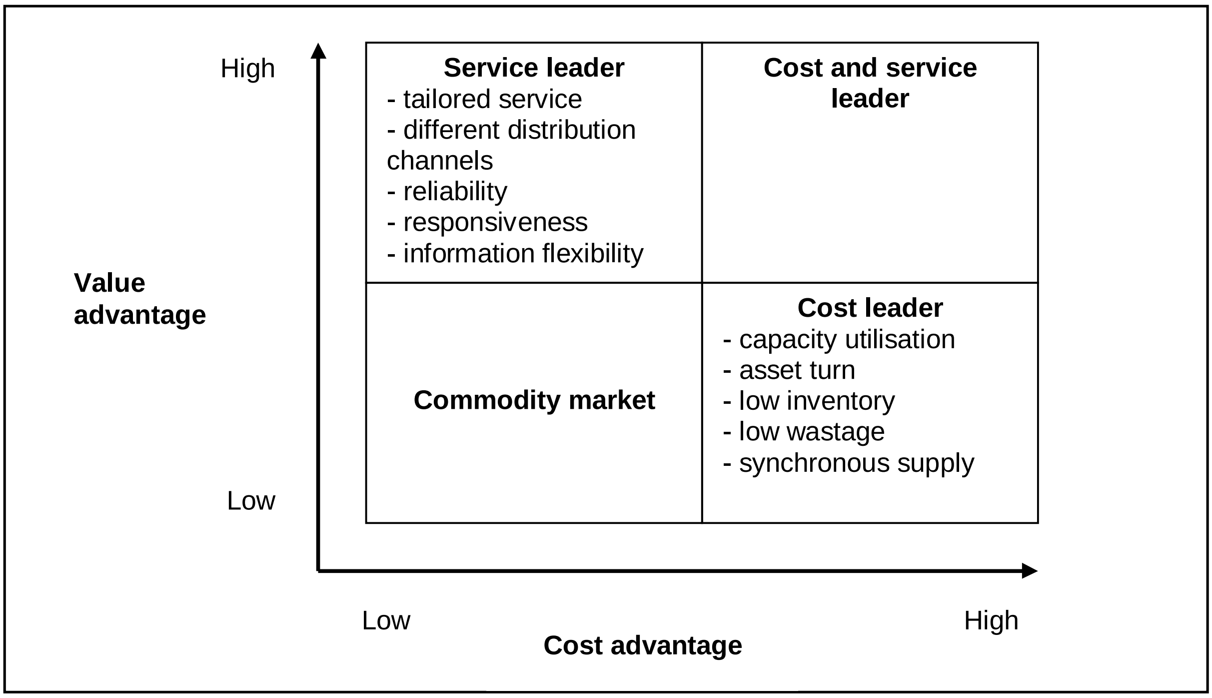

Figure 3.4: Competitive advantage positioning matrix
Source: Adapted from Christopher (2005:10) and Rushton *et al.* (2006:28).

Thus far, the discussion has centred around optimising value and minimising cost as sources of competitive advantage and the trade-off that exists between these two alternatives. However, in Figure 3.4, two other quadrants are also visible, namely commodity markets (lower left quadrant in Figure 3.4) and cost and service leaders (top right quadrant).

The products of organisations that find themselves in the bottom left hand corner of the matrix are indistinguishable from those of their competitor's. Organisations in this quadrant have no value or cost advantage over their competitors. These products fall into typical commodity market situations and ultimately have to find strategies to either move to the right of the matrix towards cost leadership, or upwards towards service leadership. Reaching cost leadership is almost impossible. This particularly will be the case in a mature market where substantial market share gains are difficult to achieve (Christopher, 2005:10). Thus, as already mentioned, organisations will have to try and gain cost reductions by, for example, re-engineering business processes (Christopher, 2005:11). The other route out of the commodity quadrant in the matrix is by means of differentiation through, for example, service excellence. Customers in all industries are seeking greater responsiveness and reliability from suppliers in the form of, for example, reduced lead times, just-in-time delivery and value-added services.

The challenge for organisations is to identify appropriate supply chain strategies to take the organisation to the top right hand corner of the matrix. Organisations who occupy that position have offers that are distinctive in the value they deliver and are also cost competitive (Christopher, 2005:11). Organisations aim to achieve this through effective SCM practices. Effective SCM allows organisations within the supply chains to drive towards achieving both goals of optimising value and minimising costs. By means of SCM there are immediate win-win positions that allow the qualities of adding value and minimising costs to be combined to some degree (Wilding, 2002:121, 122). Through SCM, a balance can thus be struck between these conflicting objectives. However, the trade-off between minimising costs and optimising value (as discussed earlier in this chapter) cannot be eliminated and is not absolute (Taylor, 2004:280). Organisations must be careful, however, not to pursue both strategies at the cost of one another (refer to Figure 3.3). Striving towards the top right quadrant of Figure 3.4 should only be attempted if both strategies can be achieved.

3.4 DIFFERENT SUPPLY CHAIN STRATEGIES

Context is important in supply chain strategy decisions. There is no such thing as either a universal supply chain strategy or an industry-wide supply chain (Hines, 2004:6). There are many types of supply chains (Hughes, Ralf & Michels, 1998:4; Baily *et al.*, 2008:75) and supply chain strategies are as varied as the disciplines from which they originate (Boone, Craighead & Hanna, 2007:594). There are different types of supply chain structures, strategies, and relationships, all of which must aim to satisfy the ultimate customer (Hines, 2004:6). The intent of supply chain strategies is consistent, however, namely to reduce uncertainties and costs while satisfying end customer's needs (Boone *et al.*, 2007:594).

Supply chain strategies may be designed to be more efficient and/or to be more effective (Hines, 2004:378, 379). Within these parameters, supply chains range from those that focus solely on being responsive to those that focus on a goal of producing and supplying at the lowest possible cost. The more capabilities constituting responsiveness a supply chain has, the more responsive it is (Chopra & Meindl, 2010:47). Supply chains can thus be grouped into two broad categories that summarise supply chain capabilities to meet their end customers' needs. These two types of supply chains are responsive and efficient supply chains (Raturi & Evans, 2005:208), which is in line with achieving competitive advantage by means of either minimising costs or optimising value.

The supply chain strategy needs to be developed to meet the specific needs of its customers (Lee, 2002:105; Hines, 2004:119), because supply chain strategies are market-driven (Hines, 2004:123; Ross, 1998:12). Supply chain strategies therefore have to focus on customer demand patterns to ensure that superior performance is delivered, compared with competitors (Hines, 2004:378, 379). The organisation's choice of supply chain depends on the nature of customers' needs, as has already become evident. If customers want innovative products, the organisation needs a more responsive supply chain to cope with demand uncertainties associated with innovative products. If customers want more mature (or functional) products, the organisation will need to be able to provide stable sales. The supply chain will therefore be less responsive and more efficient. A product with a stable demand and a reliable source of supply should not be managed in the same way as one with a highly unpredictable demand and/ or an unreliable source of supply (Lee, 2002:105). Supply chain strategies are also often categorised as push, pull or push-pull strategies (Simchi-Levi *et al.*, 2008:188). However, it will become evident later in this chapter that these strategies form a part of efficient and responsive supply chain strategies.

Organisations have to make the trade-off between efficiency and responsiveness in their supply chains. If an organisation needs to be the cost (or low-price) leader, the only viable solution will be to build the most efficient, economical supply chain possible. If an organisation, for example, concentrates on the quality of its service as means of gaining competitive advantage, they need a more responsive supply chain that can deliver the products quickly and reliably, even under most uncertain conditions (Taylor, 2004:282). This is illustrated in Figure 3.5.

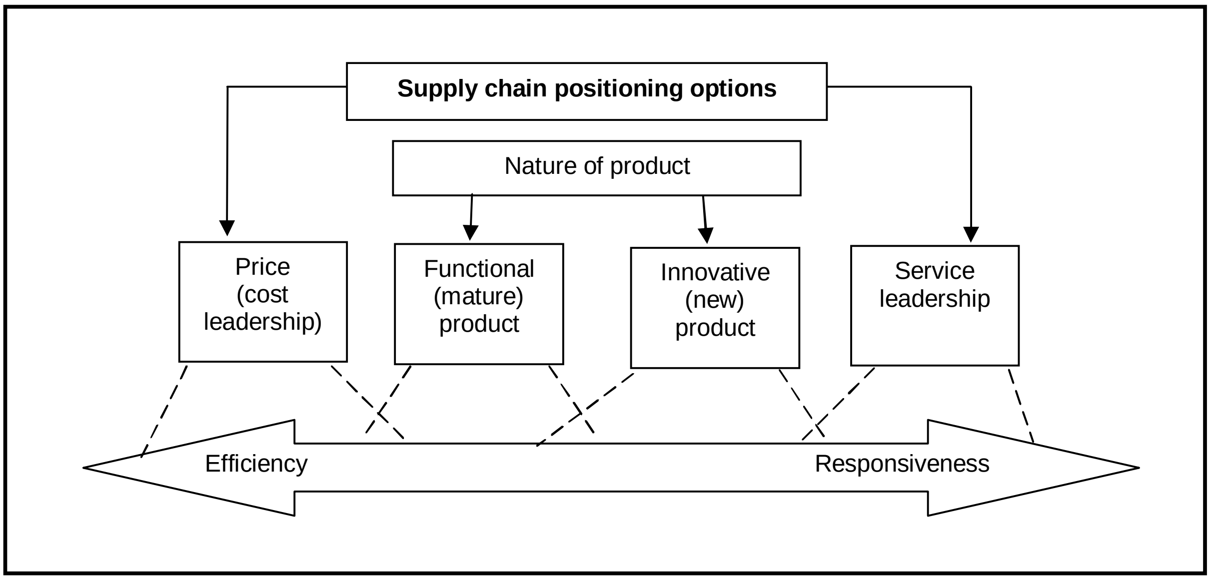

Figure 3.5: Supply chain positioning options
Source: Adapted from Taylor (2004:282).

The most critical element of a supply chain strategy is deciding how to make the trade-off between responsiveness and efficiency (Taylor, 2004:279). Like customer needs, supply chains have many characteristics that influence their responsiveness and efficiency. Supply chain responsiveness includes a supply chain's ability to handle customer demand uncertainty. A supply chain is responsive if it is able to (Chopra & Meindl, 2010:44):

- respond to wide ranges of quantities demanded;
- meet short lead times;
- handle a large variety of products;
- build highly innovative products;
- meet a high service level; and
- handle supply uncertainty.

The more the supply chain is able to respond to these abovementioned circumstances, the more responsive it is. Thus there is a trade-off between responsiveness and efficiency (Hines, 2004:61), because responsiveness comes at a cost. For instance, to respond to a wider range of quantities demanded, capacity must be increased, which increases costs (Chopra & Meindl, 2010:44; Hines, 2004:61). This is no surprise as it has already become evident that adding value and minimising cost are conflicting objectives. At this stage, it is necessary to clarify that supply chain efficiency is the inverse of the cost of making and delivering a product to the customer. Increases in cost lower efficiency. For every strategic choice to increase responsiveness, there are additional costs to lower efficiency (Chopra & Meindl, 2010:44).

3.4.1 Efficient (or lean) supply chains

Efficient supply chains can also be referred to as lean supply chains (Christopher, 2003:284). An efficient (or lean) supply chain is a set of organisations directly linked by upstream and downstream flows of information, products and finances that collaboratively work to reduce cost and waste (Vitasek, Manrodt & Abbott, 2005:40). While individual organisations can become lean by themselves, a lean supply chain requires multiple organisations to work together. It is important to understand that lean SCM is not an exercise in shifting inventories or costs to a supplier. Instead, it’s a coordinated effort among supply chain partners to eliminate waste across the supply chain. This can only be done by collaborating across common processes (Vitasek *et al.*, 2005:40).

Efficient (or lean) supply chains utilise strategies aimed at creating the highest cost efficiencies in the supply chain. For such efficiencies to be achieved, non-value-added activities should be eliminated, scale economies should be pursued and optimisation techniques should be deployed to get the best capacity utilisation in production and distribution (Lee, 2002:113; Jacobs *et al*., 2009:364). Waste can occur in the form of time, inventory, process redundancy or even digital waste (Vitasek *et al.*, 2005:42). Efficient (or lean) supply chains thus operate at low costs with constant use of capacity and high stock turning rates (Seuring, 2003:183). Matching end customer demand with reliable supply enables a lean supply chain characterised by high inventory turnovers and excellent use of supply chain resources (Ayers, 2004:46). An efficient supply chain thus focuses on high productivity in material flow and minimising costs of shipping the product to the end customer (Raturi & Evans, 2005:208).

Efficient supply chains often make use of push-based systems (Simchi-Levi *et al.*, 2008:193) especially when demand is predictable (Hilletofth, 2009:19). ‘Push’ systems push an amount of products through the supply chain that has been set by a forecast for future demand (Reid & Sanders, 2007:225). Products are thus pushed through the supply chain and are stored in anticipation of demand (Reid & Sanders, 2007:228; Waller, 2003:460). In a push-based system, production and distribution decisions are based on long-term forecasts. Demand forecasts are based on orders received from downstream supply chain partners (Simchi-Levi *et al.*, 2008:188). Inventory is therefore produced in advance of demand and 'pushed' down the supply chain towards the customer (Taylor, 2004:341) towards points of sale where they are stored as finished goods inventory (Evans & Collier, 2007:370). Push-based supply chains allow consolidation and result in cost savings (Raturi & Evans, 2005:211). However, push systems can result in higher levels of inventory, which is stored for future consumption (Reid & Sanders, 2007:225).

Push-based systems work best when sales patterns are consistent and when there is a small number of distribution centres and products (Evans & Collier, 2007:370). Uncertainty in the push portion of the supply chain is relatively small and service levels are not an issue. Therefore the focus can be on cost minimisation (Simchi-Levi *et al.*, 2008:193). Push-based strategies thus form part of efficient supply chain strategies.

Lean supply chains are appropriate for and match functional products with low demand and supply uncertainties where demand can be predicted and stable processes are operated efficiently to achieve economies of scale (Bruce, Daly & Towers, 2004:154; Seuring, 2003:184). Low demand and supply uncertainty in supply chains should stress efficiency. These are particularly enhanced by demand information that is highly predictable (Ayers, 2004:46; Towill & Christopher, 2002:301) and ensures the most efficient, accurate and cost-effective transmission of information across the supply chain (Jacobs *et al*., 2009:364). Therefore, information linkages should be established to ensure the most efficient accurate and cost effective transmission of information across the supply chain (Lee, 2002:113).

Organisations can make decisions against forecasts with little risk (Christopher, 2003:287) because demand is predictable (with low levels of uncertainty and variety that is low) (Towill & Christopher, 2002:301). Materials, components or products can be ordered ahead of demand and manufacturing and transportation facilities can be optimised in terms of cost and asset utilisation (Christopher, 2005:120). However, problems arise when the lean supply chain philosophy is implanted into situations where demand is less predictable; the requirement for variety is high; and, consequently, volume at the individual stock-keeping unit is low (Christopher, 2003:284). When replenishment lead times are short, organisations often make use of a lean continuous replenishment strategy (Hilletofth, 2009:18, 19). All the supply chain members involved under these circumstances collaborate to lower their costs, meet demand and to continuously improve their delivery times and service (Gattorna, 2006:111).

3.4.2 Agile (or responsive) supply chains

Agility is the ability of an organisation to thrive in a continuously changing, unpredictable business environment (Prater, Biehl & Smith, 2001:823). The idea of agility in the context of SCM focuses on responsiveness (Ismail & Sharifi, 2006:433; Christopher, Lowsen & Peck, 2004:369) and flexibility (Christopher, 2003:284; Swafford, Ghosh & Murthy; 2006:172). Therefore, agile supply chains utilise strategies aimed at being responsive and flexible to customer needs (Lee, 2002:114; Jacobs *et al*., 2009:364; Yusuf, Gunasekaran, Adeleeye & Sivayoganathan, 2004:381). Supply chains where demand and supply uncertainties exist require agility (Ayers, 2004:46; Seuring, 2003:184). The focus is on time compression and quick response (Christopher, 2003:287) and on eliminating the barriers to quick response, be they organisational or technical (Christopher, 2003:283). Agility means rapid strategic and operational adaptation to large-scale, unpredictable changes in a volatile business environment (Christopher, 2003:283; Prater *et al.*, 2001:823). Agility embraces organisational structures, information systems, logistics processes and, in particular, mindsets (Christopher, 2003:284). The main focus is on running businesses in network structures with an adequate level of agility to respond to changes as well as proactively anticipate changes and seek new emerging opportunities (Ismail & Sharifi, 2006:431).

Supply chain agility is the ability of the supply chain as a whole to rapidly align the network and its operations to the dynamic and turbulent requirements of customers' demands (Ismail & Sharifi, 2006:431). Supply chain agility enables an organisation to react quickly and more effectively to marketplace volatility and other uncertainties, thereby allowing the organisation to establish a superior competitive position (Swafford *et al*., 2005:171). Agile supply chains should therefore be used where demand is volatile, and where end customers want a lot of variety (Towill & Christopher, 2002:301). Agile supply chains therefore have to be market sensitive with the ability to respond to actual real time changes in demand (Bruce *et al.*, 2004:154; Swafford *et al.*, 2005:171).

Tight partnerships along the supply chain might be needed to be able to operate in such environments (Seuring, 2003:184). This may require a network of flexible supply chain partners making up the virtual organisation (Ayers, 2004:46). In fact, a key to agile response is the presence of agile partners upstream and downstream of the focal organisation. Organisations may have internal processes that are capable of rapid response, yet their agility will be constrained if, for example, suppliers have long lead times (Christopher, 2005:117).

Agile supply chains enable quick response type solutions (Christopher, 2005:120) and are, for example, able to achieve shorter cycle times (Swafford *et al.*, 2005:171). When utilising agile supply chain strategies, organisations must acquire capacity capability in order to be able to react to possible volatile fluctuations in demand. The use of information technology to share data between supply chain members is crucial in an agile supply chain. Sharing data increases visibility of requirements (Bruce *et al.*, 2004:154), therefore agile supply chains are more likely to be information based (Christopher *et al*., 2004:370).

This means that agile supply chains are relevant for innovative products where demand is unpredictable (Bruce *et al.*, 2004:154; Swafford *et al.*, 2005:171). Some characteristics of an agile supply chain include that it is (Christopher *et al.*, 2004:370; Christopher, 2005:120; Ismail & Sharifi, 2006:433):

- market sensitive (by being closely connected to end customers' needs);
- virtual (because it relies on shared information on real demand across all supply chain partners);
- network-based (because it gains flexibility by using the strengths of specialist

players); and

- process aligned (because it has a high degree of process interconnections between the network members).

Agile (or responsive) supply chains make use of pull-based systems (Simchi-Levi *et al.*, 2008:194). In a pull-based supply chain, upstream supply chain entities respond to the demand signals from downstream entities (Raturi & Evans, 2005:210; Webster, 2008:222). Production and distribution are demand driven so that they are coordinated with true customer demand rather than forecast demand (Simchi-Levi *et al.*, 2008:189, 122). With ‘pull’ systems, end customers’ needs trigger demand. This demand ‘pulls’ the required products through the supply chain (Waller, 2003:460).

Inventory is produced only in response to realised demand and the product is being ‘pulled’ down the supply chain by actual orders (Taylor, 2004:341). A pull-system thus only produces what is needed at upstream stages in the supply chain in response to customer demand signals from downstream stages (Evans & Collier, 2007:370). This is enabled by fast information flows to transfer information about customer demand (e.g. POS data) to the various supply chain partners (Simchi-Levi *et al.*, 2008:189).

Pull systems result in a decrease in lead times, inventories and variability. Pull-based systems are difficult to implement when lead times are so long that it is impractical to react to demand information. It is also difficult to take advantage of economies of scale in manufacturing and transportation since systems are not planned ahead of the time (Simchi-Levi *et al.*, 2008:189). The pull portion of the supply chain is characterised by high uncertainties, simple supply chain structures and short cycle times. The focus of pull-based supply chains is thus on service levels. High service levels are achieved by flexible and responsive supply chains (Simchi-Levi *et al*., 2008:194). Therefore, pull-based supply chains form part of agile (or responsive) supply chains.

From the foregoing sections, several characteristics of lean and agile supply chains can be distinguished. Table 3.1 illustrates some basic differences between agile and lean supply chains that can be derived from these characteristics.

Table 3.1: Characteristics of lean and agile supply chain strategies

	Lean supply chain strategy	Agile supply chain strategy
Primary focus	Efficiency: to supply predictable demand at the lowest possible cost	Effectiveness: to respond quickly to unpredictable demand in order to minimise stockouts, forced markdowns, and obsolete inventories (Quick response)
Order winners	Cost	Time, availability
Supply chain emphasis	Economies of scale	Flexibility

Source: Adapted from Christopher (2003:285); Webster (2008:352); Hines (2004:63) and Bruce *et al.* (2004:155).

3.4.3 Matching supply chains and products

In the previous sections it became evident that end customers' needs for functional products should be met with efficient (or lean) supply chains and the alternative needs for innovative products should be met with responsive (or agile) supply chains (Fisher, 1997:2,3; Bruce *et al.*, 2004:154; Seuring, 2003:184; Swafford *et al.*, 2005:171). Matching efficient and responsive supply chains to either functional or innovative products on the basis of levels of demand uncertainty associated with the attributes of products can be illustrated by means of a decision tree. This is illustrated in Figure 3.6.

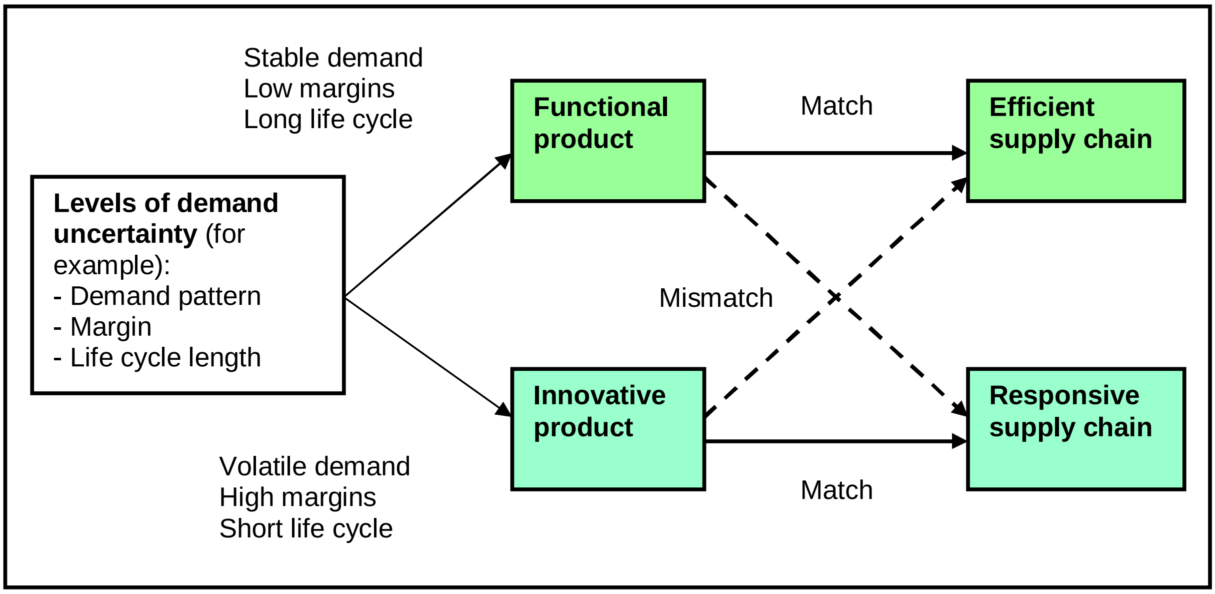

Figure 3.6: Decision tree for determining the right supply chain
Source: Adapted from Appelqvist (2003:200).

Fisher (1997:4) compiled a matrix to illustrate the combination between demand patterns based on end customers' needs for either functional or innovative products and the two basic supply chain types (efficient or responsive). The matrix is illustrated in Figure 3.7 and can be termed the '*supply chain-product positioning matrix*' (Webster, 2008:351).

Supply chain	**Functional products** (Low levels of uncertainty)	**Innovative products** (High levels of uncertainty)
Responsive (High levels of uncertainty)	Mismatch	Match
Efficient (Low levels of uncertainty)	Match	Mismatch

Figure 3.7: Supply chain-product positioning matrix
Source: Adapted from Fisher (1997:6) and Seuring (2003:184).

The *supply chain-product positioning matrix* shows that certain supply chains are well suited to certain types of products (Webster, 2008:351). Organisations can now determine whether the supply chain they are using is well matched to their product offering. The supply chains and product offerings will be well matched if there are efficient supply chains for functional products, as shown in the lower left quadrant, and responsive supply chains for innovative products, as shown in the upper right quadrant (Fisher, 1997:4).

A mismatch occurs when a responsive supply chain is used for functional products or an efficient supply chain is used for innovative products. For innovative products, efficient supply chains lead to lost sales or surplus goods (Ayers, 2004:45). This is illustrated in the bottom right quadrant (refer to Figure 3.7). For functional products, customer service as part of a responsive (or agile) supply chain can occur at a too high level, leading to excessive inventory and other costs (Ayers, 2004:45). This is illustrated by the upper left quadrant in Figure 3.7. Organisations positioned in this upper left quadrant (refer to Figure 3.7) often improve responsiveness and flexibility to higher than required levels at the expense of being efficient (Selldin & Olhager, 2007:46). This occurs when there is a move along the product life cycle from the introductory phase to the mature phase which may imply a move from a basically innovative character of the product to a more functional type of product (refer to Chapter 2) (Selldin & Olhager, 2007:46).

Chopra and Meindl (2010:46) refer to a '*zone of strategic fit'*, which implies a wider, more continuous (or overlapping) approach towards selecting a strategy than when a matrix is used. This *zone of strategic fit* is illustrated in Figure 3.8. The zone indicates where there will be a match between the supply chain (efficient or responsive) and the level of demand uncertainty.[5] The *zone of strategic fit* has very similar traits to the *supply chain-product positioning matrix*, as can be seen in Figure 3.7 concerning the areas where supply chains and customer demands match (or fit). This is shown by the shaded areas that start at the bottom left and rise to the right in both figures (3.7 and 3.8).

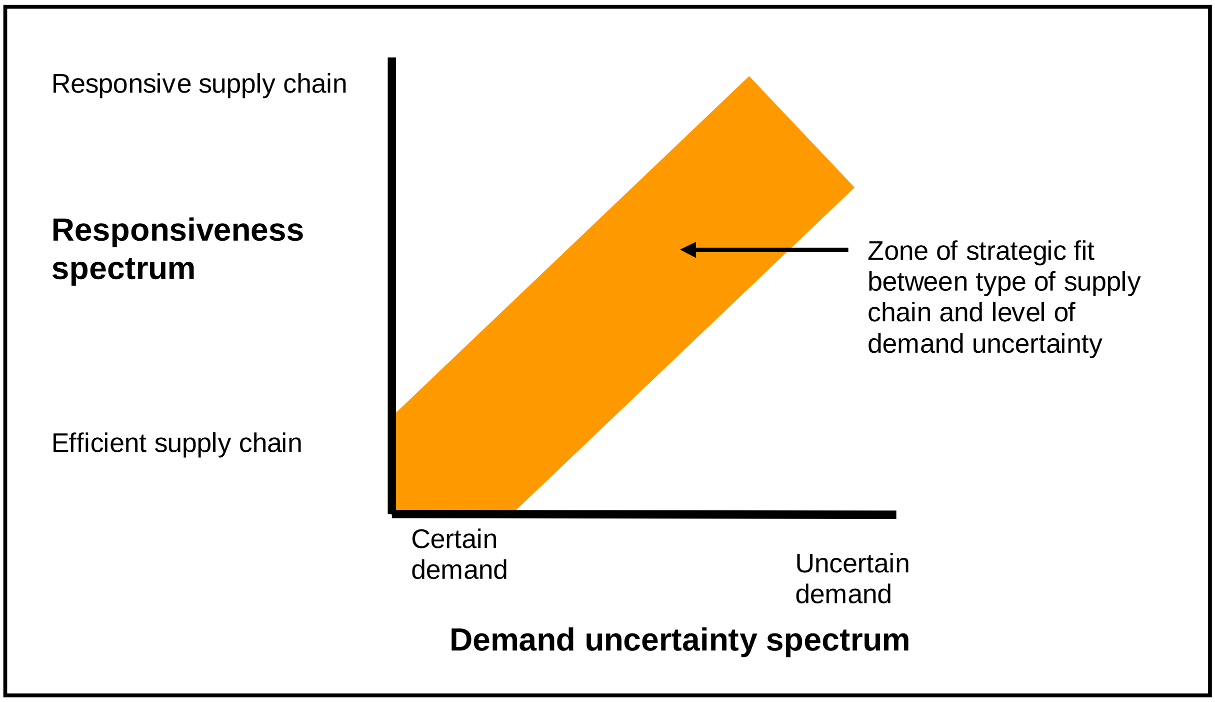

Figure 3.8: Zone of strategic fit
Source: Adapted from Chopra and Meindl (2010:46).

It is more challenging to operate a supply chain with high demand uncertainty than one with low demand uncertainty. Similarly, it is more challenging to operate a supply chain with high supply uncertainty (an evolving supply process) than one with low

[5] In chapter 2 (refer to section 2.2), the level of demand uncertainty was identified as the key determinant in determining end customers' needs.

supply uncertainty (a stable supply process) (Jacobs *et al*., 2009:364).

To conclude, managers need to align their organisation's supply chain strategy with the uncertainties inherent in their supply chains (Jacobs *et al*., 2009:364). Since organisations often have products with different levels of uncertainty, managers should follow different supply chain strategies for different products (Croxton *et al*., 2006:66).

3.4.4 Hybrid (or leagile) supply chains

Thus far, lean and agile supply chains have been discussed as trade-offs towards each other. These supply chains have been discussed as if they are mutually exclusive and represent conflicting interests. However, in reality the two approaches can complement one another and a hybrid strategy in which both lean and agile supply chains are utilised should be used in many cases, especially because it is supply chains that compete and not organisations (Towill & Christopher, 2002:299, 300). Hybrid or leagile supply chains can be defined as the combination of the lean and agile paradigm within a total supply chain strategy. Such hybrid (or leagile) supply chains exploit the benefits of both lean and agile supply chains (Towill & Christopher, 2002:300); they use a combination of lean and agile approaches within a supply chain strategy (Mason-Jones *et al*., 2000:4065).

Earlier in this chapter it was mentioned that push-based strategies are used in lean (or efficient) supply chains and pull-based strategies are used in agile (or responsive) supply chains. Push systems produce products in advance of customer demand, using a forecast of sales, and moves the products through the supply chain to points where they can be stored as finished goods. A pull system produces only what is needed at upstream stages in the supply chain in response to customer demand from downstream stages (Evans & Collier, 2007:370). As already mentioned, leagile supply chains make use of both push-based and pull-based strategies and using both strategies allows organisations to choose between efficiency and responsiveness (Raturi & Evans, 2005:22). Leagile supply chains thus make use of what can be termed push-pull strategies. In a push-pull strategy, some stages of the supply chain are operated in a push-based manner while other stages use a pull-based strategy.

3.4.4.1 Explaining the push-pull boundary (or the decoupling point)

The interface between the push-based stages and the pull-based stages is known as the push-pull boundary (Simchi-Levi *et al*., 2008:190). (The push-pull boundary is also known as the decoupling point as indicated in other sources below.) In fact, push-pull boundaries refer to the positioning of decoupling points in the supply chain (Goldsby & Garcia-Dastugue, 2006:104). The push-pull boundary is the point in the supply chain that separates the push-system from the pull-system (Evans & Collier, 2007:371). The push-pull boundary thus indicates where the organisation switches from managing the supply chain using one strategy, to managing it using another strategy (Simchi-Levi *et al*., 2008:190). This is illustrated in Figure 3.9.

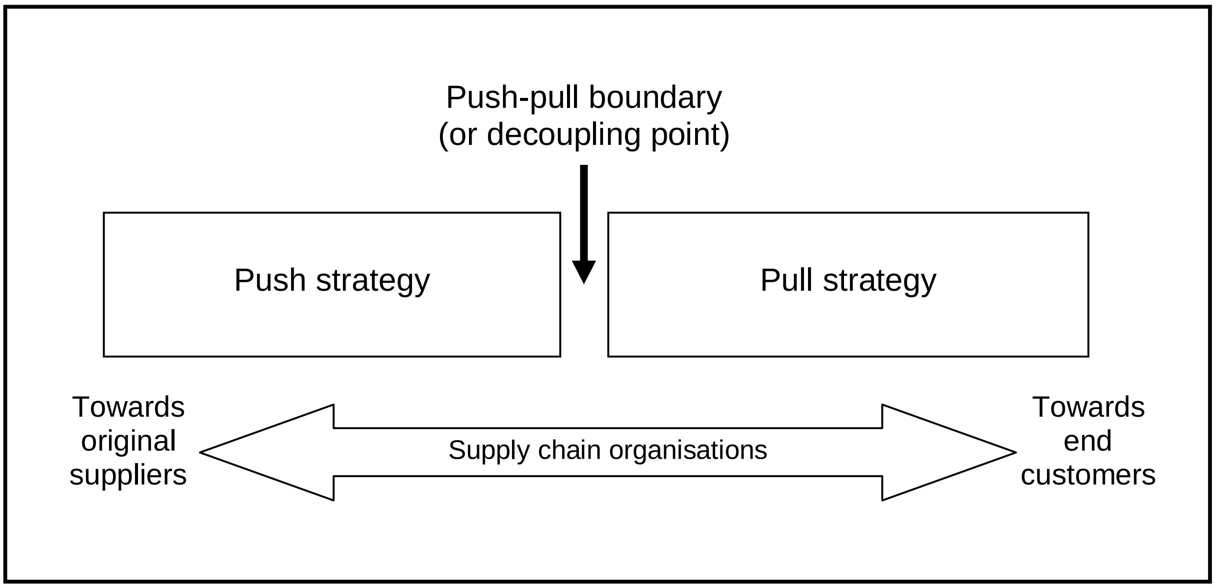

Figure 3.9: The push-pull boundary (or decoupling point)
Source: Adapted from Simchi-Levi *et al*., (2008:190) and Taylor (2004:30, 341).

The push-pull boundary or the decoupling point may be termed the point at which real demand penetrates upstream in a supply chain (Christopher, 2003:288). The decoupling point therefore is the point in the product flow stream to which the customer's order penetrates and where real-time data and forecast-driven activities meet (Mason-Jones *et al.*, 2000:4061). The decoupling point is an important choice in any supply chain design (Fleischmann, Van Nunen, Gräve & Gapp, 2005:181). The decoupling point confirms that the real focus of supply chain re-engineering should be on seeking ways in which organisations can achieve the appropriate combination of lean and agile strategies (Christopher, 2003:291). Leagile supply chains require the selection and setting up of a decoupling point (Towill & Christopher, 2002:300; Bruce *et al*., 2004:154).

The supply chain from the customer to the inventory decoupling point faces a highly volatile demand. It should therefore be agile (Appelqvist, 2003:201), and the processes consequently are designed to be agile (ie responsive) downstream of the decoupling point (Towill & Christopher, 2002:300) to make provision for the more unpredictable marketplace (Mason-Jones *et al*., 2000:4065). As the flow of products should be market driven (Lysons & Farrington, 2006:146; Christopher, 2003:289), the decoupling point must be positioned so that the supply chain can respond to volatile downstream customer demand with, for example, high service levels, while still maintaining lean objectives such as cost effectiveness upstream (Mason-Jones *et al.*, 2000:4065; Bruce *et al*., 2004:155).

The organisations downstream from the decoupling point are organised for agility and the ability to cope with variability in demand volume and high levels of product variety (Lysons & Farrington, 2006:146). The downstream parts of the supply chain are generally controlled by direct customer demand. Retailers obviously experience final customer demand, and then pass this back to their suppliers, and so on through the tiers of the supply chain (Waters, 2007a:206). The key to determining a push-pull boundary is recognising the stage of value-added processing in which differentiation from a standard configuration takes place (Goldsby & Garcia-Dastugue, 2006:104).

Upstream of this decoupling point, the processes are designed to be lean (Towill & Christopher, 2002:300), enabling a level schedule and opportunities to reduce costs (Mason-Jones *et al*., 2000:4065; Appelqvist, 2003:201). Upstream organisations work to a stable demand with relatively low variety and can therefore focus on lean low-cost manufacture (Lysons & Farrington, 2006:146). Risk can thus be reduced by delaying the time at which the decision must be taken to make a specific product available in a specific place for as long as possible (Tellarini *et al.*, 2007:190). The flow of products upstream from the decoupling point therefore may well be forecast driven (Lysons & Farrington, 2006:146; Christopher, 2003:289).

The challenge to supply chain managers is in seeking to develop lean strategies up to the decoupling point, but agile strategies beyond that point. In other words, by using generic or modular inventory to postpone the final commitment, it should be possible to achieve volume-oriented economies of scale through product standardisation. This is illustrated in Figure 3.10.

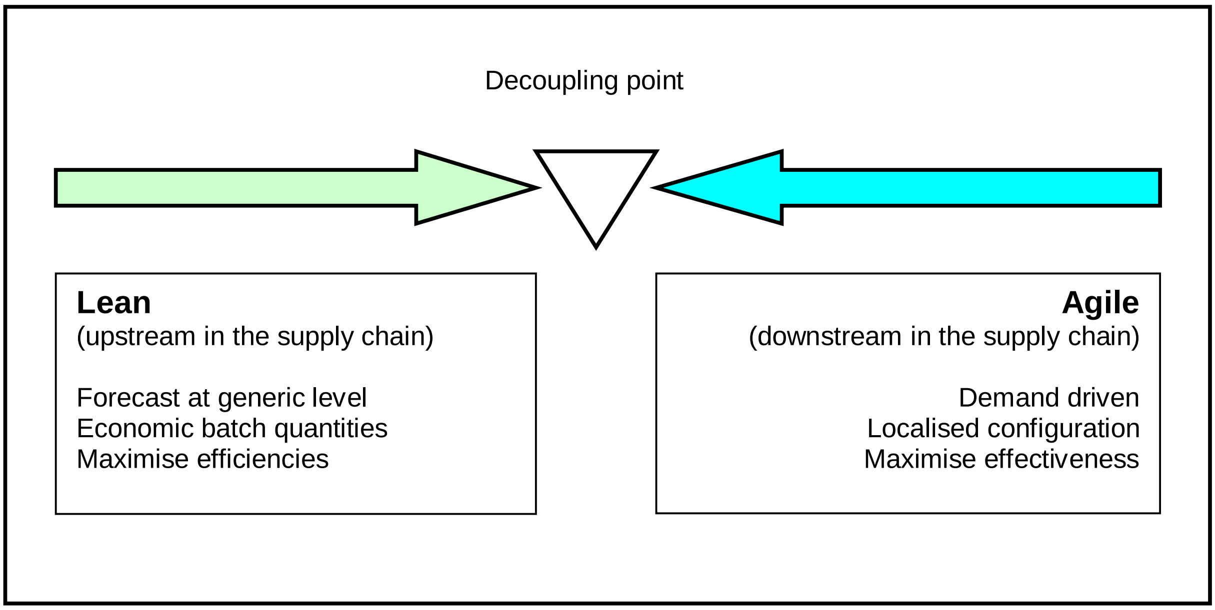

Figure 3.10: A supply chain strategy combining lean and agile strategies
Source: Adapted from Christopher (2003:290).

To achieve this, organisations can make use of the concept of postponement. Postponement refers to a concept whereby activities in the supply chain are delayed until a demand is realised (Boone *et al.*, 2007:594). This involves intentionally delaying the execution of a task, instead of starting it with incomplete or unreliable information inputs (Yeung, Selen, Deming & Min, 2007:332). *Postponement* basically involves holding inventory in a generic form, in the fewest locations, and only finishing or finally configuring the product once real demand is known (Christopher, 2003:286). Postponement is used to manage uncertainties (Koh, Demirbag, Bayraktar, Tatoglu & Zaim, 2007:105) and the final operations that result in a customised product for the end customer are performed when the uncertainty is removed (Taylor, 2004:311). This is necessary because the upstream parts of the supply chain are insulated from final customer demand by the intervening tiers of supply chain members (Waters, 2007a:206).

Postponement involving the delayed differentiation of products on the supply chain (Koh *et al.*, 2007:106) means that demand uncertainty can be reduced. Therefore postponement, or delayed configuration, is based on the principle of seeking to design products using common platforms, components or modules, but postponing the final assembly or customisation until the final market destination or customer requirement is known (Christopher, 2003:288, 289). Postponement allows organisations to be flexible in developing different versions of a product, as needed (Jeong & Hong, 207:585). It has the potential to improve responsiveness while reducing costs such as inventory, transport, storage, and obsolescence costs (Boone *et al.*, 2007:594).

Postponement is an excellent example of a push-pull strategy (Simchi-Levi *et al*., 2008:190). Before end customer demand is known, a push-based strategy is used to produce generic products based on a forecast. Demand for generic products is an aggregation of demand for all its corresponding end products and therefore forecasts are more accurate. In contrast, customer demand for a specific end product typically has a high level of uncertainty and product differentiation therefore occurs only in response to individual demand. The portion of the supply chain starting from the time of differentiation is pull-based (Simchi-Levi *et al.*, 2008:191). Earlier, the decoupling point was defined as the point at which real demand penetrates upstream in a supply chain (Christopher, 2003:28). From this, it can also be derived that the push-pull boundary is the same point as the decoupling point. Postponement takes place at the decoupling point or the push-pull boundary and the decoupling point determines the form in which inventories are held. Therefore, once the decoupling point is determined, organisations must support the push-pull decisions to support customers' expectations (Goldsby & Garcia-Dastugue, 2006:105).

To conclude, a decoupling point is the most extreme upstream point where end customer demand actually penetrates. Downstream of the decoupling point, all operations are controlled by end customer demand. Upstream of the decoupling point all operations are controlled by forecasts and plans (Waters, 2007a:206). The decoupling point is also the point at which postponement can most easily be arranged. This means that generic stocks are held upstream and customised stocks are held downstream. The best policy is to move the decoupling point as far downstream as possible. This reduces the total amount of stock and makes the response time faster, which reduces vulnerability (Waters, 2007a:206, 207).

3.4.4.2 Different decoupling points at different stages in the supply chain

The push-pull boundary or decoupling point should also dictate the form in which inventory is held. As real demand penetrates the supply chain closer to the original supplier, inventory, for example, is probably held in the form of components or materials. Because of real demand, products can thus be customised according to customers' needs. At the other extreme, if demand does not penetrate the supply chain far away from the end customer, thus only becoming visible at the end of the supply chain, inventory will be held in the form of finished products. The issue is how far back towards the original supplier, real demand is made visible (Christopher, 2003:288). The aim of the supply chain should be to carry inventory in a generic form, such as standard semi-finished products awaiting final assembly or localisation at the decoupling point using postponement (Christopher, 2003:288). The location of the decoupling point (or push-pull boundary) can affect how responsive a supply chain is. Organisations are more responsive in terms of, for example, ensuring short lead times, if they are able to push as much of the finished product close to the end customer (Evans & Collier, 2007:372).

Figure 3.11 shows how the positioning of the decoupling point changes with different supply chain structures. All the supply chains in Figure 3.11 are hybrid (or leagile) supply chains. For supply chain C, real demand information has pushed further upstream than for supply chain A. Supply chain C will hold inventories in the form of components and materials at the decoupling point (which allows for more customisation). Supply chain A will hold inventories in the form of finished goods (which allows less room for customisation).

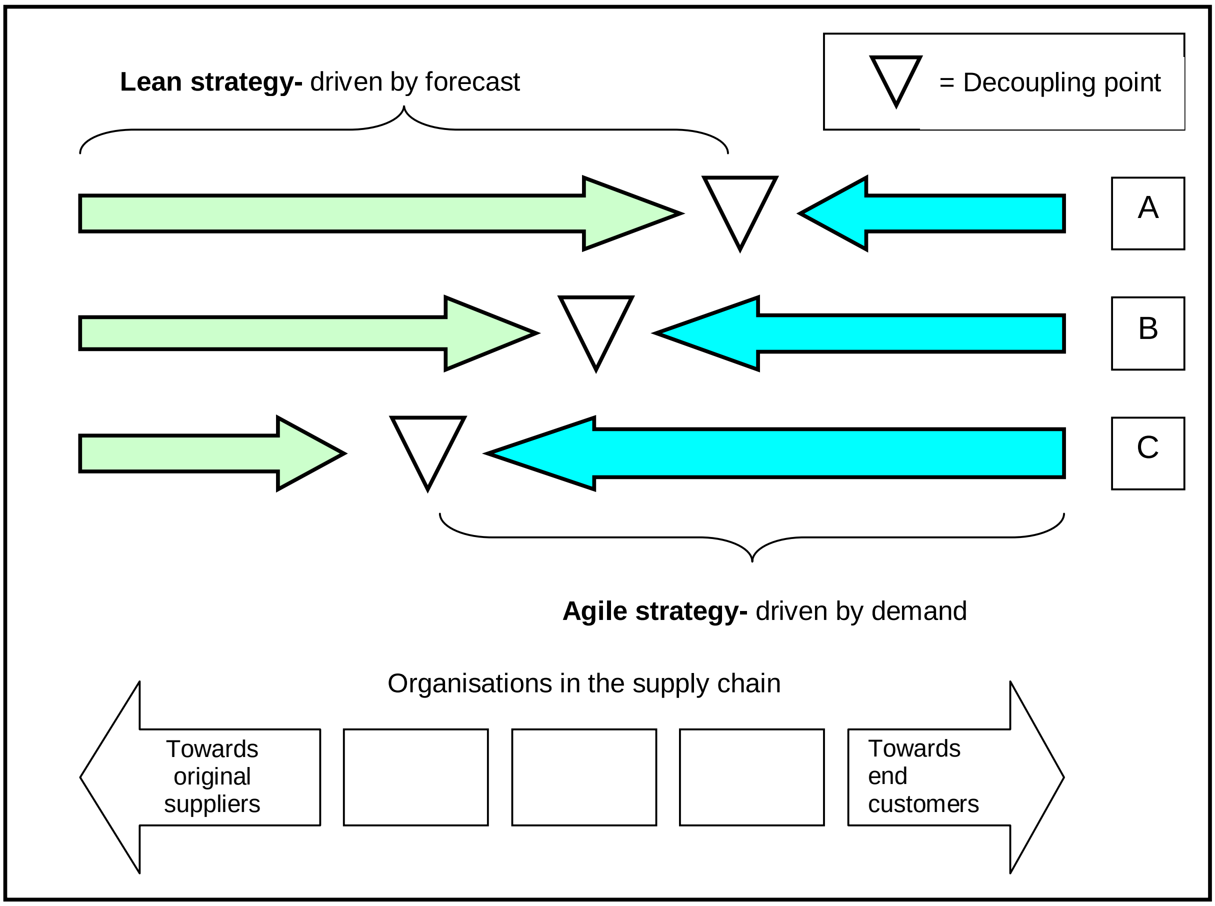

Figure 3.11: Different decoupling points
Source: Adapted form Christopher (2003:289).

Decoupling points (or push-pull boundaries) will vary depending on the degree and point where customisation (to adhere to the end customers' needs) takes place (Bozarth & Handfield, 2006:177). It became evident from the previous sections that this will depend on how far upstream real demand penetrates. The choice of production strategy determines the push-pull strategy and has a major impact on the dynamics of the supply chain (Taylor, 2004:29). To do this and utilise the concept of postponement, organisations may choose between many different production strategies by which the position of the push-pull boundary or decoupling point is closer or further away from the end customer (Bozarth & Handfield, 2006:178; Goldsby & Garcia-Dastugue, 2006:104; Hilletofth, 2009:22). Three broad production strategies will be discussed to bring across the effect of different decoupling points (in terms of their position relative towards the supply chain's end customers) on leagile supply chains. These strategies are make-to-stock, assemble-to-stock and make-to-order.

- **Make-to-stock**

When organisations produce products in anticipation of future customer orders, they operate in a make-to-stock environment. They expect to hold finished inventory in anticipation of future demand (Monczka, Handfield, Giunipero, Patterson & Waters, 2010:385). Generic or standard products are produced for immediate sale or delivery in anticipation of demand (Reid & Sanders, 2007:77; Webster, 2008:219). Products are therefore produced in advance of demand and are held in finished goods inventory until demand is realised (Taylor, 2004:337; Bozarth & Handfield, 2006:177). A make-to-stock system is thus responsive to the market because demand is satisfied immediately from inventories (Webster, 2008:219). With a make-to-stock strategy, inventories are pushed down the supply chain towards end customers so that it will be on hand if necessary (Taylor, 2004:29), but are not necessarily allocated to specific locations (Goldsby & Garcia-Dastugue, 2006:99).

Organisations that use this strategy produce a standardised product in larger volumes. Make-to-stock is used when lead times are relatively short and customer orders occur frequently (Wisner & Stanley, 2008:375). Delivery lead time is the shortest (as opposed to make-to-order and assemble-to-order strategies) (Reid & Saunders, 2007:77) and the decoupling point (or push-pull boundary) is close to the end customer (Bozarth & Handfield, 2006:177). Examples include basic tools such as hammers and screw drivers, as well as consumer products sold in retail stores (Bozarth & Handfield, 2006:177) such as refrigerators (Webster, 2008:219).

- **Assemble-to-order**

An assemble-to-order strategy involves producing standard components that can be combined to end customers' specifications (Reid & Sanders, 2007:77). The product is thus partially built in advance of demand. Final assembly is postponed until an order is received (Taylor, 2004:28; Bozarth & Handfield, 2006:177). Therefore, finished products are assembled from prebuilt and purchased components in response to a specific customer order (Webster, 2008:219). Components (as opposed to finished goods) are held in stock (Webster, 2008:219). Delivery times are longer than with make-to-stock strategies (Reid & Sanders, 2007:77), which means that this strategy is less responsive than the make-to-stock strategy (Reid & Sanders, 2007:77). It does, however, still allow for some customisation (Reid & Sanders, 2007:77). An example to illustrate assemble-to-order principles includes a T-shirt with a customer's name airbrushed onto it. The T-shirt is generic and is manufactured in advance. Final configuration only takes place when the customer's name is known (Bozarth & Handfield, 2006:177).

- **Make-to-order**

When organisations produce in response to a customer order, they are operating in a make-to-order environment. Just-in-time organisations usually operate in a make-to-order environment (Monczka *et al*., 2010:386). With a make-to-order strategy, organisations produce products to customer specifications after an order has been received (Reid & Sanders, 2007:77). The products are therefore produced on the basis of a realised demand, rather than being made to stock in advance of demand (Taylor, 2004:337) and the final configuration of the components is customer specific (Bozarth & Handfield, 2006:177). In this instance, raw materials and components can be configured into a wide variety of products depending on customers' needs (Goldsby & Garcia-Dastugue, 2006:99).

With make-to-order production, inventory is pulled down the supply chain by orders. Forecasts are less important with make-to-order, because there is no danger of making too much or too little inventory (Taylor, 2004:29). Make-to-order is used when customer demand is relatively low and lead times are long (Wisner & Stanley, 2008:375). Delivery times are the longest (as opposed to make-to-stock and assemble-to-order strategies) (Reid & Sanders, 2007:77), which means that make-to-order strategies are even less responsive than assemble-to-order strategies (Webster, 2008:219). Make-to-order products push the decoupling point further upstream in the supply chain (Bozarth & Handfield, 2006:177). As product volumes are low (Reid & Sanders, 2007:77), the decoupling point is far from the end customer.

The position in the supply chain of each of these strategies in relation to the end customer is illustrated in Figure 3.12.

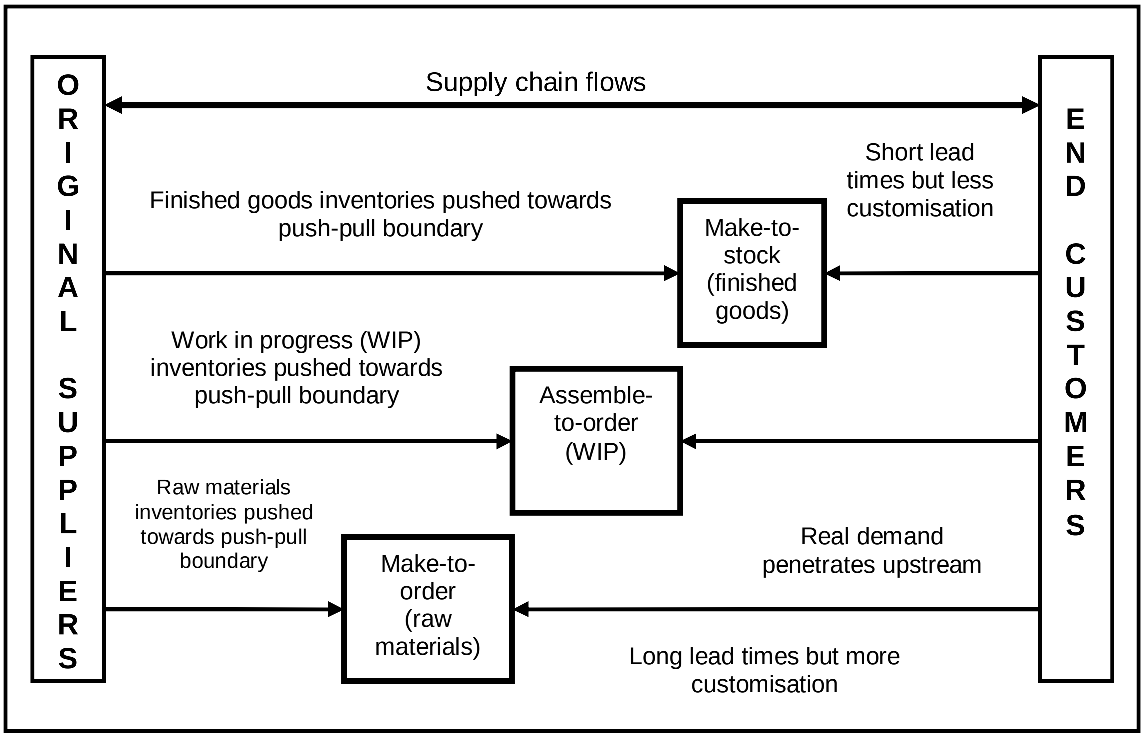

Figure 3.12: Supply chain production strategies
Source: Compiled from Taylor (2004:28) and Reid and Sanders (2007:77).

From the discussion about the push-pull boundary earlier, it can be concluded that inventories are pushed towards the push-pull boundary where final configuration of the finished product will take place to meet the needs of the supply chain's end customers. Table 3.2 shows what the benefits of each of these strategies are and also when these strategies should be used.

Table 3.2: Opportunities and benefits of production strategies

Strategy	**When to choose the strategy**	**Benefits**
Make-to-stock	For standardised products selling in high volume	Low manufacturing costs; meeting customer demands quickly
Assemble to order	For products requiring many variations	Customisation; reduced inventory; improved service levels
Make-to-order	For customised products or products with infrequent demand	Low inventory levels; wide range of product options; simplified planning

Source: Adapted from Cohen and Roussel (2005:12).

To conclude, if demand is certain and stable, organisations do not have to delay the manufacturing of finished goods. Accurate decisions can be made. Make-to-stock strategies can be used. The decoupling point is thus closer to the end customer (Goldsby & Garcia-Dastugue, 2006:100). Figure 3.13 illustrates the relationship among these three strategies based on product variety and demand volatility. The selection of the strategy depends largely on the perceived levels of demand variability across the assortment of products offered by the manufacturer (Goldsby & Garcia-Dastugue, 2006:100).

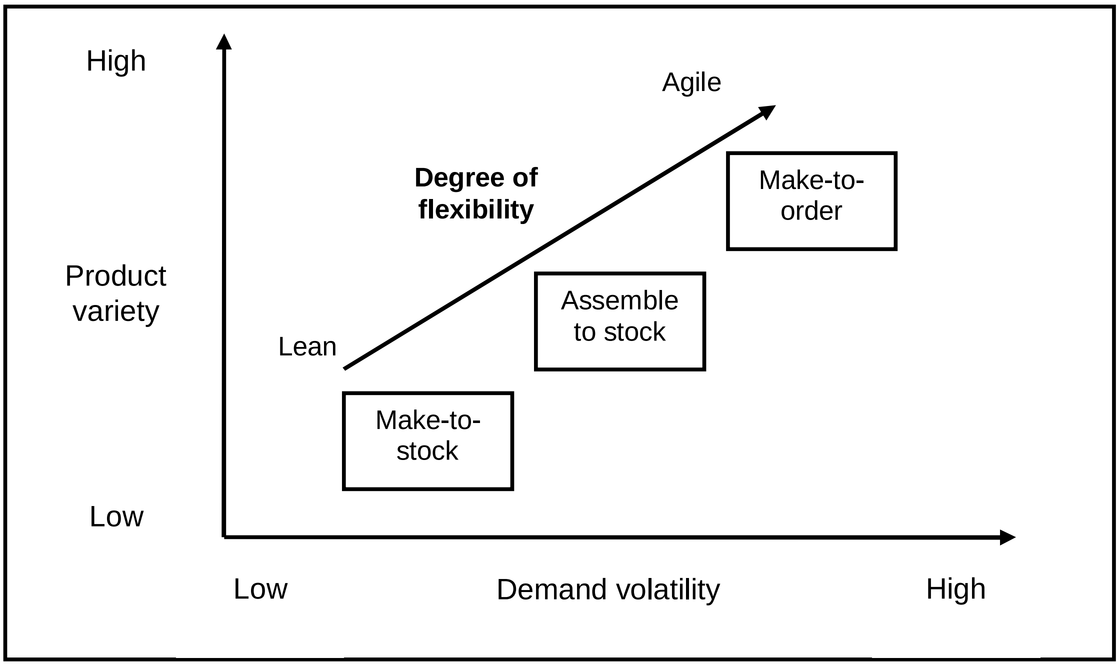

Figure 3.13: Production strategies
Source: Adapted from Goldsby and Garcia-Dastugue (2006:100) and Wisner and Stanley (2008:386).

To summarise this section: when the push-pull boundary or decoupling point is more upstream in the supply chain (and thus further away from the end customer), the following traits can be expected (Bozarth & Handfield, 2006:180):

- flexibility in response to unique customer needs will be greater;
- lead times of the finished product to the customer will tend to be longer; and
- products will tend to be more costly.

When the decoupling point is closer to the end customer (Bozarth & Handfield, 2006:180):

- flexibility in response to unique customer needs will be limited;
- lead times of the finished product to the customer will tend to be shorter; and
- products will tend to be less costly.

Due to the diverse nature of product offerings from organisations and supply chains, there are no supply chain strategies that are applicable to all types of products and markets. Organisations can use neither a lean nor an agile nor a leagile supply chain strategy when offering a wide range of products in various types of markets. It has become increasingly necessary to use several supply chain solutions concurrently. The supply chain strategy thus needs to incorporate several solutions, each of which is appropriate to a specific product or market condition (Hilletofth, 2009:17).

3.5 CONCLUSION

Selecting a supply chain strategy forms part of the second phase of SCD. A supply chain strategy is defined as a strategy required to manage the integration of all the supply chain activities through improved supply chain relationships to achieve a competitive advantage for the supply chain (Hines, 2004:5). The selection of a supply chain strategy is thus very important.

Essentially, organisations can choose between an efficient (or lean) and a responsive (or agile) supply chain strategy to meet the needs of their end customers. Efficient supply chains try to obtain a competitive advantage by minimising costs, while a responsive supply chain tries to optimise value. It is important to select a supply chain strategy that is aligned with the needs of the end customers. For functional products, organisations should select an efficient (or lean) supply chain strategy and for innovative products, organisations should select a responsive (or agile) supply chain strategy. Due to uncertainties in the supply chain, organisations also have the option to select a supply chain strategy that includes both efficient and responsive supply chains. This is known as a hybrid (or leagile) supply chain. Hybrid (leagile) supply chains utilise the benefits of efficient and responsive supply chains. Once organisations have selected a supply chain strategy, they can proceed to start scoping their supply chain’s structure. This is discussed in Chapters 4 and 5.

CHAPTER 4
SCOPING THE SUPPLY CHAIN STRUCTURE: SUPPLY CHAIN PARTNERS

4.1 INTRODUCTION

Once organisations have decided on a core supply chain strategy, they need to set a scope of the design effort (Taylor, 2004:284). Simply stated, the supply chain scope includes deciding on the members of the supply chain to be integrated under the SCD (Taylor, 2004:284). Decisions also have to be made concerning supply chain network structures. This includes deciding which supply chain members are wanted for forming partnerships and supply chain processes are to be linked (Mouritsen *et al.*, 2003:688). Decisions also need to be made about the structure of their relationships (Fawcett *et al.*, 2007:224). The supply chain network structure can be illustrated by means of supply chain mapping, which is an essential element of SCD (Hugo *et al.*, 2004:100).

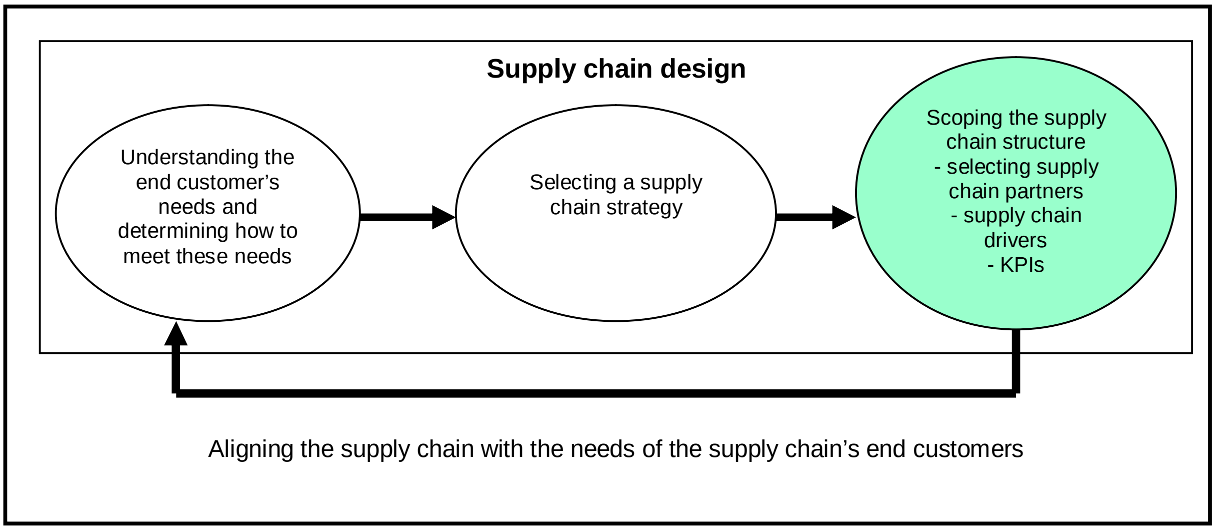

Figure 4.1: The three phases of supply chain design
Source: Compiled from Taylor (2004: 259, 279, 284), Fawcett *et al.* (2007:20) and Christopher (2005:57).

Scoping the supply chain structure will be discussed in two chapters. Chapter 4 looks at basic decisions about the supply chain network structure and supply chain relationships in particular. Once organisations understand the basics of the supply chain network structure, they also need to understand what supply chain relationships (including the integration of processes) entail. The supply chain structure also embodies managing supply chain drivers and deciding which KPIs to use to measure performance. Chapter 5 will cover supply chain drivers and supply chain KPIs and will look at the decisions that need to be taken about supply chain drivers that determine performance of the supply chain (Chopra & Meindl, 2010:59), as well as the KPIs that have to be measured (Hugo *et al.*, 2004:100). Scoping the supply chain structure is phase three of SCD and is highlighted in Figure 4.1. Scoping the supply chain structure as phase three of SCD is thus discussed in Chapters 4 and 5 and the layout of these two chapters is illustrated in Figure 4.2.

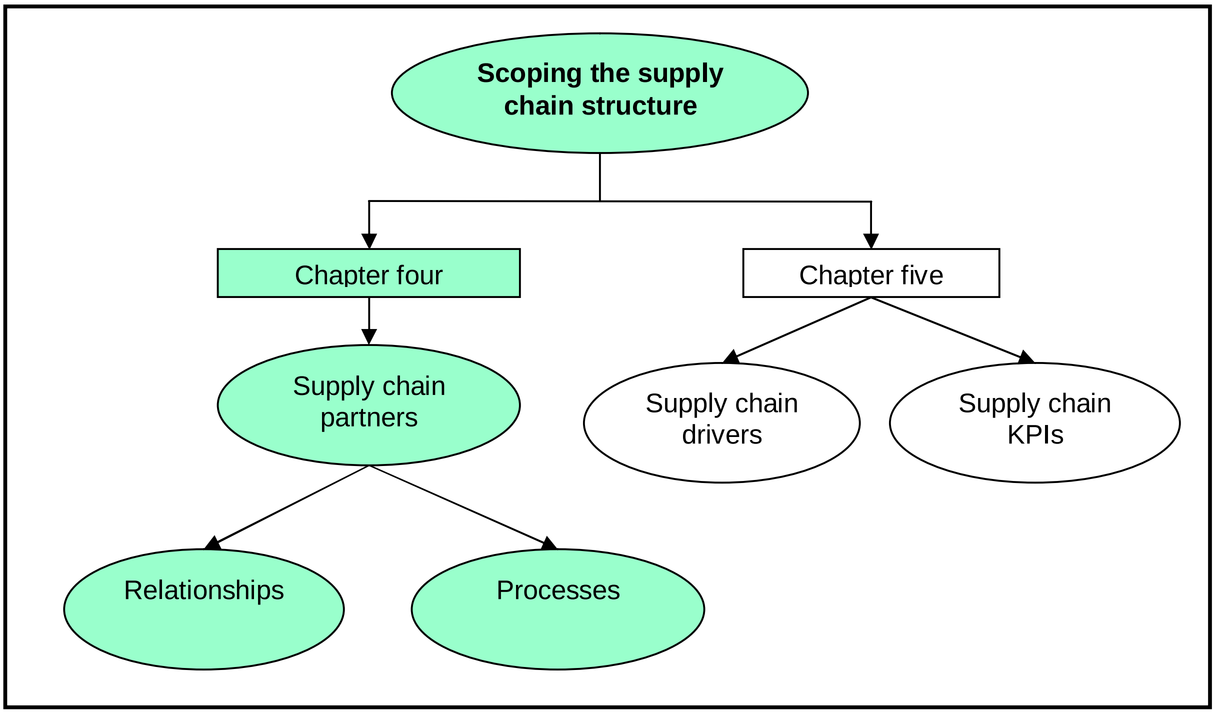

Figure 4.2: Phase three of supply chain design
Source: Researcher's own.

4.2 STRUCTURAL DIMENSIONS OF THE SUPPLY CHAIN NETWORK STRUCTURE

In Chapter 1 it was concluded that supply chains are inter-related networks of connected multiple and independent members working together mutually and co-operatively to manage, control and improve the flow of information, products and finances between suppliers and customers within complex relationships, with the goals of maximising customer value while minimising the total costs of the organisations involved (Chan & Qi, 2003:211; Wilding, 2002:118; Christopher, 2005:6; Lambert, 2006:2). The structure of the activities (or processes) within and among organisations is vital for creating superior competitiveness and profitability (Stock & Lambert, 2001:709) and one key element of managing the supply chain is to know and understand how the supply chain network structure is configured (Stock & Lambert, 2001:62). It is therefore necessary to take an in-depth look at the supply chain configuration or how the supply chain network is structured. The supply chain network structure comprises the member organisations and the sequential links between these organisations (Lambert, 2006:8; Appelqvist, Lehtonen & Kakkonen, 2004:676).

If organisations know their supply chain structures it can lead to improved performance (Quayle, 2006:105). Supply chains can be structured according to the following dimensions: (1) horizontal structure, (2) horizontal position of the focal organisation within the supply chain and (3) vertical structure of the supply chain (Lambert, 2006:12).

4.2.1 Horizontal supply chain dimensions

The horizontal structure (or supply chain length) refers to the number of tiers through which products flow across the supply chain between the initial source and end customer. The supply chain may be long, with numerous tiers between buyers and suppliers (refer to Figure 4.5), or short, with few tiers (refer to Figure 4.4) (Lambert, 2006:12; Waters, 2009:113, 114). Lambert (2006:12) distinguishes between three broad types of supply chains if their horizontal dimensions are observed. These three types are termed direct supply chain, extended supply chain and ultimate supply chain (Lambert, 2006:12).

4.2.1.1 Direct supply chain

A direct (or basic) supply chain focuses on the linkages between a single organisation and its immediate supplier and/or immediate customer. It may not necessarily be the original supplier or the end customer of the supply chain, but rather the immediate customer or supplier involved in the upstream and/or downstream flow of information, products and finances (Mentzer, 2001:6; Lysons & Farrington, 2006:94; Brindley & Ritchie, 2004:5). In a complex supply chain a given organisation may simplify the management of the supply chain by concentrating only on a portion of the overall supply chain (Stadtler, 2002:7). A direct supply chain is an example of a short horizontal supply chain and is illustrated in figure 4.3.

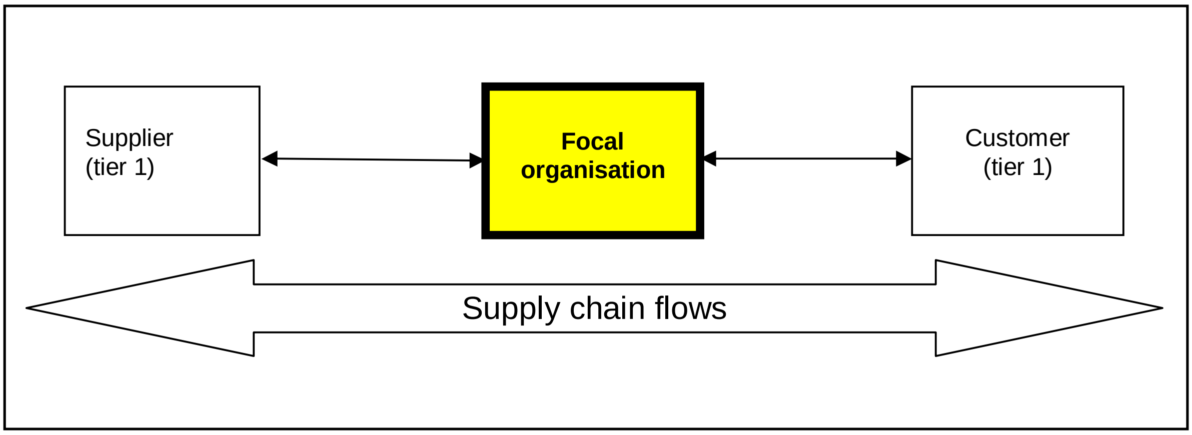

Figure 4.3: Direct supply chain
Source: adapted from Lysons & Farrington (2006:94) and Taylor (2004:26).

4.2.1.2 Extended supply chain

Extended supply chains include all those organisations working further up or down the supply chain from the immediate suppliers and customers. This may involve multiple organisations at each of the successive stages within the supply chain (Brindley & Ritchie, 2004:5). Therefore, an extended supply chain includes suppliers of the immediate supplier and customers of the immediate customer (Mentzer, 2001:6; Lysons & Farrington, 2006:94). An extended supply chain is illustrated in Figure 4.4.

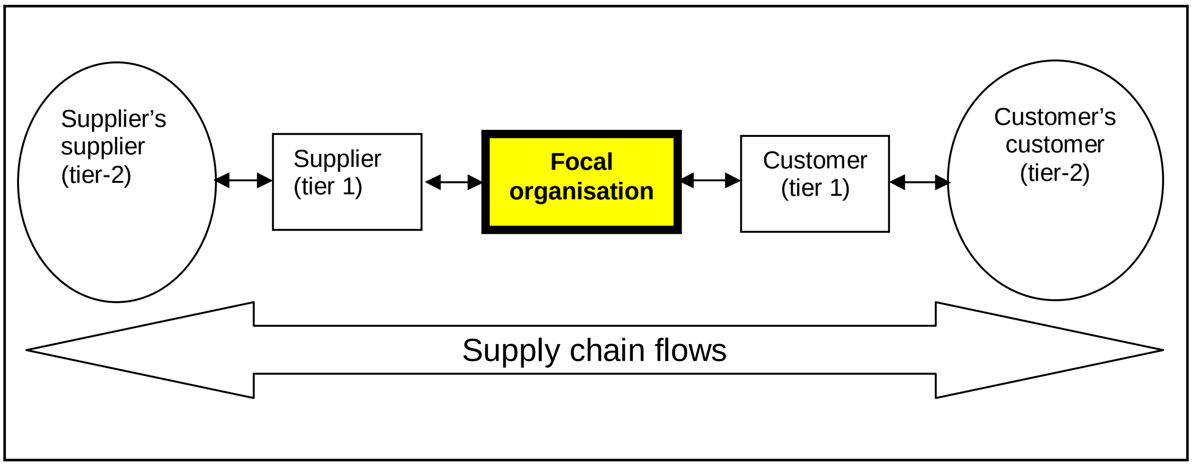

Figure 4.4: Extended supply chain
Source: Adapted from Lysons and Farrington (2006:94).

4.2.1.3 Ultimate supply chain

The ultimate supply chain refers to the complete set of stages from initial raw material through to end customer, incorporating all the associated services that contribute to the ultimate added value received by the customer (Brindley & Ritchie, 2004:5). Therefore, an ultimate supply chain includes all the organisations involved in all the upstream and downstream flows of information, products and finances from the initial supplier to the end customer (Mentzer, 2001:6; Lysons & Farrington, 2006:94). It is evident from the explanation of ultimate supply chains that supply chains can become complex. In fact, supply chains can contain many different organisations and each organisation can work with many other organisations. There can thus be a huge number of different configurations for supply chains (Waters, 2007a:39).

An organisation's immediate suppliers and customers are referred to as first-tier suppliers and first-tier customers. Immediate suppliers of the first-tier suppliers and immediate customers of the first-tier customers are referred to as second-tier suppliers and customers. Therefore, a first-tier supplier is a supplier that provides products directly to a particular organisation and a second-tier supplier is a supplier that provides products to an organisation's first-tier supplier (Bozarth & Handfield, 2006:8; Waters, 2009:9). Therefore an *n*-tier supplier is a supplier that provides products to an organisation's *(n-1)*-tier supplier. Similarly, a first-tier customer is thus a customer to whom an organisation provides products directly and a second-tier customer is a customer to whom an organisation's first-tier customer provides products. Tiers are thus numbered in sequence from one to *n* (where *n* equals the maximum number of tiers upstream or downstream from the focal organisation) (Fawcett *et al.*, 2007:7). An ultimate supply chain is illustrated in Figure 4.5.

As already mentioned, an organisation will not only focus on flows within a single chain, but usually will have to deal with divergent and convergent flows within a complex supply chain network resulting from many different customer orders to be handled in parallel (Stadtler, 2002:7). Supply chains will tend to diverge if they are followed across several links from the supplier towards the customer. This is because materials can find a way into a wide range of different products. A final product is the result of convergence, in the sense that different types of materials are embodied in the final product. While each component may have its own supply chain, the supply chains converge as soon as assembly or sub-assembly of the final product starts. Most materials diverge from their source, and converge on the finished product (Baily *et al.*, 2008:71). It is also important to know that supply chains differ because organisations involved in ultimate supply chains form networks of chains with common points of interconnection and each chain will be different from another (Lysons, 2000:68).

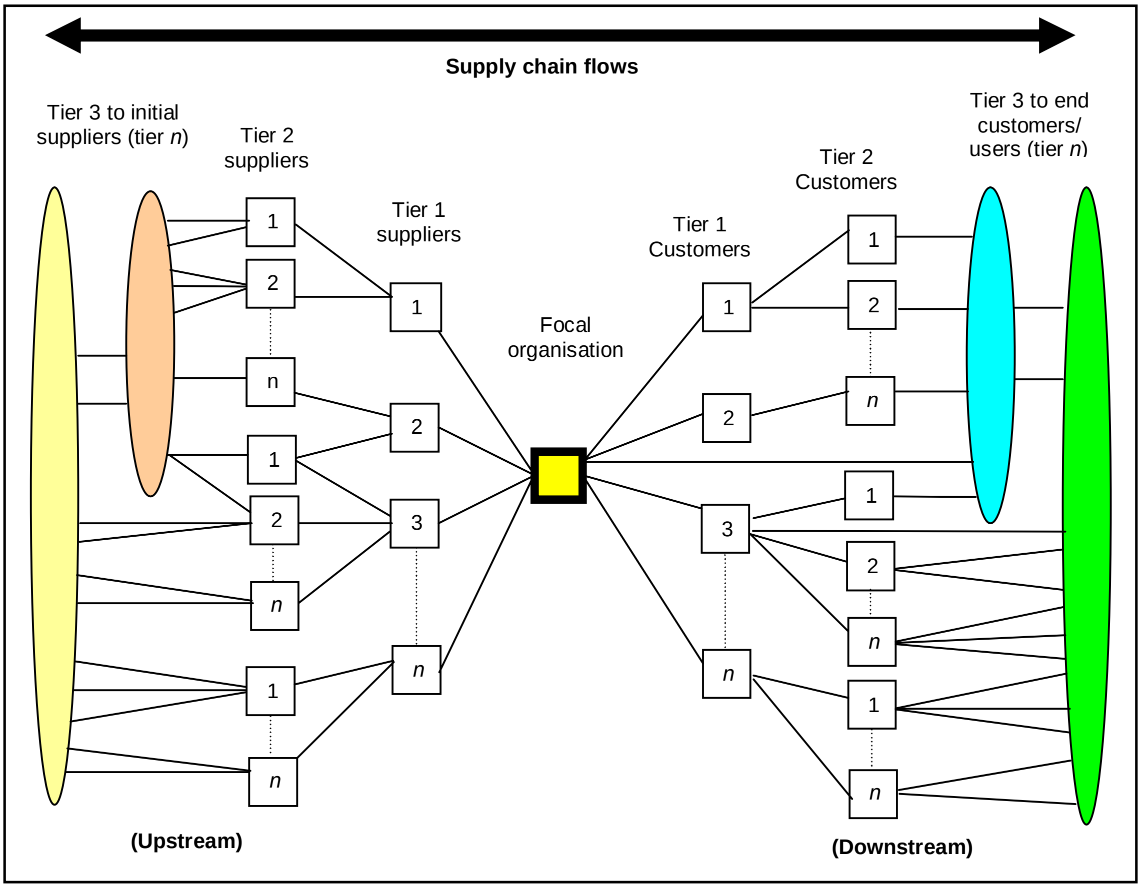

Figure 4.5: Ultimate supply chain
Source: Adapted from Lambert (2006:5).

From this discussion on converging and diverging products, another horizontal structural dimension becomes evident. It is the focal organisation's horizontal position within the supply chain. An organisation can be positioned (Lambert, 2006:12):

- at or near the initial source of supply;
- at or near the end customer; or
- somewhere between these end points of the supply chain.

Therefore, the supply chain network will look different depending on the focal organisation's position in the supply chain. The supply chain of an organisation positioned in the middle of the supply chain looks totally different from the supply chain of a supplier positioned closer to the initial supplier on one end of the supply chain or the supply chain of a customer positioned closer to the end customer at the other end of the supply chain (Lambert, 2006:8, 9; Wisner *et al.*, 2009:448). Figure 4.6 illustrates examples of supply chains as seen by an organisation near the ultimate customer end of the supply chain as opposed to a supply chain seen by an organisation closer to the original supplier end of the supply chain. These organisations may form part of the same supply chain. However, the supply chain will be viewed differently by each organisation, because each organisation sees itself as the focal organisation in the supply chain (Lambert, 2006:8).

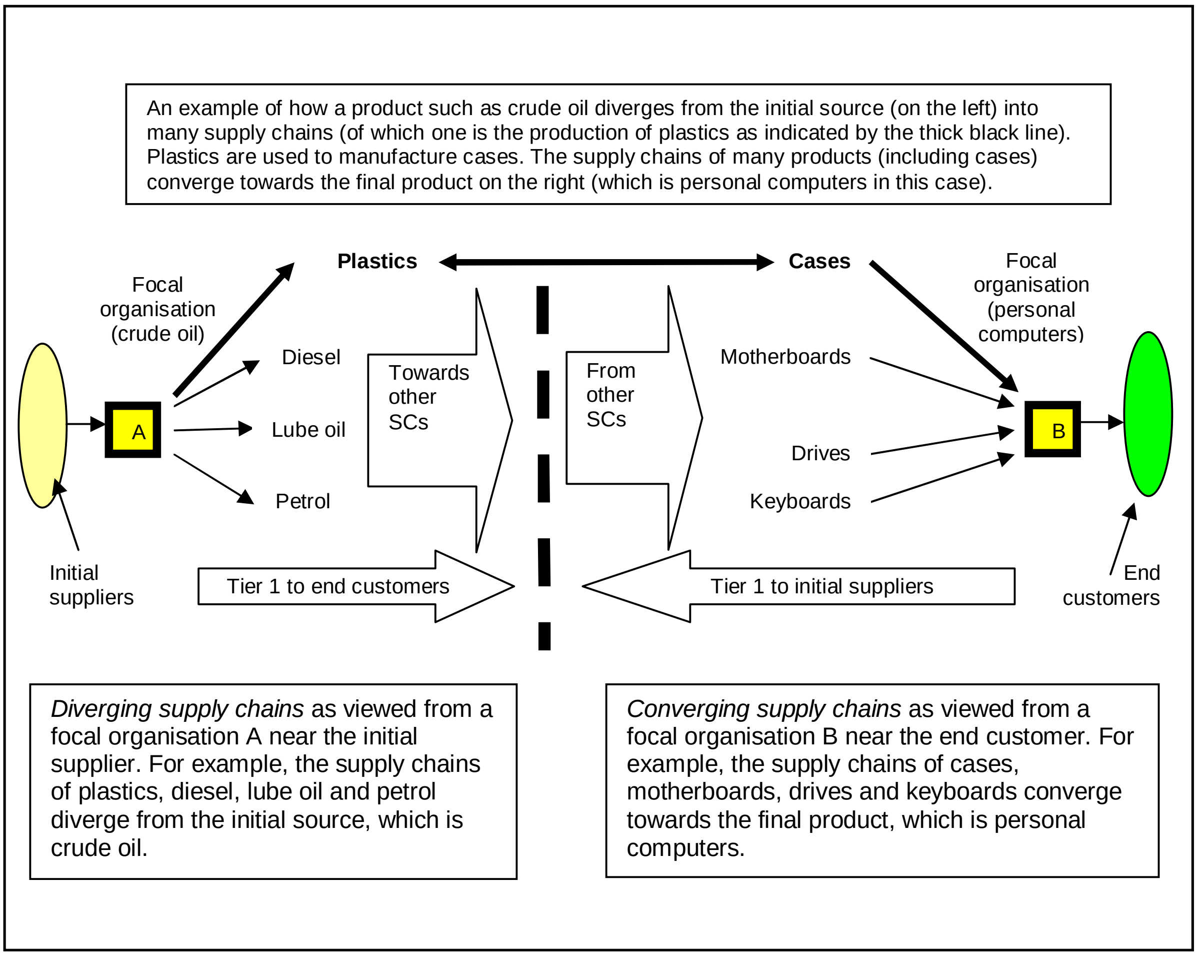

Figure 4.6: Converging and diverging supply chains
Source: Adapted from Lambert (2006:10) and Baily *et al.* (2008:74).

4.2.2 Vertical supply chain dimensions

The vertical structure refers to the number of suppliers (or customers) represented with each tier and therefore refers to the number of parallel routes along which products (or parts thereof) can flow on their way through the supply chain towards the end customer. An organisation can have a narrow vertical structure, with few organisations at each tier (as illustrated on the right or customer side of Figure 4.7), or a wide vertical structure with many suppliers (or customers) at each tier (as illustrated on the left or supplier side of Figure 4.7) (Lambert, 2006:12; Waters, 2009:114).

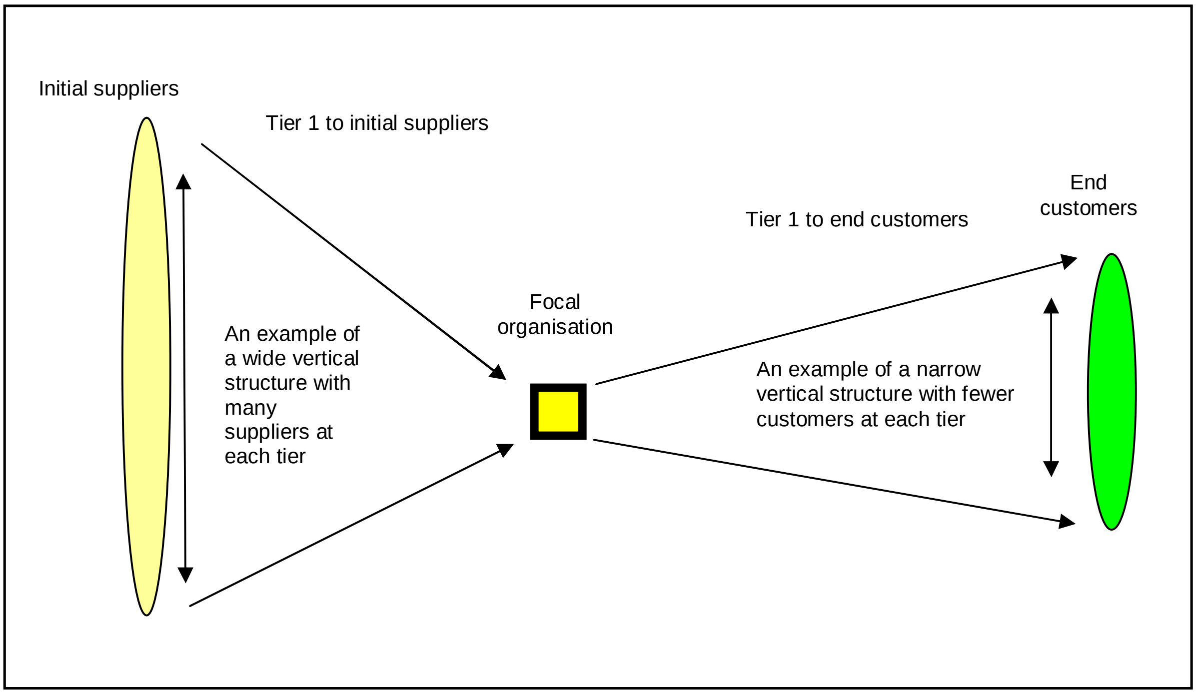

Figure 4.7: Different vertical supply chain dimensions
Source: Compiled from Lambert (2006:12).

The best choice of supply chain length and breadth depends on many factors with three of the most important being the amount of control that an organisation wants over its supply chain activities, the quality of the service and cost (Waters, 2009:115).

Organisations have to decide which organisations within their supply chain scope they want as partners in their efforts to make the supply chain work. If the design only spans a handful of organisations, it makes sense to get them all involved. But that is rarely feasible and in most cases the collaboration will be limited to the organisations that exert the most influence over the performance of the supply chain (Taylor, 2004:284, 285). The more supply chain members integrated under the new design, the greater the opportunity will be to build a competitive supply chain. Organisations must be careful, however, not to overextend themselves because returns diminish as more organisations are added to the SCD (Taylor, 2004:284). There are obvious benefits to shorter supply chains. This means fewer supply chain partners (which decreases complexity), as well as shorter distances travelled. The most obvious benefits are lower transportation costs and reduced lead times from closer suppliers. But these bring associated benefits of more flexibility, fewer delays, less loss and damage to goods, and so on (Waters, 2007a:201).

Therefore, when determining the network structure, it is necessary to carefully consider the members of the supply chain (Stock & Lambert, 2001:63) and the relationships with the supply chain members. As already mentioned, supply chain members include all parties with whom the focal organisation interacts directly or indirectly through its suppliers or customers. To make a very complex network more manageable, it seems appropriate to distinguish between primary and supporting supply chain members (Lambert, 2006:11).

4.2.2.1 Primary supply chain members

Primary supply chain members include all those autonomous organisations that carry out value-adding activities in the business processes designed to produce a specific output for a particular customer (Lambert, 2006:11). Therefore, primary supply chains are those that ultimately provide the products to the end customer (Baily *et al.*, 2008:66). Thus, production materials, parts, components and subassemblies and, finally, the finished product may be seen to be flowing in the primary supply chains of, for example, a manufacturer. In the case of retailers and wholesalers, the products sold to their customers flow through their primary supply chains (Saunders, 1997:151, 152). Once the primary supply chains have been identified, organisations have to identify their critical supply chain trading partners. Identifying the primary supply chain partners allows an organisation to concentrate its time and resources on managing the important process links, enabling the supply chain to perform well (Wisner *et al.*, 2009:448; Handfield & Nichols, 1999:43). This is an essential part of successful supply chain design.

4.2.2.2 Supporting supply chain members

In contrast, supporting supply chain members are organisations that simply provide resources, knowledge, utilities or assets for the primary supply chain members (Lambert, 2006:11). Supporting supply chains are thus regarded as those that supply consumables or maintenance, repair and operating (MRO) items and capital items to support primary supply chains (Baily *et al.*, 2008:66). Supporting supply chains thus provide the necessary supplies for organisations in the primary supply chain to carry out their activities. The key point is that these supporting supply chains do not involve outbound logistics and generally involve customers that will not be included in decision-making processes (Saunders, 1997:152). Other examples include organisations that lease trucks to manufacturers, banks that lend money to retailers, owners of buildings that provide warehouse space, or organisations that provide production equipment, or print marketing brochures. An organisation can, however, perform both primary and supporting activities within a supply chain (Lambert, 2006:11).

The challenge is to find effective methods for developing the appropriate type of relationship between buyers and suppliers in the supply chain (Lambert *et al.,* 2006:167). In fact, the essence of SCM lies in the ability to orchestrate collaborative relationships both internally and with supply chain partners. This includes coordinating supply chain performance (Bowersox *et al.*, 2010:360, 369). Supply chain relationships thus aim to achieve strong lasting relationships between customers and suppliers with a view to securing mutual benefits and the added value of competitive advantage for both parties (Lysons & Farrington, 2006:223, 224).

4.3 SUPPLY CHAIN RELATIONSHIPS WITHIN THE NETWORK STRUCTURE

From the definition of SCM it is clear that SCM focuses on improved upstream and downstream supply chain relationships with suppliers and customers by means of sharing information to achieve a sustainable competitive advantage for the supply chain as a whole (Handfield *et al.*, 2009:6; Christopher, 2005:5). Cohesion between supply chain partners is therefore necessary to reach the goals of SCM (Hugo *et al.*, 2004:6). Business relationships apply when individuals, organisations, and groups within and external to an organisation interact (Lysons & Farrington, 2006:223, 224).

Any interaction between a buyer and a supplier constitutes a buyer-supplier relationship (Hugo, Badenhorst-Weiss & Van Biljon, 2006:110). Organisations now realise that supply chains compete against each other (rather than organisations competing against each other). They have realised that supply chains can be made more competitive through the value that is added and the costs that are reduced overall. Because SCM spans organisational boundaries, the success of any one organisation will depend upon how well it manages its supply chain relationships (Christopher, 2005:202; Chan & Qi, 2003:209). The increasing importance of collaboration between supply chain partners has positioned the supply chain as a primary unit of competition and widespread realisation that cooperation is both permissible and encouraged has served to stimulate formation of supply chain partnerships (Bowersox *et al.*, 2010:9). As more and more organisations implement SCM, they are increasingly linked to their suppliers and customers inextricably throughout the whole value creation process, from the conception and design to the very end of delivering products to end customers (Maheshswari, Kumar & Kumar, 2006:278). Supply chain relationships thus are important elements of SCM (Power, 2005:253).

4.3.1 Supply chain relationship linkages

Business relationships exist between organisations (inter-organisational), as well as inside the organisations themselves (intra-organisational) (Hines, 2004:163) and a large part of managing supply chains consists of managing these different supply chain relationships (Mentzer, 2004:31; Lambert, Knemeyer & Gardner, 2006:167). There are several links or relations between buyers and sellers in a supply chain. There is an external relationship between the supplier and the buying organisation. There are also internal relations within the buying organisation between the relevant functions and there is another external relation between the buying organisation (which now becomes the supplier) and the customer (Knudsen, 2001:70). Thus, every buying organisation in turn becomes the supplier to the next buying organisation in the supply chain until the end customer is reached (Hugo *et al.*, 2006:104). It is evident that, in the SCM perspective, the link between the buying organisation and its direct suppliers and customers are external ones. The ability of an organisation to connect these two external links through its internal organisation will, to a large extent, determine the effectiveness of its total supply chain (Leenders, Johnson, Flynn & Fearon, 2006:494, 495).

Customer relationship management (CRM) and supplier relationship management (SRM) provide the critical external linkages throughout the supply chain (Lambert, 2006:27). When viewing these external linkages from the supplying organisation, CRM is the SCM process that provides the structure for how relationships with customers are developed and maintained (Lambert, 2006:25). On the other hand, SRM is, as the name suggests, a mirror image of CRM. When viewing the external relationships between buyers and sellers from the customer organisation, SRM is the SCM process that provides the structure for how relationships with suppliers are developed and maintained (Lambert, 2006:115). Just as close relationships need to be developed with key customers, management should forge close relationships with a number of key suppliers and maintain more traditional relationships with the others (Lambert, 2006:115). CRM and SRM are discussed as SCM processes later in the chapter.

Figure 4.8 provides a simplified overview of these links between customers and suppliers. The figure illustrates how CRM and SRM fit into the external relations between customers and suppliers; one relationship between buyer and seller will include CRM from the supplier’s point of view and SRM from the buyer’s point of view. Figure 4.8 also illustrates the internal relationships necessary between the various relevant functions of the focal organisation.

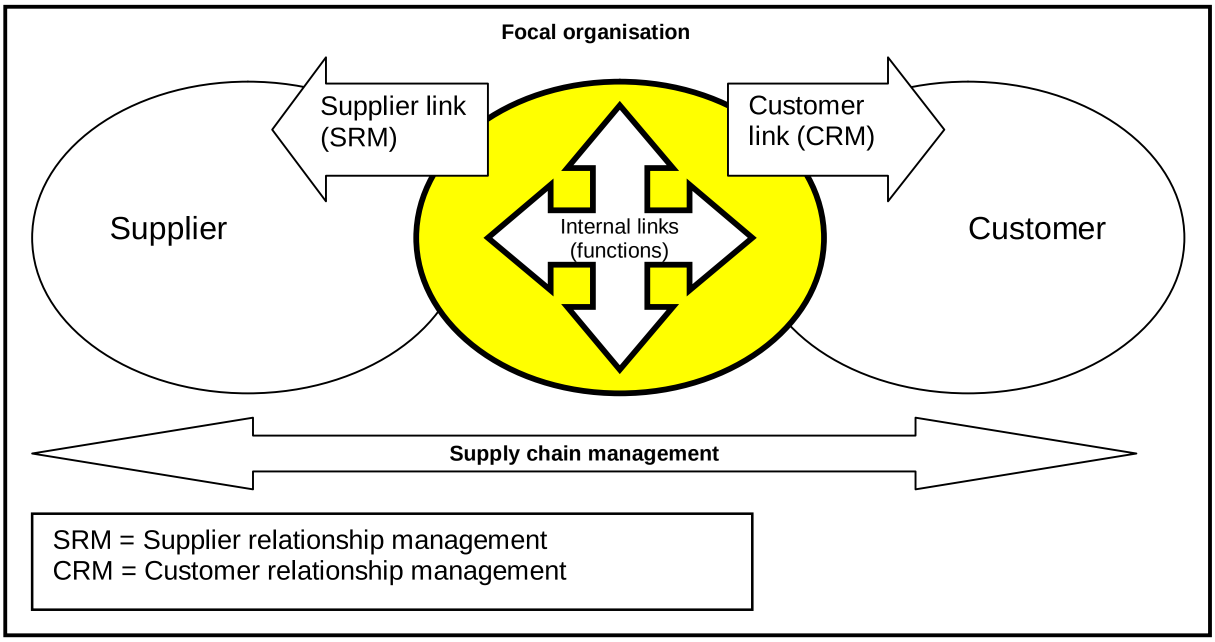

Figure 4.8: The three core supply chain relationship links
Source: Adapted from Leenders *et al.* (2006:495) and Lambert *et al.* (2006:27, 117).

4.3.2 The supply chain relationship spectrum

Relationships between buyers and suppliers in supply chains can range from single transactions to complex interdependent relationships (Mentzer, 2004:31). These relationships can be positioned on a continuum or spectrum with transactional arm's length relationships on one end of the continuum and vertical integration on the other end (Lambert *et al.*, 2006:169; Benton, 2007:187; Hines, 2004:187; Jacobs *et al*., 2009:368; Hallikas, Puumalainen, Vesterinen & Virolainen, 2005:74, 75).

However, vertical integration implies that a single organisation owns and controls the supply chain (Hines, 2004:187) including its upstream suppliers and downstream customers (Christopher, 2005:17). The emphasis with vertical integration is on ownership of the supply chain by an organisation. Vertical integration thus falls outside the scope of this study (which focuses on SCM of independent supply chain members). Vertically integrated organisations serving slow-moving mass markets once attempted to own much of their supply chains (Hugos, 2006:21) and, although vertical integration is still practiced in some supply chains (Taylor, 2004:64), it has, to a large extent, given way to virtual integration, because organisations now focus on their core competencies and partner with other supply chain members (Hugos, 2006:21).

Therefore, the supply chain relationship spectrum will stretch from transactional arm's length relationships on one end of the continuum to strategic alliances on the other end of the continuum (Fawcett *et al.*, 2007:347). Creating and nurturing supply chain alliances has been recognised as a critical source of competitive advantage (Ross, 1998:ix).

The view that relationships are either transactional or alliance based (in other words, positioned only on either end of the continuum) is a great oversimplification. These relationship types merely represent opposite extremes. In practice, many business relationships fall between these two extremes (Baily *et al.*, 2008:210, 211; Mentzer, 2004:33; Hines, 2004:187). These relationships that fall between the extremes of transactional arm's length relationships and alliances are referred to as collaborative relationships or strategic partnerships. Normally, an organisation will have a wide range of relationships spanning the entire spectrum, the majority of which will not be partnerships at all but arm's length relationships. Organisations have to decide what kind of relationships to maintain with their supply chain partners (Leenders *et al.*, 2006:494). The continuum that illustrates the range of these relationships is illustrated in Figure 4.9.

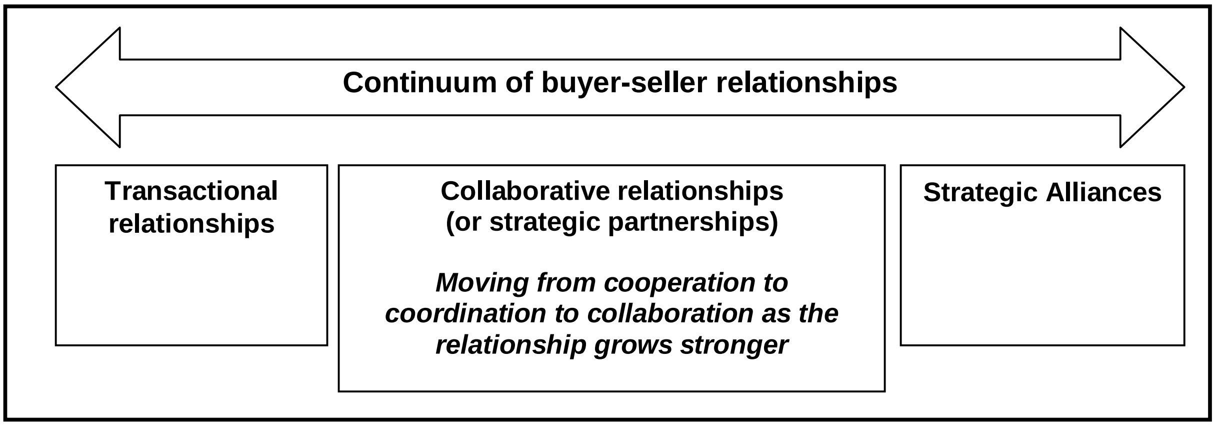

Figure 4.9: The supply chain relationship spectrum
Source: Adapted from Fawcett *et al.* (2007:347); Hines (2004:187) and Burt *et al.* (2010:66).

4.3.2.1 Transactional arm's length supply chain relationships

Arm's length or transactional supply chain relationships can be labelled the most basic type of supply chain relationship (Burt *et al.*, 2010:66). In fact, most relationships between organisations have been at arm's length (Lambert *et al.,* 2006:169; Fawcett *et al.*, 2007:349). Therefore virtually all buying and selling organisations have transactional relationships. These relationships are neither good nor bad for the supply chain partners. With a transactional relationship neither party is particularly concerned with the well-being of the other party (Burt *et al.*, 2010:66). Transactional arm's length relationships are also referred to as market exchange relationships. In these relationships, both buyer and seller have made low relationship specific investments and the switching costs and investment risks are thus low. These risks are fairly easily identified and controlled (Hallikas and Virolainen, 2004:55).

Any supply chain organisation should recognise the value of a traditional arm's length relationship and utilise it when it is appropriate. The idea that organisations should form close relationships with each other is sometimes advocated, irrespective of the circumstances (Baily *et al.*, 2008:211). However, not all supply chain relationships are strategic and not all deserve the attention and level of investment of more coupled buyer-supplier relationships (Birou, 2006:292; Davis-Sramek, Fugate & Omar, 2007:44). In many cases there is no sense in becoming involved in a joint commitment (Lambert *et al.*, 2006:169). In fact, close partnerships or alliances (which will be discussed later) are not always appropriate, for example, when (Leenders *et al.*, 2006:506; Burt *et al.*, 2010:74-76):

- there is little stability of price, market and buyer demand;
- the capability of potential supply chain members is insufficient;
- the relationship can be used to misuse the other party;
- there are no real long-term benefits to be gained from the relationship; and
- there is no internal buy-in to the partnership from within the organisations.

The place for the traditional arm's length relationship should be reserved for short-term relationships, one-time purchases, or real commodities (Birou, 2006:292). Buyers may switch to different suppliers with their next purchases (Webster, 2008:94). In most cases, when the exchange between buyer and seller ends, the relationship ends (Lambert *et al.*, 2006:169). Products involved in these relationships are referred to as routine or non-critical products (Van Weele, 2010:198; Hines, 2004:183, 185) and, in practice, most products fall into this category (Van Weele, 2010:198). In the case of routine products, there is low supply risk and little impact upon the financial results. There are many suppliers of this type of product and many standard or substitute products. In fact, many items in this category have standardised quality and technology requirements (Handfield *et al.*, 2009:212) with few technical or commercial problems from a buyer point of view (Van Weele, 2010:198). The 'switching costs' of moving from one supplier to another supplier are low in this type of relationship. Price is the most important attribute (Hines, 2004:183; Handfield *et al.*, 2009:212), with a relatively small value per item (Van Weele, 2010:198).

Generally, these products represent relatively low spending amounts but may consume a disproportionate amount of time to acquire. Buyers want to minimise their buying efforts, transaction costs, and price (Handfield *et al.*, 2009:212), preferably through mechanisation of the buying process or through outsourcing (Copacino, 1997:123). To do so, systems such as procurement cards, electronic catalogues, direct ordering systems through the Internet and other automated transaction systems that eliminate unnecessary effort should be established by buyers (Handfield *et al.*, 2009:212). This type of procurement typically involves category C products in ABC inventory analyses, in which category A represents the high value items, category B represents the medium value items and category C represents the lower value items of an organisation (Hines, 2004:183; Christopher, 2005:69, 70).

The transactional arm's length relationships can also be defined from a pure or open market view where free market competition forces are at work (Hughes *et al.*, 1998:62; Hines, 2004:178). These relationships fall within the domain of free market competition, where there are many competing suppliers to choose from. The buyer may be spending significant amounts of money and sellers may be desperate for business. Risks in these relationships are low (Hughes *et al.*, 1998:62, 63).

These relationships are characterised by competitive bidding, active use of enquiries, market testing and arm's length tendering (Hughes *et al.*, 1998:63). Price is the key negotiating point (Hines, 2004:174). In fact, full and vigorous use of competition is usually the main lever of persuasion adopted (Hughes *et al.*, 1998:63). Negotiations often involve adversarial or conflict negotiation techniques. Hence, these relationships are often referred to as win-lose relationships (Hines, 2004:174) because organisations try to take advantage of each other (Maheshswari *et al*., 2006:279). The underlying interest of the buyer in this scenario is to acquire as many resources as possible for as little money as it is necessary to pay (Baily *et al.*, 2008:14). These relationships are often adversarial rather than cooperative (Chan & Qi, 2003:209) and power is an important issue as it is a relationship in which the larger organisation has an advantage (Hines, 2004:174).

4.3.2.2 Collaborative relationships (or supply chain partnerships)

While arm's length relationships represent an appropriate option in many situations, there are times when a closer, more integrated relationship, referred to as a partnership, provides significant benefits to both buying and selling organisations (Lambert *et al.*, 2006:169; Baily *et al.*, 2008:210, 211). Simple customer-supplier relationships may evolve into more formal partnerships over time, when commitment between the buying and supplying organisations develops into enhanced collaboration in creating new value for the ultimate customers (Maheshswari *et al.*, 2006:279). As the business environment becomes more complex, organisations within supply chains realise that many benefits can be obtained through long-term relationships from sharing technology, information and planning with other organisations (Benton, 2007:190).

The development of partnerships (or collaborative relationships) invariably involves the development of inter-organisational relationships (Leat & Revoredo-Giha, 2008:398). As supply chain partners become aware of their interdependence and the necessity of co-operation, they move away from the transactional spectrum of the continuum towards more intense collaborative relationships (Burt *et al.*, 2010:69). In doing so they strengthen supply chain integration and provide sustainable competitive advantage (Lambert *et al.*, 2006:167; Chan and Qi, 2003:209). In fact, real competitive advantage comes from being able to leverage unique collaborative relationships in the supply chain to drive optimal planning decisions across organisational boundaries (Theis, Mills, Kennedy & Pearson, 2003:308). Collaboration has been referred to as the driving force behind effective SCM. The rationale behind collaboration is that a single organisation cannot successfully compete by itself (Min, Roath, Daugherty, Genchev, Chen, Arndt & Richey, 2005:238).

Collaborative relationships amongst supply chain partners thus move beyond arm's length transactions by involving efforts of both organisations to coordinate functional activities. With this development, supply chain relationships move from arm's length relationships towards strategic alliances. Initially, organisations recognise each other as partners and, on a limited basis, cooperate and coordinate activities and planning. The partnership usually has a short-term focus and typically involves only one division or a limited number of functional areas within each organisation. Most collaborative relationships (or supply chain partnerships) will fall into this category (Lambert *et al.*, 2006:170), but already the organisation focuses on fewer suppliers than with arm's length relationships (Hines, 2004:188).

Collaboration is defined as the process by which two or more parties adopt a high level of purposeful cooperation to maintain a relationship over time (Handfield *et al.*, 2009:122) and is the cornerstone of effective SCM (Cohen & Roussel, 2005:139). Collaboration is necessary to improve supply chains (Ayers, 2004:35). In fact, the motivation for supply chain collaboration is to improve overall supply chain performance (Simatupang & Sridharan, 2004:9). It is all about communicating demand information to trading partners so that they can make products, components, and materials available at the proper points in the supply chain when they are needed (Ireland & Crum, 2005:5). Therefore, collaboration among supply chain partners is an important ingredient to supply chain success and to the ultimate goal of integration, that is, operating the whole supply chain as if it were a single organisation (Coyle *et al.*, 2003:25). These collaborative ties between the supply chain members have become a means for attaining a competitive advantage (Maheshswari *et al.*, 2006:279). Benton (2007:190) even argues that supply chain partnerships are essential and inevitable in maintaining a competitive advantage. The focus has expanded from intra-organisational relationships towards inter-organisational relationships (Maheshswari *et al.*, 2006:279).

(Benton (2007:185) sums it up in saying that a supply chain partnership is a relationship formed between two independent entities in a supply chain to achieve specific objectives and benefits and it is these partnerships that form the essential building blocks of SCM. A partnership is a tailored business relationship based on mutual trust, openness, shared risk and shared rewards that results in business performance greater than would be achieved by the two organisations working together in the absence of a partnership (Lambert *et al.*, 2006:169). The term partnership does not imply partnership as in the legal form of business ownership. It is a commitment by customers and suppliers to a long-term relationship based on clear, mutually agreed objectives to strive for world class capability and competitiveness (Baily *et al.*, 2008:220; Leenders *et al.*, 2006:502). For this reason, the concept of collaborative relationships is preferred above supply chain partnerships.

A collaborative relationship thus comprises closely integrated, mutually beneficial relationships that enhance supply chain performance (Lambert *et al.*, 2006:169). The closer the relationship between buyer and supplier, the more likely it is that the expertise of both parties can be applied to mutual benefit (Christopher, 2005:201). As relationships get closer, organisations work together towards common goals and share investments (Mentzer, 2004:33) in areas such as product development, inventory control, and non-core process outsourcing (Chan & Qi, 2003:209). Many organisations have found that, by close co-operation with suppliers, they can improve product design, value engineer components, and generally find more efficient ways of working together (Christopher, 2005:201). Moreover, various value-adding processes, from material, purchasing, production and assembly to distribution and customer order delivery, are integrated and synchronised to achieve the common goal of enhancing customer satisfaction (Chan & Qi, 2003:209).

Thus, as the relationship develops further, organisations progress beyond the coordination of activities to the integration of activities. This includes information links through, for example, electronic data interchange (EDI). Although the relationship is not expected to last indefinitely, the partnership has a long-term horizon. Multiple divisions and functions within the organisation are involved in the collaborative relationship (Lambert *et al.*, 2006:170; Benton, 2007:187; Hines, 2004:188), as collaborative relationships usually involve a relationship between two or more different types of organisations at different stages of the supply chain (Hines, 2004:178, 179) and provide a way to leverage the unique skills and expertise of each partner (Lambert *et al.*, 2006:167). Organisations (and thus supply chains) are able to get new products to markets faster and more efficiently by establishing collaborative relationships (or strategic partnerships) with each other (Hines, 2004:178, 179).

Bowersox *et al.* (2010:372) argues that the driving force underlying the emergence of collaborative relationships among organisations is the recognition of mutual dependence. When an organisation acknowledges its dependency on its suppliers and/or its customers, the stage is set for collaboration. These collaborative relationships can then bridge the barrier between buyers and suppliers (Benton, 2007:188), by building collaborative relationships (Burt *et al.*, 2010:69). A collaborative relationship thus involves an interdependent relationship of coordinated planning and strategy (Benton, 2007:187).

Collaborative relationships have the ability to, amongst others, achieve cost savings and to reduce duplication of efforts by the organisations involved. For suppliers, collaborative relationships with industry leaders can enhance operations and prestige and provide stability in unstable markets. For buyers, collaborative relationships can improve profitability, reduce purchasing costs and increase technical cooperation (Lambert *et al.*, 2006:170). Buyers can also enjoy the benefits of early supplier involvement, reduced time to market and improved quality (Burt *et al.*, 2010:69; Hines, 2004:178, 179). Continuous improvement is far easier to implement and manage with recognised interdependence and cooperation. The end objective with continuous improvement is a reduction in total cost, improved quality and timeliness (Burt *et al.*, 2010:69).

The big driving force towards collaboration is technology based. Information sharing forms an integral part of collaboration and therefore new information systems are essential. These systems enable sharing of information related to, amongst others, production and inventory data, online auctions, marketplaces for buying and selling and production planning along the supply chain (Ayers, 2004:35).

4.3.2.3 Strategic alliances

A strategic alliance is a key enabler of SCM (Lysons & Farrington, 2006:97, 98). Strategic alliances share a significant level of operational integration (Lambert *et al.*, 2006:170). The supply chain is integrated through joint planning, shared technologies and process and administrative integration (Hines, 2004:188). Each party views the other as an extension of their own organisation (Lambert *et al.*, 2006:170). In this situation, independent organisations view their partners as difficult to replace (Benton, 2007:187). Strategic alliances should be reserved for those suppliers or customers who are critical to an organisation's long-term success (Lambert *et al.*, 2006:170).

Therefore, when supply chain partners achieve the greatest degree of collaboration, they form strategic alliances (Cohen & Roussel, 2005:146). The purpose of an alliance is to achieve a common goal that each organisation could not easily accomplish alone. Alliances encompass a variety of agreements, whereby two or more organisations agree to pool their resources to pursue specific market opportunities (Mentzer, 2004:50). Other opportunities include risk and reward sharing, reduction in coordination and transaction costs, ability to concentrate on core competency and rapid response to market needs (Maheshwari *et al.*, 2006:278). Strategic alliances therefore are typically multifaceted, goal oriented and long term (Lysons & Farrington, 2006:97, 98). Important attributes of strategic alliances include (1) having expectations clearly stated, understood and agreed upfront, (2) collaboration on supply chain design and product and service strategies, (3) having top management of partnering organisations interface on a regular basis and (4) having compatible IT systems (Lysons & Farrington, 2006:98).

When developing supply chain relationships, organisations thus strive towards a greater interdependence of operations (Hughes *et al.*, 1998:37) without compromising independent ownership (Taylor, 2004:66). Both the buyer's and supplier's investments are high and they become mutually dependent on each other (Hallikas & Virolainen, 2004:54; Hines, 2004). In fact, in strategic alliances total interdependence is required. Total interdependence refers to the intensity of the relationship. A high level of interdependence is an indicator for a strong co-operative long-term relationship in which both parties have invested. Mutual trust and mutual commitment will characterise those relationships (Caniëls & Gelderman, 2005:44). The products involved in these partnerships are critical to success for both buyers and suppliers. Few critical suppliers are capable of supplying the product (Hines, 2004:182; Handfield *et al.*, 2009:212) as they may be unique or customized, or they may simply represent a high-value product. Because of the small number of suppliers it may furthermore be difficult and costly to switch between suppliers (Handfield *et al.*, 2009:212; Van Weele, 2010:196). A balanced relationship between buyer and seller is thus required, in which neither of the two parties dominates the other (Van Weele, 2010:197) and power is therefore shared (Caniëls & Gelderman, 2005:44). This is illustrated in the top right quadrant in Figure 4.10.

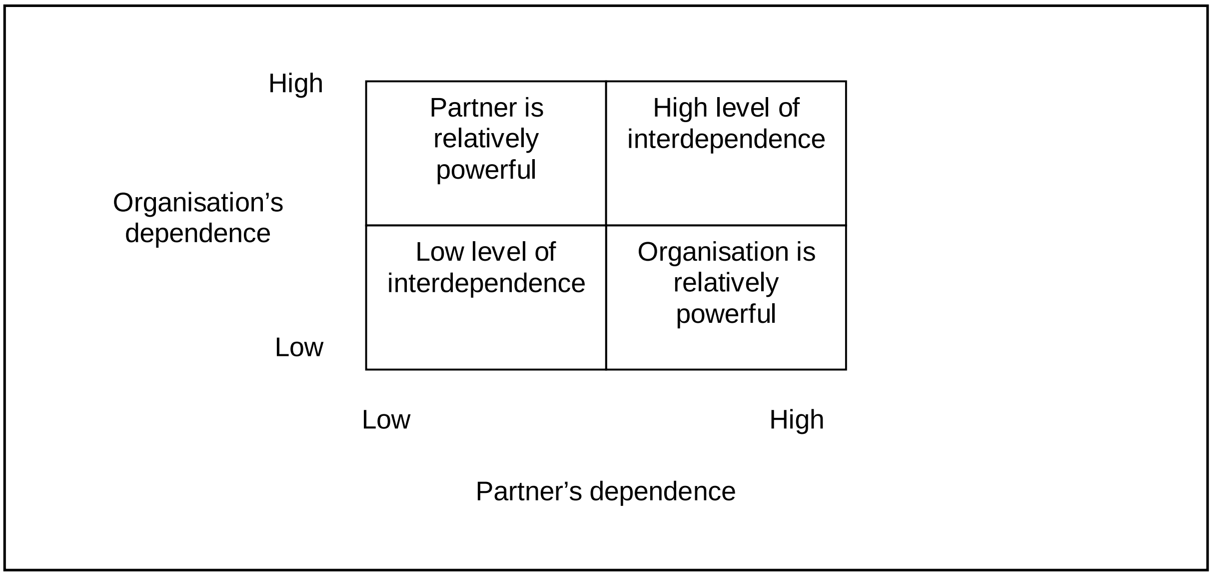

Figure 4.10: Balance of power in buyer-supplier relationships
Source: Adapted from Fernie (2009:40).

The key factor in forming strategic alliances is trust (Udin, Khan & Zairi, 2006:362). Trust is thus critical to the development of long-term relationships amongst supply chain members (Birou, 2006:303). In fact, it is difficult to imagine a successful business relationship without trust as a foundational element (Magnan & Fawcett, 2006:353). Emmett and Crocker (2006:1) support this in saying that the focus of SCM is on, amongst others, trust. Trust is developed over time (Birou, 2006:303) and a trust-based relationship between supply chain partners includes dependability between the partners. Trust involves a belief that each supply partner is interested in the other's welfare and will not take actions without considering their impact on the other partners (Chopra & Meindl, 2010:496). Trust and a desire to coordinate with another party are closely related (Mentzer, 2004:54) and it is this cooperation and trust within the supply chain that will ultimately help improve performance (Chopra & Meindl, 2010:496). Strategic alliances thus have what Burt *et al.* (2010:70) term *institutional trust*. With *institutional trust*, the parties have access to each other's strategic plans in the area(s) of the interface. Relevant cost information and forecasts are shared. Risks and rewards are addressed openly. Informal agreements are as good as written ones (Burt *et al.*, 2010:70, 82). The characteristics across the supply chain relationship spectrum are illustrated in Table 4.1.

Table 4.1: Characteristics of buyer-supplier relationships

Continuum of supply chain relationships		
Transactional Relationships		**Strategic Alliances**
High potential for problems	***Communication***	Systematic approach to enhance communication
Low	***Competitive advantage***	High
Independence	***Connectedness***	Interdependence
Little	***Continuous Improvement***	A focus
Few	***Contributions to new product development***	Many - early supplier involvement
Low	***Difficulty of exit***	Difficult - high impact
Short	***Duration***	Long
Reactive	***Expediting***	Proactive
Price	***Focus***	Total cost
Little or none	***Level of Integration***	High or total
Low	***Level of trust***	High
Many	***Number of suppliers***	One or few
No	***Open books***	Yes
Incoming inspection	***Quality***	Design quality into system
Inward looking	***Relations***	Concern with each other's wellbeing
Few - low skill level	***Resources***	Professional
Minimal	***Service***	Greatly improved
No	***Shared forecasts***	Yes
Possible	***Supply disruptions***	Unlikely
No	***Technology inflows***	Yes
Tactical	***Type of interaction***	Strategic synergy

Source: Adapted from Burt *et al.* (2010:66) and Handfield *et al.* (2009:123).

The implementation of collaborative relationships remains a difficult process because supply chain partnerships extend beyond a simple inter-organisational relationship (Benton, 2007:186). Therefore, there is a wide gap between intent and achievement, especially when most of the strategic benefits of supply chain partnerships are long-term and rewards increase over time (Maheshswari *et al.*, 2006:278). The focus of supply chain relationships in this study is illustrated in the highlighted sections in Figure 4.11.

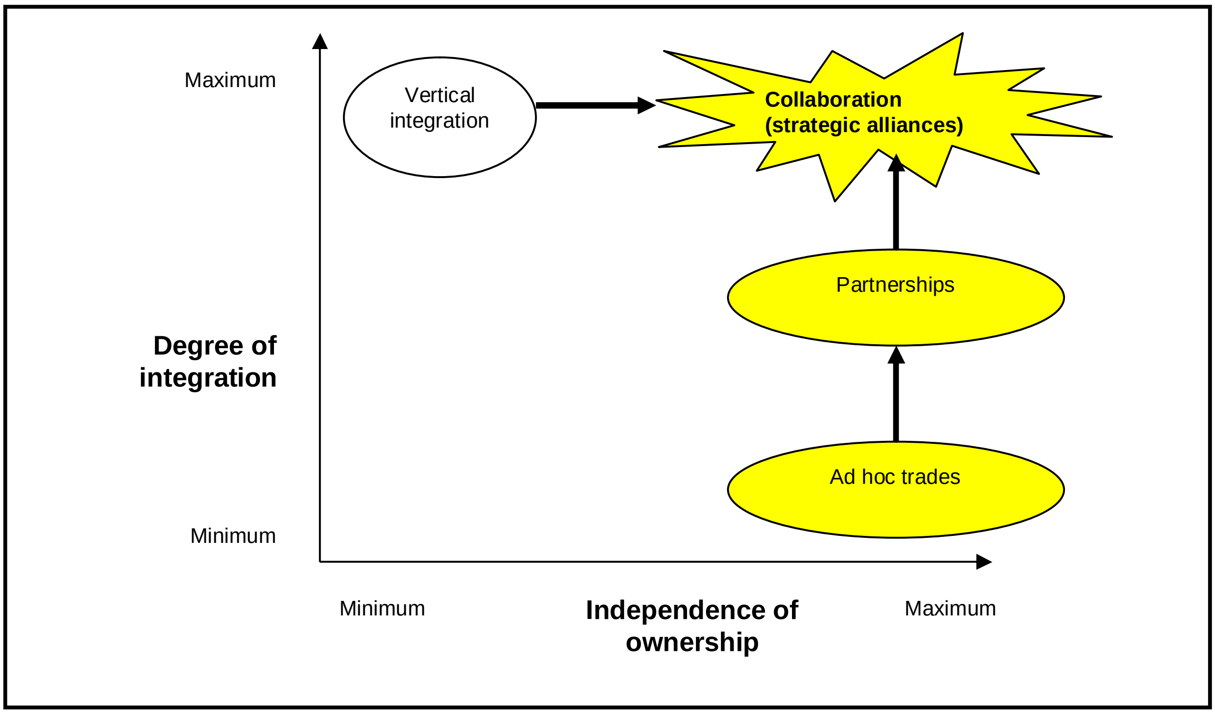

Figure 4.11: Degree of integration and independence of ownership between supply chain partners
Source: Adapted from Taylor (2004:65).

4.4 INTEGRATING SUPPLY CHAIN MANAGEMENT PROCESSES

As mentioned in Chapter 1, supply chain integration includes the integration of all the *key business processes* and *relationships* between all the organisations that form part of the supply chain (Cagliano *et al.*, 2006:283; Lambert, 2006:1; Fawcett *et al.*, 2007:8; Wisner *et al.*, 2009:8; Bozarth & Handfield, 2006:8; Handfield & Nichols, 2002:4; Kim, 2006b:1087). SCM integrates not only major business functions but also business processes within and across organisations into a cohesive business model (Ayers, 2006:10). These key business processes and relationships are determined during the scoping of the supply chain design. Organisations have to know which links in the supply chain are more important than others. Organisations thus need to understand the supply chain's processes that are used to deliver products to their end customers.

4.4.1 Explaining processes from a supply chain perspective

SCM implies the implementation and integration of all key business processes with other key members of the supply chain (Lambert, 2006:5; Chan & Qi, 2003:181).

From the explanation of SCM in Chapter 1, it has become evident that SCM is the systematic, strategic coordination of all the traditional business functions and processes involved in any flows, upstream or downstream, across any aspect of the supply chain system within a particular organisation and across businesses within the supply chain (thus being inter-organisational). The purpose of the coordination is to improve the long-term performance of the individual organisations and the supply chain as a whole (Lambert, 2006:2; Mentzer, 2004:4, 5; Danese, Romano & Vinelli, 2004:167). The supply chain is a mix of processes which ties together organisations from purchasing to distribution. It is also an integrated process, where raw materials are manufactured into final products and then delivered to customers. Numerous organisations work together in order to develop activities such as manufacturing, warehousing and transportation. Each of these activities can influence performance (Rafele, 2004:282). As mentioned earlier in the chapter, the supply chain is actually a supply network consisting of many different configurations between the various tiers of supply chain members consisting of suppliers and customers.

A supply chain should thus be regarded as an extended enterprise that crosses over boundaries of individual organisations to span the related activities of all the organisations involved in the supply chain and attempts to execute or implement a coordinated flow of information, products and finances (Greeff & Ghoshal, 2004:49; Christopher, 2005:17; Coyle *et al.*, 2003:18). When managed effectively, complex supply chains link various supply chain members in the form of a chain network to develop and deliver products as one *virtual seamless* organisation of pooled skills and resources that reach far beyond organisational boundaries (Greeff & Ghoshal, 2004:49).

The virtual seamless supply chain is an idealised concept of perfect information, product and finance flows, facilitated by all supply chain members thinking and acting as one, which can only be achieved through SCM (Cagliano *et al.*, 2006:282). Although it is an idealised concept, the virtual seamless supply chain is not beyond reach in reality. Supply chain flows need to move freely between the supply chain members to best suit the total performance of the supply chain in the satisfaction of end customer requirements (Geary *et al.*, 2002:53; Childerhouse & Towill, 2003:111). This implies integration across organisational boundaries.

As mentioned earlier, organisations recognise the importance of putting in place business processes that effectively manage the flow of information, products and finances across the supply chain (Bozarth & Handfield, 2006:45). A process is generally a set of logically related tasks or activities performed to achieve a defined business outcome (Bozarth & Handfield, 2006:46). It transforms a set of inputs into a specific set of outputs (products) for customers, through a combination of people, methods and tools (Trkman *et al.*, 2007:116; Chan, Qi, Chan, Lau & Ip, 2003:638). Therefore, it is a specific ordering of work activities across time and place, with a beginning, an end and clearly identified inputs and outputs. It is a structure for action (McCormack & Johnson, 2003:49; Lysons & Farrington, 2006:92).

From a SCM context, process thus refers to linked activities with the purpose to produce products for customers within or outside the organisation. SCM is typically seen as the entire set of business processes that produces and delivers products to the supply chain's end customers from suppliers (Mouritsen *et al.*, 2003:688). The supply chain is thus generated by several processes (Rafele, 2004:282). Processes are a pivotal part of SCM (Bozarth & Handfield, 2006:47) and have become strategic assets (Lockamy III & McCormack, 2004:272). Improving processes is at the very core of SCM (Bozarth & Handfield, 2006:47).

It has been mentioned that the network of organisations in SCM is structured through upstream and downstream linkages among the processes and activities that add value along the supply chain (Chan & Qi, 2003:182). Moreover, every process consists of a set of identifiable flows and value-added activities. Three distinct, but related, flows define each process. These flows are information flows, product flows and financial flows. The flows have been referred to as supply chain flows in this study (refer to Chapter 1). Most processes begin with an information flow, which triggers a specific value-added activity towards the end customer (Fawcett *et al.*, 2007:72).

Organisations are thus no longer viewed as a collection of functional areas but as a combination of highly integrated processes (Lockamy III & McCormack, 2004:272). The process-based model of a supply chain thus blurs organisational and departmental borders between the connected processes and activities, thus diluting the structural barriers and encouraging cross-organisational optimisation (Chan & Qi, 2003:182). It implies a new way of looking at organisations on the basis of the processes they perform rather than on the functional units, divisions or departments they are divided into (Trkman *et al.*, 2007:117; Copacino, 1997:10). The definition of SCM used in this study implies the integration of business processes from original supplier to end customer that provides products and information that add value for customers (Mouritsen *et al.*, 2003:687). This is evident in Figure 4.12, which illustrates the range of SCM processes that stretch across the entire supply chain network structure and does not focus on an individual organisation only.

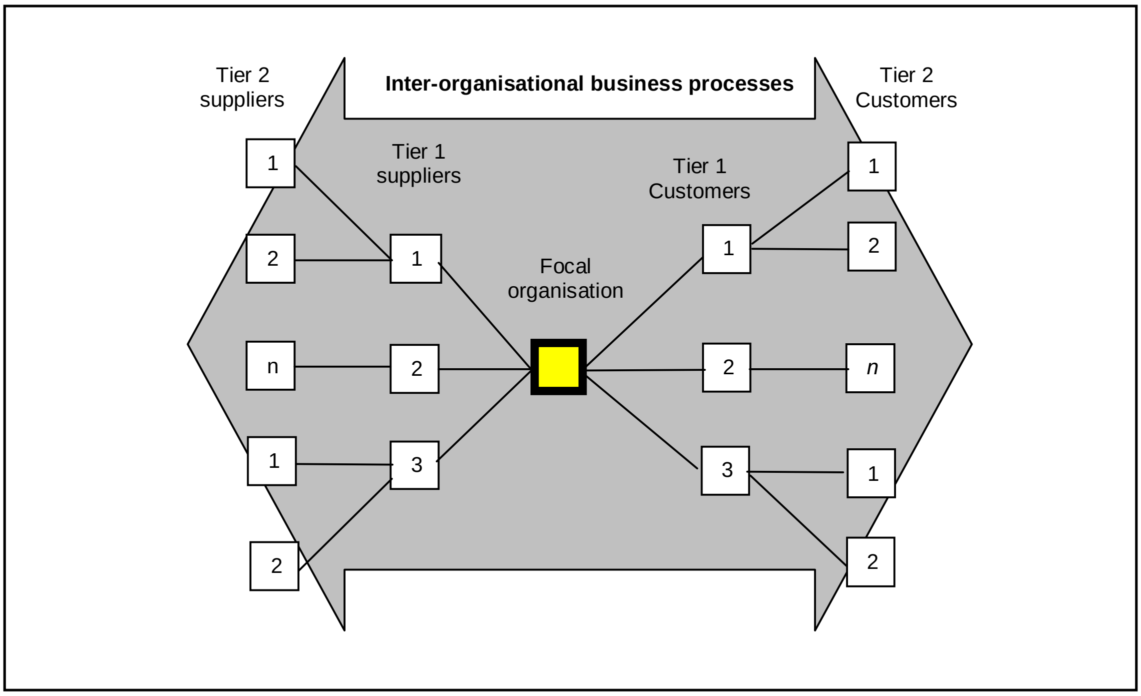

Figure 4.12: Inter-organisational process across the ultimate supply chain
Source: Adapted from Danese *et al.* (2004:167).

Successful SCM thus requires a change from managing individual functions to integrating activities into key supply chain processes (Serve, Yen, Wang & Lin, 2002:245, 251). It is therefore clear that managerial attention should not be on the individual organisation only, but on the interactions between the series of organisations which constitute the supply chain (Baily *et al.*, 2008:69). Organisations will thus have to accept process-based management principles to cope with the challenges they face, especially those wishing to successfully manage their supply chains (Chan & Qi, 2003:181) and business processes are used to structure the activities between supply chain members (Lambert, 2006:5). In conclusion, SCM involves collaborative efforts of multiple supply chain members to design, implement and manage seamless value-added processes to meet real needs of end customers (Magnan & Fawcett, 2006:346).

However, many organisations are still organised on a functional basis (Yee & Tan, 2004:355). This means that they have created a division of responsibility by function, so that the organisation's activities may be divided into, for example, the purchasing function, production function and marketing function (Christopher, 2005:263). The organisation charts of these organisations are represented by the vertical arrows illustrated in Figure 4.13. As already mentioned, organisations will have to move towards an output-focused, market-driven process approach (Christopher, 2005:269) where all supply chain members contribute towards a common goal (Danese *et al.*, 2004:167). Successful SCM requires this change from managing individual functions to integrating activities into key supply chain business processes (Chan & Qi, 2003:211). This is illustrated by the horizontal arrows in Figure 4.13.

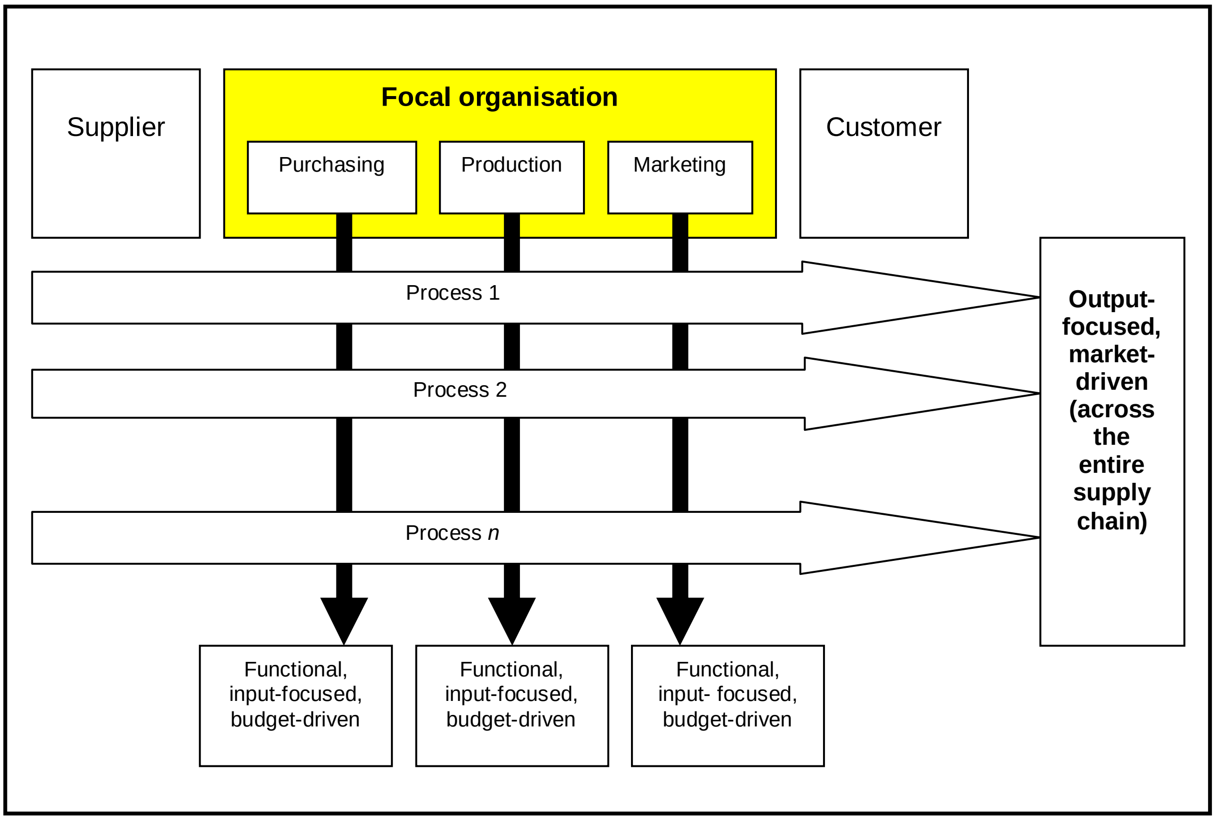

Figure 4.13: Horizontal supply chain and vertical organisational focus
Source: Adapted from Christopher (2005:263, 268, 269).

To conclude, the supply chain is a mix of processes across the entire supply chain that ties organisations together. It is an integrated process where raw materials are manufactured into final products and then delivered to customers. In this process, numerous organisations work together. Organisations in the supply chain cannot deal with a single process, but with several processes that, together, generate the supply chain (Rafele, 2004:282) and organisations have to determine the choice of structure, partners and processes (Mouritsen *et al.*, 2003:688).

4.4.2 Types of process links within the supply chain network structure

It is highly unlikely that all business process links will be integrated and managed throughout the entire supply chain, but some links are more critical than others and need to be integrated and managed (Lambert, 2006:15). This is an important aspect of supply chain design. According to Lambert (2006:15) there are four fundamentally different types of business process links between members of a supply chain. These are managed process links, monitored process links, not-managed process links and non-member process links. Examples of these links are illustrated in Figure 4.14.

4.4.2.1 Managed process links

Managed process links are links that the focal organisation finds important to integrate and manage (Lambert, 2006:15). It involves a process that addresses the main value-added activities of an organisation (Bozarth & Handfield, 2006:46). The focal organisation will integrate and manage process links with first-tier customers and suppliers, but can also be actively involved in the management of a number of other process links beyond tier one (Lambert, 2006:15). These are critical processes in the supply chain (Lysons & Farrington, 2006:140), as shown in Figure 4.14, which shows that these links may extend beyond first-tier suppliers or customers (Stock & Lambert, 2001:65).

4.4.2.2 Monitored process links

Monitored process links are not as critical to the focal organisation (Lambert, 2006:15). These links perform necessary albeit not value-added activities (Bozarth & Handfield, 2006:46). However, it is important to the focal organisation that these process links are integrated and managed appropriately among the other supply chain members. The focal organisation thus merely monitors or audits as frequently as necessary how the process link is integrated and managed (Lambert, 2006:15).

4.4.2.3. Not-managed process links

Not-managed process links are links which the focal organisation is not actively involved in managing, and they are not critical enough for using resources to monitor them. In other words, the focal organisation fully trusts the other members to manage the process links appropriately, or because of limited resources, which leaves it up to them (Lambert, 2006:15).

4.4.2.4 Non-member process links

Non-member process links are process links between members of the focal organisation's supply chain and non-members of the supply chain. Organisations are aware that their supply chains are influenced by decisions made in other connected supply chains. Non-member links are not considered as links of the focal organisation's supply chain structure, but they can and often will affect the performance of the focal organisation and its supply chain (Lambert, 2006:16). From a focal organisation's point of view it is important to understand how well its supply network is competing with its near competitors (Mills, Schmitz & Frizelle, 2004:1024).

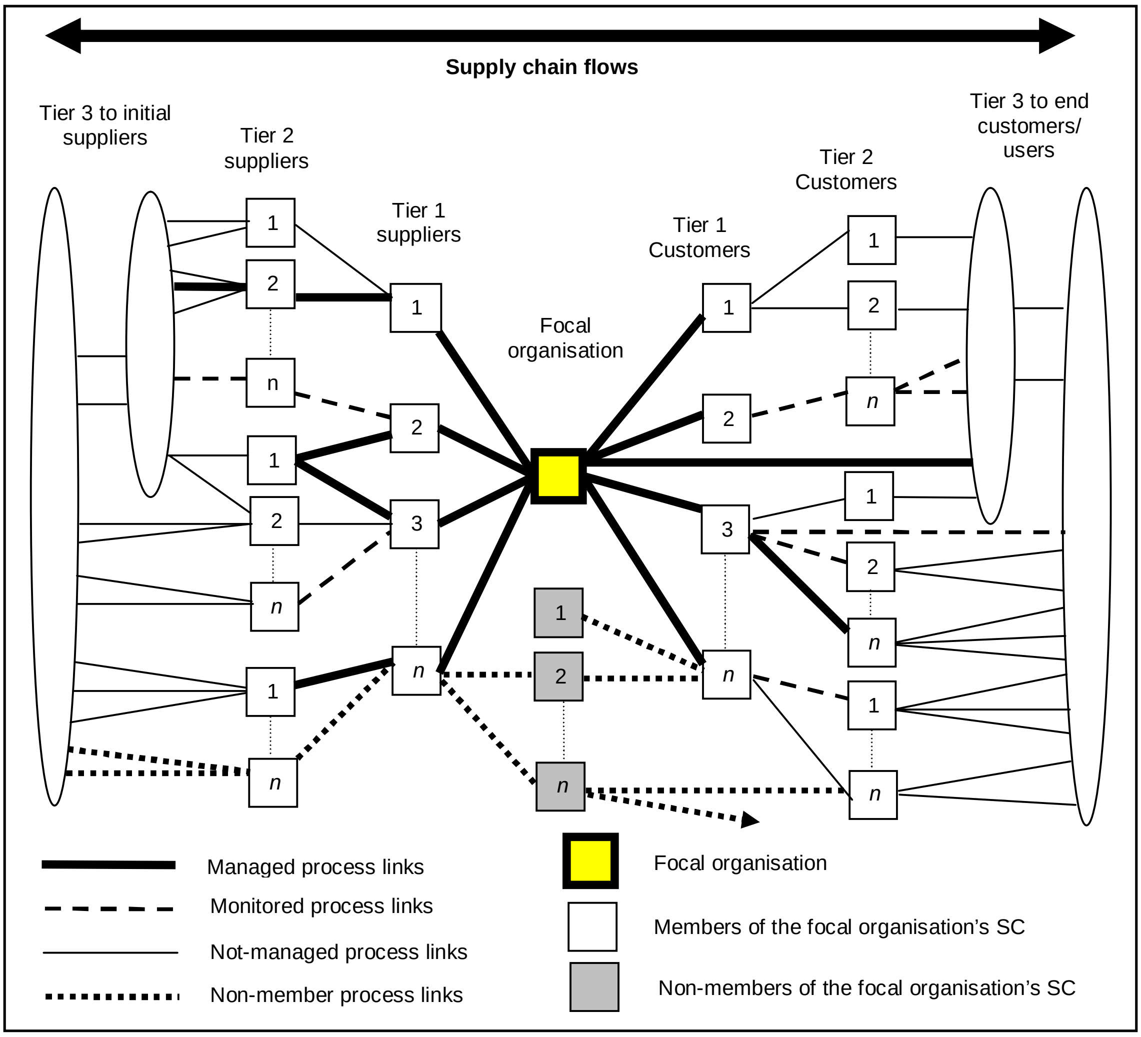

Figure 4.14: Process links within the supply chain network structure
Source: Adapted from Lambert (2006:16).

A focal organisation therefore has three alternatives (seeing that non-member process links are not really an option for the focal organisation) for integrating and managing links with suppliers or customers. This is illustrated in Figure 4.15. The focal organisation may choose to integrate with and actively manage tier two (alternative one). The focal organisation could also choose to not integrate, but only to monitor the processes of organisations A and B who are the first-tier and second-tier customers (alternative two). Both these alternatives necessitate some level of resource allocation from the focal organisation. Finally, the focal organisation can choose not to be involved and leave the integration and management of the tier two link up to organisations A and B (alternative three) (Stock & Lambert, 2001:66). Wisner *et al.* (2009:456) do, however, emphasise the importance of integrating and managing the critical processes beyond tier one supply chain members.

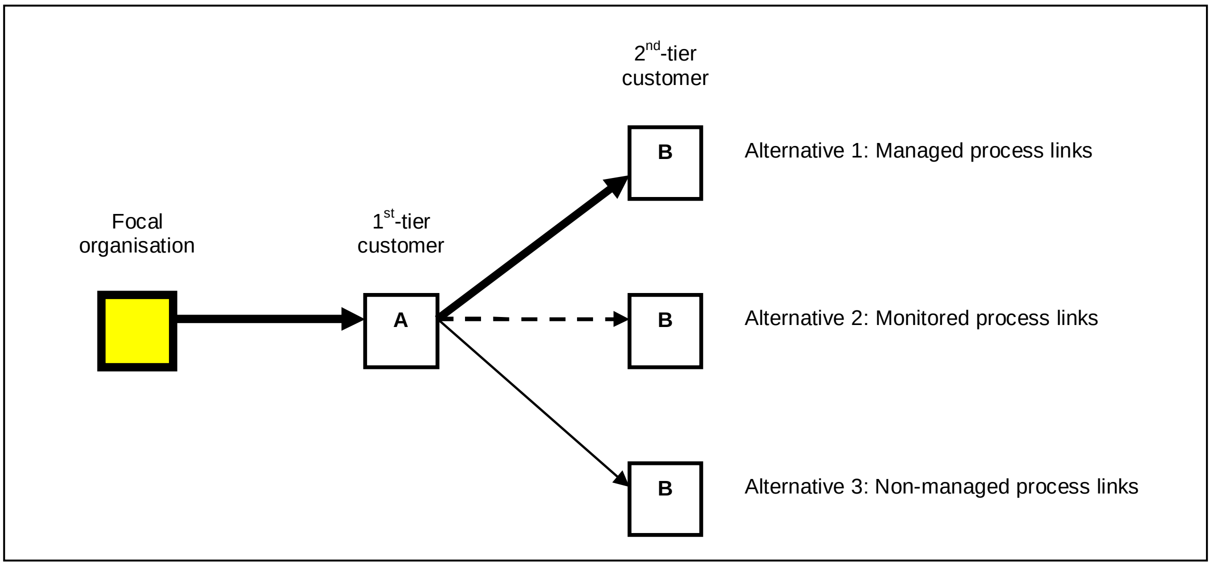

Figure 4.15: Three alternatives for integrating and managing links with suppliers and customers

Source: Adapted from Stock and Lambert (2001:66).

4.4.3 Using supply chain mapping to design supply chains

Once organisations understand their supply chain network structure, they can use supply chain mapping to design their supply chains. Supply chain mapping is an essential element of the overall supply chain design (Hugo *et al.*, 2004:99, 100). In fact, SCD is enhanced by supply chain mapping (Fawcett *et al.*, 2007:224). The supply chain must be documented or mapped to achieve an optimised supply chain (Cavinato, 2006:9). A map is a visual representation of some actuality. Maps also enable organisations to comprehend and communicate information, while maps also communicate specific and general information (Lysons and Farrington, 2006:148). A supply chain map is a representation of the processes and activities that are involved as materials or products move through the supply chain (Christopher, 2005:162). Therefore, a supply chain map creates visibility regarding the right supply chain members, the right relationships, the right roles and responsibilities and the right structure and systems to achieve SCM goals and objectives (Fawcett *et al.*, 2007:21; Tummala, Philips & Johnson, 2006:180). Mapping thus helps to generate an awareness of the other members and how directly they are impacted by an organisation's decisions (Cavinato, 2006:9; Saxton, 2006:59). Organisations therefore need to map their supply chain network structure (as shown in Figure 4.14) and determine which links will be (1) managed process links, (2) monitored process links, (3) not managed process links and (4) non-member process links (Lambert, 2006:

21).

Most supply chains, when mapped, look quite complex with many elements. The resulting supply chain is not a concise, linear graphic. In fact, this is why some organisations refer to their supply chains as supply networks with all the elements pointing in the direction of the end customer (Cavinato, 2006:9). Because a supply chain map can become very complex in terms of the number of organisations included in each tier, it will be necessary to determine which organisations are key and need to be represented on the map (Lambert, 2006:21, 22). It would be nearly impossible for a complex organisation to map its entire supply chain in detail. This could entail thousands of linkages. An organisation should determine where it believes the greatest opportunity lies before it begins the detailed mapping process. The supply chain map can be a useful tool for identifying the unnecessary complexity in the supply chain network so that decisions can be made on whether and how to remove it (Fawcett *et al.*, 2007:229).

There are numerous reasons for supply chain mapping. An organisation may map its supply chain when the supply chain is not performing up to expectations, when it needs to reduce costs or time in the supply chain, or when it wants to gain a better understanding of its supply chain (Fawcett *et al.*, 2007:229). Supply chain mapping can also be done to redesign the supply chain. Such mapping is thus undertaken for a specific purpose (Lysons & Farrington, 2006:148). Ultimately, supply chain mapping helps organisations to look for opportunities to improve the supply chain. If the supply chain, for example, needs additional capacity, how should that be achieved? Can existing facilities be expanded, or would it be better to close some of them and build new ones? Would it make sense to move some of the operations from one facility to another? Are there ways of reducing the distance materials have to travel as they move through the supply chain (Taylor, 2004:284, 288)?

By seeing the supply chain in an extended way from the original sources to the end customers, supply chain managers can gain the benefit of seeing the total efficiency and performance outcomes of each party and overall chain. That is why, in some industries, one organisation at a particular point in the supply chain seems to dominate many of the decisions and actions of the entire supply chain (Cavinato, 2006:12).

Once organisations understand the supply chain network structure and have mapped their supply chain, the next step is to determine which processes should be linked with each organisation on the supply chain map (Lambert, 2006:21, 22). Supply chain mapping will also help the organisation to better understand the processes involved, and wherever inefficiencies may be occurring (Fawcett *et al.*, 2007:232, 233). Supply chain mapping enables organisations to reduce redundancies and improve reliability and flexibility (Tummalo *et al.*, 2006:179). As already mentioned, organisations that desire to implement SCM will be challenged to focus their efforts on implementing cross-functional organisational business processes. These processes provide the structure to manage the relationships with key members of the supply chain (Lambert, García-Dastugue, Knemeyer & Croxton, 2006:217). The key processes for integrating and managing the supply chain are customer relationship management and supplier relationship management (Lambert, 2006:21).

4.4.4 The different supply chain management processes

According to Lambert *et al.* (2006:217, 218), there are basically two frameworks that represent the alternatives available with sufficient detail to assist the management of organisations in the implementation of business processes. These two frameworks are the eight business processes according to the Global Supply Chain Forum (GSCF) framework and the Supply-Chain Operations Reference (SCOR) framework. Both these frameworks are process-based and each one takes a distinctly different approach to SCM. In the current research, a process in the supply chain is concerned with a series of activities from original suppliers and manufacturers to retailers to add value for the end customers (Chan & Qi, 2003:182). It executes the planned management and operations along the supply chain.

4.4.4.1 SCMt processes according to the Global Supply Chain Forum

The Global Supply Chain Forum (GSCF) has compiled a framework in which they distinguish between eight business processes. Each of these processes is discussed in the next section (Lambert, 2006:16). The integration of managing these business processes across the supply chain is illustrated in Figure 4.16. These processes can be incorporated into the supply chain flows.

- **Customer relationship management (CRM)**

CRM provides a structure and strategy for a relationship with customers (Hyland, 2004:32). It is concerned with learning about customers' needs and behaviour and the integration of sales, marketing and service strategies (Lysons & Farrington, 2006:96). Key customers and customer groups are segmented on the basis of their value over time and to increase customer loyalty by providing customised products (Lambert, 2006:13). Over time, relationships with these key customers are solidified through the sharing of information; the formation of cross-organisational teams to improve products, deliveries, quality and costs; the development of shared goals and, finally, improved performance and profitability for the trading partners along with agreements on how to share these benefits (Wisner *et al.*, 2009:449, 450).

- **Customer service management (CSM)**

CSM is the organisation's face for the customer (Hyland, 2004:32). It is concerned with providing internal and external customers with high-quality products at the lowest possible cost, with the shortest waiting times and maximum responsiveness and flexibility regarding their needs (Lysons & Farrington, 2006:96). Customer service management also provides the customer with real-time information on promised shipping dates and product availability through interfaces with functions such as manufacturing and logistics (Lambert, 2006:13, 14). The process also includes methods for monitoring and reporting customer service performance to allow organisations to understand to what extent their management efforts are achieving the process objectives (Wisner *et al.*, 2009:450).

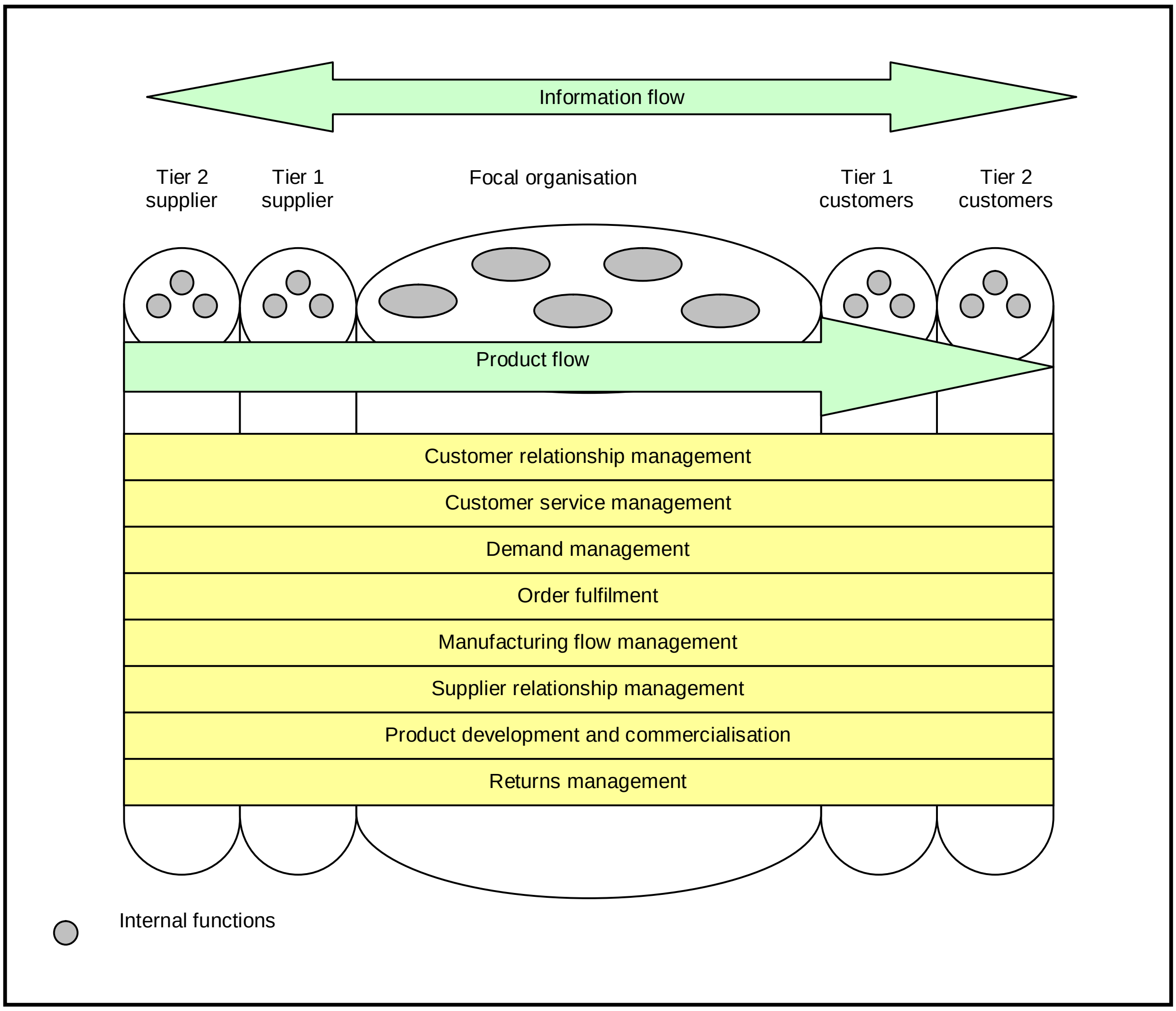

Figure 4.16: The eight supply chain management processes
Source: Adapted from Lambert (2006:3).

- **Demand management**

Demand management is the SCM process that balances the requirements of internal and external customers with the capabilities of the supply chain (Lysons & Farrington, 2006:96). With the right process in place, management can proactively match supply with demand and execute the plan with minimal disruptions. The process is not limited to forecasting; it includes synchronising supply and demand, increasing flexibility and reducing the variability of demand (Lambert, 2006:14) by means of standardisation and control of inventory, for example (Lysons & Farrington, 2006:96). Inventory is either essential or variability-driven. Essential inventory includes work-in-process in factories and products in the supply chain pipeline. Variability stock is necessary due to variance in process, supply and demand (Hyland, 2004:32). Performance measurement systems can prove quite useful here to increase the accuracy of forecasts and to track the success of implementing various demand management activities (Wisner *et al.*, 2009:451).

- **Order fulfilment**

Order fulfilment processes involve more than just filling orders. It includes all activities necessary to define customer requirements, design a network and enable an organisation to meet customer requests while minimising the total delivered cost, as well as filling customer orders. The objective is to develop a seamless process from the supplier to the organisation and its various customer segments (Lambert, 2006:14). Customers' orders thus need to be fulfilled efficiently, effectively and at the minimum total cost (Lysons & Farrington, 2006:97). The order fulfilment process therefore is a set of activities that allows the organisation to fill customer orders while providing the required levels of customer service at the lowest possible delivered cost. The order fulfilment process must integrate closely with CRM, CSM, SRM and returns management to assure that customer requirements are being met; customer service levels are being maintained; suppliers are helping to minimise order cycle times and customers are getting undamaged, high quality products (Wisner *et al.*, 2009:451).

- **Manufacturing flow management**

Manufacturing flow management is the SCM process that includes all activities necessary to move products through the plants and to obtain, implement and manage manufacturing flexibility in the supply chain. Manufacturing flexibility reflects the ability to make a wide variety of products in a good time at the lowest possible cost (Lambert, 2006:14). Therefore, manufacturing flow management is concerned with all the processes and activities required to transform inputs and a variety of resources into finished products (Lysons & Farrington, 2006:97). Simply stated, the manufacturing flow management process is the set of activities responsible for making the actual product (Wisner *et al.*, 2009:451). Manufacturing processes must be flexible to respond to market changes (Hyland, 2004:32). To be effective, manufacturing flow management activities must be interfaced with the demand management and CRM processes, using customer requirements as inputs to the process. As customers and their requirements change, so too must the supply chain and the manufacturing flow process change to maintain organisational competitiveness. Manufacturing flow characteristics also impact supplier requirements. For instance, as manufacturing batch sizes and lead-time requirements are reduced, supplier deliveries must become smaller and more frequent, resulting in a potential change in supplier interactions and the supplier relationship (Wisner *et al.*, 2009:451).

- **Supplier relationship management (SRM)**

SRM is the process that defines how an organisation interacts with its suppliers (Lambert, 2006:14) and determines which of these relationships are key (Hyland, 2004:32). Relationships may be either short- or long-term and vary in intensity from arm's length to high involvement (Lysons & Farrington, 2006:97). An organisation will forge close long-term relationships with a small subset of its suppliers with a desired outcome of win-win relationships, while managing arm's length relationships with others (Lambert, 2006:14). SRM is becoming increasingly critical as organisations concentrate on core competencies and rely on suppliers to maintain critical advantage or a superior position over competitors (Lysons & Farrington, 2006:97).

- **Product development and commercialisation**

Product development and commercialisation is the SCM process that provides structure for developing and bringing new products to meet changing customer requirements (Wisner *et al.*, 2009:452). This process happens jointly with customers and suppliers. The product development and commercialisation process team must coordinate with the CRM process team to identify customers' articulated and unarticulated needs; select materials and suppliers in conjunction with the SRM process team to manufacture and provide the best supply chain flow for the product/market combination (Lambert, 2006:14, 15). This process typically consists of four phases, namely (1) idea generation, (2) concept development, (3) product and process design and (4) production and delivery. SCM is involved because product development extends across internal and external boundaries. Internally, product development involves teamwork between marketing, design, purchasing, production, quality engineering and transportation. Externally, the uncertainties of supply and demand, shorter life cycles, faster rates of technological change and the increased use of manufacturing, distribution and logistics partners has resulted in increasingly complicated supply chain networks. Some advanced organisations have begun to transfer design responsibility upstream to the supplier base (Lysons & Farrington, 2006:97).

- **Returns management**

Returns management is the SCM process by which activities associated with returns, reverse logistics, gate keeping and avoidance are managed within the organisation and across key members of the supply chain. The correct implementation of this process enables management not only to manage the reverse product flow efficiently, but to identify opportunities to reduce unwanted returns and to control reusable assets such as containers. Effective returns management is an important part of SCM and provides an opportunity to achieve a sustainable competitive advantage (Lambert, 2006:15). It is clear that returns management has extended the supply chain to beyond the end customer. It also extends relationships beyond customer and suppliers to include cooperation with agencies such as local authority and private waste collection, recycling and disposal (Lysons & Farrington, 2006:97) and therefore includes environmental compliance. Returns management personnel frequently communicate with customers and personnel from CRM, product development and commercialisation and SRM during the returns process (Wisner *et al.*, 2009:452).

All eight these business processes have to be managed to effectively manage the supply chain. Moreover, organisations have to decide which business processes to adapt to their own circumstances and how deep to go within the process, therefore the number of processes to integrate will vary among organisations (Hyland, 2004:32).

4.4.4.2 SCM processes according to the Supply-Chain Operations Reference (SCOR) framework

The Supply-Chain Council developed the supply chain operations reference (SCOR) model (Wisner *et al.*, 2009:495). In brief, SCOR specifies a framework for describing supply chain processes with associated terminology, metrics and best practices. SCOR defines 177 elementary supply chain processes called process elements. These process elements contribute to five basic tasks (Webster, 2008:353), therefore, the SCOR model separates supply chain operations into five process categories, namely plan, source, make, deliver and return (Webster, 2008:353; Lambert *et al.*, 2006:219; Wisner *et al.*, 2009:495). These processes are illustrated in Figure 4.17 and the process categories will be discussed briefly.

- **Plan**

Plan balances aggregate demand and supply to develop a course of action which best meets sourcing, production and delivery requirements (Lambert *et al.*, 2006:220). Therefore, *Plan* refers to all the operations needed to plan and organise the operations in the other categories (Hugos, 2006:44). *Plan,* as process in this model, includes balancing resources with requirements (demand forecasting); establishing and communicating plans for SCM of business rules, supply chain performance, data collection, inventory, capital assets, transportation, product pricing and regulatory requirements (Wisner *et al.*, 2009:495, 496; Hugos, 2006:44).

- **Source**

Source includes activities related to procuring products to meet planned and actual demand (Lambert *et al.*, 2006:220). *Source* thus includes the activities necessary to acquire the inputs to create products. An example of a process here is procurement, which is the acquisition of materials and services (Hugos, 2006:44).

- **Make**

Make includes activities related to transforming products into a finished state to meet planned or actual demand (Lambert *et al.*, 2006:220). It includes the operations required to develop and build the products that a supply chain provides. Although the SCOR model does not specifically include the product design and development process, it is included here for purposes of this study because it is integral to the production process. Other examples include production management, and facility management (Hugos, 2006:45).

- **Deliver**

Deliver involves providing finished products to meet planned or actual demand, typically including order management, transportation management, and distribution management (Lambert *et al.*, 2006:220). These operations encompass the activities that are part of receiving customer orders and delivering products to customers (Hugos, 2006:46).

- **Return**

Return deals with returning or receiving returned products for any reason and extends into post-delivery customer support (Lambert *et al.*, 2006:220).

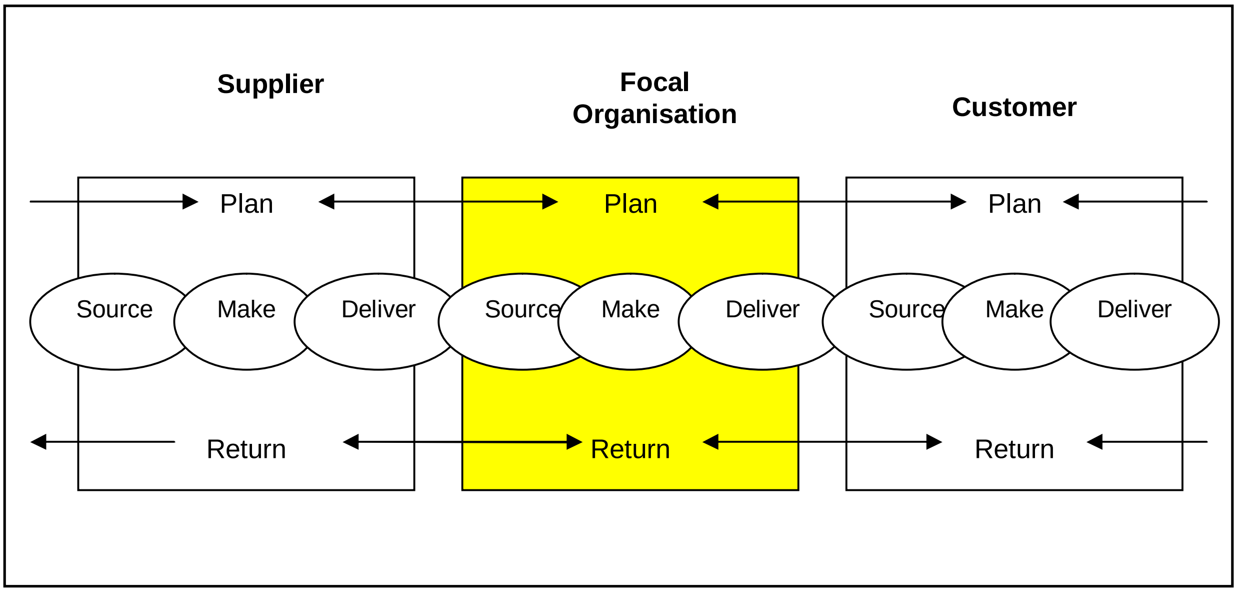

Figure 4.17: The SCOR model linkages
Source: Wisner *et al.* (2009:495).

Each of the processes in this model is implemented in four levels of detail. Level one defines the number of supply chains as well as the metrics that will be used. Level two defines the planning and execution processes in material flow. Level three defines the inputs, outputs and flow of each transactional element. At level four, the implementation details of the processes are defined (Lambert *et al.*, 2006:220).

4.5 SUPPLY CHAIN INTEGRATION

Organisations have to determine the level of integration and management that should be applied for each supply chain link (Lambert, 2006:21, 22). The level of supply chain integration will be determined by the relationships between the members of the supply chain (Lambert, 2006:22). When organisations have determined the level of integration, they also have to define roles and responsibilities for each supply chain partner (Fawcett *et al.*, 2007:335). Organisations will thus be part of supply chain relationships between supply chain members and will have to decide which type of partnership is most appropriate for a particular relationship (Sadler, 2007:170) (refer to section 4.3). Supply chain relationships in the form of *strategic partnerships* and *alliances* are thus key to supply chain integration (Saxton, 2006:97).

Handfield *et al.* (2009:114) define integration as "the process of incorporating or bringing together different groups, functions or organisations either formally or informally, physically or by information technology, to work jointly and often concurrently on a common business related assignment or purpose". Supply chain integration (SCI) can thus be defined as supply chain members using techniques enabling them to work together to optimise their collective performance in the creation, distribution, and support of the end product (Sundaram & Mehta, 2002:537). It is often described as the seamless flow of products and information from supplier to customer (Van Donk *et al.*, 2008:218). SCI is strictly related to coordination mechanisms and in particular implies that business processes should be streamlined and interconnected both within and outside the organisation's boundaries (Cagliano *et al.*, 2006:283). The basis of integration can therefore be characterised by cooperation, collaboration, information sharing, trust, partnerships, shared technology and a fundamental shift away from managing individual functional processes to managing integrated chains of processes (Power, 2005:253).

The integration of supply chains is often seen as a prerequisite for supply chain development (Hertz, 2006:208). Higher levels of integration allow a supply chain to work together (Waters, 2007b:6). However, only complex business conditions require a high level of SCI because complex conditions correspond with a high level of uncertainty within the supply chain (Van Donk *et al.*, 2008:220). There are basically two types of integration processes, namely, internal integration and external integration, which can be divided into four stages of SCI. The internal supply chain is that portion of the supply chain that occurs within an individual organisation and can be complex (Handfield & Nichols, 2002:48). The external supply chain includes suppliers and customers (Handfield & Nichols, 2002:49).

The key to the effective SCI lies in focusing initially on internal SCI within the organisation and then extending the process to include suppliers and customers (Yee & Tan, 2004:355; Power, 2005:253; Saxton, 2006:58). With internal integration, all the related activities within an organisation work together as a single function (Waters, 2009:138). Internal SCI requires every function within the business to act in harmony and is a prerequisite to progressing towards external SCI (Saxton, 2006:95). External integration refers to the integration of activities external to the organisation across the supply chain (Sundaram & Mehta, 2002:537). External SCI involves collaboration between supply chain members which ultimately results in strategic alliances. This emphasises the closeness of the relationship between supply chain partners (Saxton, 2006:97).

As mentioned above, the two basic types of integration can be divided into four stages of supply chain integration and, as mentioned earlier, each stage involves further development (Childerhouse & Towill, 2003:111). The four stages of SCI are (1) internally focussed (or baseline organisation), (2) functional integration, (3) internal integration and (4) external integration (Wisner *et al.*, 2009:263; Hines, 2004:81). At each stage of SCI, product flows become smoother and inventory holding becomes less (Hines, 2004:81). Some authors include a fifth stage of supply chain integration, which is referred to as virtual integration (Gattorna, 2003:xi; Birou, 2006:295). However, virtual integration forms part of the external supply chain integration stage because virtual integration can be regarded as the most advanced stage of external SCI (Birou, 2006:295). The four stages of SCM integration are illustrated in Figure 4.18.

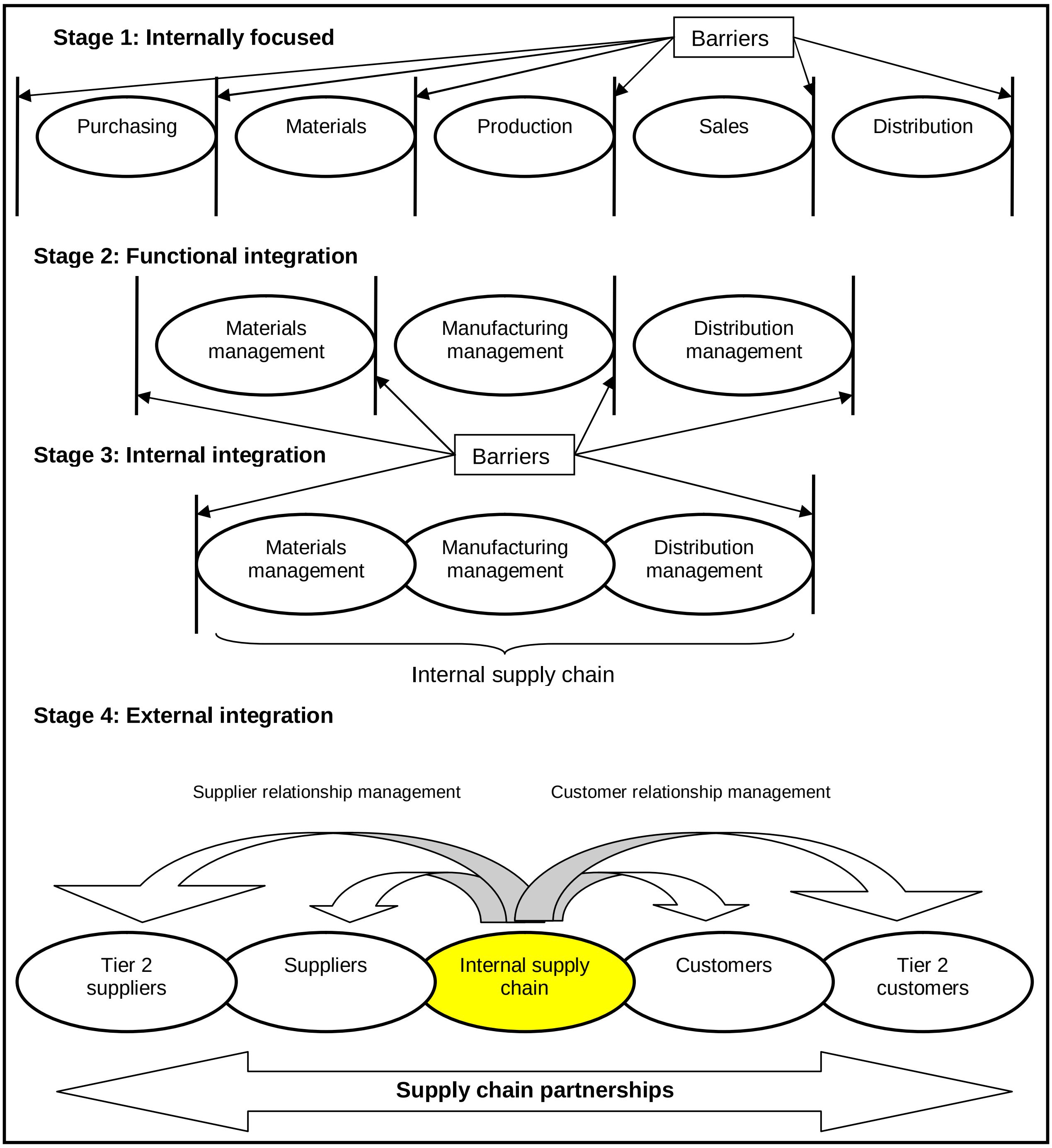

Figure 4.18: From internal integration to external supply chain integration
Source: Adapted from Benton (2007:188); Hines (2004:81) and Christopher (2005:19).

4.5.1 Stage one of SCI: Internally focussed (or baseline organisation)

In stage one, the organisation is internally focussed. Organisational functions are managed separately and performance monitoring is based on achieving departmental goals (Wisner *et al.*, 2009:262), thus causing what literature generally terms functional silos. Functional cooperation is low (Lockamy III & McCormack, 2004:275). This is illustrated in Figure 4.18 by the barriers that exist between the functions of an organisation. This silo effect causes the organisation to be reactive and short-term goal oriented. At this stage, no internal functional integration is occurring (Wisner *et al.*, 2009:262); independent and often incompatible control systems and procedures will be covering the various organisational functions (Childerhouse and Towill, 2003:112). Processes, activities and organisational structures are not based on horizontal processes across the supply chain (Trkman *et al.*, 2007:118).

Basically, complete functional independence describes this stage well, as each business function operates independently in complete isolation from the other business functions (Christopher, 2005:18). Decision making occurs through a series of modules operated by various members of the supply chain. There are separate modules for decision making at every echelon of the supply chain (Sundaram and Mehta, 2002:539) and the supply chain and its practices are unstructured and ill-defined. Process measures are not in place. Targets, if defined, are often missed. SCM costs are high (Lockamy III & McCormack, 2004:275). This results in organisations having, for example, high levels of inventory and being vulnerable to market changes (Geary *et al.*, 2002:56) due to failure to integrate and synchronise activities (Childerhouse & Towill, 2003:112).

4.5.2 Stage two of SCI: Functional integration

Moving from stage one to functional integration combines areas of common interest focused on serving the customer better (Hines, 2004:81). Most organisations organise their activities through functional groupings. Examples of functional groupings include purchasing, marketing, logistics, operations and finance departments (or functions) (Copacino, 1997:9, 10). In stage two of supply chain integration, the organisation focuses on functional and process improvement. These efforts are internal to the organisation and oriented around organisational integration and finding the best ways of executing the supply chain process steps by functional area (Birou, 2006:293, 294). In this stage, organisations have begun to recognise the need for at least a limited degree of integration between adjacent functions (Christopher, 2005:18; Theis *et al*., 2003:318) and have begun integrating efforts and resources among internal functions. The focus of the organisation is still on cost reduction and not performance improvement (Geary *et al.*, 2002:56; Childerhouse & Towill, 2003:112), but has started to shift towards an emphasis on the flow of products and information through the organisation to achieve production efficiencies and to reduce throughput times (Wisner *et al.*, 2009:262). In spite of these efforts, SCM costs remain high (Lockamy III & McCormack, 2004:275).

Organisations have found that functional excellence does not equate to business excellence. It was found that organisations that strive for functional integration (stage two of supply chain integration) outperformed those that worked towards functional excellence (stage one of supply chain integration) (Copacino, 1997:9, 10). However, discrete business functions still exist in stage two, each of which is buffered by inventory (Childerhouse & Towill, 2003:112) and, unfortunately, most organisations at this stage do not leverage scale across the entire organisation (Birou, 2006:294). Organisations still focus inwardly on products and are reactive towards their customers. There are some internal trade-offs (Geary *et al.*, 2002:56) because organisations focus on functional or business-unit savings and they see no advantage in centralising any function or sharing any supply chain improvements between functions. Collaboration between functions or business-units is resisted (Birou, 2006:294) and overcoming these functional silos takes considerable effort owing to these boundary concerns and the mentioned competing goals (Lockamy III & McCormack, 2004:275).

4.5.3 Stage three of SCI: Internal integration

Stage three is still on an intra-organisational basis as the organisation begins to recognise the savings being generated and strives for organisation wide excellence in its supply chain processing (Birou, 2006:294). With internal integration all the related activities within an organisation work together as a single function (Waters, 2009:138). The internal supply chain is that portion of a given supply chain that occurs within an individual organisation (Handfield & Nichols, 1999:42). Internal integration requires all members within an organisation to use the same information systems that span across the organisation (Handfield *et al.*, 2009:675). In stage three, internal integration of products and information which is directly under the control of the organisation has been achieved (Childerhouse & Towill, 2003:112). The focus begins to shift toward linking suppliers and customers to the organisation's processes (Wisner *et al.*, 2009:263) and organisations employ SCM with strategic intent and results (Lockamy III & McCormack, 2004:276).

As the focus turns to integrating the organisation to best provide end-to-end product delivery, the functional silo mentality begins to disintegrate (Birou, 2006:294). This stage is characterised by a comprehensive integrated planning and control system (Childerhouse & Towill, 2003:112) and cooperation between intra-organisational functions, suppliers and customers takes the form of teams that share common SCM measures and goals that reach horizontally across the supply chain (Lockamy III & McCormack, 2004:276). As such, some informal channels of integration may be developing between traditionally separate functions within the organisation, including, for example, purchasing, engineering, manufacturing, marketing and accounting to form multi-functional teams (Handfield *et al.*, 2009:224; Ross, 1998:177).

At this stage, there is also an emphasis on using the capabilities of logistics to manage the movement and storage of products from supplier delivery to distribution to the customer. Just-in-time (JIT) activities begin to be used as the organisation realises the impact of reduced throughput times on customer service and inventory cost. As inventory levels are reduced, the need for improved quality from suppliers is magnified and organisations begin to make a more proactive approach to managing and developing their suppliers. Successful use of JIT also impacts the organisation's customers in terms of better quality products, more flexibility and faster delivery times, and organisations begin to realise the need to proactively manage their customer relationships well (Wisner, Leong & Tan, 2005:210). Better flow of information through internal automation of transactional activities aids the organisation in meeting customer demands. Improvements begin to show up in on-time deliveries and fill rates (Birou, 2006:294); reduced inventory (and safety stock) levels; reduced inspection due to fewer errors; and value enhancement (Poirier, 1999:57, 58). SCM costs begin decreasing. Customers are included in process improvement efforts and customer satisfaction begins to show marked improvements (Lockamy III & McCormack, 2004:276).

To conclude, internal integration improves organisational performance and most organisations in general find it is a good idea to begin with processes within the organisation (Bozarth & Handfield, 2006:62; Burt *et al.*, 2010:529), thus moving through the stages of SCI. In fact, a prerequisite for successful SCM is to coordinate activities within the organisation (Stock & Lambert, 2001:709). This allows the organisation to build up its internal competencies before trying to coordinate efforts across multiple organisations (Bozarth & Handfield, 2006:62; Burt *et al.*, 2010:529). It is a fundamental concept of SCM that an organisation cannot coordinate business functions across organisations within their supply chains if these organisations cannot coordinate their internal relationships (Mentzer, 2004:29). Therefore, all the traditional business functions should be coordinated within individual organisations before they can be coordinated across organisations in the supply chain (Mentzer, 2004:5; Theis *et al.*, 2003:308). Although integration begins within an organisation (Rudzki, Smock, Katzorke & Stewart, 2006:30) it is not necessarily easy to achieve and some of the most challenging integration issues involve cross-functional trade-offs within a specific organisation (Bowersox *et al.*, 2007:257).

4.5.4 Stage four of SCI: External integration

However, it is important to move from internal integration towards external integration, thus offering improved levels of customer service (Hines, 2004:81; Handfield & Nichols, 1999:43). As processes develop or mature, a higher level of integration is required and therefore it is necessary for an organisation to move beyond organisational boundaries towards external integration (Gattorna, 2003:xii; Lockamy III & McCormack, 2004:273). External integration refers to the integration of activities external to the organisation across the supply chain (Sundaram & Mehta, 2002:537). External integration thus refers to the systems that link external suppliers and customers to the focal organisation (Handfield *et al.*, 2009:675). Therefore, the links outside of the ownership boundary of an organisation are its external supply chain (Taylor, 2004:35). External integration removes the boundaries (or barriers) between organisations to improve the whole supply chain (Waters, 2009:141). Eventually, integration must be taken further so that processes are coordinated across all the organisations in the supply chain (Serve *et al*., 2002:250; Bozarth & Handfield, 2006:62). The ultimate goal of SCM is to successfully align both internal and external supply chains (Serve *et al.*, 2002:245, 251).

Stage four thus represents true supply chain integration in that the concept of linkage and co-ordination that is achieved in stage three is now extended upstream to suppliers and downstream to customers (Christopher, 2005:18). In this stage, total collaboration among the various links in the supply chain is achieved. The scope of management now embraces the suppliers and customers and it embodies a change of orientation away from product to customer. A high level of integration with the customer organisation is involved in order to understand the products, culture, market and organisation. It also involves integration back up the supply chain to include all supplier partners. Each organisation is connected to the decision-making process (Sundaram & Mehta, 2002:539, 540; Geary *et al.*, 2002:57). In stage four, the supply chain forms an extended enterprise (Geary *et al.*, 2002:57). Product flows are optimised and barriers are removed from the supply chain (Hines, 2004:81). This stage is also characterised by efforts to broaden the organisation's supply chain influence beyond immediate or first-tier suppliers and customers, as well as strengthening relationships with existing key suppliers and customers (Wisner *et al.*, 2009:263).

In stage four of SCI, new metrics are introduced in areas such as on-time delivery, fill rates, and returns to underscore the importance of satisfying customers. Network partners begin to use activity-based costing and balanced scorecards to turn the supply chain into a value chain of allies working together towards the same strategic objectives. With information being shared electronically, network members can more readily identify opportunities to achieve higher performance levels. Joint teams are established to find solutions to specific customer problems (Birou, 2006:295). As a result, cost and time is reduced, which consequently adds value to the customer (Hines, 2004:81).

In this stage of SCI, process performance becomes predictable and targets are reliably achieved, so process improvement goals are set by the teams and achieved with confidence. SCM costs are dramatically reduced and customer satisfaction becomes a competitive advantage (Lockamy III & McCormack, 2004:276).

On the supply side, supplier relationship management (SRM) is emphasised more as external SCI improves. The organisation works closely with key suppliers to enhance value for both parties. Collaboratively, they focus on the important buy categories and look at the total cost of ownership to find any additional, hidden value that may have otherwise eluded them. A similar tactic is taken on the customer side. Customer relationship management (CRM) initiatives involving serious data sharing are launched with the goal of developing joint strategies and business goals that increase revenues for both parties (Birou, 2006:295).

In conclusion, the key to successful supply chain integration initially lies in focusing on integrating internal business functions within an organisation's boundary (Yee & Tan, 2004:355) and on introducing changes within the organisation. Only then should the process be extended to include suppliers and customers (Power, 2005:253). This external integration starts with managing dyadic relationships with long-term and more co-operative partners (inter-firm). The focus of these integration efforts moves towards the management of the supply chain flows between a chain of organisations that ultimately includes a supplier, a supplier's supplier, a customer and a customer's customer (Yee &Tan, 2004:355). Integration is important because the essence of SCM lies in the integration of the internal processes of the organisation with its suppliers and customers (Koh *et al.*, 2007:104). Wisner *et al.* (2009:456) also emphasise the importance of extending the process integration to second-tier supply chain partners. Top management will be required to guide an organisation from internal to external integration (Poirier, 1999:89).

Therefore, all SCM efforts evolve or develop through several stages and supply chain integration (or development) is also referred to as an evolution of integration amongst the supply chain members (Christopher, 2005:18) or a process busy maturing (Geary *et al.*, 2002:56). Because of this, the stages of SCM integration can also be referred to as the stages of SCM maturity (or even supply chain development[6]). SCM maturity implies that a process has a life cycle that is assessed by the extent to which the processes are explicitly defined, managed, measured and controlled (Lockamy III & McCormack, 2004:273). Once organisations know how mature their supply chains

[6] At this point it is important to mention that supply chain development (or any of the related concepts mentioned in this study, such as supply chain integration or supply chain maturity) does not refer to the development of the field of study or discipline of SCM. In this study, these concepts refer to the development stage of an organisation (or supply chain) in its endeavours to implement SCM.

are, they can assess at which stage the organisation and/or supply chain is and also assist in developing a road map to help them get where they want to go (Trkman *et al.*, 2007:118). This emphasises that not only the supply chain integration, but also the progress towards goal achievement, comes in stages (Lockamy III & McCormack, 2004:272). Hence, an organisation's internal supply chain decisions and supply chain development are interrelated (Yee & Tan, 2004:355).

As already mentioned, external supply chain integration at its most advanced stage can be referred to as virtual integration (Birou, 2006:295) or fully integrated supply chains (Handfield *et al.*, 2009:225). Here, competition is no longer between individual organisations but between supply chains (Lockamy III & McCormack, 2004:276). This extreme side of external supply chain integration is characterised by communication connectivity across the total supply chain network (Birou, 2006:295), thus being virtual to its fullest extent. This network encompasses the extended supply chain and includes outsourced service providers (Theis *et al.*, 2003:319). In fact, at this point organisations may even take aggressive action, say, to directly improve supplier capabilities and to accelerate supplier performance contributions (Handfield *et al.*, 2009:225).

Virtual (or optimal external) integration consists of full network collaboration and the use of technology to gain positions of market dominance (Birou, 2006:295). These supply chains are fully synchronised and are self-sufficient and self-sustaining (Theis *et al.*, 2003:319). Only a few organisations in any given industry have reached this level, which requires a set of highly developed relationships between the parties involved (Theis *et al.*, 2003:320; Rushton *et al.*, 2006:30). The organisations that do reach this level are moving to positions of industry dominance as they achieve unprecedented levels of order accuracy and cycle-time reductions across end-to-end networks that are completely electronically enabled (Birou, 2006:295). In summary of section 4.5, Table 4.2 shows the characteristics of the four stages of supply chain integration.

Table 4.2: Characteristics of supply chain management development

Stage of integration	Characteristics	Impact on seamless supply chain
Stage one: Internally focussed	- Functional silos - Top-down management - Internal measures used to monitor performance - Reactive, short-term planning - No internal integration - Fire fighting leads to 'quick fix' mentality - Many pools of inventory - Vulnerability to market changes	- work processes and islands - entrenched organisation - controls concentrate on cost, not value - stop-go material flows cause horrendous waste
Stage two: Functional integration	- Focus on internal flow of goods - Emphasis on cost reduction (and not performance) - Realisation of efficiencies gained by internal integration - Work processes still buffered by inventory - Customer service still reactive - Move towards internal trade-offs	- work processes now efficient - some integration of product and information flows - technology concentrated on discrete work processes - organisation still based around function, not process
Stage three: Internal integration	- Realisation of integration of goods flow throughout organisation (all organisational work processes are integrated) - Focus on logistics and JIT activities to manage flow of goods and information - Measurement of supplier performance and customer service performance - Customer back-to-supplier planning - Integrated organisation controls - Full visibility from distribution back to supplier - Extensive use of EDI to support customer but still reacting to the customer	- effective work processes from integrated business process - appropriate technology investment - good controls in place - organisation actively supports integration - flows much more stable
Stage four: External integration	- Extending integration efforts to suppliers and customers to form extended enterprise - Realisation of need to control goods and information to second- and third-tier suppliers and customers - Emphasis on alliance development and communication capabilities - Focus on customer, not product - Open-book operation at all interfaces - Synchronised material flows - Total trust and visibility	- linked business processes form 'seamless' supply chain - emphasis on shared value - accelerated cash flows - capacities balanced throughout chain

Source: Adapted from Wisner *et al.* (2009:263) and Childerhouse and Towill, 2003:113).

As mentioned above, a majority of organisations are still preoccupied with the internal integration of functional activities and supply chain flows (Burt *et al.*, 2010:529). The integration efforts in these organisations are still mainly focused on their own functional levels and they seldom take into account the overall supply network decisions, or fully understand how their decisions will impact on other members in the supply chain (Yee & Tan, 2004:355). In other organisations, there is quite some way to go before these organisations take full advantage of the promises of supply chain integration (Bagchi *et al.*, 2005:278). Organisations are concerned with decisions that influence their bottom line directly. The result is that there is not a single, integrated plan for the entire supply chain. Independent and conflicting plans are made by each of the supply chain members to achieve individual goals (Sundaram & Mehta, 2002:533).

4.5.5 The effect of SCI on supply chain performance

Moving towards higher levels of supply chain integration has often been discussed as a way of increasing the effectiveness and efficiency of supply chains (Hertz, 2006:208). In fact, Jeong and Hong (2007:583) argue that inter-organisational SCI is essential for supply chain performance. Depending on the developmental stage of SCI, integration can remove the barriers between functions or organisations, thus leading to efficient linkages in a supply chain and the strengthening of supply chain competitiveness. In fact, the level of supply chain integration has a positive influence on performance outcomes (Kim, 2006a:241, 242) and supply chain performance can be improved by well integrated supply chains (Lee *et al*., 2007:444). However, it must be remembered that improvements in the supply chain's performance do not take place overnight (Childerhouse & Towill, 2003:109).

The challenge in SCI is thus to coordinate activities across the supply chain to improve performance (Simchi-Levi *et al.*, 2003:120). This was emphasised in Chapter 1, as well. There is a strong correlation between the level of supply chain integration (or supply chain maturity) and improved performance (Cohen & Roussel, 2005:230); the higher the level of integration (or supply chain maturity), the higher the SCM process performance of the organisation (Trkman *et al.*, 2007:118; Cagliano *et al.*, 2006:284; Bagchi *et al.*, 2005:275). This correlation is illustrated in Figure 4.19. Organisations with more mature supply chain practices, for example, reduce their costs faster than those organisations that are less mature and achieve higher profit margins. This advantage is then used to increase market share and to drive out competition (Hoole, 2005:3).

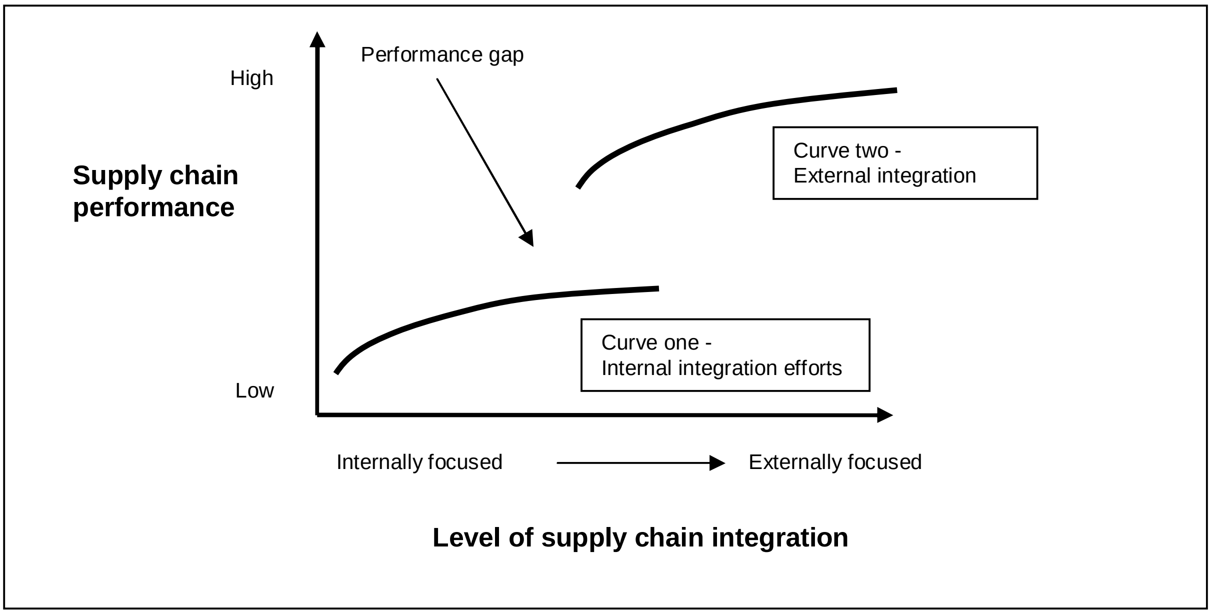

Figure 4.19: The correlation between the level of supply chain integration and supply chain performance
Source: Adapted from Gattorna (2003:xi) and Cohen and Roussel (2005:231).

Gattorna (2003:xii) emphasises the improved supply chain performance as organisations integrate from internal to external supply chains. The author states that internal integration will reach a stage where improvement is no longer sufficient and performance improvement slows down. As external integration takes place, there is a significant improvement in supply chain performance and performance gaps exist due to this remarkable improvement, because these improvements cannot be achieved merely internally (Gattorna, 2003:xii). Cohen and Roussel (2005:231) also imply these performance gaps, hence the importance of developing towards external supply chain integration. Gattorna (2003:xii) even includes a third performance curve because he distinguishes between external integration and virtual integration, but, as already mentioned, in this study virtual integration forms part of external integration. For this reason only two curves are portrayed.

4.6 CONCLUSION

Chapter four has discussed supply chain partners as part of the scoping of the supply chain in phase three of SCD. Once organisations understand the needs of their end customers and have selected a supply chain strategy, organisations need to scope the structure of their supply chains. To do this, organisations need to make certain decisions about their supply chain network structure. These decisions include decisions about supply chain partners. Organisations must know who they want to form relationships with and then collaborate with their important supply chain partners across supply chain processes. Supply chain relationships and processes have formed the core of this chapter and the chapter closes with a discussion on SCI. Chapter five looks at supply chain drivers and supply chain KPIs as part of the scoping of the supply chain structure (phase three of SCD).

CHAPTER 5

SCOPING THE SUPPLY CHAIN STRUCTURE: SUPPLY CHAIN DRIVERS AND KEY PERFORMANCE INDICATORS

5.1 INTRODUCTION

The third phase of SCD entails scoping the supply chain structure, which consists of identifying and selecting the right supply chain partners, managing the supply chain drivers and selecting the right KPIs to measure performance. Chapter 4 covered supply chain partners as part of scoping the supply chain structure. The supply chain network structure and the topic of supply chain relationships and processes were covered. The chapter closed with SCI. Chapter 5 will cover the last elements of phase three of SCD. These elements are supply chain drivers and KPIs. This is highlighted in Figure 5.1.

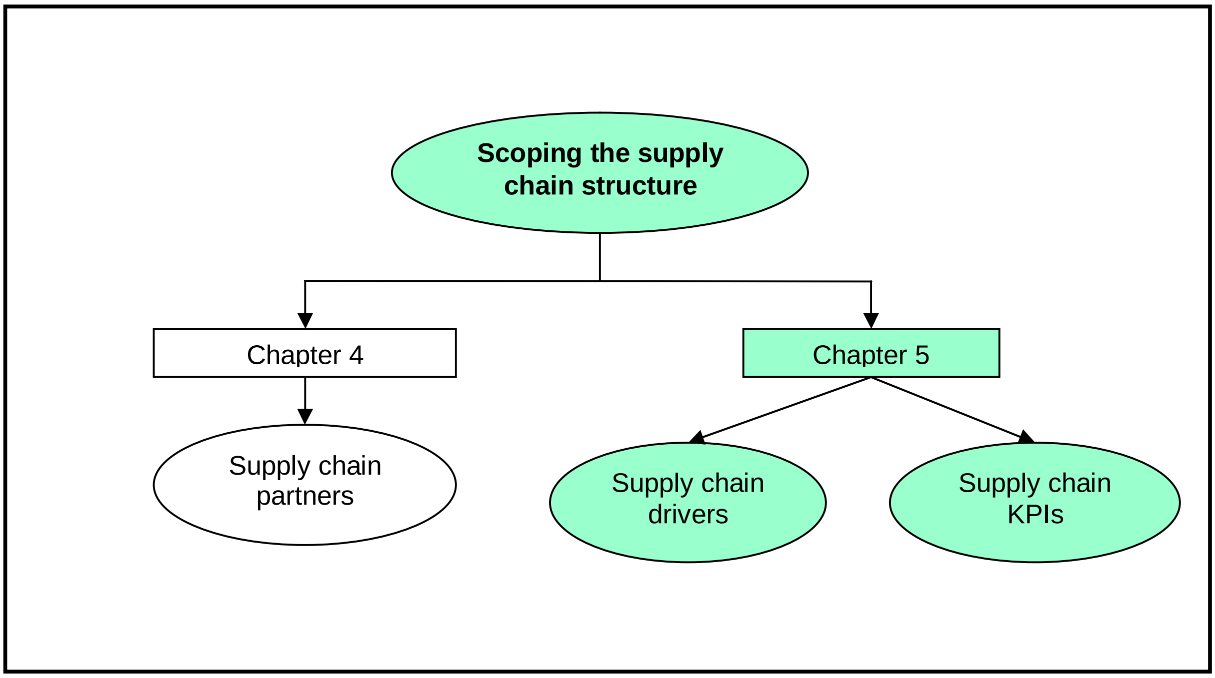

Figure 5.1: Phase three of supply chain design
Source: Researcher's own.

There are six supply chain drivers of supply chain performance. These drivers are facilities, inventories, transportation, information, sourcing and pricing. Organisations have to manage these drivers according to the supply chain strategy that has been selected. There are trade-offs between responsiveness and efficiency that have to be considered for each one of the drivers. The chapter closes by looking at KPIs. Organisations have to measure their performance and must select the right KPIs to do so. These KPIs must be selected according to the supply chain strategy that is being implemented.

5.2 SUPPLY CHAIN DRIVERS

If a supply chain is broken down into simple components, it basically comprises a set of facilities connected by transportation lanes (Taylor, 2004:21) in which inventories (products) are moved towards end customers through various supply chain members on the basis of information and finance flows (Taylor, 2004:24). This is illustrated in Figure 5.2. When these components are analysed, facets of SCD that need attention are the selection of supply chain partners; location and capacity of warehouse and production facilities where products will be produced and stored; the modes of transportation; and supporting information systems (Ayers, 2006:553; Saxton, 2006:244). Organisations thus need detailed information about suppliers, customers, products, operations, facilities and transportation links (Taylor, 2004:289).

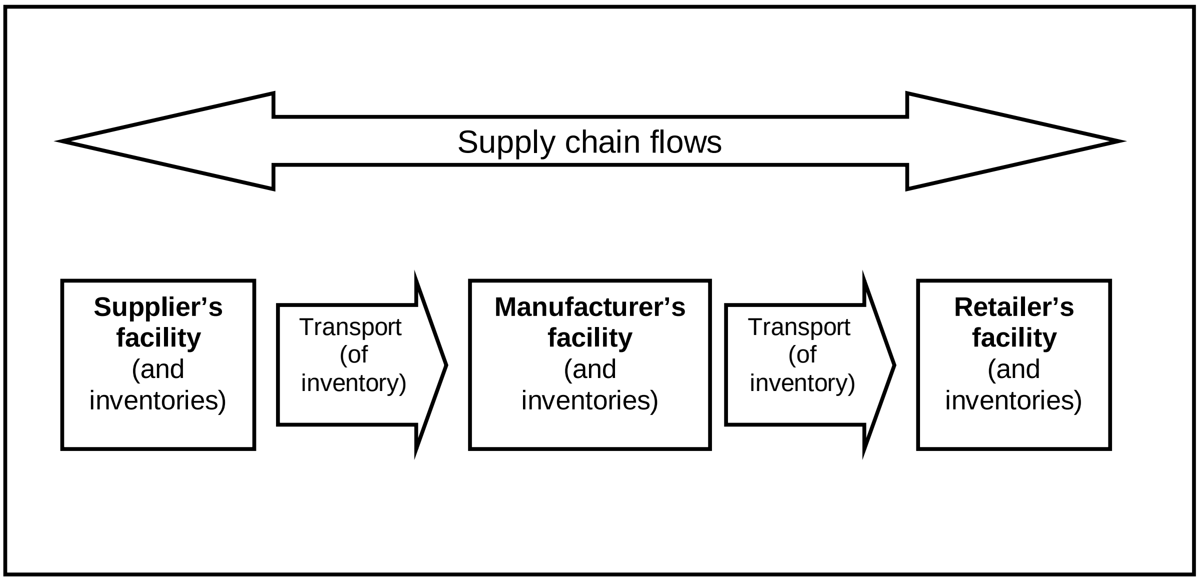

Figure 5.2: The interactions between facilities, inventory and transport
Source: Adapted from Taylor (2004:22, 24) and Waters (2009:341).

In any supply chain there are drivers that determine performance of the supply chain (Chopra & Meindl, 2010:59). These drivers interact with each other and are facilities, inventory, transportation, information, sourcing and pricing (Chopra & Meindl, 2010:59). In the previous chapters it became evident that organisations need to meet end customers’ needs with a supply chain strategy that matches these needs. This strategy requires a balance between responsiveness and efficiency. To understand how an organisation can improve supply chain performance in terms of responsiveness and efficiency, these supply chain drivers of supply chain performance have to be examined. These drivers play an important role in SCD, not only in the supply chain’s performance but also in aligning end customers’ needs with supply chain strategy (Chopra & Meindl, 2010:59).

In designing a supply chain, decisions must be made about suppliers, the number of facilities (such as manufacturing sites) and where they should be located. Decisions should be made about what products should be produced at each site and they have to decide on the best distribution network to support the delivery of the product to their end customers. Decisions need to be made about the amount of centralisation or decentralisation they want in their facilities and the type of planning system they will use (Raturi & Evans, 2005:208, 209).

Supply chain design helps determine strategic decisions (Mo & Harrison, 2005:243) made about supply chain drivers. These decisions have an impact on the supply chain’s capabilities of responsiveness and efficiency (Hugos, 2006:37). In Chapter 3, it became evident that supply chains can be either responsive or efficient. The supply chain strategy thus determines how the supply chain should perform with respect to efficiency and responsiveness. To understand how an organisation can improve supply chain performance, these drivers of supply chain performance will be examined briefly by determining how they play a role in efficient and responsive supply chains (Chopra & Meindl, 2010:59). The relation of the supply chain drivers to supply chain strategy is illustrated in Figure 5.3.

Many of the supply chain drivers have an effect on each other and in many cases organisations have to make decisions concerning some trade-offs between the drivers. Although the drivers are discussed separately, these trade-offs will become evident while discussing each supply chain driver.

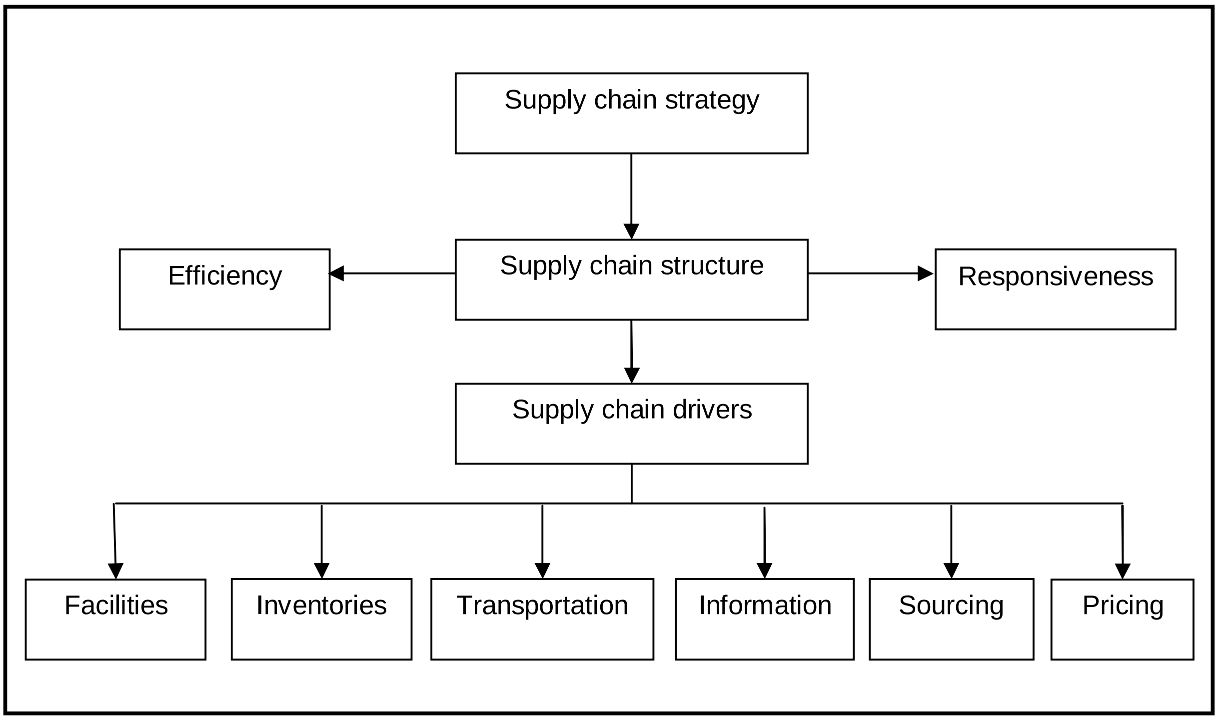

Figure 5.3: The relation of supply chain drivers to supply chain strategy
Source: Adapted from Chopra and Meindl (2010:62).

5.2.1 Facilities

Decisions regarding the facilities (and their locations) owned and operated by organisations and their relationships with other supply chain members are important elements of SCD (Shapiro, 2007:325; Jacobs *et al*., 2009:387). Even though there are many different types of facilities (Vogt, 2009:305), facilities generally fall into one of two categories, depending on their primary function. The categories are production facilities (for example factories) and storage facilities (for example warehouses and distribution centres) (Taylor, 2004:21). Storage facilities vary. Warehouses, for example, usually contain only a single kind of inventory, but distribution centres that do final assembly contain all kinds of inventory (Taylor, 2004:22).

Facilities are the actual physical locations in the supply chain network where the product is stored, assembled, or fabricated. Decisions regarding the role, location, capacity and flexibility of facilities have a significant impact on the supply chain's performance (Chopra & Meindl, 2010:59; Hugos, 2006:10) and there are certain trade-offs between responsiveness and efficiency that have to be made concerning facilities. Factories and warehouses with a lot of excess capacity are flexible and can respond quickly to fluctuations in demand, whereas facilities with little excess capacity cannot (Hugos, 2006:10). Facilities working at full capacity cannot suddenly change and start moving products around. Flexibility and agility naturally are not always possible if available resources are utilised at full capacity (Waters, 2007a:205). However, capacity costs money and excess capacity is idle and not generating revenue. Therefore, the more excess capacity an organisation has, the less efficient it is (Hugos, 2006:10). Two important issues in the trade-off between responsiveness and efficiency are location and capacity factors.

5.2.1.1 Location factors of facilities

According to Hugos (2006:13), location refers to the geographical setting of supply chain facilities. It also includes the decisions regarding which activities should be performed in each facility. Location decisions have significant influence on the cost and service characteristics of the supply chain and are particularly important for two reasons. Firstly, facilities require long-term commitments in buildings and factories (Reid & Sanders, 2007:316). The design, location and size of such facilities are not easily changed (Saxton, 2006:171; Louw, 2009:159). Many costs are fixed (Louw, 2009:159). Secondly, these decisions require sizable financial investments. Poor locations can result in high transportation costs; inadequate supplies of materials and labour; loss of competitive advantage; and financial loss (Reid & Sanders, 2007:316). There are some important issues to consider when determining location factors. These include:

- The location of customers and markets. Organisations have to decide how close they need to be to their customers and markets. Being close to customers reduces delivery costs and gives higher levels of service (Waters, 2009:203). This is determined by logistical variables (Langley, Coyle, Gibson, Novack & Bardi, 2009:477) such as the availability of transportation, freight cost, and geographical market size that can be served by the organisation and its supply chain (Langley *et al*., 2009:477).

- The location of suppliers and materials. In the manufacturing sector, the availability and cost of raw materials and component parts, as well as the cost of transporting these materials to the proposed plant site, are important decisions (Langley *et al*., 2009:478). Therefore, it is more likely that manufacturers will locate themselves close to suppliers of raw materials (Waters, 2009:203; Jacobs *et al*., 2009:388). For a distribution centre, it is important to know how the proposed facility site will fit the geographic location of key supplier facilities (Langley *et al*., 2009:478). The cost and service of inbound suppliers therefore are important considerations.

- The location of competitors. The location of a facility can be less attractive when competitors offer similar products and are aggressively fighting for a larger share of a fixed market. On the other hand, it can make a location more attractive when a cluster of similar organisations attracts new customers and consolidates expertise (Waters, 2009:203).

- Infrastructure and availability of transport. The availability of transportation is of great significance in many location factors (Langley *et al*., 2009:477; Jacobs *et al*., 2009:388). Appropriate transportation is essential for moving materials to and from facilities. This often means that access to good road, rail, air, sea, or pipeline networks must be considered, depending on the needs of the organisation (Waters, 2009:203; Langley *et al*., 2009:477; Hugos, 2006:14).

- Direct and indirect costs. Organisations have to consider several cost factors and these cost considerations are critical (Langley *et al*., 2009:479; Jacobs *et al*., 2009:387). There are direct costs of operation, which include wages, materials, overheads, utilities, transport, interest rates and construction. The most attractive locations offer a combination of low direct costs, and high performance. Unfortunately, lower costs often mean lower productivity (Waters, 2009:203). Organisations also have to consider indirect costs such as local taxes, currency exchange rate fluctuations, restrictions of exports and inflation (Waters, 2009:203; Hugos, 2006:14).

Location decisions also influence market size and market share. This is particularly important for some services whose competitive advantage depends on having a facility located near customers. An organisation might choose to locate a plant in a new geographic region not only to reduce distribution costs, but also to create cultural ties between the organisation and the local community. Broadly speaking, an organisation may choose to locate all its products closer to the factory (centralised system) or closer to the retail outlets (decentralised system) in a supply chain (Raturi & Evans, 2005:209). Waters (2009:206) includes a third option, namely that organisations can compromise and locate their facilities somewhere in between. These three options are illustrated in Figure 5.4.

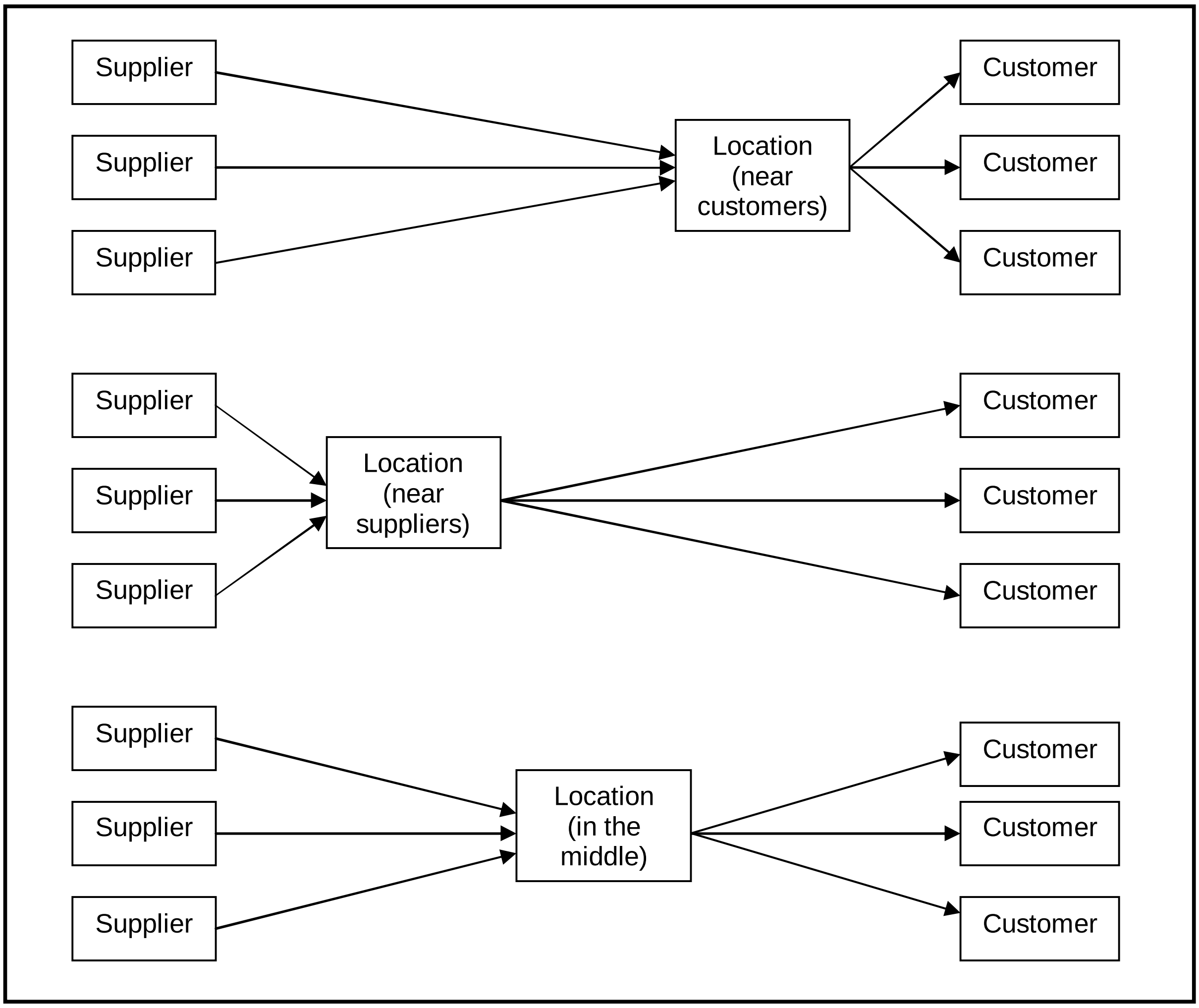

Figure 5.4: Alternative facility location options
Source: Adapted from Waters (2009:206).

With centralised systems, inventories are aggregated or 'pooled', thereby reducing overall inventory levels (Raturi *and* Evans, 2005:209; Simchi-Levi *et al.*, 2008:232). Generally, the lead time to end customers increases with centralised facilities because the organisation takes longer to move the product through its supply chain upon the initiation of an order, because facilities are further away from the end customers (Raturi & Evans, 2005:209). However, economies of scale can be utilised by centralising production in large central plants (Hugos, 2006:35). It is much less costly to operate a few large facilities than to operate many smaller facilities with the same total capacity (Simchi-Levi *et al*., 2008:232). An organisation with fewer warehouses will increase efficiency, but reduce responsiveness (Chopra & Meindl, 2010:59). Centralised facilities will thus be used in an efficient (as opposed to responsive) supply chain design to obtain efficiency as discussed earlier. With a centralised distribution system, both the cycle inventory and the safety stock levels are reduced (Raturi & Evans, 2005:209, 210; Simchi-Levi *et al*., 2008:51; Wisner *et al*., 2009:325). If organisations strive for efficiency, they can also build factories with very little excess capacity and have the factories optimised for producing a limited range of items (Hugos, 2006:35).

Alternatively, an organisation striving for responsiveness in its supply chain could have many warehousing facilities located close to customers. However, this practice would reduce efficiency (Chopra and Meindl, 2010:59). Overhead costs are much greater in a decentralised system because there are fewer economies of scale. Customer lead times are much shorter, though, because facilities (such as warehouses) are much closer to customers (Simchi-Levi *et al*., 2008:52; Wisner *et al*., 2009:325). Similarly, from a manufacturing point of view, organisations could do their production in more, but smaller plants that are close to major groups of customers so that delivery times will be shorter (Hugos, 2006:35).

It is clear that the number of facilities used by an organisation plays an important role in the management of the supply chain. There is an optimal number of facilities that should be determined by organisations. This optimal number is determined by two major factors, namely transportation costs and operating costs (Swink *et al*., 2011:330), hence emphasising the interrelationship between the supply chain drivers. This optimal point can be determined by considering the following issues (Waters, 2009:213):

- When an organisation concentrates activities in a few key centralised locations, inward transport consists of a few large deliveries and the cost is lower. However, the facilities, on average, are further away from customers and the outward transport costs are high. This option generally gives lower customer service and is used when cost is a major consideration (Waters, 2009:213; Wisner *et al*., 2009:325).

- In the case of a large number of facilities, such as retail shops or warehouses, inward transportation consists of small deliveries to more destinations and the cost is high. Facilities on average are nearer to customers, customer service is higher and outward transportation costs are lower (Waters, 2009:213), because increasing the number of facilities brings them closer to the customer and market area, thus reducing the outbound transportation distance and costs (Langley *et al.*, 2009:422; Simchi-Levi *et al*., 2008:52).

- Operating costs will increase with a larger number of facilities (Langley *et al*., 2009:422). Operating costs also vary with facility size. Larger facilities are generally more efficient due to economies of scale. However, care must be taken because larger facilities do not necessarily give economies of scale and dis-economies can be caused by higher cost of supervision, coordination, communications, fixed costs, employment effects, customer service and information flows (Waters, 2009:213; Simchi-Levi *et al*., 2008:52).

Therefore, with the number of facilities increasing, overall transportation costs and the cost of lost sales decrease, whereas inventory costs and warehousing costs increase (Langley *et al*., 2009:422). If transport and operating costs are plotted against the number of facilities, the optimal number of warehouses can be determined. However, managers have to consider a whole range of other factors, as well such as management overheads, communications, fixed costs, employment effects, customer service and information flows (Waters, 2009:213). The optimal number of facilities based on these costs is illustrated in Figure 5.5.

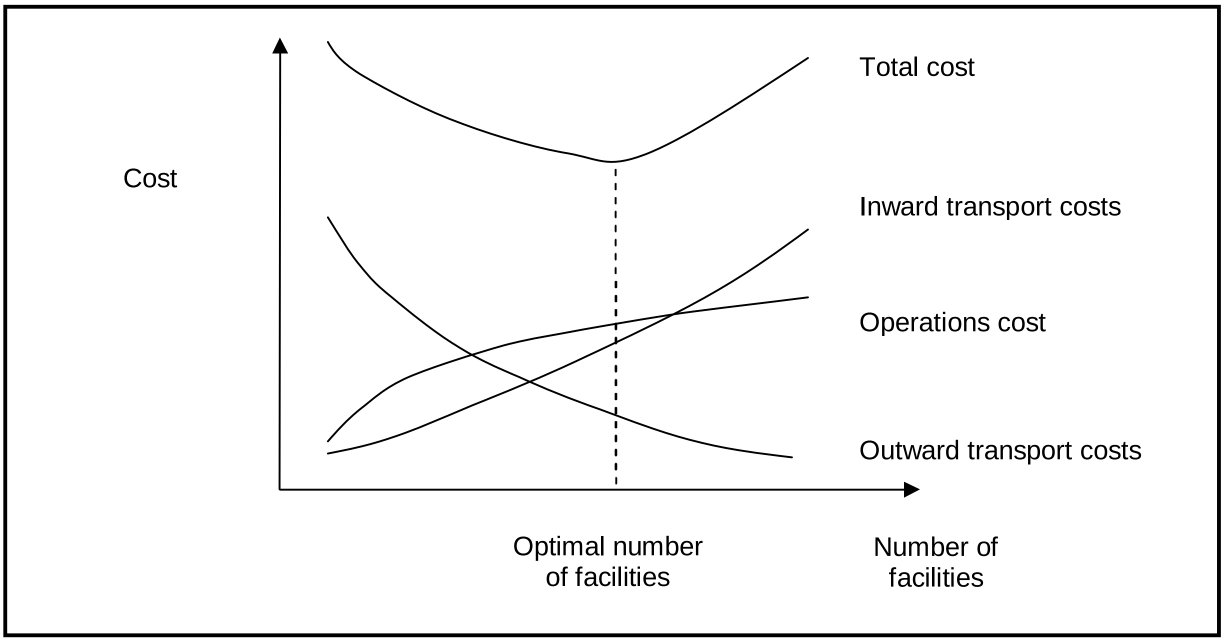

Figure 5.5: Optimal number of facilities
Source: Adapted from Waters (2009:214) and Langley *et al*. (2009:423).

The number of facilities that an organisation must consider can be viewed from a centralised versus a decentralised system. With a centralised system, the organisation has fewer facilities and, conversely, an organisation has more facilities with a decentralised system (Langley *et al*., 2009:424). In conclusion, organisations will use centralisation to gain economies of scale and will decentralise to become more responsive to customers' needs (Chopra & Meindl, 2010:63). Therefore, the fewer the levels and warehouses the greater the degree of centralisation. The advantages and disadvantages of a centralised warehouse structure are tabled in Table 5.1. The advantages and disadvantages of a decentralised warehouse structure are the opposite of those for a centralised warehouse structure.

Table 5.1: The advantages and disadvantages of a centralised warehouse structure

Disadvantages	Advantages
Increased distance from customers	Economy of scale
Increased transport costs	Reduced bullwhip effect
Longer delivery times	Reduced non-value activities
Not local existence	Reduced obsolescence risks

Source: Adapted from Jonsson (2008:228).

Organisations can decide to eliminate or greatly reduce the use of facilities by making use of direct shipments. With direct shipments, all shipments come directly from the supplier to each buyer's location. The organisation has to decide on the quantities of goods that need to be shipped and the mode of transport to be used. The major advantage of direct shipments is the elimination of intermediate warehouses. Lead times and inventory carrying costs will be reduced significantly. However, transportation costs will increase. (Chopra & Meindl, 2010:389). A direct shipments network is illustrated in Figure 5.6.

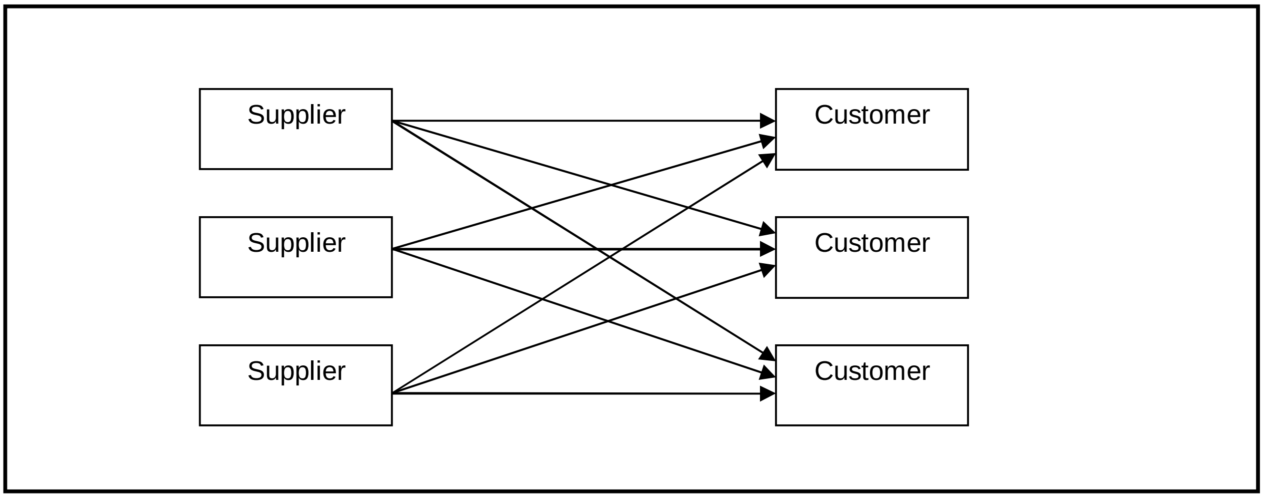

Figure 5.6: Direct shipment network
Source: Adapted from Chopra and Meindl (2010:389).

However, facilities can also be used to reduce lead times. If lead times are reduced, inventory levels can be reduced (Mangan, Lalwani & Butcher, 2008:106). When the total transportation time to customers exceeds the customers' requirements, organisations should try to reduce the lead times. Total transportation time can be broken into two parts, namely the time to the facility (such as a warehouse) and the time from the facility to the customer (Bozarth & Handfield, 2006:347). Average lead time impacts the amount of safety stock, as does the standard deviation of lead time. Both of these may be reduced by some combination of buying from a supplier located closer; using a more reliable method of transportation; and/or using a faster method of transportation. This is the objective of just-in-time systems (Swink *et al*., 2011:435, 436).

Facilities can also be used to reduce overall inventory levels and related costs throughout the supply chain by reducing the number of warehouses and distribution centres in their networks. Inventory will be reduced due to the consolidation of facilities (Swink *et al*., 2011:436). Inventory pooling can, for example, also be used for this purpose. Safety stock is often required to meet unexpected changes in customers' demands. However, organisations do not always want to keep this safety stock in the stores where floor space is expensive. These safety stocks of various outlets can be consolidated in a centralised location which can provide quick service to all the organisations. Inventory is thus pooled in a centralised location, which, in turn, reduces inventory levels, risks associated with stockouts and thus costs (Bozarth & Handfield, 2006:348; Wisner *et al*., 2009:324; Mangan *et al*., 2008:106; Swink *et al*., 2011:435).

Organisations can use two major types of warehousing systems to exploit economies of scale. These systems are consolidation and cross docking systems (Bozarth & Handfield, 2006:344). *Consolidation* takes place when a warehouse receives materials from a number of sources (often plants) in the same geographical area and combines them into larger and more economical shipping loads (Bozarth & Handfield, 2006:344). This allows the customer to receive an assortment of products in a single shipment, thus reducing time and effort required for the customer (Swink *et al*., 2011:323). The benefits of consolidation are the realisation of the lowest possible freight rate; timely and controlled delivery; and reduced congestion at a customer's receiving dock. The warehouse enables both the inbound movement from origin and the outbound movement to destination to be consolidated into a larger size shipment (Bowersox *et al*., 2010:249). Consolidation is illustrated in Figure 5.7.

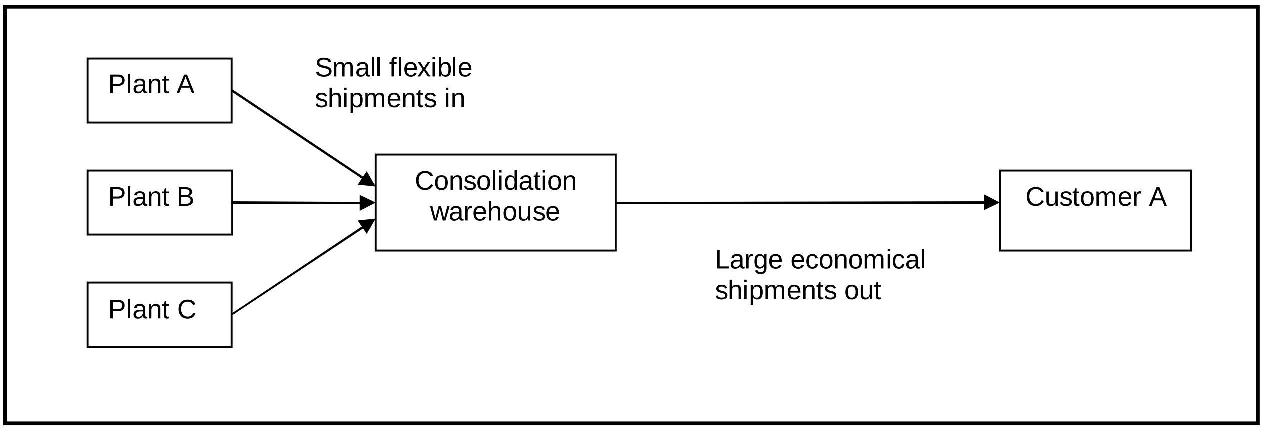

Figure 5.7: Consolidation
Source: Adapted from Bozarth and Handfield (2006:344); Waters (2009:378) and Bowersox *et al*. (2010:249).

Cross-docking is another system that reduces transportation costs. This is a form of warehousing where large incoming shipments are received and then broken into smaller outgoing shipments to demand points in a geographical area. Cross-docking combines the economies of large incoming shipments with the flexibility of smaller local shipments (Bozarth & Handfield, 2006:345; Jacobs *et al*., 2009:386). Break-bulk warehousing is a specialised form of cross-docking in which the incoming shipments are received from a single source or manufacturer (Bozarth & Handfield, 2006:346). Delivery is then arranged to multiple destinations. Economy of scale is achieved by transporting the larger consolidated shipment (Bowersox *et al*., 2010:249). Retailers often use cross-docking to receive large shipments from multiple suppliers and re-sort the goods into customised shipments to individual facilities (such as retail outlets). They receive large shipments from suppliers and then remix the incoming goods and deliver them to individual stores (Bozarth & Handfield, 2006:346). An example of cross-docking is illustrated in Figure 5.8.

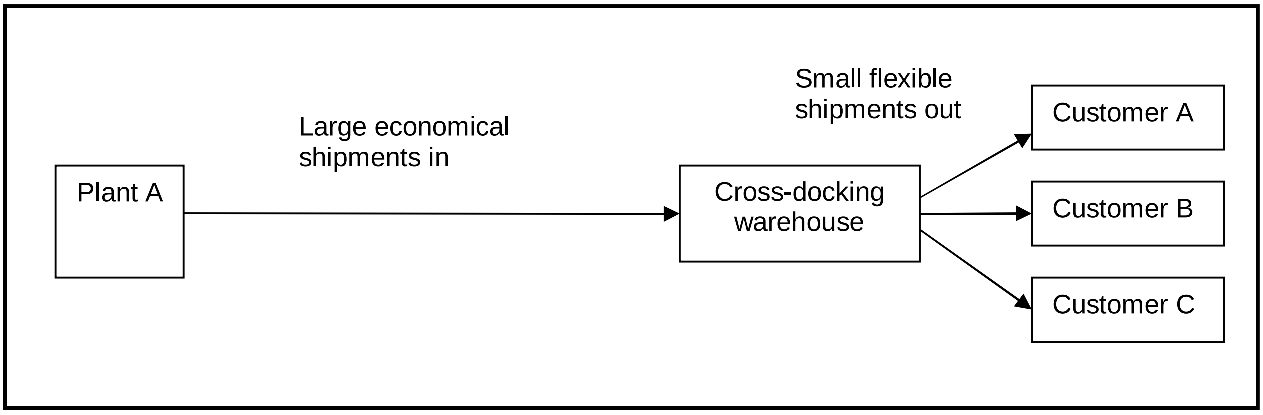

Figure 5.8: Cross-docking
Source: Adapted from Bozarth and Handfield (2006:344); Waters (2009:378) and Bowersox *et al*. (2010:249).

5.2.1.2 Capacity considerations

Organisations must also consider capacity factors. The capacity of a facility is the maximum average rate at which entities, such as inventories, can flow through the system (Hopp, 2008:13). It is the limit on the amount of output that a process can produce given an amount of inputs and resources made available to the process in terms of, for example, machine hours, labour hours and tools (Swink *et al*., 2011:57). The capacity of a facility is a function of some of the following elements (Waller, 2003:365):

- existing labour force within the organisation;
- machines and equipment already in the facility;
- raw materials and components that need to be purchased; and
- outside labour services including subcontracting.

Maximum capacity is the highest output rate that an activity or process can achieve under ideal conditions in the short term. This assumes that all equipment and workers are fully operational for the maximum amount of variable time. Maximum capacity can usually only be maintained for relatively short periods. Effective capacity is the level of capacity or output that a process can be expected to produce under normal conditions. This is what management plans for under normal conditions (Swink *et al*., 2011:58). Effective capacity thus is the maximum realistic throughput under normal conditions (Waters, 2009:235). As capacity utilisation refers to the percentage of the capacity that is actually used, organisations are able to determine performance based on the maximum capacity a process was designed for (Mangan *et al*., 2008:119; Waller, 2003:365). Very low utilisation rates suggest that equipment or employees are being underused, while extremely high utilisation rates suggest overuse of capacity. Yield rate is the percentage of goods produced as a percentage of total units begun. For example, a yield rate of ninety percent means that out of 100 units begun, 90 units were successfully completed (Swink *et al*., 2011:58).

Organisations have to determine whether their capacity is able to perform its intended function or functions. A large amount of excess capacity allows the facility to be very flexible and to respond to a wide range of customer demands (Chopra & Meindl, 2010:64). However, excess capacity costs money and therefore decreases efficiency. A facility with little excess capacity is likely to be more efficient per unit of product it produces than one with a lot of unused capacity, although such a facility will struggle to respond to demand fluctuations. Organisations therefore have to make a trade-off to determine the right amount of capacity to have at each of their facilities (Chopra & Meindl, 2010:64; Waters, 2007a:205).

Capacity planning is an integral part of SCM. Capacity planning involves determining the production capacity needed to meet the changing needs of customers (Van

Eeden, 2009:171). The two main drivers of capacity planning are changing demand patterns and limited production capabilities. If organisations know what their customers' needs are, they can plan their capacity accordingly. If too few products are manufactured, customer needs will not be met optimally. On the other hand, if too many products are manufactured, it may lead to waste (Van Eeden, 2009:171; Swink *et al*., 2011:126). If capacity is insufficient, organisations can try to increase capacity by (Taylor, 2004:284, 288):

- expanding existing capacity;
- building new facilities; or
- moving operations to other facilities.

The second driver of capacity has to do with production capacity. Organisations will incur unnecessary expenses if they invest in too much capacity. On the other hand, if customer demand exceeds capacity, the organisation will have to acquire additional capacity by either developing such capacity in-house or outsourcing production to other organisations (Van Eeden, 2009:171). During capacity planning, organisations will try to match production as closely as possible to customer demand (Van Eeden, 2009:171).

5.2.2 Inventory

A typical supply chain consists of various supply chain members such as suppliers and manufacturers, who convert raw materials into finished products. As already mentioned in the previous section, these supply chain members have various facilities, from which finished products are distributed to customers (Simchi-Levi *et al.*, 2008:31). Facilities thus contain controlled quantities of materials called inventories (Taylor, 2004:22). Inventory is thus the stock of any item or resource used in an organisation (Jacobs *et al*., 2009:547).

It is important to realise that inventory is not just the amount of end products stored in a warehouse. It is also the inventory of raw materials and partially assembled products in the supply chain. It includes the warehouse inventory of suppliers and suppliers' suppliers, reaching all the way back to the elements of the raw materials from which products are created. Inventory also sits in distribution channels, with end customers (Saxton, 2006:148). Therefore, inventory ties up money in the supply chain (Jacobs *et al*., 2009:546).

Managing inventory in complex supply chains is difficult and may have a significant impact on the customer service level and supply chain cost (Simchi-Levi *et al.,* 2008:30) which, in turn, will influence supply chain performance. In managing inventory, organisations face uncertainty throughout the supply chain. On the upstream end, they face supply uncertainty, or the risk of interruption in the flow of components needed in their internal operations. On the downstream side, organisations face demand uncertainty, or the risk of significant and unpredictable fluctuations in the demand for their products. In dealing with uncertainty in supply and demand, organisations have to determine what types of uncertainty can be reduced and then focus on reducing them. For example, poor quality is a source of supply uncertainty that can be substantially reduced or even eliminated through quality improvement programmes. On the other hand, forecasting may help to reduce demand uncertainty, but can never completely eliminate it. A change in forecasting methods, then, may not be helpful in reducing demand uncertainty (Bozarth & Handfield, 2006:417).

5.2.2.1 Types of inventory

There are many different types of inventory classifications. Inventory can be classified according to its position in the supply chain or based on its purpose (Cronje, 2009:216). When classified according to its position in the supply chain, inventory encompasses all raw materials, work-in-progress, packaging and finished goods within a supply chain (Chopra & Meindl, 2010:65; Hugos, 2006:35).

Raw materials inventory consists of materials ready for use in production (Taylor, 2004:22). Raw materials consist of purchased assemblies, parts or materials that are delivered by suppliers and used in the production of finished products (Wisner & Stanley, 2008:179). *Work-in-progress* (WIP) inventory includes all the materials currently being worked on (Taylor, 2004:22). Once raw materials have been delivered and put into the production process, they become WIP inventories (Wisner & Stanley, 2008:179). WIP is incomplete and has not yet been transformed to a saleable finished product (Monczka *et al.,* 2010:385); it includes materials that are waiting to be moved to another process or are currently being worked on at a work centre, as well as materials that are lining up at a processing centre due to a capacity bottleneck or machine breakdown. If WIP increases over a certain level, this may indicate such production bottlenecks or delays (Monczka *et al.,* 2010:385). Different types of packaging materials can be used in different stages of the total logistics process and inventory of packaging materials play a similar role to WIP inventories (Cronje, 2009:216).

Finished goods inventory holds completed products ready for shipment (Taylor, 2004:22) or for delivery to end customers. WIP inventories thus become finished inventories (Wisner & Stanley, 2008:179). An organisation that produces items in anticipation of customer orders should monitor its finished goods inventory closely (Handfield *et al.,* 2009:588). A higher-than-anticipated level of finished products may mean that a decrease in customer demand is occurring, while a lower-than-anticipated finished products inventory level may indicate that customer demand is increasing. Both cases may be examples that indicate that forecasts of anticipated customer demand do not match current output levels (Handfield *et al.,* 2009:588).

Maintenance, repair and operating supplies (MRO) inventory includes the items used to support production and operations. These items are not physically part of a finished product but are critical for the continuous operation of the facilities (Handfield *et al.,* 2009:588), thus the inventories for these goods form part of the supporting supply chain (refer to section 4.2.2.2).

When inventories are classified according to purpose, a distinction can be made between cycle stock, transit inventories and safety stock. From a manufacturing perspective *cycle stock* is often defined as the amount of stock that is produced in an average production run. From a distribution perspective, cycle stock can be described as the inventory that is required to meet normal or average demand for the product (Cronje, 2009:217). *Transit inventory* is inventory that is en route (either moving or awaiting movement) from one location to another. Transit inventory should be considered as part of cycle stock even though it is not available for sale until it arrives at the destination (Cronje, 2009:217). Pipeline (or in-transit inventory) is in transit to a customer or is located throughout distribution channels. The supplying organisation, however, owns the inventory and receives payment when the consumer buys the product (Handfield *et al.,* 2009:588).

Supply and demand requirements can never be completely synchronised. It is especially difficult with respect to the timing of inbound deliveries with outbound deliveries governed by demand. Some materials requirement uncertainties exist in all flows of materials. Disruptions in the flows, which occur for different reasons from supplying units to consuming units, also make the supply situation uncertain. To control these uncertainties, organisations make use of *safety stocks* (Jonsson, 2008:285). *Safety stock* is thus held over and above cycle stock to make provision for uncertainties (Cronje, 2009:217). The amount of safety stock will be determined by the variability of demand, the variability and duration of the supply lead time, the policy on service level of the organisation and the order quantity. The more the demand varies from period to period, the more safety stock is required. Similarly, the greater the lead time variation, the higher the safety stock level required (Cronje, 2009:227).

5.2.2.2 Inventory costs

A variety of costs are associated with inventories. *Ordering costs* associated with ordering inventories include the administration, allowances for preparing an order, communication, correspondence, delivery, insurance, receiving, unloading, checking, testing, use of equipment and follow-up (Cronje, 2009:220; Waters, 2009:341). Sometimes a range of other costs are also included, such as costs incurred for quality control, sorting, repackaging and the movement of received goods (Waters, 2009:342).

*Carrying (or holding) co*sts are a very significant cost to inventory (Swink *et al*., 2011:214). These are the costs associated with holding one unit of an item in stock for a unit period of time (Waters, 2009:342). Carrying costs include storage costs (such as warehouse rent, financing, taxes, equipment, building maintenance), risks (such as deterioration, damage, loss, obsolescence) and services (such as insurance, materials handling, tracking, special treatment such as refrigeration, and administration) (Waters, 2009:342; Swink *et al*., 2011:214). Together with transport costs, these costs are regarded as one of the major components of logistics costs (Cronje, 2009:220).

Shortage costs occur when an organisation does not have inventory available to meet demand (Swink *et al*., 2011:215). In its simplest instance, it means a lost sale. However, the effects of such shortages can be much wider and may include the loss of goodwill, loss of reputation, and loss of potential future sales (Waters, 2009:342). Shortages of raw materials for production can cause disruption, rescheduling of production, re-timing of maintenance periods, and laying off of employees. Shortage costs may also include payments for positive actions to remedy orders, such as expediting orders, sending out emergency orders, paying for special deliveries, storing partly finished goods, or using more expensive suppliers (Waters, 2009:342).

5.2.2.3 The economic ordering quantity

An important concept in managing inventories is the concept of the economic ordering quantity (EOQ). The EOQ is the order quantity that minimises the combined inventory carrying and ordering costs (Bowersox *et al*., 2010:164). The EOQ is thus the optimal size for an order in a simple inventory system (Waters, 2009:345). This is illustrated in Figure 5.9. However, the EOQ model assumes certain scenarios when ordering inventories. These assumptions do not always hold true in practice. They include (Swink *et al*., 2011:424):

- no quantity discounts are given by the supplier. Product costs are constant;
- there are no lot size restrictions;
- no partial deliveries take place. The product is produced and delivered in a single batch;
- there is no variability. Product demand and replenishment lead times are known and constant; and
- there are no product interactions. When one product is ordered, it is not tied to ordering another product.

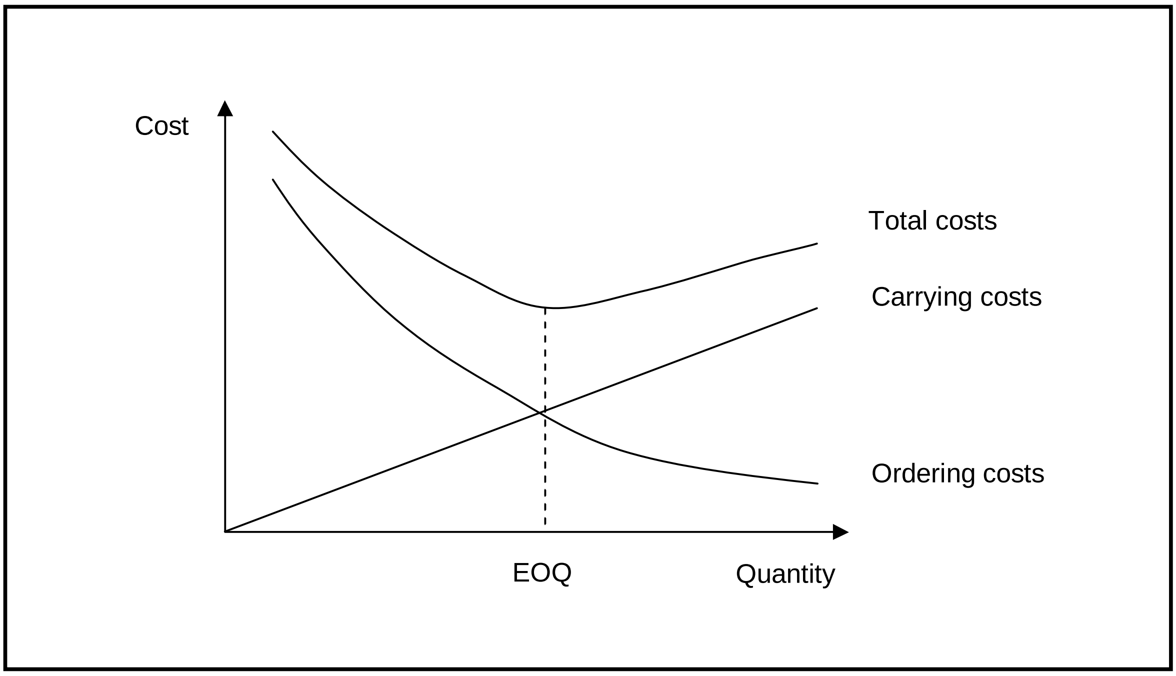

Figure 5.9: The economic ordering quantity
Source: Adapted from Waters (2009:347); Swink *et al*., (2011:423).

In practice, organisations have to consider some additional factors. When buying large quantities, discounts can also be taken into account (Cronje, 2009:225). Another factor is transportation costs. As a general rule, the larger the order, the lower the transport cost per unit because the transport cost is spread over more units. Lower transport rates can therefore be negotiated for larger order quantities (Cronje, 2009:225). In the EOQ formulation, no consideration was given to the impact of transportation cost upon order quantity (Bowersox *et al*., 2010:166).

Production lot size refers to the most economical quantities from a manufacturing perspective (Bowersox *et al*., 2010:168; Cronje, 2009:25). In practice, products must sometimes be ordered in a particular batch size (Swink *et al*., 2011:425). Also, inventory replenishments are often produced and delivered in multiple shipments. These products may also not be immediately available for use. Product demand and replenishment lead times are often variable and uncertain, which, in turn, necessitates the holding of safety stock. Lastly, products are often ordered and shipped with same shipments (Swink *et al*., 2011:426-428). Ultimately organisations have to consider all these factors to optimise their inventory levels as stipulated in their service level policy.

A service level is a performance target specified by management (Bowersox *et al*., 2010:159). A service level policy specifies the amount of risk of incurring a stockout that an organisation is willing to incur. Inventory carrying costs are weighed against stock-out costs, but stockout costs are often difficult to quantify, which means that a service level policy is usually a matter of managerial judgment. The decision depends upon the organisation's willingness to take a chance of being out of stock of an item while waiting for it to be replenished (Swink *et al*., 2011:428), therefore organisations will often define inventory performance objectives (Bowersox *et al*., 2010:159).

Organisations have to consider these issues relating to cost and to customer service requirements (Langley *et al*., 2009:348). The relationship between inventory levels and customer service levels (or in-stock probability) is illustrated in Figure 5.10. This relationship suggests that increasing investments in inventory may result in higher levels of customer service (Langley *et al*., 2009:348). Inventory carrying costs rise increasingly (Swink *et al*., 2011:430).

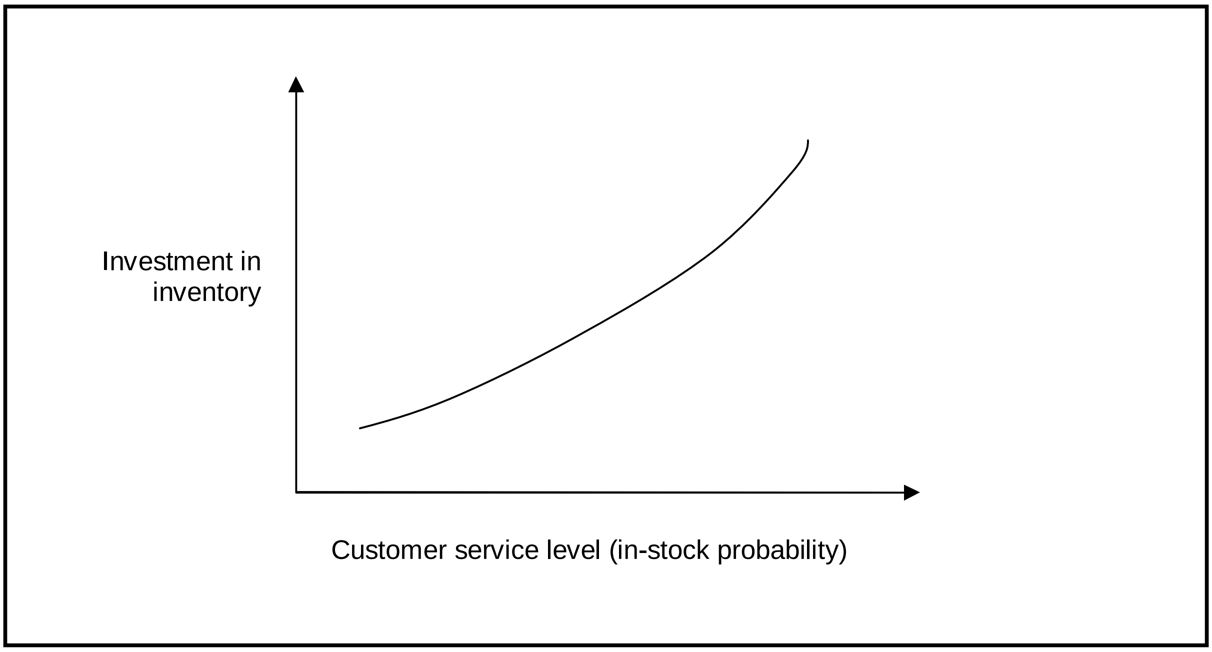

Figure 5.10: The relationship between inventory and customer service levels
Source: Adapted from Langley *et al*. (2009:349) and Swink *et al*. (2011:430).

Modern business organisations are trying to identify practices that will result in higher levels of customer service together with reduced investments in inventory. This can be achieved by (Langley *et al*., 2009:348):

- more responsive order processing, and order management systems;
- the enhanced ability to manage logistics information;
- more capable and reliable transportation resources; and
- improvements in the ability to position inventories so that they will be available when and where they are needed.

Organisations can, for example, reduce their order quantities. If order costs can be reduced, order quantity declines, with a resulting decline in cycle stock. Order costs can be reduced through techniques such as online ordering, a reduction in receiving costs, or automated payment of invoices. Set-up costs in production can be reduced through automation and process improvements. Working more closely with suppliers to discourage quantity discounts (which typically result in larger order quantities) and, instead, offering the lowest possible price per unit regardless of order quantity would result in smaller order quantities. Organisations that implement just-in-time (JIT) or lean processes may make longer-term commitments to suppliers in return for an agreement to deliver smaller quantities at the lowest price per unit (Swink *et al*., 2011:435). JIT suggests that inventories should be available exactly when an organisation needs them. The main principle underlying a JIT system is that an organisation has inventory when needed and no inventory when it is not needed (Cronje, 2009:237). JIT systems therefore organise inventory to arrive just as it is needed. By coordinating supply and demand, organisations eliminate stocks of raw material and work in progress by using a JIT system (Waters, 2009:286).

To conclude, organisations also need to make decisions about inventory concerning responsiveness and efficiency (Hugos, 2006:12). For example, an organisation can be more responsive by holding large amounts for a wide range of products, thus satisfying customer demand. However, in doing so the organisation increases its costs, thereby making it less efficient. Reducing inventory therefore makes the organisation more efficient but less responsive (Chopra & Meindl, 2010:60; Hugos, 2006:12, 35).

5.2.3 Transportation

The importance of inventory management and the need for coordination of inventory decisions and transportation policies are evident (Simchi-Levi *et al.,* 2003:44). Transport is required for the physical movement of materials between points in the supply chain (Waters, 2009:404), transportation therefore is the physical link connecting an organisation's customers, raw material suppliers, plants, warehouses and supply chain members (Langley *et al*., 2009:271). Transportation thus entailing moving inventory from point to point between facilities of supply chain members in the supply chain, knowledge of the transportation system is fundamental to the efficient and economic operation of an organisation's supply chain. Transportation can take the form of many combinations of modes and routes, each with its own performance characteristics (Chopra & Meindl, 2010:60; Langley *et al*., 2009:271). It typically supports the linkages throughout a supply chain, namely inbound logistics, intra-organisational movements and outbound logistics (Handfield *et al.*, 2009:623). Externally (inbound and outbound), it satisfies customers' needs and expectations and internally transportation leads to efficiency in supply chain performance, enabling the organisation to operate with lower inventory levels at lower cost (Raturi & Evans, 2005:220).

5.2.3.1 Modes of transportation

A major issue in designing an effective supply chain is determining the way in which inventories are moved between different facilities in the supply chain towards the end customer (Hugos, 2006:14). For consumer products, this often involves moving products from the manufacturing plant to a warehouse and then to a retail store. The mode of transport describes the type of transport used (Waters, 2009:408). A mode thus identifies a basic transportation method or form (Bowersox *et al*., 2010:203) and the basic modes of transportation available are rail, road, water, pipeline and air. Each mode has different economic and technical structures and each provides different qualities and a different linking service (Langley *et al*., 2009:277).

Railroads are most commonly used for heavy and bulky loads over long distances (Waters, 2009:412; Swink *et al*., 2011:319). The reason for these long-distance, large-volume rail movements is ingrained in the mode's economic and technical characteristics (Langley *et al*., 2009:279). Once the rail track has been built, it has the advantage of very high capacity, low unit costs, maintaining a consistent service, reasonably high speed and causing less pollution than road transport (Waters, 2009:412). A major advantage of using railroad transportation is thus the long-distance movement of commodities in large quantities at relatively low rates. Products of forests, mines, and agriculture are the major commodities transported on railroads. Low accessibility, which refers to the carrier's ability to provide service to and from the facilities in a particular situation, is one primary disadvantage of rail transport; the rail carrier cannot deviate from the route that the rail track follows. Long transport time is another disadvantage of rail transport (Langley *et al*., 2009:279).

Road transport is the most widely used mode of transport and it involves vehicles (such as trucks) driving along roads (Waters, 2009:410). Road transport by trucks is common for transport over short as well as long distances (Jonsson, 2008:65). As road transport has flexibility (Bowersox *et al*., 2010:205), its major advantage thus is its inherent ability to provide service to any location. It is the most accessible transportation mode (Langley *et al*., 2009:283) and can offer accessibility to widely scattered markets (Jonsson, 2008:65).

Water transport primarily involves long-distance movers of low value high density shipments. The main advantages of water transport are its low cost (Langley *et al*., 2009:285) and its ability to transport large shipments (Bowersox *et al*., 2010:207; Swink *et al*., 2011:319). All water transport depends on geography and the access of suppliers and customers to waterways (Waters, 2009:414), thus accessibility is low and is only gained if access is available to ports (Jonsson, 2008:64). Being limited to appropriate ports, water transport is inflexible (Waters, 2009:416). Large loading capacity is a great advantage of water transport over other transportation modes (Jonsson, 2008:64). However, the shipper is given a slow movement method in return of the low rates of water transport. Water transport is generally the slowest of the transportation modes (Jonsson, 2008:64) and possibly provides the highest transit time of all modes (Langley *et al*., 2009:285).

Air transport offers terminal-to-terminal movements and relies on other transport for the initial movement from supplier to airport and the final movement from airport to customer (Waters, 2009:417). Air transport provides a very fast service over long distances (Swink *et al*., 2011:320), but is limited to terminals, just like sea and rail transport, and cannot provide access directly to and from suppliers' and customers' facilities (Jonsson, 2008:67). Air transport accessibility is therefore somewhat limited. As airports require significant real estate they are generally limited with respect to integration with other transportation modes (Bowersox *et al*., 2010:208) and most organisations must rely on land carriers to transport freight to and from the airport (Langley *et al*., 2009:288). Air transport typically consists of high variable costs in proportion to fixed costs. The major advantage of air transport is speed, therefore air transport affords a distinct advantage in low transit time over long distances. Cost, on the other hand, is the major disadvantage of air transportation. Air transport may also prove disadvantageous as far as reliability is concerned as weather conditions can interrupt it (Langley *et al.,* 2009:287, 288).

Rail, road, water and air transport are the traditional traffic modes of transportation. Figure 5.11 presents a comparison of these four modes of transport.

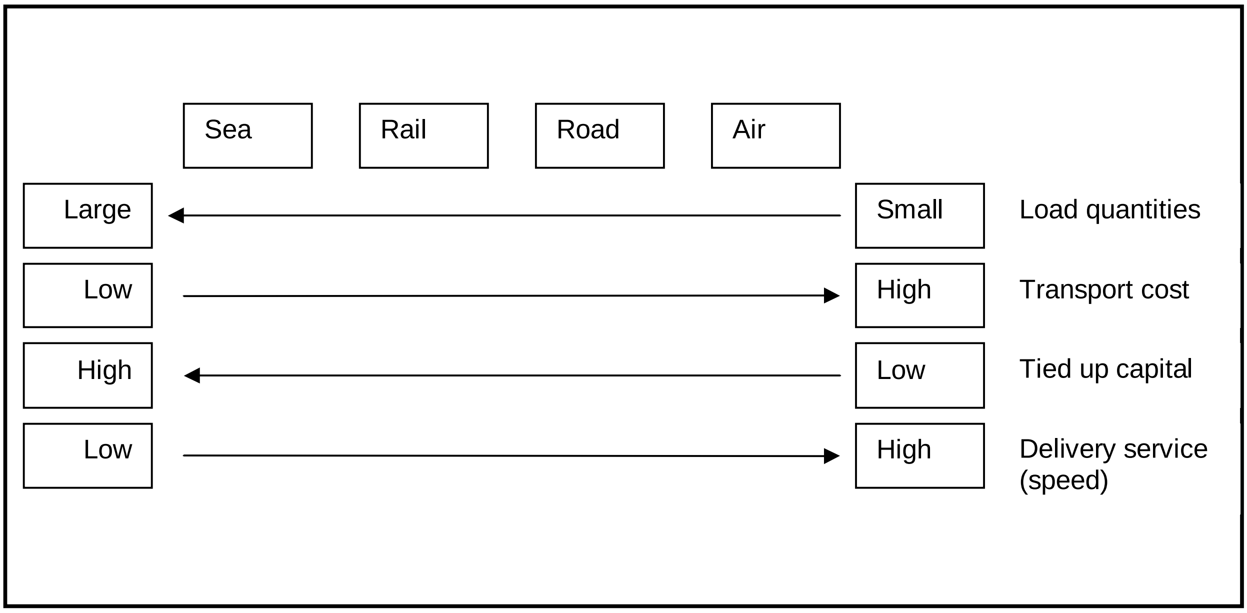

Figure 5.11: Comparison between the four traditional transportation modes
Source: Adapted from Jonsson (2008:64).

Pipeline transportation is not suitable for general commodity transportation. It is restricted to the movement of liquid petroleum products, such as oil and gas. Pipeline accessibility is limited, as only shippers adjacent to the pipeline can use this mode directly. Low cost is the major advantage of pipeline transportation (Langley *et al*., 2009:288; Waters, 2009:417).

Combined (or intermodal) transport involves any single journey that uses a combination of several transportation modes, for example rail and road transport (Jonsson, 2008:67). It refers to journeys that involve more than one mode of transport (Waters, 2009:421), with the aim of such intermodal transport being to combine the benefits of several separate modes of transport (Waters, 2009:421; Jonsson, 2008:67).

5.2.3.2 Transportation selection determinants

The problem of deciding how best to transport goods from plants to customers is a complex one that affects the cost of a product. Major trade-offs related to the cost of transporting the product, the speed of delivery, and flexibility to react to changes are involved (Jacobs *et al*., 2009:384), therefore certain determinants play a role in transportation decisions.

Transportation cost involves the total costs for moving a product from one location to another. These costs include loading and unloading costs, as well as goods-in-transit costs (Cant, 2005a:182; Langley *et al*., 2009:274, 275). Transportation costs may even vary for different stages in the supply chain. Transportation costs between production facilities and warehouses will increase if the number of warehouses increases because the total distance travelled is greater. However, transportation costs from warehouses to retailers are likely to be less because warehouses tend to be located closer to retailers (Simchi-Levi *et al.,* 2008:232).

Speed (or transit time) refers to elapsed movement time (Bowersox *et al*., 2010:209). *Reliability* refers to the consistency of the transit time of a specific method of transportation (Langley *et al*., 2009:275). It refers to the potential variance from expected delivery schedules (Bowersox *et al*., 2010:209). Transit time and reliability affect inventory and stockout costs; shorter transit times result in lower inventories, and more dependability also leads to lower inventory levels or stockout costs. With a given level of lead time, organisations can minimise inventories and, consequently, inventory carrying costs. But if the transit time is not consistent, the organisation must increase inventories above the level that a consistent transit time would require. More specifically, a facility must hold larger amounts of inventory as safety stock against stockouts that could arise from inconsistent service (Langley *et al*., 2009:275; Handfield *et al*., 2009:631). *Availability* refers to the ability of a mode to service any given pair of locations (Bowersox *et al*., 2010:209). *Capability* refers to the ability of a mode to handle any transport requirement, such as load size (Bowersox *et al*., 2010:209; Handfield *et al*., 2009:631). *Accessibility* refers to the transportation's ability to provide the required service over a specific route in question and/or the transportation's physical access to facilities (Langley *et al*., 2009:276). *Frequency* relates to the quantity of scheduled movements (Bowersox *et al*., 2010:209). *Security* concerns the arrival of goods in the same condition as when they were given to the transportation for transport. Although the transportation service provider is held liable for losses and damages, the organisation may incur other costs if goods are damaged. Opportunity costs may, for example, be lost due to stockouts (Langley *et al*., 2009:276; Waters, 2009:418).

Transportation choices also have a large impact on supply chain responsiveness and efficiency (Chopra & Meindl, 2010:60). Responsiveness can be achieved by a transportation mode that is fast and flexible, while efficiency can be emphasised by transporting products in larger batches and doing it less often, thus being more cost effective (Hugos, 2006:36). An organisation may use faster modes of transportation, thus making its supply chain more responsive, but also less efficient, given the high costs associated with faster modes of transport. In contrast, an organisation can use slower and cheaper means of transport, to make the supply chain more efficient, but it will be less responsive (Chopra & Meindl, 2010:60; Bozarth & Handfield, 2006:342).

Efficiency can be improved by reducing waiting times, eliminating the excessive movement of goods and by reducing transport distances. An obvious way of reducing distances travelled is to design more efficient routes for vehicles. There usually are different kinds of constraints on the routes. Constraints include the distance the vehicle can travel, the time available, the speed it can travel, space and weight limitations and the times at which customers can accept deliveries. Organisations thus have to determine the optimal routes (Waters, 2009:429; Pienaar, 2009:373-376).

5.2.4 Information

Supply chains are also networks of information flows. SCM is as much about managing information as it is about managing materials (Hopp, 2008:201). Therefore, timely and accurate demand information is a critical component of an effective supply chain (Wisner *et al.,* 2009:140) and information sharing, in fact, is the key to a seamless supply chain (Jeong & Hong, 2007:584; Sridharan *et al.,* 2005:314), because all information across the supply chain is not necessarily visible (Langley *et al*., 2009:189). Information affects the design and operation of the supply chain. By affectively harnessing the available information, organisations can design and operate the supply chain more efficiently and effectively (Simchi-Levi *et al.,* 2008:153; Chopra & Meindl, 2010:60). Information is the basis on which to make decisions regarding the other supply chain drivers. It is the connection between all the activities and members in a supply chain (Jacobs *et al*., 2009:384; Hugos, 2006:15). The strength of this connection by means of accurate, timely and complete data has a direct influence on decisions made by the members of a supply chain (Hugos, 2006:15, 16).

Information has become a useful commodity because it can be applied directly to enhance the performance of the other supply chain drivers (Hugos, 2006:36). Information technology has become vital to supply chain performance (Raturi & Evans, 2005:221; Christopher, 2005:180) and is potentially the biggest driver of performance in the supply chain (Bozarth & Handfield, 2006:339; Chopra & Meindl, 2010:60) because it directly affects each of the other drivers (Chopra & Meindl, 2010:60). Many successful organisations (or supply chains) use information to improve customer responsiveness (Christopher, 2005:181).

Organisations need information about all elements within the supply chain (Raturi & Evans, 2005:221). This will improve the visibility within the supply chain. System-wide visibility is enhanced by using near real time databases that can collect daily or hourly snapshots of demand, inventory and capacity levels at key nodes in the supply chain, including ports and shipping locations. Systems can be put in place that automatically track breaking news and monitor media websites for information regarding problems at high risk locations. This information flow provides the needed visibility required in a supply chain (Autry & Sanders, 2008:316). As a supply chain driver, information consists of data and analysis concerning facilities, inventory, transportation, costs, prices, customer demand and suppliers throughout the supply chain (Chopra & Meindl, 2010:60; Raturi & Evans, 2005:221). It includes activities such as allocating resources, managing inventory levels, scheduling and order tracking (Jacobs *et al*., 2009:384). Information about inventory levels, orders, production and delivery status throughout the supply chain provides a tremendous opportunity to improve the way the supply chain is designed and managed (Simchi-Levi *et al.,* 2008:153). Information sharing across the supply chain includes three aspects, namely real time information sharing, the quality of the information and the relevancy of the information (Jeong & Hong, 2007:584). Unfortunately, using information effectively does make the design and management of the supply chain more complex, because many more issues must be considered. Relevant information that is available (Simchi-Levi *et al.,* 2008:153):

- helps reduce variability in the supply chain;
- helps suppliers to make better forecasts;
- enables the coordination of manufacturing and distribution systems and strategies;
- enables retailers to better serve their customers by offering tools for locating desired items;
- enables retailers to react and adapt to supply problems more rapidly; and
- enables lead time reductions

Information must therefore be accessible, relevant, accurate, timely and transferable (Langley *et al*., 2009:190). Failure to accurately estimate demand and share information among supply chain members increases demand uncertainty and can result in, for example, bloated inventory levels due to a cumulative effect of poor information cascading up through the supply chain. Poor demand data forces the supplying organisation to either carry additional inventory or increase lead times to account for the uncertainty. This then leads to the bullwhip effect (Burt *et al.,* 2010:532), which will be discussed later in this chapter. Forecasts are therefore vital to every organisation and every significant management decision (Jacobs *et al*., 2009:468).

Forecasting can be defined as the prediction of future outcomes (Lysons & Farrington, 2006:330). A forecast is an estimate of the future level of some variable (Bozarth & Handfield, 2006:245) and, in terms of SCM, an estimate of future demand. It is a calculated guess or estimate about the future demand for an organisation's products under conditions of uncertainty (Burt *et al.,* 2010:534). This means that forecasts are the basis of all planning and decision making within the supply chain and are used to make decisions such as which products will be required, what amount of these products will be called for and when they will be needed. (Lysons & Farrington, 2006:330; Jacobs *et al*., 2009:468; Hugos, 2006:16). The many approaches to forecasting range from simple time series analysis or the charting of trends through to highly complex modelling systems (Baily *et al.,* 2008:170). The limitations of demand forecasts should be kept in mind, however. They are (Shapiro, 2007:222; Chopra & Meindl, 2010:199):

- good forecasts will still have significant errors;
- effective forecasting is often achieved by aggregating products and markets as they have a smaller standard deviation of error relative to the mean;
- forecast errors may be correlated in time, across geographic regions and among products;
- the science and art of forecasting attempts to identify and use predictable patterns, but exogenous or nonstatistical disruptions are difficult to anticipate and forecast;
- the further up the supply chain an organisation is, the greater the distortion of information it receives; and
- long-term forecasts are usually less accurate than short-term forecasts.

For supply chain integration to be successful, organisations must be able to accurately forecast demand so that they can produce and deliver the right quantities demanded by their customers in a timely and cost-effective fashion (Wisner *et al.,* 2009:140).

The trade-off between responsiveness and efficiency involves weighing the benefits of obtaining good information against the cost of acquiring it (Hugos, 2006:16). High levels of responsiveness can be achieved when organisations collect and share accurate and timely data generated by the other supply chain drivers (Hugos, 2006:37, 38). For example, with information on customer demand patterns, an organisation can produce products in anticipation of customer demand, which makes the supply chain more responsive (the organisation thus uses a make-to-stock production strategy). This demand information can also make the supply chain more efficient because the organisation is better able to forecast demand and produce only the required amount of products. Information can also make the supply chain more efficient by, for example, providing organisations with shipping options that allow them to choose the lowest-cost alternatives while still meeting the necessary service requirements (Chopra & Meindl, 2010:60).

Organisations have to make a need assessment concerning their information requirements and select and implement relevant software solutions. The most important step in software selection and implementation is to understand the supply chains that the technology is intended to support (Langley *et al*., (2009:206). Information technology enablers for SCM include the Internet, the Web, EDI (electronic data interchange), intranets and extranets, bar code scanners, point of sales demand information, enterprise resource planning (ERP), radio frequency identification (RFID), collaborative planning, forecasting and replenishment (CPFR) and vendor managed inventory (VMI) (Reid & Sanders, 2007:104; Chopra & Meindl, 2010:71; Mangan *et al*., 2008:154-156; Wisner *et al*., 2009:157; Hopp, 2008:208; Jonsson, 2008:398).

Uncertainty surrounds demand forecasting (Troutt, Ambrose & Chan, 2005:32). Faced with the challenge of uncertainty and the fact that forecasts seldom predict the exact level of future demand (Bozarth & Handfield, 2006:246), organisations are faced with two options. They either accept that forecasts are always likely to be flawed (which should not be an option) or they endeavour to find a better way of forecasting. This means that they must find ways to respond to unexpected events or reduce them (Baily *et al.,* 2008:170).

Ultimately, it is necessary for supply chain partners to collaborate by sharing forecasts, combining their differing perspectives on consumer behaviour in order to obtain the most reliable predictions of future sales (Taylor, 2004:212). Forecasting is not just about an individual organisation. It includes key supply chain members. Therefore, more accurate forecasting has to be a collaborative process (Saxton, 2006:119). To be useful, data must be accessible to those who need it (Hopp, 2008:207). Because knowledge is shared, forecasting accuracy is increased (Taylor, 2004:213).

The impact of poor communication and inaccurate forecasts resonates all along the supply chain and results in the bullwhip effect (Wisner *et al.,* 2005:127). This effect is one of the most common dynamics in supply chains (Hugos, 2006:170). In many cases, although the demand of the product at the end customer level is stable, distortion of demand signals can occur up the supply chain (Lee, 2002:108). The location of the organisation within the supply chain (whether it is located towards the final customer or towards the raw material end) is governed by the different interactions that exist at various tiers within the chain. This means that the nature of the complexity experienced by supplier-customer systems will vary along the supply chain (Sivadasan, Efstathiou, Calinescu & Huatuco, 2004:142, 143).

As the positioning of supplier-customer systems moves away from the consumer end of the network, there firstly is greater potential for amplification, and secondly, the greater the number of tiers, the greater the amplification will be towards the raw material supplier end of the chain. Adding more stages to the system increases the complexity because each additional tier within the supply chain acts as a further obstacle to flow (Evans & Collier, 2007:367; Sivadasan *et al.,* 2004:142, 143).

Essentially, the time lags associated with information and flows of materials cause a mismatch between the actual customer demand and the supply chain's ability to satisfy that demand (Evans & Collier, 2007:367). Forecasts of demand thus become less reliable as they move up the supply chain from users or retailers to wholesalers, to manufacturers to suppliers (Lysons & Farrington, 2006:334).

The bullwhip effect thus comprises an extensive change in the supply position upstream in a supply chain that is generated by a small change in demand downstream in the supply chain (Bozarth & Handfield, 2006:433). It is the uncertainty caused by information flowing upstream and downstream in the supply chain (Lysons

& Farrington, 2006:334). The bullwhip effect has been observed across most industries (Raturi & Evans, 2005:212) and increases costs and decreases service to the customer (Webster, 2008:373; Evans & Collier, 2007:367), which results in excessive inventory investment, poor customer service levels, ineffective transportation use, misused manufacturing capacity and lost revenues (Reid & Sanders, 2007:102).

Although there are several major factors that cause the bullwhip effect, the fundamental approach to resolving the bullwhip effect is to ensure transparency and information sharing throughout the supply chain (Lysons & Farrington, 2006:335; Swink *et al*., 2011:361). Only through information sharing and tight coordination can control of supply chain efficiency be regained. Sharing of demand information and synchronised planning across the supply chain are crucial for this purpose (Lee, 2002:108). Organisations should rely more on direct demand data. Supply chain systems that provide open communication and reliable demand data avoid situations in which small demand fluctuations result in problems of high variability (Lysons & Farrington, 2006:335).

One of the options for reducing the bullwhip effect is to centralise demand information within a supply chain, that is, to provide each stage of the supply chain with complete information on the actual end customer demand. If demand information is centralised, each stage of the supply chain can use the actual customer demand data to create more accurate forecasts, rather than relying on the orders received from the previous stage in the supply chain, which can vary significantly compared to the actual customer demand (Simchi-Levi *et al.,* 2008:158, 159).

5.2.5 Sourcing

The fundamentals of supply chain relationships were discussed in Chapter 4. However, sourcing is a supply chain driver that has major implications for an organisation and its supply chain's responsiveness and efficiency. Sourcing decisions are often strategic decisions and are important because they determine the capacity and resource requirements of supply chain members (Bozarth & Handfield, 2006:297). Sourcing involves the choice of who will perform a particular supply chain activity, such as production, storage, transportation, or the management of information. At the strategic level, these decisions determine what functions an organisation performs and what functions the organisation outsources to other organisations (Chopra & Meindl, 2010:60).

Organisations therefore have to decide whether they need to outsource certain activities to other supply chain members or whether they should insource the activities. A distinction can be made between insourcing and outsourcing. Insourcing takes place when resources within the organisation are used to produce products and outsourcing uses external supply chain members to provide products. Insourcing provides an organisation with control over its operations and encourages the development of core competencies (refer to Chapter 2) (Bozarth & Handfield, 2006:297, 298), while outsourcing provides advantages such as making use of the specialised knowledge and capabilities of suppliers (Burt *et al*., 2010:230).

The selection of suppliers is an important decision. They have to be identified, evaluated, selected, developed and managed (Burt *et al*., 2010:241). This is illustrated in Figure 5.12.

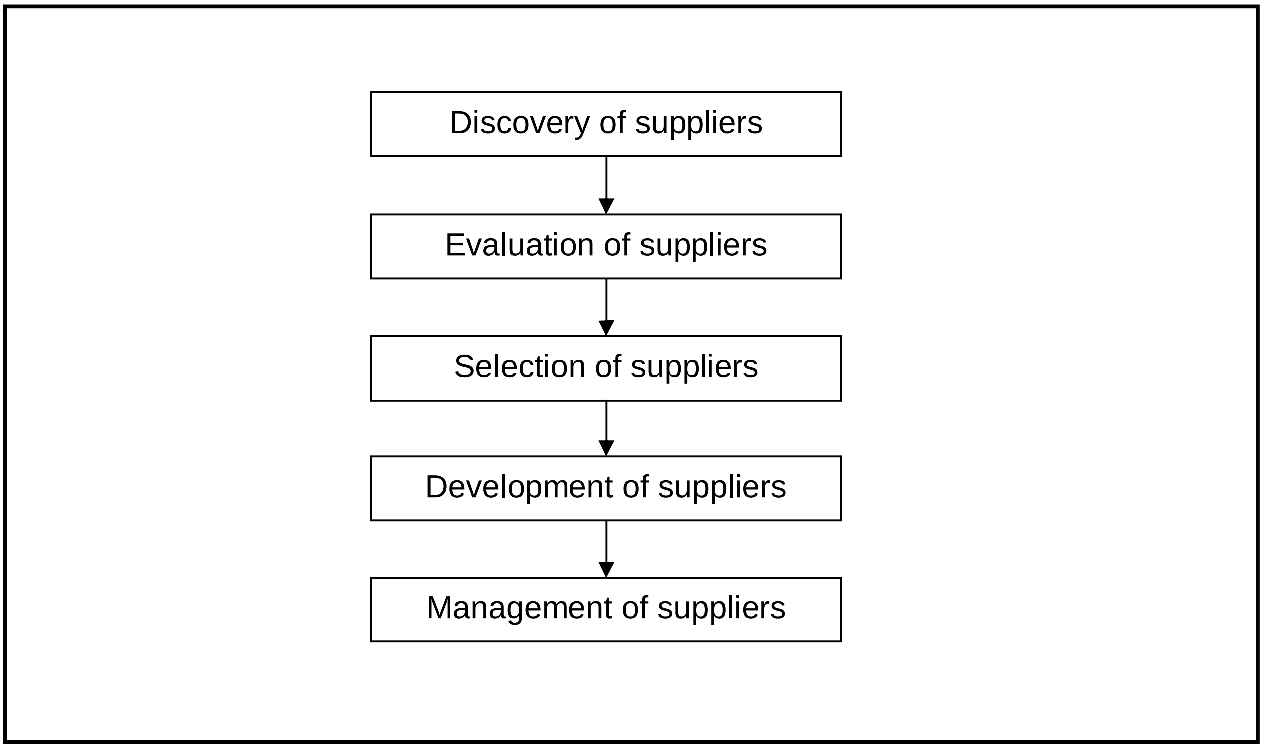

Figure 5.12: The sourcing process
Source: Adapted from Burt *et al*. (2010:241).

As indicated in Figure 5.12, sourcing decisions commence with identifying potential suppliers. This can be done by gathering information about potential suppliers by means of (Handfield *et al.*, 2009:238-241; Burt *et al*., 2010:242-243):

- current suppliers, including supplier information files, supplier websites and supplier catalogues;
- sales representatives;
- information databases;
- experience about dealing with suppliers in general;
- trade journals, trade directories and trade shows;
- second parties or indirect information such as other supply management departments or professional organisations;
- internal sources;
- Internet searches; and
- telephone directories.

Once potential suppliers have been identified they have to be evaluated. According to Swink *et al*. (2011:290), organisations have to assess the supplier's fit with the organisation's core competencies. Organisations have to assess suppliers on the basis of their compliance with the following factors and how these factors fit into the organisation's strategic objectives (Chopra & Meindl, 2010:420; Swink *et al*., 2011:297; Handfield *et al.*, 2009:248-255; Burt *et al*., 2010:244-247):

- operations and logistics processes and systems capabilities (including production scheduling, control systems, delivery frequencies, supply flexibility and capacity capabilities such as minimum lot sizes);
- technological capabilities (including information coordination capability such as e-commerce capabilities);
- total quality performance (including supply quality, quality processes and quality systems);
- supply management processes (in terms of replenishment lead times and on-time performance;
- cost structures (including pricing terms, inbound transportation costs and exchange rates, taxes, and duties, if applicable);

- design collaboration capability;
- employee capabilities (including labour skills, training and morale);
- management capabilities;
- financial stability; and
- supplier viability and thus longer-term relationship potential.

After evaluating all the potential suppliers, organisations select their suppliers. Once suppliers have been selected, organisations realise that their ability to be competitive on cost, quality, timeliness and service is dependent on their suppliers' abilities to contribute towards these objectives in the supply chain. For this reason, organisations will develop and manage their suppliers. However, not all suppliers need to be developed (Burt *et al*., 2010:252).

Organisations must also consider the number of suppliers they want to use. This is referred to as supply base optimisation. Using too few suppliers increases supply risk such as shortages. Prices may also be higher without competition and sources of innovation may be limited. Using too many suppliers increases complexity and makes communications and control difficult (Swink *et al*., 2011:293). Usually, a distinction is made between single versus multiple sourcing. Single sourcing means that an organisation acquires materials, or related materials, from a single supplier only (Waters, 2009:315). Single sourcing may be used when (Burt *et al*., 2010:254; Waters, 2009:315; Fawcett *et al*., 2007:320):

- lower total costs result from greater economies of scale;
- quality considerations dictate;
- stronger relationships result which lead to better performance;
- lower costs are incurred to source, process, expedite and inspect;
- the quality, control, and coordination required with just-in-time manufacturing requires a single source;
- significantly lower freight costs may result;
- special tooling is required;
- total system inventory will be reduced;
- an improved commitment to the success of the relationship from the supplier may result;

- improved interdependency and risk sharing result;
- more reliable, shorter lead times are required;
- time to market is critical because collaboration with one supplier leads to responsiveness; and/or
- confidentiality of requirements and conditions are necessary.

There is a strong trend towards using fewer suppliers. However, some organisations still use more than one supplier to protect them from the vulnerabilities of using a single supplier (Waters, 2009:316). Dual or multiple sourcing may be used (Burt *et al*., 2010:255; Waters, 2009:316; Fawcett *et al*., 2007:320):

- to protect the buying organisation against various risks during times of shortages, strikes, and other emergencies;
- to maintain competition (which leads to lower prices and better service) and provide a backup source to reduce the risk of supplier dependence;
- to meet local content requirements for international manufacturing locations;
- to meet customers' volume requirements;
- to avoid lethargy or complacency of a single source supplier;
- when the customer is a small organisation in the market for a specific product;
- to hedge technological risks;
- in areas where suppliers tend to leapfrog each other technologically; and/or
- to learn from different suppliers.

To conclude, sourcing decisions affect both the responsiveness and efficiency of a supply chain. Sourcing certain processes to other parties may increase a supply chain’s efficiency, but reduce its responsiveness due to longer lead times due to location (Chopra & Meindl, 2010:60). However, it can also increase an organisation’s flexibility by, for example, gaining access to state-of-the art products (Bozarth & Handfield, 2006:298). Organisations have to decide which criteria they will use to achieve these objectives. If organisations aim for efficiency, they will select suppliers on the basis of low prices and economies of scale. If organisations want to achieve responsiveness they will select suppliers on e basis of speed, delivery and quality.

5.2.6 Pricing

Pricing determines how much an organisation will charge for products that it makes available in the supply chain (Chopra & Meindl, 2010:60). Demand usually (but not always) will go up as a product's price goes down. Organisations must also know how sensitive customers are to price changes. Organisations thus have to determine the optimal price for their products. To find the optimal price for a product, organisations have to be able to characterise the relationship between pricing and demand for each product that is sold (Simchi-Levi *et al.*, 2008:389).

Pricing affects the behaviour of the buyer of the product, thus affecting supply chain performance. For example, if a transportation organisation varies its charges based upon the lead time provided to customers, it is very likely that customers who value efficiency will order early to be able to make use of the slower but cheaper means of transport. Customers who value responsiveness, will be willing to wait and order just before they need a product transported (Chopra & Meindl, 2010:60). All pricing decisions should be made with the objective of increasing an organisation's profits. This requires an understanding of the cost structure of performing a supply chain activity and the value it brings to the supply chain. Strategies such as everyday low pricing with low margins may foster stable demand that allows for efficiency (Chopra & Meindl, 2010:76).

5.2.7 Summary of the effect of supply chain drivers on efficiency and responsiveness

Throughout the previous sections it became evident that supply chain drivers will have a significant effect on supply chain performance. Depending on how these supply chain drivers are utilised they will have different effects on a supply chain's efficiency and responsiveness. The effect of the supply chain drivers on efficiency and responsiveness is illustrated in Table 5.2.

Table 5.2: Effect of supply chain drivers on efficiency and responsiveness

Supply chain driver	**Responsiveness (high customer service levels)**	**Efficiency (low cost)**
Facilities	Excess capacity (maintain excess buffer capacity to meet unexpected demand); Flexible manufacturing; Many smaller facilities closer to customers	Little excess capacity (lower costs through maintaining high average utilisation rate); Narrow focus; Few central facilities serve wide areas
Inventory	High inventory levels; Wide range of items; Maintain significant buffer stocks of parts or finished goods to meet unexpected demand	Low inventory levels; Fewer items; Generate high turns and minimise inventory throughout the supply chain to lower cost
Transportation	Frequent shipments; Fast and flexible mode (choose fastest means of delivery depending on need, regardless of cost); Invest aggressively in ways to reduce lead time even if it means incurring higher cost	Shipments are few, large; Slow, cheaper modes (choose lowest cost mode of transport); Shorten lead time as long as it does not increase cost
Information	Collect and share timely accurate data	Cost of information drops while other costs rise
Sourcing	Dependent on other parties included; Supplier selection criteria: Speed, flexibility and quality and dependability	Economies of scale; Supplier selection criteria: Price and quality
Pricing	Higher margins as price is relatively less important to the customer	Lower margins, higher volume, price is the prime customer driver

Source: Compiled from Hugos (2006:37); Chopra & Meindl (2010:48, 59, 60); Christopher (2003:285); Webster (2008:352); Hines (2004:63) and Bruce *et al.* (2004:155).

5.3 SUPPLY CHAIN KEY PERFORMANCE INDICATORS

One of the keys to improving supply chain performance is to have sound performance measures in place for monitoring performance (Taylor, 2004:173). Performance measurement supports SCM and provides useful information about long-term decisions regarding SCD (Wang *et al.,* 2007:333). Supply chain performance measurement systems must effectively link supply chain partners to achieve breakthrough performance in satisfying end customers' needs (Wisner *et al.,* 2009:486). Therefore, measurement systems have to provide feedback regarding customers' needs and the supply chain's capabilities. Measurement thus creates understanding of the supply chain's processes and guides the collaboration efforts (Fawcett *et al.,* 2007:409). It facilitates inter-understanding and integration among supply chain members. Measurement results reveal the effects of strategies and potential opportunities (Chan *et al.,* 2003:635). Performance measures thus have to be established for inter-organisational structures and processes (Seuring & Muller, 2003:10). Well designed measures keep the focus on key performance objectives, thus promoting fast response to the issues affecting them (Ackerman, 2003:291). It is unrealistic to believe that all supply chain partners will introduce the same performance measurement systems. However, it is necessary that performance measurement enables and supports the organisational spanning management of supply chain processes (Reiner & Schodl, 2003:307).

In the past there has been considerable debate regarding the specific performance measures that are required to measure an integrated supply chain (Handfield & Nichols, 1999:64). Performance measures need to be aligned across all levels of the organisation to ensure that organisational performance and supply chain performance are closely aligned (Kussing, 2009:447). Numerous KPIs can be used to evaluate supply chain performance and identify improvements to the design and operation of supply chains (Evans & Collier, 2007:363), but unless the right KPIs are established to support the organisation's strategy, the supply chain may be poorly designed and managed (Raturi & Evans, 2005:203). In fact, the manner in which supply chain performance measures are incorporated in the supply chain design plays an important role in determining the effectiveness of the supply chain (Sadler, 2007:179). The supply chain map provides a basis for improving supply chain performance. This map assists in identifying specific KPIs that are to be measured and should clearly indicate what has to be measured and improved (Hugo *et al.,* 2004:99, 100). Supply chain measures monitor supply chain performance and are thus key to improving supply chain performance (Taylor, 2004:173).

5.3.1 KPI categories

Supply chain performance KPIs can be categorised in five performance categories across the supply chain, with several performance measures within each category. These performance categories have several KPIs that measure them. According to Bolstorff and Rosenbaum (2003:51-53, 68), these KPI categories and the specific KPIs that measure them can be tabled as follows.

Table 5.3: Supply chain performance categories and KPIs

KPI category	Specific KPIs
Supply chain delivery reliability	Delivery performance Fill rates Perfect order fulfilment
Supply chain responsiveness	Order fulfilment lead time
Supply chain flexibility	Supply chain response time Production flexibility
Supply chain cost	Cost measures within the organisation Total supply chain management cost (across the supply chain)
Supply chain asset management efficiency	Cash-to-cash cycle time Inventory days of supply Asset turns

Source: Adapted from Bolstorff and Rosenbaum (2003:51-53).

Organisations need to monitor and control their operations on a daily basis to get the performance desired from their supply chains (Hugos, 2006:133). Performance measurement provides the necessary assistance for performance improvement in pursuit of supply chain excellence (Chan *et al*., 2003:635). These supply chain KPI categories are discussed in the next section.

5.3.1.1 Supply chain delivery reliability

Supply chain delivery reliability refers to the performance of the supply chain in delivering the correct product to the correct place at the correct time in the correct condition and packaging in the correct quantity with the correct documentation, to the correct customer (Bolstorff & Rosenbaum, 2003:51; Jonsson, 2008:87; Cohen & Roussel, 2005:208; Langley *et al*., 2009:153). Reliability generally refers to the ability to deliver products when promised (Bozarth & Handfield, 2006:28; Wang *et al.,* 2007:149). An organisation can have long lead times, yet still maintain a high level of reliability (Bozarth & Handfield, 2006:28). Three KPIs were identified to measure supply chain delivery reliability. These KPIs are delivery performance, fill rates, and perfect order fulfilment.

Delivery performance measures the average percentage of orders delivered on time to customers' requests (Bolstorff & Rosenbaum, 2003:51; Wisner *et al*., 2009:490). Delivery performance measures the degree to which deliveries take place at the times agreed with the customer. It can be defined as the number of deliveries made on time in relation to the number of deliveries made (Jonsson, 2008:86). In top-performing supply chains, delivery dates are being met from 94 to 100 percent of the time. For average organisations, delivery performance is approximately 70 to 80 percent (Wisner *et al*., 2009:490).

Fill rates measure the customer orders filled on time (Chan *et al.,* 2003:637). Fill rates describe to what extent stock items are actually available in stock when they are demanded. It is a measurement of the probability of being able to directly deliver from stocks to customers from customers' orders. It measures the delivery ability of, for example, a warehouse, and is an important delivery service element in make-to-stock and delivery from stock situations (Jonsson, 2008:85).

Perfect order fulfilment measures the percentage of orders delivered on time, in full and damage free to customers' requests (Bolstorff & Rosenbaum, 2003:51; Wisner *et al*., 2009:491; Kussing, 2009:447).

5.3.1.2 Supply chain responsiveness

Supply chain responsiveness refers to how quickly a supply chain delivers products to the customer (Cohen & Roussel, 2005:208; Langley *et al*., 2009:153). It involves the time that elapses from a customer order being received to the completed delivery (Jonsson, 2008:88). Order fulfilment lead time therefore is the KPI for supply chain responsiveness and measures the number of days from order receipt in customer service to the delivery receipt at the customer's dock (Cohen & Roussel, 2005:56; Bolstorff & Rosenbaum, 2003:51). Taylor (2004:178) mentions that lead time variability must also be considered. Organisations may have short average lead times, but these lead times may vary considerably. In some cases it may be better for organisations to have longer but less variable lead times.

5.3.1.3 Supply chain flexibility

Supply chain flexibility is the agility of the supply chain in responding to random marketplace changes to gain or maintain competitive advantage (Bolstorff &

Rosenbaum, 2003:51; Chan *et al.,* 2003:636; Langley *et al*., 2009:153). Flexibility thus is a performance dimension that considers how quickly supply chains can respond to the unique needs of customers (Bozarth & Handfield, 2006:29). More specifically, flexibility indicates how easily organisations can adapt or change products to meet the changing needs of their end customers (Hugo *et al.,* 2004:12; Jonsson, 2008:89). Flexibility has become particularly valuable in new product development. Some organisations compete by developing new products faster than their competitors. This requires supply chain partners who are flexible and willing to work closely with designers, engineers, and marketing personnel (Bozarth & Handfield, 2006:30).

Two KPIs that measure supply chain flexibility are supply chain response time and production flexibility (Cohen & Roussel, 2005:208; Bolstorff & Rosenbaum, 2003:51). Supply chain response time measures the number of days it takes a supply chain to respond to marketplace changes without cost penalties (Bolstorff & Rosenbaum, 2003:51). It is calculated as the amount of time required for organisations in a supply chain to recognise a fundamental shift in marketplace demand and adjust the output to meet that demand (Bowersox *et al*., 2010:392). Production flexibility therefore measures the number of days to achieve an unplanned increase or decrease in orders without cost penalty (Bolstorff & Rosenbaum, 2003:51). The ability for the supply chain to react quickly to unexpected demand spikes while still operating within financial targets provides tremendous competitive advantage (Wisner *et al*., 2009:490).

5.3.1.4 Supply chain costs

Focusing on an individual organisation's costs may lead to sub optimisation and attempts by one organisation to shift costs to another. The aim should be to reduce total supply chain costs across the entire supply chain and to share these cost reductions between the supply chain members (Bowersox *et al*., 2010:392). Supply chain costs include all costs associated with operating the supply chain (Langley *et al*., 2009:153). This includes cost of goods, as well as the total supply chain management cost (Bolstorff & Rosenbaum, 2003:52), which includes supply chain costs associated with forecasting, administration, transportation, inventory, manufacturing, customer service and supplier relationship management (Burt *et al*., 2010:308).

Total supply chain cost thus includes the total cost to manage orders, acquire materials, manage and hold inventory and manage supply chain finances, as well as planning and information systems (Cohen & Roussel, 2005:56; Wisner *et al*., 2009:490). As these costs include the total cost of acquisition, ownerships and use (Hugo *et al.,* 2004:12), it is always a concern for organisations, even if they compete primarily on some other performance area (Bozarth & Handfield, 2006:30). Cost performance being critical, it is tracked more carefully and comprehensively than any aspect of competitive performance (Fawcett *et al.,* 2007:412).

5.3.1.5 Supply chain asset management

The efficiency with which a supply chain utilises its resources must be measured. If facilities, vehicles, equipment and other assets are not used at or near their full capacity, their indirect cost must be spread over fewer products, thereby raising the cost of each (Taylor, 2004:184). Supply chain asset management efficiency refers to the effectiveness of an organisation in managing assets to support demand satisfaction. This includes the management of all assets (Bolstorff & Rosenbaum, 2003:52). Three KPIs that measure supply chain asset management efficiency are cash-to-cash cycle times, inventory days of supply and asset turns.

Cash-to-cash cycle times measure the number of days the cash is tied up as working capital. It is the average number of days between paying for raw materials and getting paid for the product by the members of the supply chain (Wisner *et al*., 2009:490). It thus measures the time it takes for cash to flow back into the organisation after it has been spent on external purchases (Cohen & Roussel, 2005:56). Cash-to-cash cycle times typically run about 70 to 90 days, but efficient organisations get this number below 60 days (Taylor, 2004:176). Top organisations have a cash-to-cash cycle time of approximately 30 days (Wisner *et al*., 2009:490; Taylor, 2004:176).

Inventory days of supply measures the number of days the cash is tied up in inventory. Asset turns are calculated by dividing revenue by total assets, including both working capital and fixed assets (Bolstorff & Rosenbaum, 2003:52). Of the many assets required for supply chains, inventory usually receives the most attention because of the financial investments in it. The most widely used measure is the inventory turnover ratio (or inventory turns). The turnover ratio for a product is the annual sales of that product divided by the average quantity on hand (Taylor, 2004:185).

5.3.2 Aligning KPIs with market winners

To highlight the relative importance of different performance factors, organisations often use the concepts of market winners and market qualifiers. Market winners are performance dimensions that differentiate an organisation’s products from those of its competitors. Organisations win the customer’s business by providing superior levels of performance on market winners (Bozarth & Handfield, 2006:31). Market qualifiers are performance dimensions on which customers expect a minimum level of performance (Hines, 2004:248). Superior performance on a market qualifier will not in itself give an organisation a competitive advantage (Bozarth & Handfield, 2006:31).

Implementing a supply chain strategy requires KPIs that align performance with the objectives of other supply chain members (Lambert & Pohlen, 2006:204). The selected KPIs to measure supply chain performance measurement has to be able to translate the supply chain strategy (Wang *et al.,* 2007:333). Specific measures must be adopted by supply chain trading partners such that performance can be further aligned with supply chain objectives (Wisner *et al.,* 2009:488). It became evident in Chapters 2 and 3 that supply chain strategies should be aligned with the market winners that organisations have identified to meet the needs of their end customers.

Market winners thus correspond with an organisation's supply chain strategy. Supply chain strategies and market winners and qualifiers must be aligned out of the pool of relevant performance measures such as those mentioned above (Reiner & Schodl, 2003:312; Christopher and Towill, 2001:237). As already implied, organisations will select an agile supply chain strategy when aiming to gain a value advantage and organisations will select a lean strategy when trying to gain a cost advantage. Leagile supply chains seek to gain the benefits of both lean and agile supply chains (Towill &

Christopher, 2002:300).

In Chapter 2 it was concluded that organisations will include several important characteristics in their supply chain networks. For innovative products, these characteristics are speed and flexibility, innovation, and quality supremacy. For functional products, these characteristics are cost reduction and quality sustainability (Lyons *et al.,* 2004:659). It was concluded in Chapter 3 that agile supply chains will be used for innovative products and lean supply chains will be used for functional products. Therefore, the market winner for an agile supply chain is customer service level (which includes availability, speed, flexibility, innovation and quality supremacy) and for a lean supply chain, it is cost (Agarwal & Shankar, 2002:32; Christopher & Towill, 2001:237). Taylor (2004:184) adds that cost does not necessarily measure the efficiency with which a supply chain uses its resources and includes supply chain asset management efficiency KPIs to measure leanness.

KPIs thus have to be selected to measure the extent to which the organisation succeeds in meeting these market winners. The various KPIs for different supply chain strategies are illustrated in Table 5.4. It shows that supply chain delivery reliability, supply chain responsiveness and supply chain flexibility KPIs should be used to measure agile supply chains, while cost and supply chain asset management efficiency KPIs should be used to measure lean supply chains. A combination of these KPIs should be used to measure leagile supply chains (Taylor, 2004:185, 189; Bolstorff & Rosenbaum, 2003:51-53).

Table 5.4: Linking supply chain strategies with supply chain KPI categories by means of market winners

Supply chain strategy	Market winners	Supply chain KPI category
Agile supply chain	Service level (availability, speed, flexibility, innovation, quality supremacy)	Supply chain delivery reliability, Supply chain responsiveness Supply chain flexibility
Lean supply chain	Cost	Total SCM cost (across the entire supply chain) Supply chain asset management efficiency
Leagile supply chain	Service and cost	Combination of KPIs for agile and lean supply chains

Source: Compiled from Agarwal and Shankar (2002:32); Christopher and Towill (2001:237); Reiner and Schodl (2003:312) Taylor (2004:184-189) and Bolstorff and Rosenbaum (2003:51-53, 68).

5.4 CONCLUSION

Chapter 5 has covered supply chain drivers and supply chain KPI categories as part of phase three of SCD. There are six supply chain drivers and each one of them has an impact on an organisation's efficiency and responsiveness. The chapter also covered the supply chain KPI categories and has shown that supply chain KPI categories have to be aligned with an organisation's supply chain strategy. This concludes the literature review of this study. Chapter 6 proposes the conceptual framework that has been developed from the literature review for the analysis of SCD practices.

CHAPTER 6

THE PROPOSED CONCEPTUAL FRAMEWORK FOR ANALYSING SUPPLY CHAIN DESIGN PRACTICES

6.1 INTRODUCTION

This study is concerned with the development of a conceptual framework to analyse SCD practices and, as mentioned in Chapter 1, the research for this has comprised two phases. These phases were introduced in Chapter 1 and are revisited in Figure 6.1. The first phase entailed exploratory research into secondary sources about the topic of SCD. From this literature study, several essential elements of SCD were identified from the three phases of SCD discussed in the literature study. The current chapter reports on those elements of SCD that were included in the proposed conceptual framework to be used in the analysis of the supply chain designs of organisations. Chapter 6 thus reflects on the first phase of the research (as highlighted in Figure 6.1).

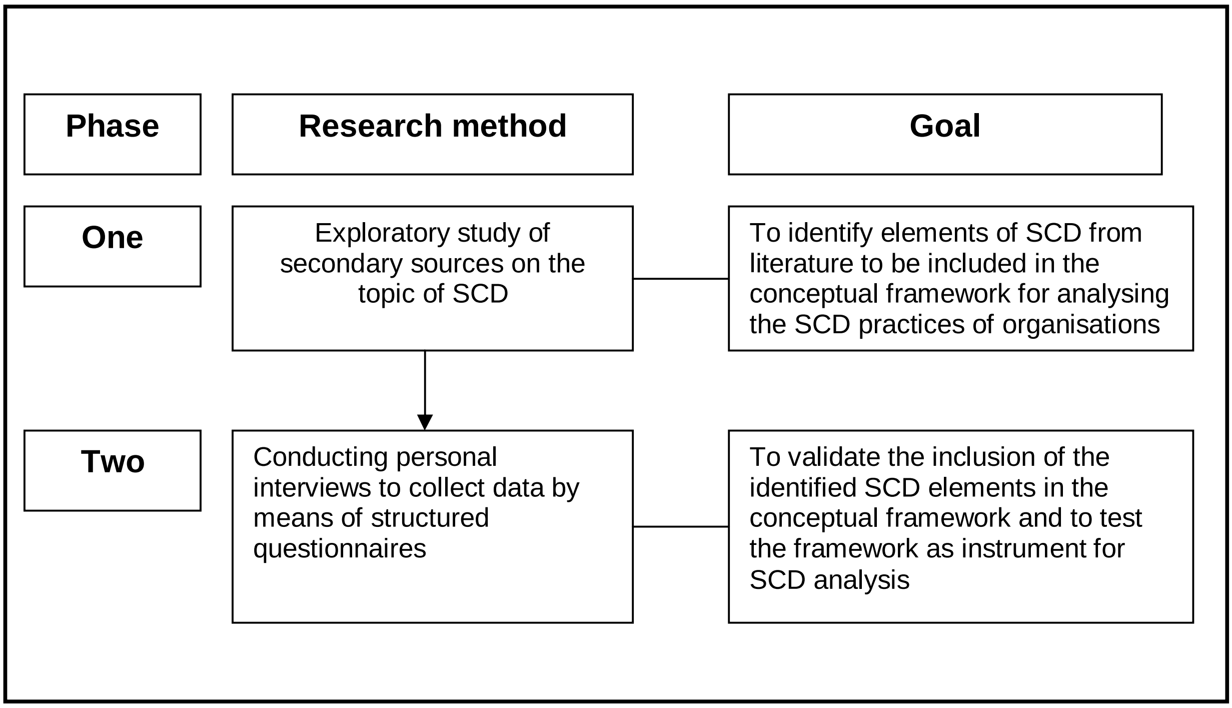

Figure 6.1: The research process used in this study
Source: Researcher's own.

From existing secondary literature it was concluded that SCD can be categorised according to three broad phases. These phases are illustrated in Figure 6.2. *Firstly*, according to Taylor (2004:259), the nature of the needs of the supply chain's end customers must be understood throughout the supply chain. Christopher (2005:57) suggested that these needs can be met by some value proposition must also be understood. Each organisation must know how it can contribute value to meet the demands of the end customer in its supply chain (Fawcett *et al.,* 2007:222; Christopher, 2005:57). *Secondly*, organisations must select a supply chain strategy to meet those needs and be able to deliver value to their end customers (Taylor, 2004:279). *Thirdly*, once a supply chain strategy has been selected, the supply chain structure needs to be configured (Sharifi *et al.,* 2006:1078; Fawcett *et al.,* 2007:222). This includes deciding which supply chain partners to partner with, the level of integration required, and assigning roles and responsibilities to each of the members in the supply chain. This third phase was referred to as scoping the supply chain structure (Fawcett *et al.,* 2007:335; Taylor, 2004:284). Phases two and three have to be aligned towards meeting the first phase, which comprises meeting the end customers' needs (Sharifi *et al.,* 2006:1078).

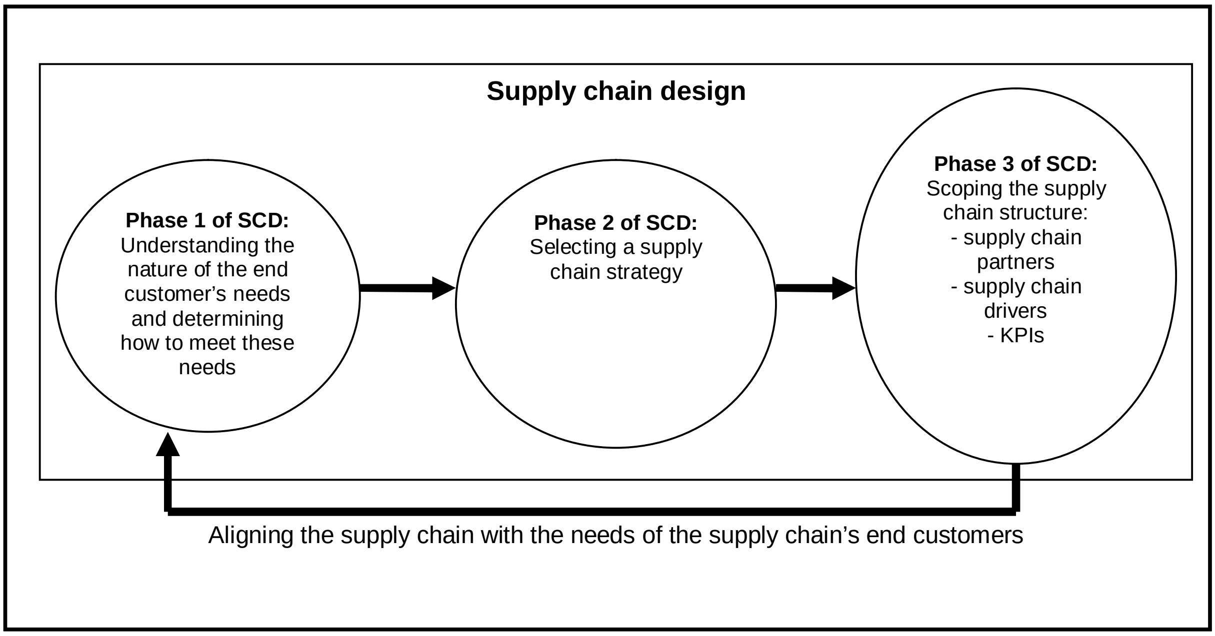

Figure 6.2: The three phases of supply chain design
Source: Compiled from Taylor (2004:259, 279, 284), Fawcett *et al*. (2007:20) and Christopher (2005:57).

Having revisited the three broad phases of SCD, it is necessary to establish the elements with which organisations can analyse the SCD practices that need to be included in the proposed conceptual framework of this study. The elements that need to be included were derived from the literature study and will be discussed under three headings (which are in conjunction with the three phases of SCD), namely:

- SCD elements of *phase one of SCD: Understanding the needs of end customers and determining how to meet them;*
- SCD elements of *phase two of SCD: Selecting a supply chain strategy; and*
- SCD elements of *phase three of SCD: Scoping the supply chain structure.*

6.2 SCD ELEMENTS OF PHASE ONE OF THE SCD: UNDERSTANDING THE NEEDS OF END CUSTOMERS AND DETERMINING HOW TO MEET THEM

Exploratory research into secondary sources led to the conclusion that the design of any supply chain should start with the needs of the supply chain's end customers in mind. The first phase of SCD can be split into two main sections. The first section is based on organisations' understanding of the needs of their supply chain's end customers and the second part is based on how organisations can meet those needs (refer to Chapter 2). Five SCD elements were identified from the literature for inclusion in phase one of SCD. These elements were discussed in depth in Chapter 2. This is illustrated in Figure 6.3. A brief summary of each one of these supply chain design elements is provided below. The elements are:

- SCD element #1.1: Knowing who the end customers are;
- SCD element #1.2: Knowing the needs of the end customers;
- SCD element #1.3: Identifying a formal value proposition to meet end customer needs;
- SCD element #1.4: Possessing a core competency to deliver the value proposition; and
- SCD element #1.5: Identifying market winners.

6.2.1 SCD element #1.1: Knowing who the end customers are

Organisations must know who their end customers are. They have to obtain knowledge of their end customers by means of market research. For this, organisations must know which market segments they want to target. Once they know who their end customers are, they will be able to determine the nature of their customers' needs.

6.2.2 SCD element #1.2: Knowing the needs of the end customers

Once organisations know who their end customers are, they have to know what needs these customers have. These needs may be expressed in terms of, for example, service levels or products and prices, but organisations may need to conduct market research to obtain this information.

When the needs of their end customers are known, organisations have to determine how to meet the needs. This forms the second part of the first phase of SCD. Organisations now have to determine a value proposition to meet these needs. They must also determine which core competencies are required to offer the value proposition and which market winners are essential to deliver the value proposition.

6.2.3 SCD element #1.3: Identifying a formal value proposition to meet end customers' needs

A value proposition is the value an organisation promises to deliver to customers (Fawcett *et al.,* 2007:81). It consists of the programme of products, services, ideas and solutions that an organisation offers its customers (Hutt & Speh, 2004:7) and is the reason why customers will choose it over other alternatives (Plantes & Finfrock, 2009:5). To match promised value to customer's desires, supply chain managers should know what their customers are looking for and how the organisation's products can satisfy those desires (Fawcett *et al.,* 2007:38). The value proposition should thus be defined in terms of benefits that the target market will value, or costs and risk reductions it will value (Plantes & Finfrock, 2009:106). These value areas are quality, cost, innovation, flexibility and delivery (Fawcett *et al.,* 2007:32). Delivery is concerned with time issues and was discussed under delivery time (or speed) and delivery reliability. The value proposition is quite simply a statement of how, where and when value is to be created for specific customers or market segments. The value proposition should guide all the activities of the organisation (Christopher, 2004:32).

6.2.4 SCD element #1.4: Possessing a core competency to deliver the value proposition

To develop a value proposition, organisations must know what their core competencies are (Reid & Sanders, 2007:33). As already mentioned, competencies are the skills and processes that are developed to create a value proposition which, in turn, is the value an organisation promises to deliver to its end customers (Fawcett *et al.,* 2007:81). A core competency is defined as a bundle of skills and capabilities that enable an organisation to provide a particular benefit to customers (Hines, 2004:49) and through which they create uniquely high value for customers (Hutt & Speh, 2004:176). It is something the organisation is so good at, that it provides the organisation with a competitive advantage (Fawcett *et al.,* 2007:81; Saunders, 1997:103). Core competencies therefore are organisational strengths or abilities (Bozarth & Handfield, 2006:24). Examples of core competencies are processes, planning systems, technology, people and culture and supply chain relationships (Swink *et al*., 2011: 36). It is difficult to describe these aspects without describing them in terms of outcomes such as quality, flexibility and timeliness (refer to Chapter 2).

6.2.5 SCD element #1.5: Identifying market winners

The value proposition and core competencies of organisations will thus be the foundation on which market winners are identified. The value proposition and core competencies should be aligned with the identified market winners, which are those aspects that differentiate an organisation's products from competition (Bozarth & Handfield, 2006:31). The supply chain must excel at market winners and be highly competitive at market qualifiers (Mason-Jones *et al*., 2000:4063). As mentioned in Chapter 5, market qualifiers are performance dimensions on which customers expect a minimum level of performance (Hines, 2004:248). Organisations have to determine the extent to which they have identified a market winner.

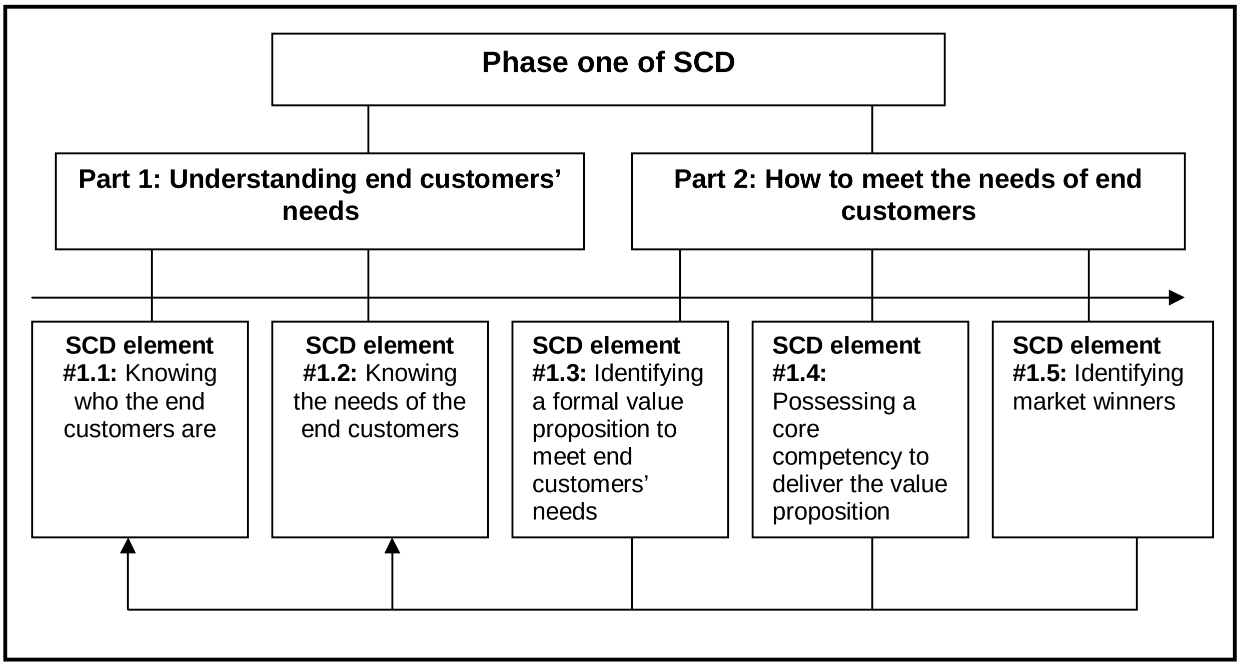

Figure 6.3: SCD elements of phase one of SCD
Source: Researcher's own.

6.3 SCD ELEMENTS OF PHASE TWO OF SCD: SELECTING A SUPPLY CHAIN STRATEGY

Once organisations understand the needs of their end customers and how to meet these needs (in terms of a broad value proposition and core competencies based on market winners), they have to select an appropriate supply chain strategy. However, before selecting a supply chain strategy, organisations have to determine how predictable the market demand is. They also have to determine what the market winners for the specific product are. Therefore, the level of demand uncertainty and specific market winners were identified as SCD elements #2.1 and 2.2.

6.3.1 SCD element #2.1: Market demand predictability

It became evident in the literature that end customers' needs can be quite diverse, but that one measure could be used to define the nature of an organisations' end customers' needs. This measure is the level of demand uncertainty associated with the value proposition with which the organisation aims to meet the needs (Chopra & Meindl, 2010:41) (refer to Chapter 2.2). The level of demand uncertainty will be referred to as market demand predictability. This view is supported by other authors

(Lee, 2002:106; Jacobs *et al*., 2009:363). Based on the knowledge of the level of demand uncertainty, organisations will determine a value proposition and build core competencies based on market winners that are necessary to deliver the value proposition.

Organisations thus have to understand the nature of the demand of their end customers for products that will satisfy their needs. A distinction was made between functional and innovative products (Fisher, 1997:2). Functional products satisfy the basic needs of customers. These needs do not change much over time, which means that the demand for these products is stable and predictable (Fisher, 1997:2). Innovative products are new or modified products that organisations create to achieve higher margins (Raturi & Evans, 2005:208). Innovative products are the hardest to manage (Taylor, 2004:267). They are characterised by high changes in demand over short periods of time and thus have a volatile demand (Lee, 2002:106; Seuring, 2003:183). This is summarised in Table 6.1. For organisations to understand the needs of their end customers they have to know the level of demand uncertainty associated with products that will satisfy those needs. The level of demand uncertainty (ie the predictability of demand) was identified as SCD element #2.1.

Table 6.1: Basic differences between innovative and functional products

	Functional products	**Innovative products**
Demand	Stable, predictable	Variable, difficult to forecast
Length of product life cycle	Long	Short
Profitability	Low	High
Forecast error	Low	High
Stock-out rates	Low	High
Markdown	Low	Potentially high
Obsolescence	Low	High
Product variety	Low	High
End result: Demand uncertainty	***Low***	***High***

Source: Adapted from Fisher (1997:1, 2); Ayers (2006:63) and Jacobs *et al*. (2009:363).

6.3.2 SCD element #2.2: Market winners

After identifying market winners (SCD element #1.5), organisations also have to know what their specific market winners are. Market winners are different for functional and innovative products (Bozarth & Handfield, 2006:31). Generally, service level is the market winner for innovative products and price is a market winner for functional products. The market winner for the specific product category was identified as SCD element #2.2 (refer to Figure 6.5).

6.3.3 SCD element #2.3: The organisation's position in terms of the decoupling point (or push-pull boundary)

The point at which real demand penetrates upstream in a supply chain may be termed the push-pull boundary or the decoupling point (Christopher, 2003:288). The push-pull boundary is the point in the supply chain that separates the push system from the pull system (Evans & Collier, 2007:371). The decoupling point therefore is the point in the product flow stream to which the customer's order penetrates and where real-time data and forecast-driven activities meet (Mason-Jones *et al.,* 2000:4061). This point is an important choice in any supply chain design (Fleischmann *et al*., 2005:181), because the push-pull boundary indicates where the organisation switches from managing the supply chain using one strategy, to managing it using another strategy (Simchi-Levi *et al.,* 2008:190). Determining the decoupling point in terms of the organisation's position in the supply chain becomes essential in the implementation of the supply chain strategy.

Downstream of the decoupling point the processes are designed to be agile (ie responsive) (Towill & Christopher, 2002:300) to make provision for the more unpredictable marketplace (Mason-Jones *et al.,* 2000:4065). The flow of products should be market driven (Lysons & Farrington, 2006:146; Christopher, 2003:289). Upstream of the decoupling point, the processes are designed to be lean (Towill & Christopher, 2002:300) enabling a level schedule and opportunities to reduce costs (Mason-Jones *et al.,* 2000:4065; Appelqvist, 2003:201). Upstream organisations work to a stable demand with relatively low variety and can therefore focus on lean low-cost manufacturing (Lysons & Farrington, 2006:146).

While organisations upstream from the decoupling point select a lean strategy, organisations downstream from the decoupling point select an agile supply chain strategy. Organisations at the decoupling point select a leagile supply chain strategy. These different supply chain strategies for different positions in the supply chain in terms of the decoupling point are illustrated in Figure 6.4. The organisation's position in terms of the decoupling point will be referred to as SCD element #2.3.

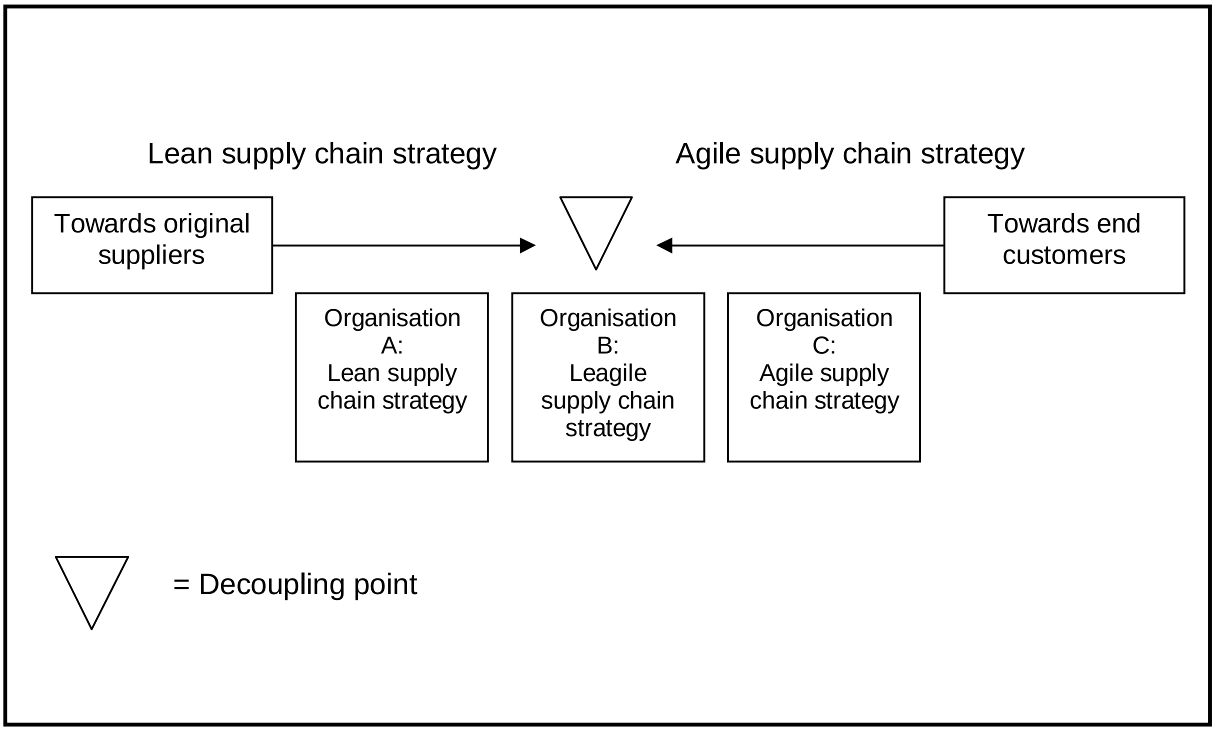

Figure 6.4: Supply chain strategies for different positions in the supply chain
Source: Adapted from Christopher (2003:289).

6.3.4 SCD element #2.4: The supply chain strategy

Once organisations understand the needs of their supply chain's end customers, they have to select a supply chain strategy (SCD element #2.4) to meet these needs based on their competitive advantage, which generally can be either low cost or high service levels. The SCD elements of phase two are illustrated in Figure 6.5. Alignment between the various SCD elements is also highlighted in Figure 6.5.

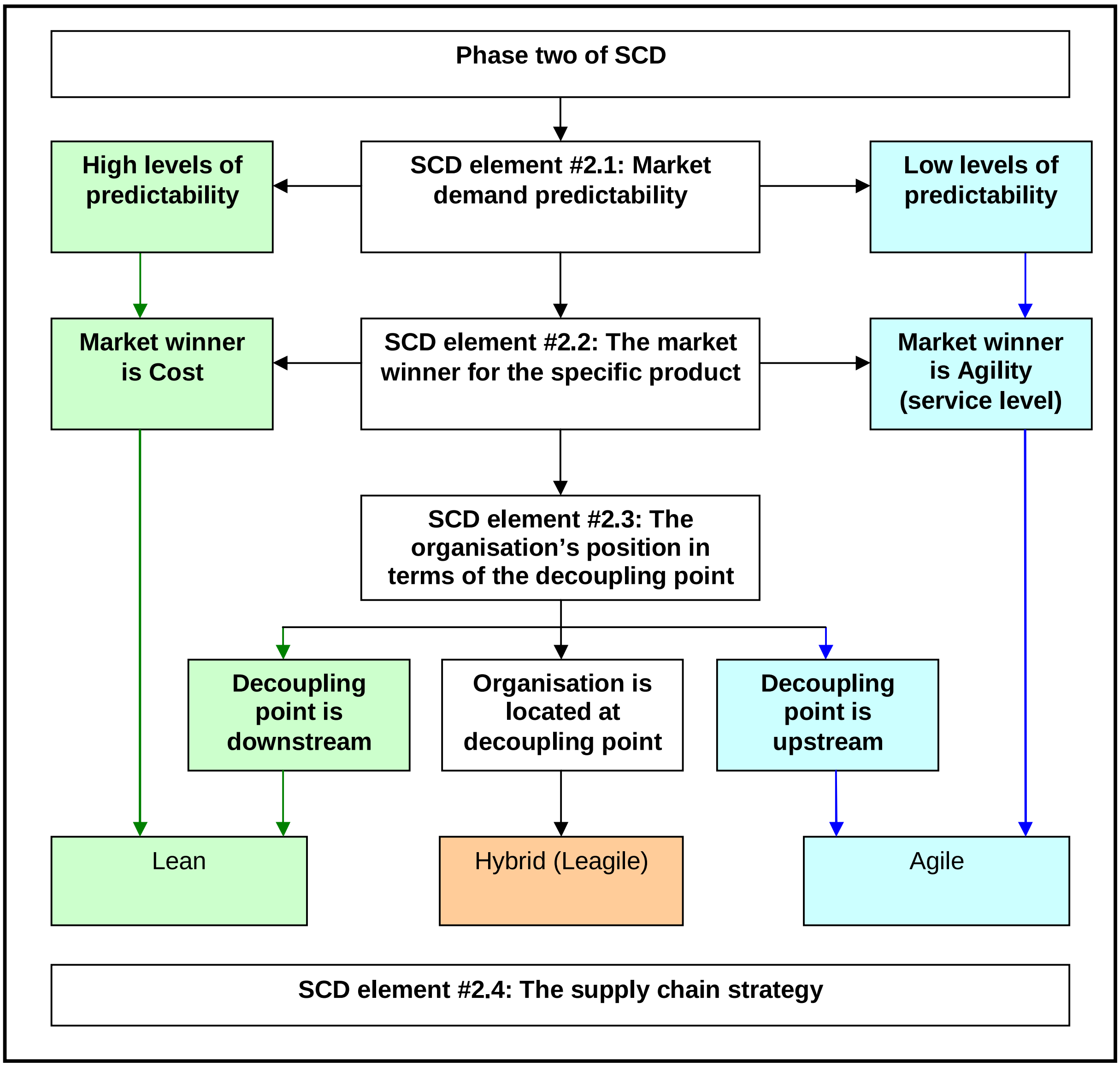

Figure 6.5: SCD elements of phase two of SCD
Source: Researcher's own.

To repeat, selecting a supply chain strategy is phase two of SCD. Organisations can select or implement one of two basic supply chains (refer to Chapter 3). These supply chains are either lean or agile or a combination of the two types of supply chains, namely a leagile supply chain. A lean supply chain should be selected to accommodate the need to be efficient and satisfy end customers' needs for functional products while an agile supply chain should be selected to meet the needs of responsiveness and to satisfy customers' needs for innovative products.

A lean (or efficient) supply chain is a set of organisations directly linked by upstream and downstream flows of information, products and finances that collaboratively work to reduce cost and waste (Vitasek *et al*., 2005:40). Agile supply chains utilise strategies aimed at being responsive and flexible with regard to customer needs (Lee, 2002:114; Jacobs *et al*., 2009:364). Supply chains where demand and supply uncertainties exist require agility (Ayers, 2004:46; Seuring, 2003:184). Hybrid (or leagile) supply chains exploit the benefits of both lean and agile supply chains (Towill & Christopher, 2002:300). When demand uncertainties are low, a lean supply chain strategy should be used. When demand uncertainties are high an agile supply chain strategy should be used. The importance of the decoupling point to determine where the supply chain should move from being lean to being agile is evident in the literature, and these issues are discussed in Chapter 3.

6.4 SCD ELEMENTS OF PHASE THREE OF SCD: SCOPING THE SUPPLY CHAIN STRUCTURE

The third phase of SCD entails scoping the supply chain's structure. Having determined the needs of their end customers and having selected a supply chain strategy, organisations have to structure their supply chains to meet those needs. Structuring the supply chain entails selecting the right supply chain partners and determining how supply chain drivers should be utilised. Organisations therefore also have to decide which partnerships and processes need to be integrated to optimise supply chain performance. According to the literature, SCI results in improved supply chain performance (refer to chapter 4). The implementation of supply chain drivers is also instrumental in improving supply chain performance and must be aligned to supply chain strategies. To determine whether supply chains are performing well, they have to be measured against the right supply chain key performance indicators (KPIs). The KPIs have to be aligned with supply chain strategies which have to be aligned with the needs in the market (refer to chapter 5). The SCD elements of phase three of SCD will therefore include the determination of:

- supply chain partners;
- supply chain drivers; and
- supply chain KPIs being used to measure performance.

6.4.1 SCD element #3.1: Supply chain partners

In phase three of SCD, organisations need to determine the extent to which they have structured their supply chains and decided who to partner with. Due to time and cost constraints, organisations cannot build collaborative relationships with all their supply chain partners. They have to identify the particular supply chain partners where collaborative relationships have to be developed. Therefore an important element of SCD is to determine the extent to which organisations have identified supply chain partners with which they want or need to build collaborative relationships. These are important links in their supply chains that need to be managed. Having identified their important supply chain partners, organisations need to determine to which level they want to integrate their relationships and processes. The relationships with supply chain partners will be referred to as SCD element #3.1. This element has five sub elements, which are:

- SCD element #3.1.1: Knowledge of supply chain partners;
- SCD element #3.1.2: Effort to get in touch with the right supply chain partners;
- SCD element #3.1.3: Management of supply chain partners (1st tier);
- SCD element #3.1.4: Potential for managing supply chain partners (beyond 1st tier); and
- SCD element #3.1.5: Management of supply chain partners (beyond 1st tier).

6.4.2 SCD element #3.2: Supply chain drivers

Part three of the conceptual framework also aims to determine the manner in which organisations implement their supply chain drivers and whether the supply chain drivers are being managed in line with their supply chain strategy. These drivers interact with each other and are facilities, inventory, transportation, information, sourcing and pricing (Chopra & Meindl, 2010:59) and, depending on how they are utilised, will have different effects on an organisation's responsiveness and/or efficiency (Hugos, 2006:37; Chopra & Meindl, 2010:59). Supply chain drivers will be referred to as SCD element #3.2, which has nine sub elements. They are:

- SCD element #3.2.1: Capacity utilisation in facilities;
- SCD element #3.2.2: Location of facilities;
- SCD element #3.2.3: Inventory levels;
- SCD element #3.2.4: Lead times;
- SCD element #3.2.5: Transportation cost;
- SCD element #3.2.6: Transportation frequency;
- SCD element #3.2.7: Information collection;
- SCD element #3.2.8: Supplier selection criteria; and
- SCD element #3.2.9: Pricing/ profit margins.

6.4.3 SCD element #3.3: Focus of supply chain KPI categories

Part three of the conceptual framework also aims at determining on which supply chain KPIs organisations should focus according to the supply chain strategy selected (refer to Chapter 5). It was concluded that market winners for an agile supply chain are service level (or availability) and cost for a lean supply chain. The KPI categories can be selected on the basis of the market winners. The KPI categories for specific supply chain strategies are illustrated in Table 6.2. Supply chain KPIs will be referred to as SCD element #3.3.

Table 6.2: Linking supply chain strategies with supply chain KPIs by means of market winners

Supply chain strategy	Market winners	Supply chain KPI categories
Agile supply chain	Service level (availability, speed, flexibility, innovation, quality supremacy)	Supply chain delivery reliability Supply chain responsiveness Supply chain flexibility
Lean supply chain	Cost	Total SCM cost Supply chain asset management efficiency
Leagile supply chain	Service and cost	Combination of KPI categories for agile and lean supply chains

Source: Compiled from Agarwal and Shankar (2002:32); Christopher and Towill (2001:237); Reiner and Schodl (2003:312); Taylor (2004:184-189) and Bolstorff and Rosenbaum (2003:51-53, 68).

Part three of the conceptual framework is derived from the discussion above (also refer to Chapters 4 and 5) and is illustrated in Figure 6.6.

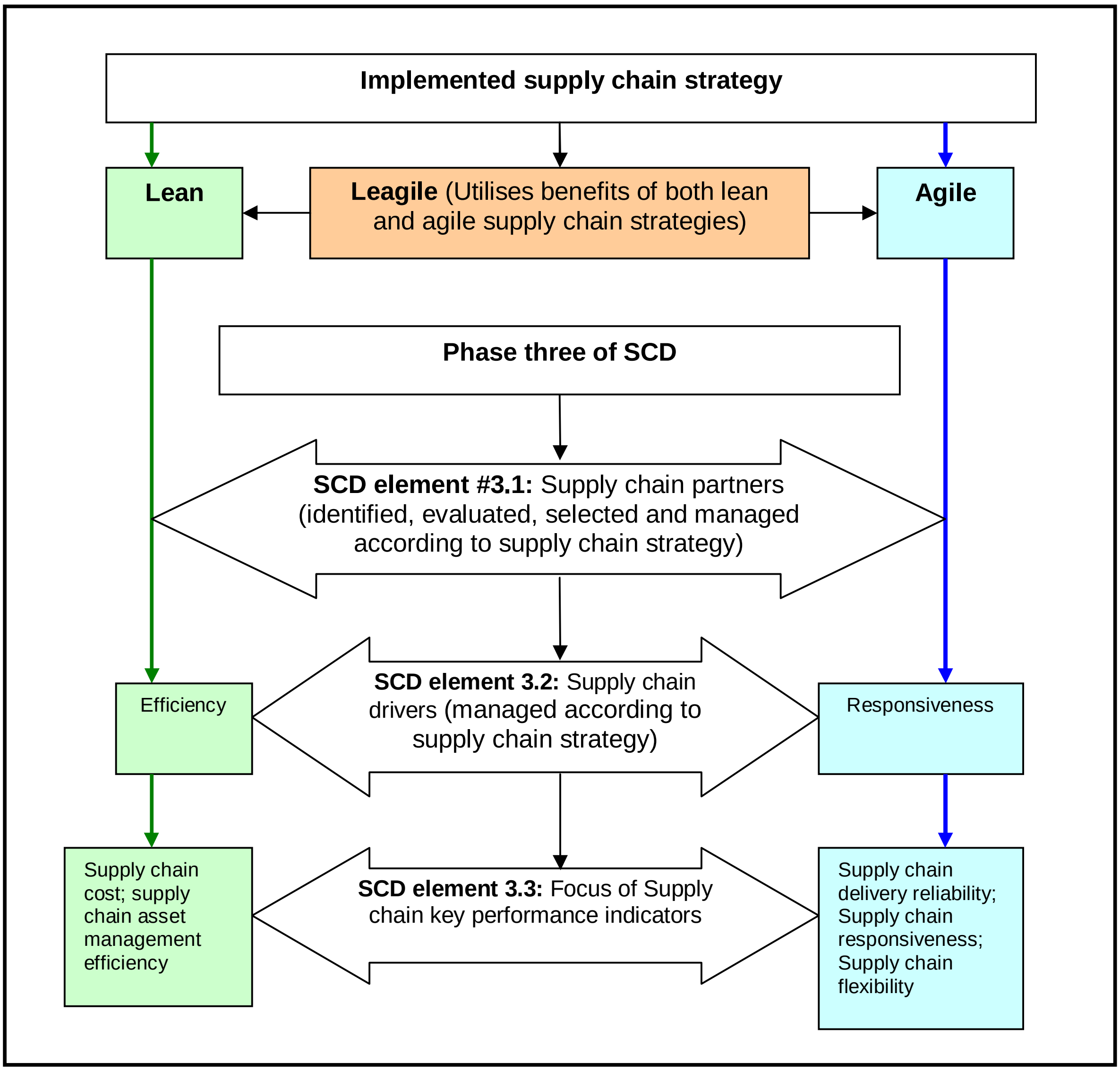

Figure 6.6: SCD elements of phase three of SCD
Source: Researcher's own.

To conclude this section, the three phases of SCD as illustrated in Figure 6.2 can now be elaborated on to include all twelve SCD elements. *Phase one* of SCD thus looks at understanding end customers' needs and determining how to meet them with five SCD elements. *Phase two* of SCD looks at the selection of a supply chain strategy under four SCD elements and *phase three* of SCD looks at scoping the supply chain structure with three SCD elements. These are illustrated in Figure 6.7.

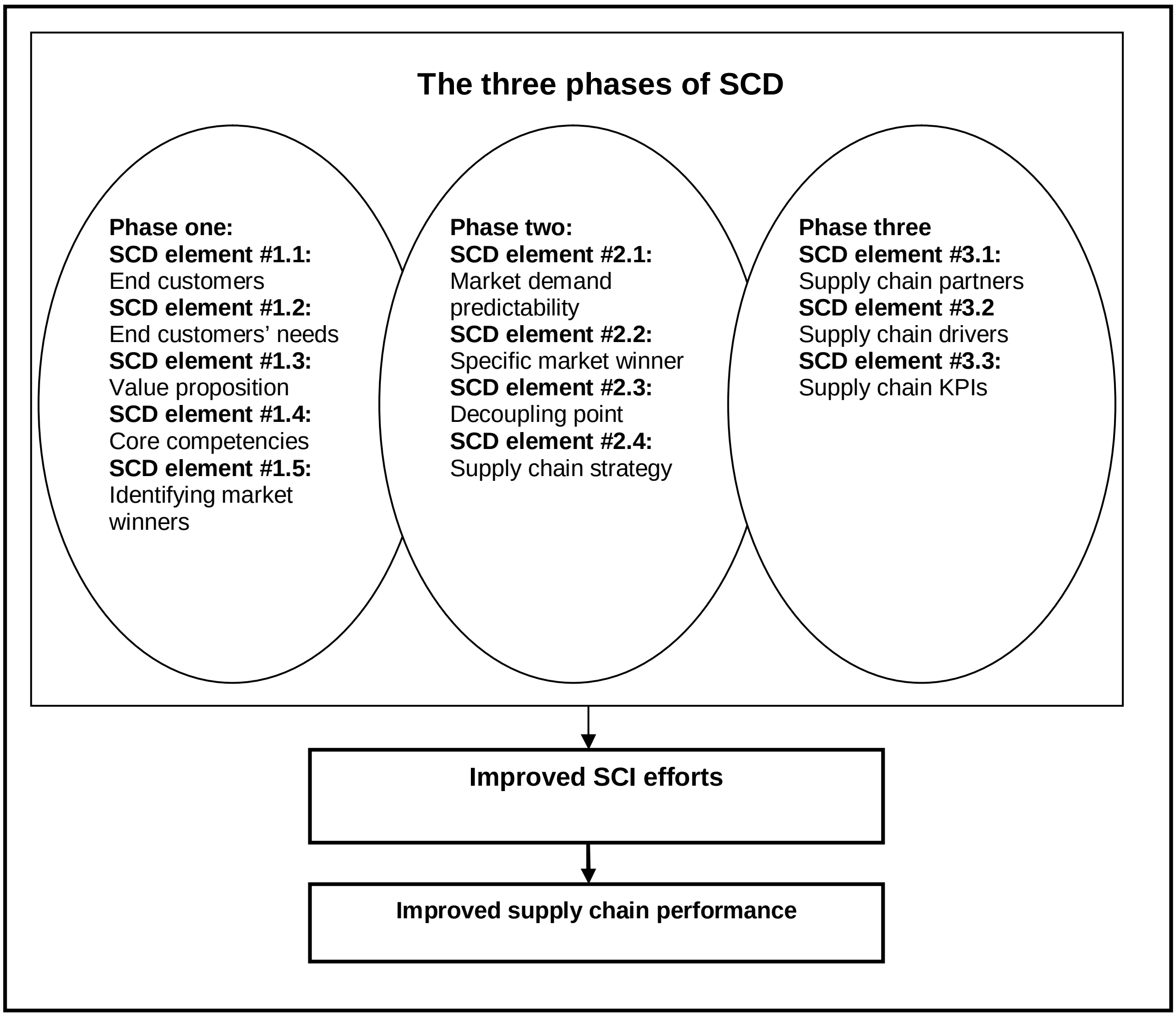

Figure 6.7: Summary of SCD elements in SCD (as derived from literature)
Source: Researcher's own.

In theory, these three phases of SCD must be aligned. The proposed conceptual framework analyses SCD practices across the three phases of SCD. The previous section showed that phase one is about end customers' needs and how to meet them. Phase two is about market demand predictability, market winners, the decoupling point and the supply chain strategy. Phase three is about the supply chain structure which includes supply chain partners, supply chain drivers and supply chain KPIs. The conceptual framework can thus be used to analyse each phase of an organisation's SCD practice and to determine whether the organisation has sound SCD practices in each phase and whether there is an alignment between the three phases. The conceptual framework thus determines whether the supply chain strategy (and level of market demand predictability as well as market winners) is aligned with end customers' needs and how to meet them. The conceptual framework also measures alignment between supply chain structure and supply chain strategy and whether the supply chain partners, drivers and KPIs are aligned with the selected supply chain strategy.

6.5 THE CONCEPTUAL FRAMEWORK FOR ANALYSING SCD PRACTICES

Based on the discussion that has gone before, the conceptual framework proposed in this study can now be introduced. This framework includes all the identified SCD elements discussed in the previous section. The functioning of the framework is illustrated in Figure 6.8. The SCD elements of each phase in the SCD are assessed by means of assessment questions. The respondents have to provide a score for each assessment question. The responses to each assessment question provide the basis on which the conceptual framework will either refer the respondent to a next assessment question or suggest that the respondent undertakes further analysis or explores the initial responses to the assessment question to determine potential areas for improvement. The scores for each assessment question (and scales according to which they function) will be explained as each phase of the conceptual framework is discussed. Briefly stated, the outcome can either be:

- satisfactory (which means that the response indicated a minimum acceptable score at least) or unsatisfactory (which means that the response did not at least indicate a minimum acceptable score); or
- aligned or misaligned with other responses to comply with a selected supply chain strategy (from phase two onwards).

When responses by organisations are satisfactory or aligned, they can proceed to the assessment questions in the next phase of SCD analysis. If their responses are unsatisfactory or misaligned, they can also proceed to the assessment questions of the next phase of SCD, but they have to bear the potential areas for improvement (as indicated by the conceptual framework) in mind when continuing with the analysis.

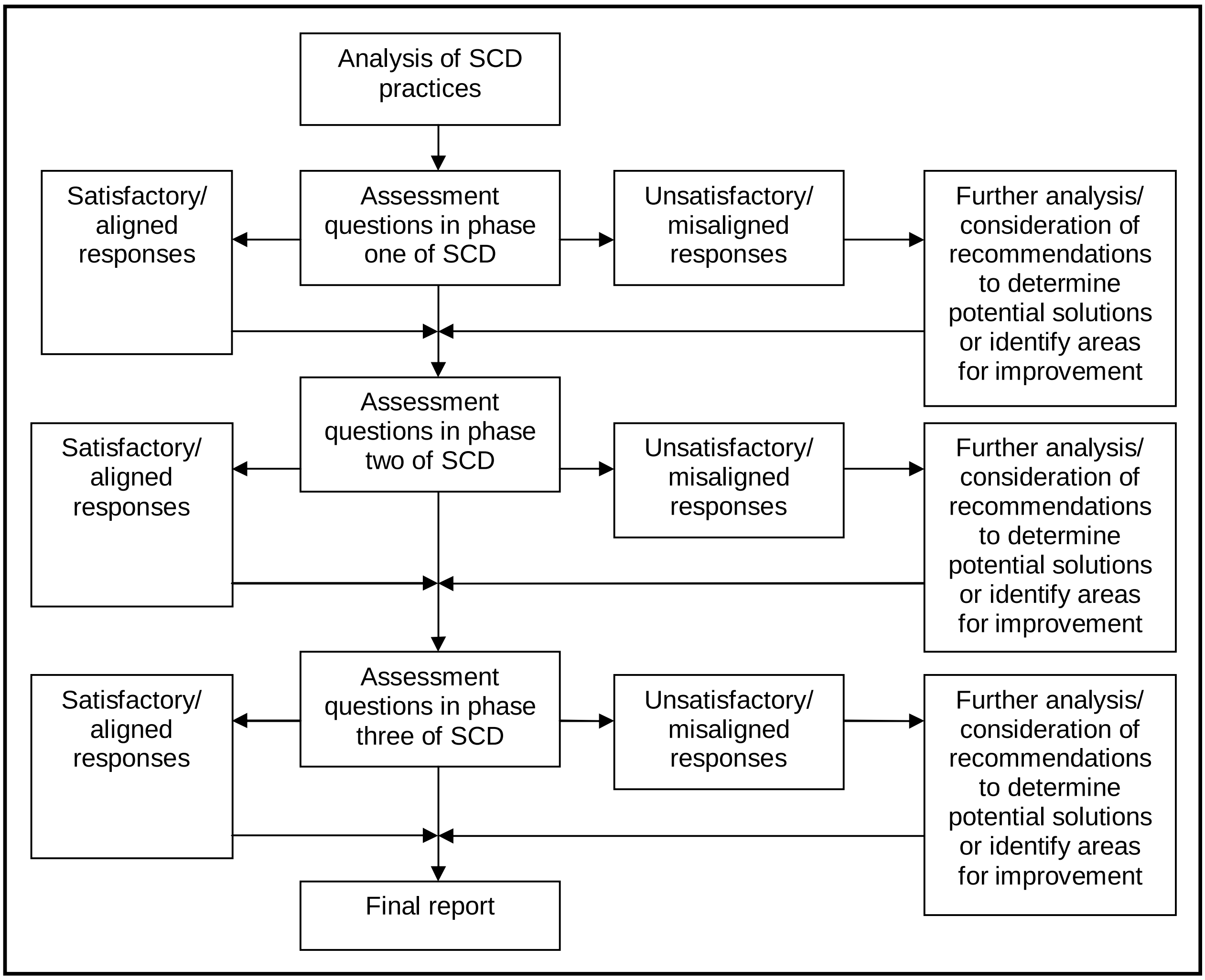

Figure 6.8: How the conceptual framework for analysing supply chain design practices functions

Source: Researcher's own.

6.6 USING THE CONCEPTUAL FRAMEWORK FOR ANALYSING PHASE ONE OF SCD

As already mentioned, phase one of SCD entails understanding who the end customers are and what their needs are, as well as how to meet those needs with a value proposition based on core competencies and market winners.

6.6.1 Assessment questions for analysing SCD elements in phase one of SCD

Five assessment questions are used in the conceptual framework to determine whether organisations understand their customers' needs and know how to meet these needs, which is phase one of SCD. There is one assessment question for each SCD element in phase one. Organisations have to achieve a minimum acceptable score in each of these assessment questions in this section and those that do not achieve the minimum score are provided with possible reasons (or explanations) and potential solutions to improve their SCD practices in this phase. A five-point Likert-response format *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)* will be used to measure the elements in phase one of SCD. The assessment questions for phase one of SCD are tabled in Table 6.3.

Table 6.3: Assessment questions for analysing the SCD elements of phase one of SCD

	Organisations have to indicate to which extent their organisation: *(where 1= very limited; 2= limited; 3= average; 4= good and 5= very good)*	(mark with an *x*)				
1	knows **who** their customers for this supply chain are (by means of market research/ market segmentation/ customer profitability profiles)	1	2	3	4	5
2	knows what the **needs** of their customers for this supply chain are in terms of service levels, products, prices, and so on, by means of market research, etc.	1	2	3	4	5
3	has identified a formal *value proposition* to meet customers' needs for this supply chain	1	2	3	4	5
4	possesses a *core competency* (that creates customer-perceived value and is superior to what competition does)	1	2	3	4	5
5	has identified how to win customers' orders for this product (with either low prices or by means of differentiation by being flexible and responsive to customers' demands; providing superior service and high quality)	1	2	3	4	5

For the testing of the conceptual framework for phase one of SCD, a score of three (3) (which indicates an average extent) was deemed satisfactory. Therefore, organisations that scored at least three for each of these assessment questions were referred to the next assessment question. However, organisations that scored less than three were referred for further analysis on these issues. However, if organisations want to analyse and improve their SCD practices through, for example, continuous improvement efforts, the organisations may use a score of four (good extent) as a minimum score. As already mentioned, a score of three was deemed satisfactory for the initial testing of the framework. The SCD practices for phase one of SCD of organisations can be analysed on the basis of their responses.

6.6.2 Broad conceptual framework for phase one of SCD

Figure 6.9 illustrates the process flow of analysing phase one of SCD on which the conceptual framework is based. The framework shows how organisations will start by analysing SCD element #1.1 and move on to SCD element #1.2 and so on until they have analysed all the SCD elements in phase one of SCD. If organisations have a response of 3, 4 or 5 for these issues, they have at least average knowledge of these issues. If organisations score two or less for these sections it implies that they have a limited or very limited knowledge of the above-mentioned issues and it is suggested that they address these issues by referring to Tables 6.4 and/or 6.5. This is discussed in the next section.

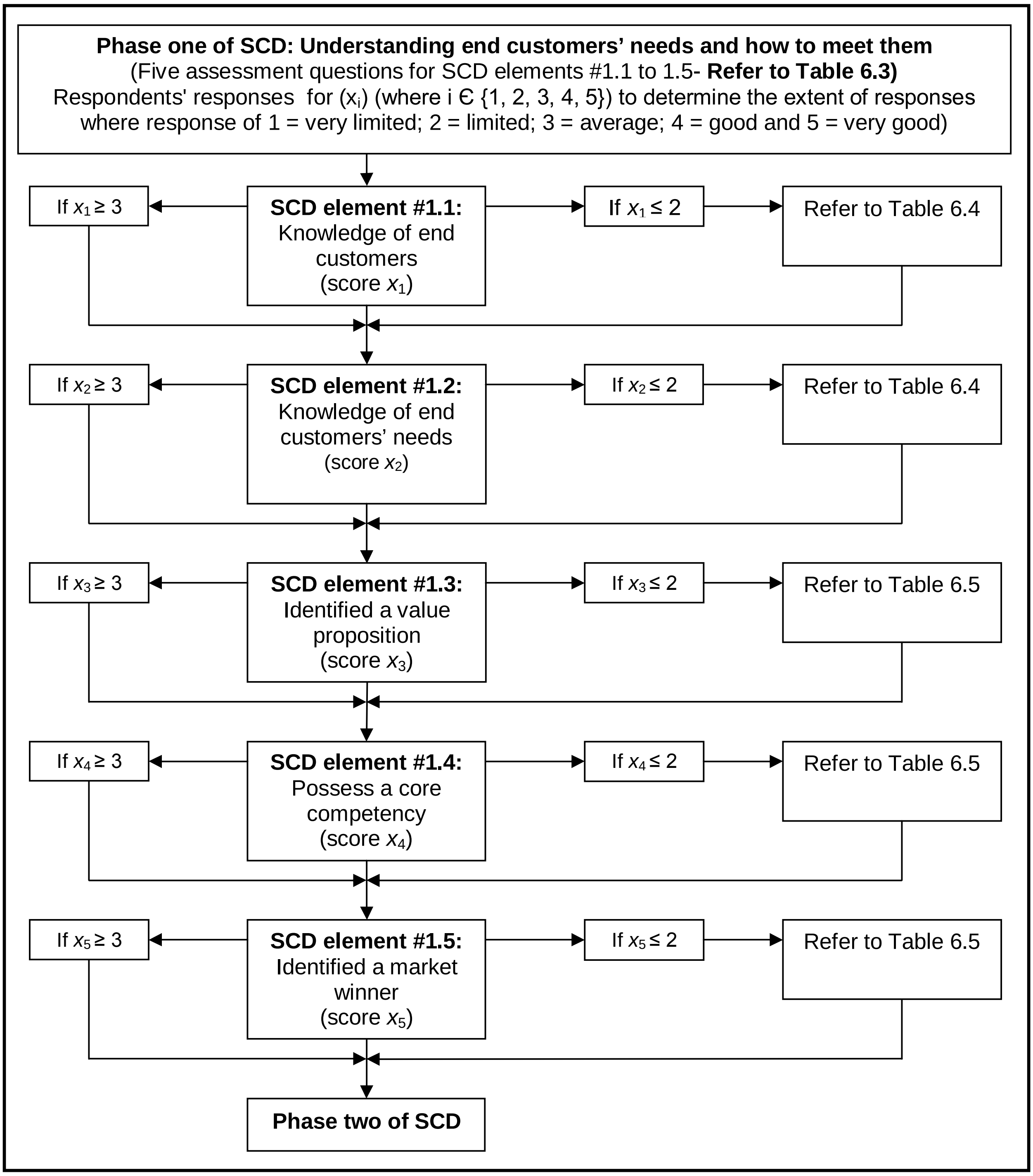

Figure 6.9: Broad conceptual framework for phase one of SCD
Source: Researcher's own.

If organisations' resultant responses are satisfactory (ie at least a score of three for the assessment questions in phase one) they can move on to phase two of the SCD analysis. However, if they are not satisfied with their responses (ie they have scores of one or two for some issues), they can use Tables 6.4 and 6.5 to find recommendations on how to improve these issues. They proceed in the assessment of their SCD bearing in mind that they need to address these issues and that the responses may have an impact on the other phases of their SCDs.

6.6.3 Recommendations for limited knowledge of SCD elements in phase one of SCD

As already mentioned, if organisations have a response of 3, 4 or 5 for these issues then they have at least an average knowledge of these issues. However, if organisations score two or less for these sections it implies that they have a limited or very limited knowledge of the issues involved (in the first phase of SCD) and it is suggested that they address these issues. Table 6.4 provides recommendations for organisations that have a response of one or two for SCD elements #1.1 and 1.2. Organisations can use these recommendations to improve their knowledge of who their end customers are and what the needs of their end customers entail.

SCD elements #1.3 to 1.5 have been identified as the extent to which organisations:

- SCD element #1.3: have identified a formal value proposition;
- SCD element #1.4: possess a core competency; and
- SCD element #1.5: have identified how to win customers' orders.

As mentioned above, a five-point Likert response format *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)* will also be used to measure these elements in phase one of SCD. As with SCD elements #1.1 and 1.2, organisations who score two or less for these elements are limited or very limited in these areas and Table 6.5 helps organisations identify these value propositions by analysing their core competencies and market winners.

Table 6.4: Possible explanations (or reasons) and recommendations for SCD elements #1.1 and 1.2

Recommendation:

Conduct market research and segment the market to understand the end customer. The organisation must know who the end customers are as well as what their needs are because:

(1) The supply chain's end customer is the person at the end of the supply chain who makes the decision whether or not to buy the product or service offered by the supply chain.

(2) The customer is the ultimate judge of supply chain performance. Specific customer knowledge is achieved by segmenting the markets that were identified through market research. Segmentation can be based on:

(i) sales territory or region,
(ii) preferred sales channel,
(iii) profitability,
(iv) products purchased,
(v) sales history,
(vi) demographic information,
(vii) desired product features, and
(viii) service preferences.

Determine the following customer attributes:

- the volume quantities demanded by the customer
- the response time the customer is willing to wait for fulfilment of the order
- the variety of products needed
- the service level required
- the price of the product
- the desired rate of innovation in the product (including new product development)

Use existing information (information can be obtained from):

- Past proprietary market research reports
- Multi client market research reports
- Other published material pertinent to the organisation's industry, customer base, technology gathered from publications, the Web, seminars and so on.
- Competitors' Web sites, press releases, media references, and annual and quarterly reports and stock analyst reports (if available).
- Websites of companies selling complementary products and services
- The organisation's financial statements overall by business unit, by product category, by market, by channel, and in B2B markets and by customer
- Any tracking information on market size, market share, penetration rates, repeat purchase rates, win rates, and any other variable that measures outcome of the organisation's selling process

Obtain information from outside sources: (Outside resources will depend on the organisation, its industry, and the amount that can be invested in information collection). Sources of qualitative information include:

- *Current, lost and potential customers*
- *Potential customer groups not using the organisation's offerings due to some features*
- *End users of the industry's offering (including those who are using competitors' offerings)*
- *Key suppliers*
- *Organisations selling complementary offerings*
- *Experts in any area*

Source: Compiled from Plantes and Finfrock (2009:88-93); Harrison (2001:1); Jeong and Hong (2007:578); Wisner *et al*. (2009:351); Chopra and Meindl (2010:40); Hines (2004:58) and Hugos (2006:33, 34).

As already mentioned, the *value proposition* quite simply is a statement of how, where and when value is to be created for specific customers or market segments. The value proposition should form the guiding principles around which all the activities of the organisation are conducted (Christopher, 2004:32). Core competencies will also be developed. However, the value proposition will require specific market winners. Market winners differentiate an organisation's products from their competition (Bozarth & Handfield, 2006:31) and can, for example, comprise low cost or high service levels (Mason-Jones, Naylor & Towill, 2000:4064). The value proposition thus reflects the order winners for a critical customer segment (Swink *et al*., 2011:31) and will be developed with core competencies (Swink *et al*., 2011:35). Organisations must know what their market winners and core competencies are.

Therefore, organisations are referred to Table 6.5 if they have a response of two or less in these issues. Table 6.5 helps organisations to determine what their value proposition as based on their core competencies and market winners should be. Organisations can therefore use Table 6.5 to determine the value proposition, market winners and core competencies.

Table 6.5: Determining a value proposition based on market winners and core competencies

Core competencies	Possible market winners	Value proposition
Processes *Planning systems* *Technology* *People and culture* *Supply chain relationships*	*Quality (sustainability vs supremacy)* *Timeliness* *Cost* *Innovation* *Flexibility*	*A value proposition can be determined by using the list of core competencies and possible market winners*

Source: Compiled from Bozarth and Handfield (2006:27, 28); Swink *et al*. (2011:31-34) and Lyons *et al*. (2004:659).

In conclusion of the analysis of phase one, organisations should now have a good idea of who their end customers are and what the needs of their customers are, as well as how to meet the needs with a value proposition based on their core competencies and market winners.

6.7 USING THE CONCEPTUAL FRAMEWORK TO ANALYSE PHASE TWO OF SCD

Analysis of phase two of an organisation's SCD practices consists of four sections. Usually organisations have several supply chains. An organisation has to decide which supply chain they want to analyse and then consider the important aspects of the supply chain. This includes the level of market demand predictability as well as specific market winners. Organisations will select a specific supply chain strategy on the basis of these characteristics. Organisations may select a lean or an agile supply chain strategy. In some cases, organisations may select a leagile supply chain strategy. The conceptual framework identifies the decoupling point and tries to justify why organisations may have selected a leagile supply chain strategy.

6.7.1 Analysing the market demand predictability (SCD element #2.1)

To analyse the level of market demand predictability, organisations will be requested to indicate the extent to which the demand for their product is predictable as opposed to being unpredictable. A continuum is used for the assessment question where a score of one indicates high levels of predictability and a score of four indicates a low level of predictability. In essence, the level of market demand predictability links to SCD element #1.2, which focuses on the needs of the end customers. The assessment question to determine the level of market demand predictability is shown in Table 6.6

Table 6.6: Assessment question to determine the level of market demand predictability

<table>
<tr><td colspan="7">Organisations have to indicate (with an x) where they would position the level of market demand predictability on a continuum with two extremes on each end of the continuum (where 1 = very predictable and 4 = very unpredictable</td></tr>
<tr><td>The market demand for the product (based on orders/sales fluctuations during a certain period) is:</td><td>Predictable
(low levels of uncertainty)</td><td>1</td><td>2</td><td>3</td><td>4</td><td>Volatile
(high levels of uncertainty)</td></tr>
</table>

6.7.2 Analysing market winners (SCD element #2.2)

To analyse specific market winners for a product, organisations will be requested to indicate what the specific market winners for their products are. A continuum is also used in this assessment question where a score of one indicates that the market winner for the product is low costs, while a score of four indicates that the market winner is agility in the form of high service levels, high quality and so on. This links to SCD element #1.5. The assessment question to determine the specific market winner of the organisation is shown in Table 6.7.

Table 6.7: Assessment question to determine specific market winners

Organisations have to indicate (with an *x*) what their market winner is on a continuum with two extremes at each end of the continuum (where 1 = low cost and 4 = agility in terms of short lead times; availability of products; high service levels; high quality)						
The market winner for the product category is *(what customers consider as essential)*	Low cost (within acceptable levels of service, availability and quality)	1	2	3	4	Agility (short lead times; availability of products; high service levels; high quality) within acceptable costs

6.7.3 Conceptual framework to illustrate alignment for SCD elements #2.1 and 2.2.

At this stage a lean supply chain strategy can be suggested for those products where the market demand is predictable and the market winner is low cost. An agile supply chain can be suggested where the market demand is unpredictable and the market winner is agility. Figure 6.10 shows that there is alignment if organisations have a product with a predictable market demand and low cost as market winner, or if the market demand is unpredictable and the market winner is agility.

6.7.4 Addressing misalignment between market demand predictability and market winners

If organisations have a score of one or two for market demand predictability (which indicates that their market demand is predictable) and they have a score of three or four for their market winners (which indicates that their market winner is agility) they will have to verify their market demand predictability and market winners. Similarly if organisations have a score of three or four for market demand predictability (which indicates that their market demand is unpredictable) and they have a score of one or two for their market winners (which indicates that their market winner is low cost) then the organisations will also have to verify their responses about market demand predictability and market winners. This can be done by looking at each of the characteristics in the table below. Organisations will therefore have to confirm their responses for market demand predictability and market winners. Organisations can verify their market demand predictability by referring to Table 6.8. Table 6.5 (refer to section 6.6.3) can be used to verify an organisation's market winners.

Table 6.8: Variables to determine market demand predictability

Demand uncertainty	Low	High
Length of product life cycle	Long	Short
Profitability	Low	High
Forecast error	Low	High
Stock-out rates	Low	High
Markdown	Low	Potentially high
Obsolescence	Low	High
Product variety	Low	High
End result: Market demand	***Stable, predictable***	***Variable, difficult to forecast***

Source: Adapted from Fisher (1997:1, 2); Ayers (2006:63) and Jacobs *et al*. (2009:363).

Table 6.8 addresses issues that confirm organisations' responses regarding market demand predictability. Table 6.5 can be used to confirm responses about market winners. If organisations are satisfied with their initial responses concerning market demand predictability and market winners and there is still a misalignment between their market demand predictability and their market winners, then their position in terms of the decoupling point will be used to suggest a supply chain strategy for such an organisation. This is also illustrated in Figure 6.10.

6.7.5 Analysing the organisation's position in terms of the decoupling point (SCD element #2.3)

An organisation's position in terms of the decoupling point will only be used to suggest a supply chain strategy if the organisation's market demand predictability and market winners are contradictory (i.e., when organisations indicate that their market demand is predictable and that their market winner is agility, or if the market demand is unpredictable and the market winner is low cost). The assessment question for SCD element #2.3 measures the organisation's position in terms of the decoupling point. Organisations will be requested to indicate where they are positioned in terms of the decoupling point. The assessment question to determine the organisation's position in terms of the decoupling point is shown in Table 6.9.

Table 6.9: Assessment question to determine the organisation's position in terms of the decoupling point

The organisation has to indicate which ONE of the following statements best fits its organisation in terms of the point where final assembly of the finished product (as end customers will use it) takes place.	**Please select one option only** *(mark with an x)*
The organisation's supplier(s) is/are responsible for the final assembly of the finished product as it will be distributed to end (or final) customers. The organisation merely distributes the finished product further to the end customers.	
The organisation is responsible for the final assembly of the finished product as it will be distributed to end (or final) customers The organisation receives the raw materials/components/work in progress parts and assembles (or compiles) the final product as it will be distributed to the end (or final) customers	
The organisation's customer(s) is/are responsible for the final assembly of the finished product as it will be distributed to end (or final) customers. The organisation merely distributes the raw materials/components/work in progress parts to them so that they can complete the final assembly.	

If suppliers to organisations are responsible for the final assembly of the finished product as it will be distributed to end customers, the organisation should implement an agile supply chain strategy. If the customers of organisations are responsible for the final assembly of the finished goods as it will be distributed to end customers, the organisation should implement a lean supply chain strategy. If organisations are responsible for the final assembly of the finished product as it will be distributed to the end customer, the organisation should utilise a lean supply chain strategy upstream and an agile supply chain strategy downstream. This is illustrated in Figure 6.10. Supply chain strategies can be suggested at this stage. Suggested supply chain strategies based on market demand predictability, market winners and the decoupling point (if necessary) are tabled in Table 6.10.

Table 6.10: Alignment between market demand predictability, market winners and position in terms of the decoupling point

Characteristic	Suggested supply chain strategy		
	Lean	**Leagile**	**Agile**
Market demand	High predictability	Either	Low predictability
Market winner	Low cost	Either	Agility
Decoupling point (will only be used if there is contradiction between responses for market demand predictability and market winner)	Downstream towards customers	At the organisation	Upstream towards suppliers
Characteristics	Because of high predictability, organisations can manufacture generic products at low cost. Customisation is not necessary yet, because the decoupling point is downstream (and real demand is not yet known). Use make-to-stock	If market demand is predictable and market winner is agility, the decoupling point should be at the organisation to use a leagile supply chain strategy *Reason*: Organisations have to manufacture at low cost upstream from the decoupling point (because generic products can be manufactured) and be agile downstream from the decoupling point (because customisation is required).	Because of low predictability, organisations cannot necessarily manufacture generic products at low cost. Customisation is necessary because the decoupling point is upstream (and real demand is known). Agility is required to provide a combination of quality, timeliness, and improved service (depending on what the customer wants). Use make-to-order

Source: Compiled from Christopher (2003:289, 290).

Organisations can use Table 6.10 to establish the extent of alignment. The table indicates when organisations have achieved alignment between market demand predictability, market winners and the organisation's decoupling point. A supply chain strategy can be suggested.

6.7.6 Analysing the implemented supply chain strategy (SCD element #2.4)

At this point, organisations will be asked to indicate on a continuum what the primary focus of their organisation's supply chain strategy is. A response of one on this continuum indicates a focus on achieving the lowest cost; achieving economies of scale, reducing waste and so on within acceptable service levels, while a response of five indicates a focus on being agile, ie being responsive and flexible concerning customers' demands and providing high service levels within acceptable cost levels. On this continuum, a response of three will indicate that the focus of the supply chain strategy is a combination of a lean and an agile strategy and that a leagile supply chain strategy is therefore being used. Organisations can establish whether there is alignment between their selected supply chain strategy and the supply chain strategy that is suggested to them on the basis of market demand predictability, market winners and the decoupling point's position (if necessary) (refer to previous section). The assessment question to determine the organisation's supply chain strategy is illustrated in Table 6.11.

Table 6.11: Assessment question to determine the focus of the organisation's supply chain strategy

<table>
<tr><td colspan="8">Organisations have to indicate on a continuum what the primary focus of their organisation's supply chain strategy for a specific selected supply chain is (where 1 = a focus on achieving the lowest cost; achieving economies of scale, reducing waste and so on within acceptable service levels and 5 = a focus on being agile, ie being responsive and flexible concerning customers' demands, and providing high service levels within acceptable costs levels)</td></tr>
<tr><td>All things considered, the focus of your organisation's supply chain strategy for the selected supply chain is:</td><td>Cost-efficiency; economies of scale reduction of waste</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Agility (responsiveness; flexibility, high service levels)</td></tr>
</table>

If organisations select an agile supply chain strategy when they have a predictable demand or low cost as a market winner, they need to be able to justify their response (also refer to section 6.7.4) because it does not make sense as far as the literature is concerned. Selecting a lean supply chain strategy when there is an unpredictable market demand, or agility as market winner, will similarly need to be justified.

6.7.7 The broad conceptual framework to illustrate alignment between the supply chain elements of phase two of SCD

Figure 6.10 also shows when organisations have achieved alignment and when they have not (according to the literature). With the aid of the conceptual framework so far, organisations can establish whether their selected supply chain strategy is aligned with the value proposition (based on core competencies and market winners as determined in phase one). The green sections in Figure 6.10 show alignment for a lean supply chain strategy while the blue sections show alignment for an agile supply chain strategy. Organisations that select a different supply chain strategy to the one suggested, are referred to Table 6.10 for evaluating their response.

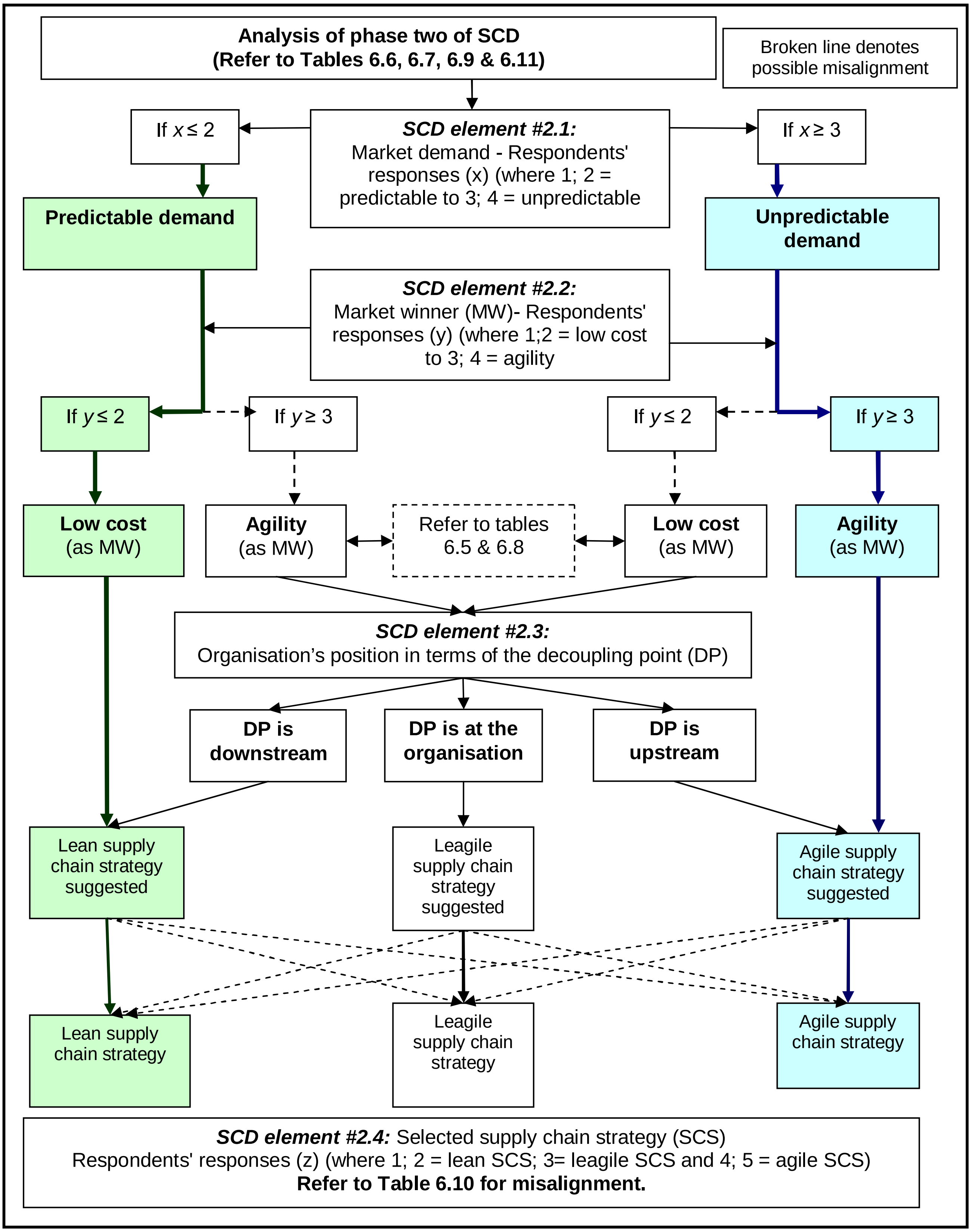

Figure 6.10: Conceptual framework for analysis of SCD elements in phase two of SCD

Source: Researcher's own.

6.8 USING THE CONCEPTUAL FRAMEWORK TO ANALYSE PHASE THREE OF SCD

The analysis of phase three of an organisation's supply chain practices (scoping the supply chain structure) consists of three sections. As already mentioned, these are supply chain partners, supply chain drivers and supply chain KPIs.

6.8.1 Analysing supply chain partners

The first section analyses an organisation's *relationships* with its supply chain partners (ie suppliers and customers). This was identified as SCD element #3.1. Five assessment questions are used to establish how well organisations have identified and manage these relationships. These assessment questions are illustrated in Table 6.12. Organisations will be asked to indicate the extent (1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable) to which their organisation:

- SCD element #3.1.1: Knows who its critical supply chain partners are (where supply chain relationships need to be managed concerning processes, information, technology, and so on);
- SCD element #3.1.2: Has made an effort to get in contact with the 'right' direct tier-one supply chain partners (identified, evaluated and selected their most important direct suppliers and customers) based on capability considerations;
- SCD element #3.1.3: Manages their critical direct (1^{st} tier) supply chain relationships;
- SCD element #3.1.4: Is able to manage their critical supply chain relationships beyond 1^{st} tier (2^{nd} tier to n^{th} tier); and
- SCD element #3.1.5: Manages their critical supply chain relationships beyond 1^{st} tier (2^{nd} tier to n^{th} tier).

Table 6.12: Assessment questions to assess supply chain relationships

Organisations have to indicate the extent to which their organisation: *(where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)*	Most important suppliers					Most important customers				
knows who its critical supply chain partners are (where supply chain relationships need to be managed concerning processes, information, technology, etc.)	NA	1	2	3	4	NA	1	2	3	4
has made an effort to get in contact with the 'right' direct tier-one supply chain partners (identified, evaluated and selected their most important direct suppliers and customers) based on considerations of capability	NA	1	2	3	4	NA	1	2	3	4
manages their critical direct (tier one) supply chain relationships	NA	1	2	3	4	NA	1	2	3	4
is able to manage their critical supply chain relationships beyond tier 1 (tier 2 to tier n)	NA	1	2	3	4	NA	1	2	3	4
manages their critical supply chain relationships beyond tier 1 (tier 2 to tier n)	NA	1	2	3	4	NA	1	2	3	4

6.8.2 The conceptual framework for evaluating supply chain relationships

Figure 6.11 illustrates how the conceptual framework analyses supply chain partnerships with both buyers and sellers and shows the flow of how organisations can determine how they manage their supply chain partnerships. For the testing of the conceptual framework for phase one of SCD, a score of two (which indicates an average extent) was deemed satisfactory. Therefore, organisations that score at least two for each of these assessment questions are referred to the next assessment question. However, organisations that score less than two are referred for further analysis regarding these issues. If organisations want to analyse and improve their SCD practices through, for example, continuous improvement efforts, such organisations may use a score of three (good extent) as the minimum acceptable score. As already mentioned, a score of two was deemed satisfactory for the initial testing of the framework.

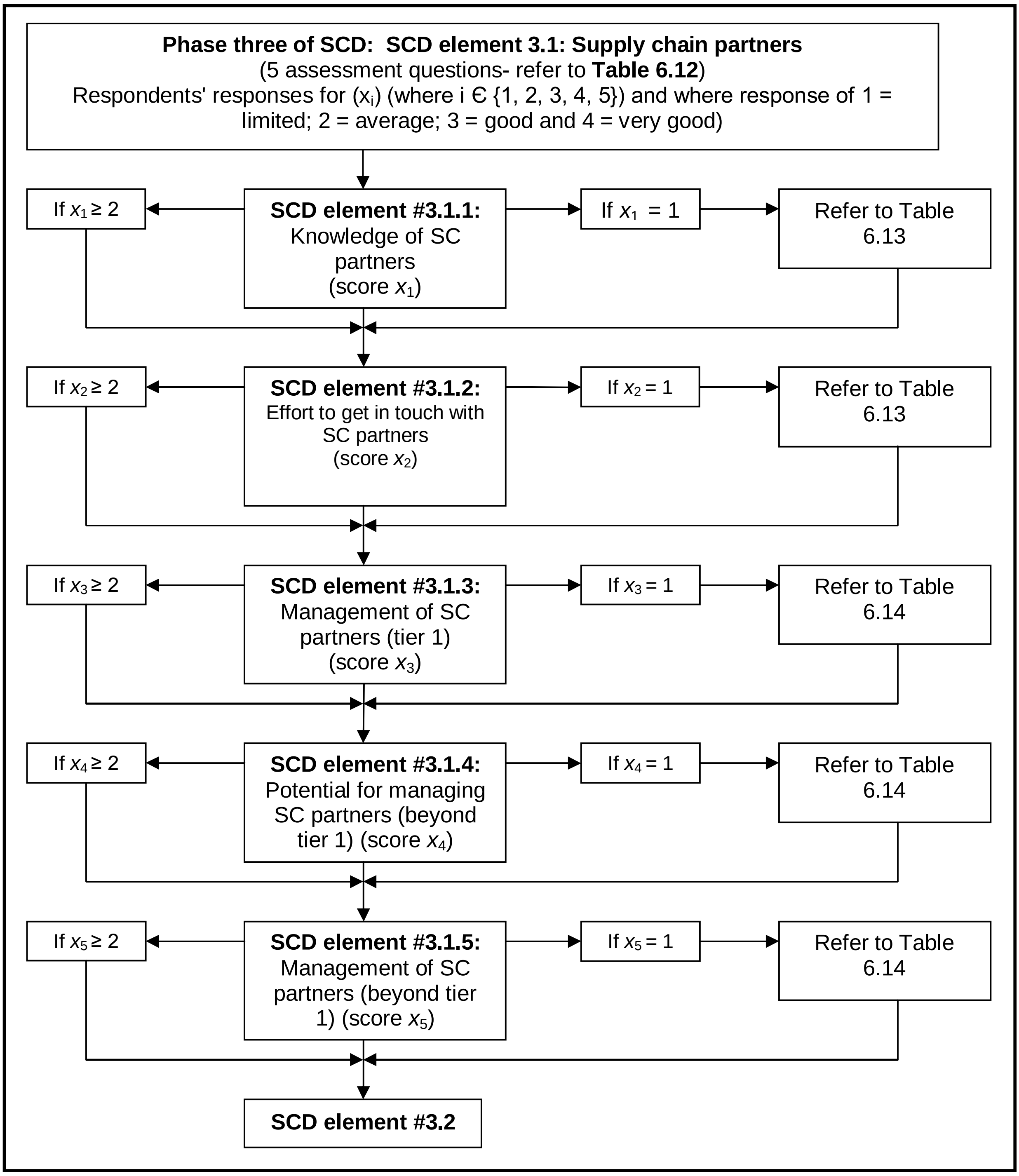

Figure 6.11: Conceptual framework for analysis of SCD element #3.1 in phase three of SCD

Source: Researcher's own.

6.8.3 Identifying areas to improve supply chain relationships

Organisations have to determine how important these issues are to their organisations. If organisations have a score of one regarding these issues and it is important for the organisation to manage its relationship with its supply chain partners, it will have to address these issues. Organisations have to identify, evaluate and select the right supply chain partners. If they have not identified, evaluated and selected their most important direct suppliers and customers according to considerations of capability on the basis of the score of one for SCD elements #3.1.1 or 3.1.2, they can refer to Table 6.13 for recommendations.

Table 6.13: Recommendations for the identification, evaluation and selection of supply chain partners

Identify supply chain partners by means of gathering information through: - current suppliers including supplier information files, supplier websites and supplier catalogues - sales representatives - information databases - experience of dealing with suppliers in general - trade journals, trade directories and trade shows - second parties such as, or indirect information from, other supply management departments or professional organisations - internal sources - Internet searches - telephone directories Evaluate and select supply chain partners based on their compliance with the following factors and how these factors fit into the organisation's strategic objectives: - Operations and logistics processes and systems capabilities (including production scheduling, control systems, delivery frequencies, supply flexibility and capacity capabilities such as minimum lot sizes) - Technological capabilities (including information coordination capability such as e-commerce capabilities) - Total quality performance (including supply quality, quality processes and quality systems) - Supply management processes (in terms of replenishment lead times and on-time performance - Cost structures (including pricing terms, inbound transportation costs and exchange rates, taxes, and duties, if applicable) - Design collaboration capability - Employee capabilities (including labour skills, training and morale) - Management capabilities - Financial stability - Supplier viability and thus longer-term relationship potential

Source: Compiled from Handfield *et al*. (2009:238-241; 248-255); Burt *et al*. (2010:242-243; 244-247); Chopra and Meindl (2010:420) and Swink *et al*. (2011:297).

Supply chain integration (SCI) is fundamental to SCM and involves integrating with other important supply chain members across relationships and processes (Cagliano *et al*., 2006:283; Lambert, 2006:1; Fawcett *et al*., 2007:8). Table 6.14 illustrates potential areas where supply chain relationships and processes (thus integration) can be improved. In each of these relationship and process areas organisations have to provide a response (where 1 = limited, 2 = average, 3 = high and 4 = very high). This will show organisations where there may be room for improvement. Organisations can determine in which areas they need to and want to improve by analysing their scores in specific areas.

Table 6.14: Evaluating supply chain relationships and processes

	Organisations have to indicate the extent to which the following SCI characteristics are applied in their organisation and its supply chain relationships *(where 1 = limited; 2 = average; 3 = high; 4 = very high)*	**with most important suppliers**				**with most important customers**			
1	The level of interdependence among supply chain partners (dependence on one another - can a partner opt out easily?)	1	2	3	4	1	2	3	4
2	The long-term commitment to the relationship by both parties	1	2	3	4	1	2	3	4
3	The level of trust among supply chain partners	1	2	3	4	1	2	3	4
4	The reliability of the organisation's supply chain partners in terms of eliminating supply uncertainties such as unnecessary breakdowns, disruptions, and so on	1	2	3	4	1	2	3	4
5	Sharing supply chain risks amongst supply chain partners (are risks every party's responsibility or not?)	1	2	3	4	1	2	3	4
6	Sharing benefits/rewards amongst supply chain partners (are direct benefits shared or are they to the advantage of the individual organisation?	1	2	3	4	1	2	3	4
7	The degree of collaboration achieved (to what extent is purposeful cooperation achieved to maintain the relationship over time?)	1	2	3	4	1	2	3	4
8	Development of any supply chain capabilities (in organisations where it is necessary) to optimise the supply chain	1	2	3	4	1	2	3	4
9	Measuring and sharing supply chain performance with partners to improve the supply chain's performance (of all relevant organisations across the supply chain)	1	2	3	4	1	2	3	4
10	Adhering to predetermined payment conditions	1	2	3	4	1	2	3	4

	Organisations have to indicate the extent to which the following SCI characteristics are applied in their organisation and its supply chain processes *(where 1= limited; 2= average; 3= high; 4= very high)*	**by/towards most important suppliers**				**by/towards most important customers**			
1	The compatibility of essential technologies to ensure the seamless flow of materials/goods between supply chain partners	1	2	3	4	1	2	3	4
2	Contribution towards new product development (NPD)	1	2	3	4	1	2	3	4
3	The compatibility of essential technologies to ensure the mutual sharing of accurate relevant information between supply chain partners	1	2	3	4	1	2	3	4
4	The focus on total supply chain costs (and not only price) across the supply chain	1	2	3	4	1	2	3	4
5	A focus on continuous improvement across processes	1	2	3	4	1	2	3	4
6	A focus on adhering to predetermined quality levels (albeit with product or service features)	1	2	3	4	1	2	3	4
7	The level of supply chain integration between the organisation and its supply chain partners with regard to essential processes, technologies, information sharing, etc.	1	2	3	4	1	2	3	4

6.8.4 Analysing supply chain drivers

In the second section on analysing, phase three of SCD (SCD element #3.2) the manner in which the *supply chain drivers* are managed is analysed. Nine assessment questions are used across six supply chain drivers to determine whether the supply chain drivers are being managed in line with the selected supply chain strategy. The supply chain drivers of a lean supply chain should be managed differently to those of an agile supply chain. If discrepancies exist, organisations are prompted to determine possible reasons and/or solutions for these discrepancies. Organisations are asked to indicate where they would position their organisation in terms of how they manage their supply chain drivers along a continuum (where 1 = a strong focus on efficiency and 4 = a strong focus on responsiveness).

A response of one on the one side of the continuum will indicate that the supply chain drivers are managed according to lean principles while a response of four will indicate that the supply chain drivers are managed with agility in mind. The nine assessment questions range across the six supply chain drivers of facilities, inventory, transportation, information, sourcing and pricing. The nine assessment questions are illustrated in Table 6.15 and specifically cover the areas of:

- SCD element #3.2.1: Capacity utilisation in facilities;
- SCD element #3.2.2: Location of facilities;
- SCD element #3.2.3: Inventory levels;
- SCD element #3.2.4: Lead times;
- SCD element #3.2.5: Transportation cost;
- SCD element #3.2.6: Transportation frequency;
- SCD element #3.2.7: Information collection;
- SCD element #3.2.8: Supplier selection criteria; and
- SCD element #3.2.9: Pricing/ profit margins.

Table 6.15: Assessment questions to assess supply chain drivers

Organisations have to indicate where they would position their organisation (with regards to a selected supply chain) along a continuum (where 1 = a strong focus on efficiency and 4 = a strong focus on responsiveness).							
SCD element #3,2:							
1	Capacity utilisation in facilities	There is little excess capacity in the organisation. The organisation has high utilisation rates to maintain lower costs and run or stock its facilities at full capacity because of predictable demand	1	2	3	4	The organisation makes provision for excess capacity to allow for flexibility (to meet unexpected customer demand). The organisation even places orders with suppliers if necessary to meet varying demands
2	Location of facilities	The organisation has one or a few central facilities to serve wide areas	1	2	3	4	The organisation has many smaller facilities closer to customers
3	Inventory levels	Because of predictable demand, the organisation tries to minimise inventory levels throughout the supply chain to lower cost	1	2	3	4	The organisation /its supplier(s) maintains significant buffer (or safety) stocks of parts or finished goods to meet unexpected customer demand at short notice if necessary
4	Lead times	Short lead times are not essential, but the organisation tries to shorten lead times as long as it does not increase cost	1	2	3	4	Short lead times are essential and the organisation even invests aggressively in ways to reduce lead times if necessary (even if it means incurring higher costs)
5	Transportation cost	The organisation selects the lowest acceptable cost mode of transport	1	2	3	4	The organisation selects fast (flexible) means of delivery depending on their customers' needs regardless of cost
6	Transportation frequency	The organisation has less frequent shipments (to save cost) (and because demand is predictable, the organisation can plan the frequency more easily)	1	2	3	4	The organisation has frequent shipments (to adhere to customers' flexible demands) (The organisation will ensure availability and timeliness, even it means more frequent shipments)
7	Information collection	The organisation places low emphasis on collecting and sharing accurate and timely data among supply chain members (forecasts are used without consulting other supply chain members)	1	2	3	4	The organisation places high emphasis on collecting and sharing accurate and timely data among supply chain members (determining real market demand and exactly what the customers want is important)
8	Supplier selection criteria	The organisation selects its suppliers on the basis of low prices and acceptable quality standards (cost considerations are most important)	1	2	3	4	The organisation selects suppliers on the basis of speed, flexibility, superior quality and dependability (cost considerations are important but of secondary importance)
9	Pricing/ profit margins	The organisation bases profit margins on lower margins and higher volumes	1	2	3	4	The organisation bases profit margins on higher margins and lower volumes

6.8.5 The conceptual framework for analysis of supply chain drivers

Figure 6.12 shows the conceptual framework for analysis of the supply chain drivers (SCD element #3.2). The left side of Figure 6.12 indicates the ideal responses for alignment for a lean supply chain strategy (highlighted in green) while the right side of the figure indicates the ideal responses for alignment for an agile supply chain strategy (highlighted in blue).

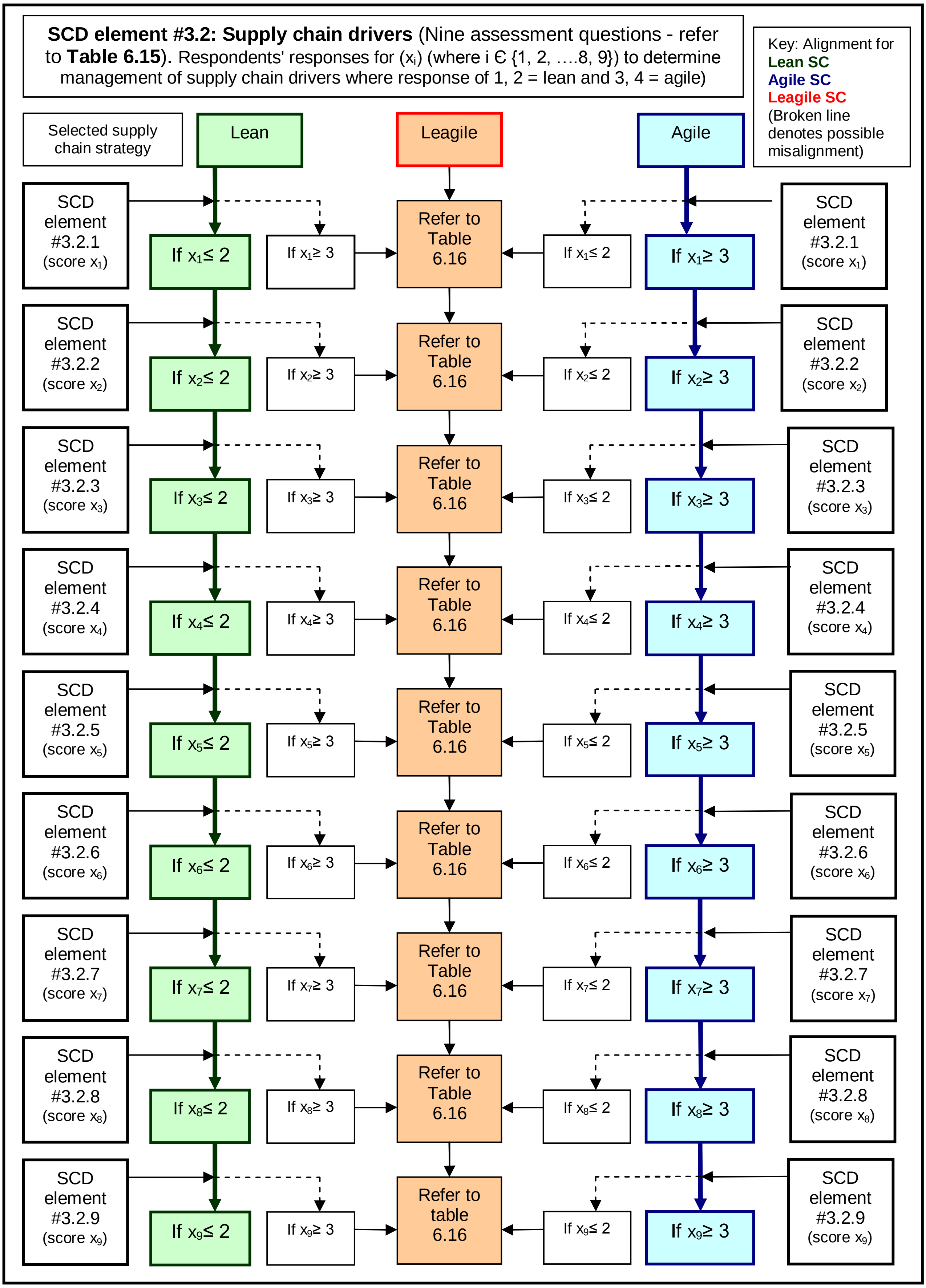

Figure 6.12: Conceptual framework for analysis of SCD element #3.2

Source: Researcher's own.

Due to the nature of leagile supply chain strategies, organisations will have to consider each supply chain driver and take into consideration the different trade-offs that may exist between the supply chain drivers.

6.8.6 Addressing misalignment between supply chain strategy and supply chain drivers

If organisations select a lean supply chain strategy, they, according to theoretical principles, should have a response of one or two for the nine assessment questions. Alternatively, if organisations select an agile supply chain strategy, they, according to theoretical principles, should have a response of three or four across the nine assessment questions. Table 6.16 provides recommendations and considerations concerning how organisations should manage their supply chain drivers according to the supply chain strategy that they select. The table can be used when, for example, organisations with a lean supply chain strategy have results of 3 or 4 for the assessment questions about their supply chain drivers, or if organisations with an agile supply chain strategy and have results of 1 or 2 for the assessment questions about their supply chain drivers. Organisations can then consider these recommendations and decide, on the basis of their knowledge and judgment, whether (or not) they want to implement these recommendations.

Table 6.16: Recommendations and considerations for management of supply chain drivers

SCD element	Lean SC strategy	Agile SC strategy
Facilities: Capacity and location (SCD elements #3.2.1 & 3.2.2)	**Utilise full capacity because lower costs will be achieved due to economies of scale.** Therefore, organisations have to know what their maximum and effective capacity are. **Utilise make-to-stock production strategy** because product characteristics should be highly standardised with high volumes. Process flexibility is low and a key resource is equipment and materials. **Centralise facilities to serve wide areas.** However, if centralisation is	**Allow for excess capacity to be flexible to meet unexpected customer demands.** **Utilise make-to-order production strategy** because product characteristics should be low standardisation and low volumes. Process flexibility is high and a key resource is skilled labour. **Decentralise with many smaller facilities closer to customers** This increases customer service and substitutability of products because of shorter lead times and less loss of sales.

	used, transportation must be reliable. Customer service is lower than with decentralisation. Lead times are longer. Inward transport costs consist of fewer larger deliveries and cost is low. Facilities, however, are further from customers, which means that outward transport costs are higher. Operating costs are also lower with bigger facilities because of economies of scale. Safety stock is lower. **Consolidation and cross docking can be considered** if products have a continuous flow; suppliers are reliable; there are no unpredictable fluctuations in the sales and products have uniform handling methods.	However, consider that inward transportation costs may be high because of many smaller deliveries, but outward transportation costs can be low because of closer proximity to customers. Safety stocks will be higher and overhead costs are higher. **Direct shipments** can be considered to reduce lead times and inventory carrying costs.
Inventory (SCD element #3.2.3)	**Minimise inventory levels** throughout the supply chain because market demand is predictable. Determine why inventory levels are not minimised. Determine stockout frequency if organisation runs out of stock (and if stockouts are crucial). Provide tight management of usage rates, lead times, and safety stock. Inventory levels (including safety stocks) can be minimised with centralised facilities. Requirements for low inventory levels are reliable suppliers with reliable lead times. Product features for lean supply chains are components and standard products. If suppliers are reliable, consider JIT systems.	**Maintain significant buffer (or safety) stocks** (in supply chain) of parts or finished goods to meet unexpected customer demand at short notice if necessary, because market demand is unpredictable (volatile). This will be necessary with decentralised facilities. Invest into more responsive order processing and transportation resources to improve responsiveness Product features for agile supply chains are customised and differentiated products.
Transportation Lead times, cost & frequency (SCD elements #3.2.4, 3.2.5 & 3.2.6)	**Select the lowest acceptable cost mode of transport.** **Use less frequent shipments.** Shorten lead times as long as it does not increase cost. Eliminate excessive movement of parts to various facilities. Transportation costs can be	**Select fast (flexible) means of delivery depending on customers' needs regardless of cost.** Use more frequent shipments (to adhere to customers' flexible demands and to ensure availability and timeliness. Short lead times are essential. Invest aggressively in ways to

	reduced with consolidation and cross docking systems.	reduce lead times if necessary (even if it means incurring higher costs). Reduce distances travelled. Eliminate waiting times by scheduling transportation effectively. Direct shipments reduce lead times and cuts down on warehousing and DC costs. However, risk pooling is also eliminated.
Information (SCD element #3.2.7)	**Use forecasts** because lower emphasis is placed on collecting and sharing accurate and timely data among supply chain members. When using forecasts, beware of the bullwhip effect. To reduce the bullwhip effect, communicate with supply chain partners. Try to reduce forecast errors because accurate forecasts mean bigger economies of scale which reduce costs. Use information systems to reduce costs and time involved in receiving goods and services.	**Invest in information systems** to collect real-time market demand because high emphasis is placed on collecting and sharing accurate and timely data among supply chain members. Ensure visibility with reliable supply chain partners. This will enable organisations to synchronise supply and demand to increase flexibility and reduce variability in demand.
Sourcing (SCD element #3.2.8)	Base selection of suppliers on low prices and acceptable quality standards (cost considerations are most important).	Base selection of suppliers on speed, flexibility, superior quality and dependability (cost considerations are important but of secondary importance).
Pricing (SCD element #3.2.9)	Base profit margins on lower margins and higher volumes.	Base profit margins on higher margins and lower volumes.

Source: Compiled from Raturi and Evans (2005:209); Simchi-Levi *et al*. (2003:52); Simch-Levi *et al*. (2008:201, 202); Hugos (2006:35, 37); Chopra and Meindl (2010:48, 59, 60, 389); Waters (2009:213, 384, 429); Wisner *et al*. (2009:325); Langley *et al*.(2009:348, 422); Jonsson (2008:228); Bozarth and Handfield (2006:344); Bowersox *et al*. (2010:249); Cohen and Roussel (2005:12); Swink *et al*. (2011:428); Cronje (2009:237); Pienaar (2009:306); Christopher (2003:285); Webster (2008:352); Hines (2004:63); Lambert (2006:14) and Bruce *et al* (2004:155).

6.8.7 Analysing KPI categories

Section three (SCD element #3.3) provides an analysis of the *key performance indicator* (KPI) categories on which organisations focus. Certain KPIs are essential for the selected supply chain strategy and are highlighted in the conceptual framework if organisations do not focus on them. Organisations are asked to rank the importance of the following supply chain KPI categories within their organisation in terms of a selected product category (where 1 = most important KPI category and 6 = least important KPI category). The assessment question for analysing supply chain KPI categories is illustrated in Table 6.17. If two or more KPI categories are of equal importance, organisations have to indicate it as such. Organisations have to rate the following KPI categories:

- supply chain delivery reliability;
- supply chain responsiveness;
- supply chain flexibility;
- cost measures within the organisation;
- cost measures across the supply chain; and
- supply chain asset management efficiency.

Table 6.17: Assessment question for analysing supply chain KPIs

Organisations have to rate the relative importance of the following supply chain KPI categories within the organisation in terms of a selected supply chain (where 1 = most important KPI category and 6 = least important KPI category).		
	Supply chain key performance indicator category *(with examples of measures for each category in brackets)*	*Rating (1-6)*
1	**Supply chain delivery reliability** (in terms of fill rates, delivery performance, perfect orders) (with these KPIs it is all about being reliable with regard to the quality and completeness of orders)	
2	**Supply chain responsiveness** (in terms of order fulfilment lead times) (with these KPIs it is all about being on time with orders)	
3	**Supply chain flexibility** (to adapt to changing customer needs in terms of supply chain response time, production flexibility) (with these KPIs it is all about being flexible regarding changing needs and being able to deliver whatever the customer wants in the required time)	
4	**Cost measures within the organisation** (includes all costs and is measured to see where reductions can be made, as well as to ensure that the organisation is not over spending and stays within budget)	
5	**Cost measures across the supply chain** (sharing cost information with other supply chain members about total supply chain costs, which includes ordering, inventory and distribution costs across all the supply chain members with the aim of reducing supply chain costs of the supply chain as a whole)	
6	**Supply chain asset management efficiency** (reduction of inventory levels; cash-to-cash cycle times, asset turns) (with these KPIs it is all about measuring how overall asset management objectives such as increasing asset turns, reducing inventory levels and reducing cash-to-cash cycle times are being met)	

The conceptual framework for analysis of supply chain KPI categories is illustrated in Figure 6.13. The figure shows organisations which KPI categories are important in their selected supply chain strategy.

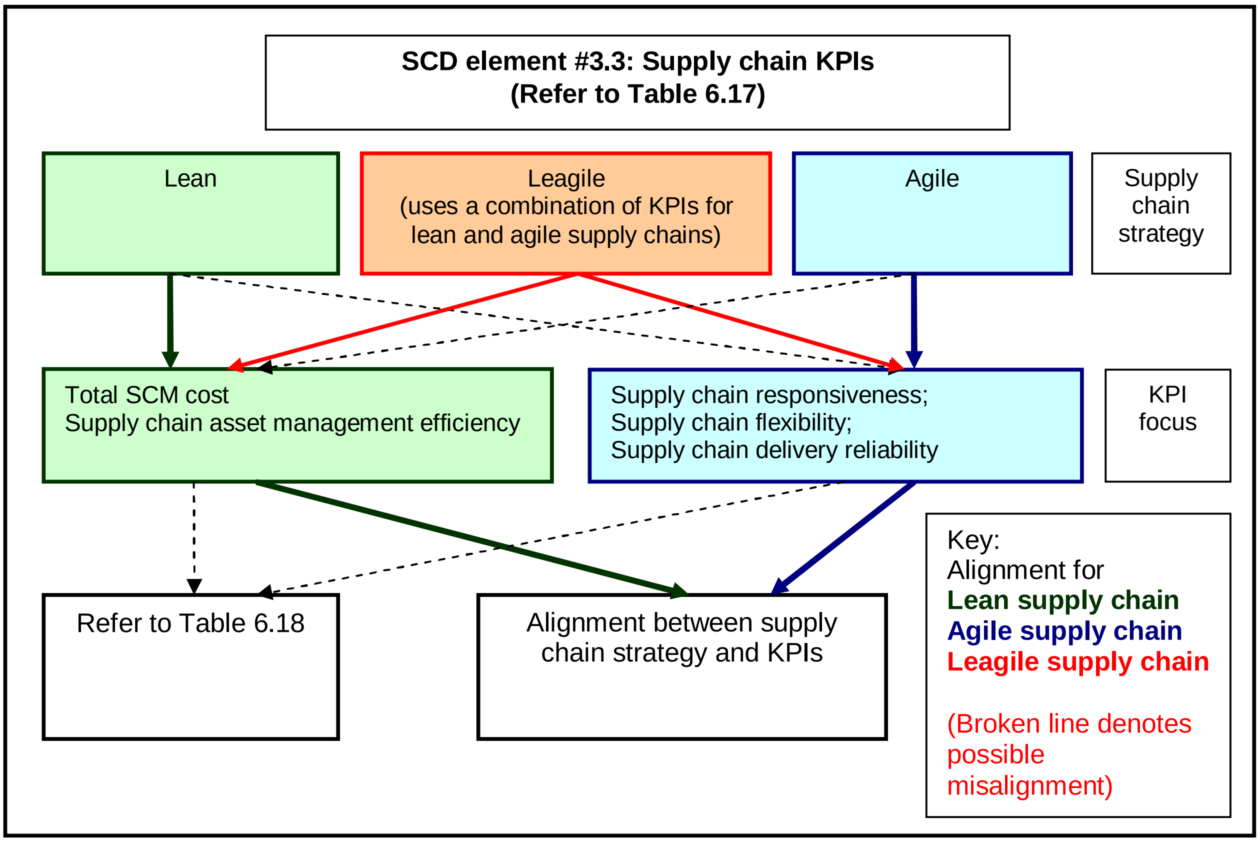

Figure 6.13: Conceptual framework for analysis of SCD element #3.3 in phase three of SCD

Source: Researcher's own.

Organisations with a lean supply chain strategy must focus on cost measures within the organisation and across the supply chain, as well as on supply chain asset management efficiency. Organisations with an agile supply chain strategy must focus on at least delivery reliability, responsiveness and flexibility. Organisations with a leagile supply chain strategy must focus on all the mentioned KPI categories. If organisations do not focus on the correct KPI categories there may be misalignment between their supply chain strategies and the KPI categories on which they are focusing. Table 6.18 can be referred to decide which KPI categories are important for the organisation. This table contains the important KPI categories as identified from the literature and provides suggestions in case of misalignment. The KPI categories for leagile supply chain strategies are not included in Table 6.18 because leagile supply chains should focus on a combination of the KPI categories of both lean and agile supply chains.

Table 6.18: KPI and specific measures for selected supply chain strategies

	Lean supply chain strategy	**Agile supply chain strategy**
KPI category	Supply chain cost Supply chain asset management efficiency	Supply chain delivery reliability Supply chain responsiveness Supply chain flexibility
Market winners measured	Cost	Service level (availability, timeliness, flexibility, innovation, quality, supremacy)
Specific measures	*Cost*: Cost of goods sold Total supply chain costs *Supply chain asset management efficiency:* Cash-to-cash cycles Inventory turns Asset turns	*Reliability*: Delivery performance (such as on-time delivery) (percentage) Fill rates (percentage) Perfect order fulfilment (percentage) *Responsiveness*: Order fulfilment lead times (days) *Flexibility*: Supply chain response time (days) Production flexibility (days)

Source: Compiled from Agarwal and Shankar (2002:32); Christopher and Towill; (2001:237); Reiner and Schodl (2003:312); Taylor (2004:184-189) and Bolstorff and Rosenbaum (2003:51-53, 68).

6.9 SUMMARY OF THE CONCEPTUAL FRAMEWORK

The aim of the conceptual framework is to analyse organisations' SCD practices and to indicate whether their SCD practices are satisfactory (according to set parameters) or are aligned with one another. Therefore, for the testing of the conceptual framework, organisations need to record at least an average extent to which they understand their end customers and how to meet the needs of their end customers (phase one of SCD). If the phase two SCD practices are aligned with one another, the organisation can proceed towards analysing phase three of their SCD practices. In phase three, organisations need to record at least an average extent to which they manage their supply chain partnerships and then manage their supply chain drivers in alignment with their supply chain strategy. In conclusion, organisations must ensure that they focus on the right KPIs to measure their supply chain performance. A broad presentation of alignment between the different phases of SCD is presented in Figure 6.14. The complete conceptual framework is provided in Annexure A at the end of this study.

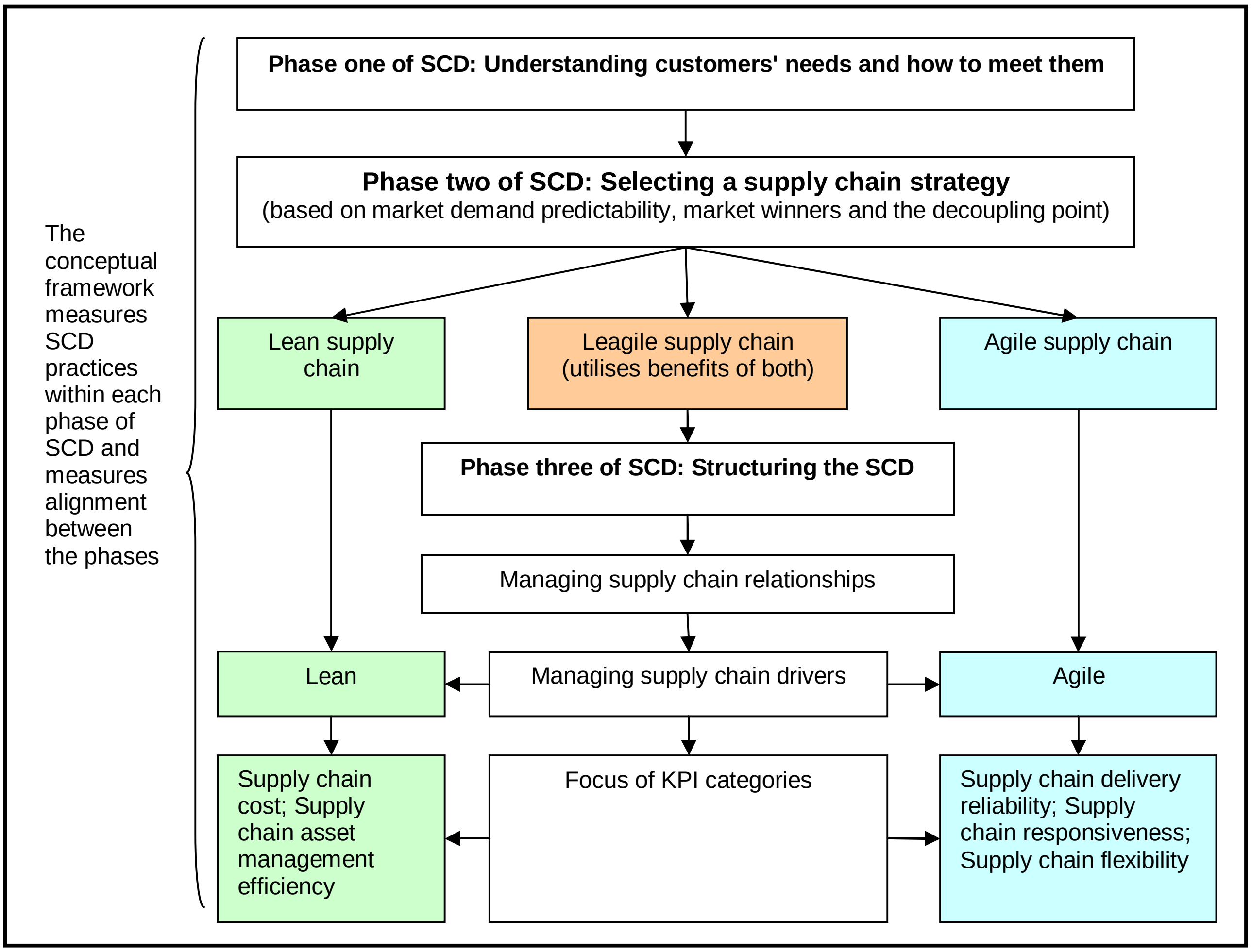

Figure 6.14: Showing alignment between the three phases
Source: Researcher's own.

Figure 6.15 provides a summary of the SCD phases, the questions asked to analyse the design practices and the recommended actions when a misalignment is detected.

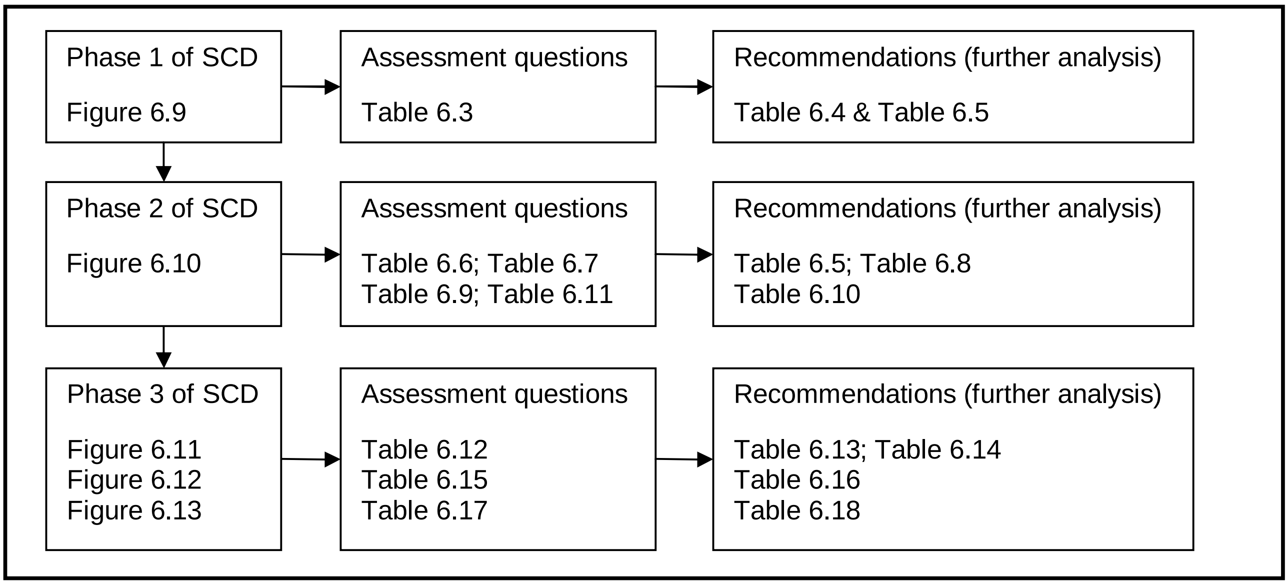

Figure 6.15: Summary of SCD phases, questions and recommendations
Source: Researcher's own.

6.10 CONCLUSION

Chapter 6 has presented the conceptual framework of SCD that was developed on the basis of the extensive literature study. The purpose of the conceptual framework is to analyse organisations' SCD practices. The chapter commenced with the identification from the literature of the SCD elements that needed to be included in the conceptual framework. From the literature study, twelve SCD elements were identified across the three phases of SCD. Organisations need to analyse each SCD element to be able to analyse their SCD practices. To achieve this, assessment questions are asked for each SCD element. The chapter therefore has also introduced assessment questions for each of the twelve SCD elements. Analysis of the responses guided organisations to either proceed to the next assessment question or referred them to tables for further analysis. The possible recommendations or considerations for the improvement of unsatisfactory or misaligned responses were also addressed. Chapter 7 looks at the research methodology followed in the study.

CHAPTER 7
RESEARCH METHODOLOGY

7.1 INTRODUCTION

Chapter 7 describes the methodology used in this research. The main objective of the study was the development of a conceptual framework to analyse SCD practices. Secondary research (literature) played a major role in achieving this objective. As mentioned in Chapter 1, the research conducted for this study comprised two broad phases. The first phase entailed exploratory research from secondary sources on the topic of SCD. Chapters 2 to 5 in this study cover the secondary research on SCD that was conducted. From the literature study, twelve SCD elements were identified. These SCD elements were used to construct the conceptual framework discussed in Chapter 6. This formed the first part of the research. The conceptual framework was developed from the secondary sources and needed to be tested through primary research. The explorative testing of the conceptual framework formed part two of the research. This is illustrated in Figure 7.1.

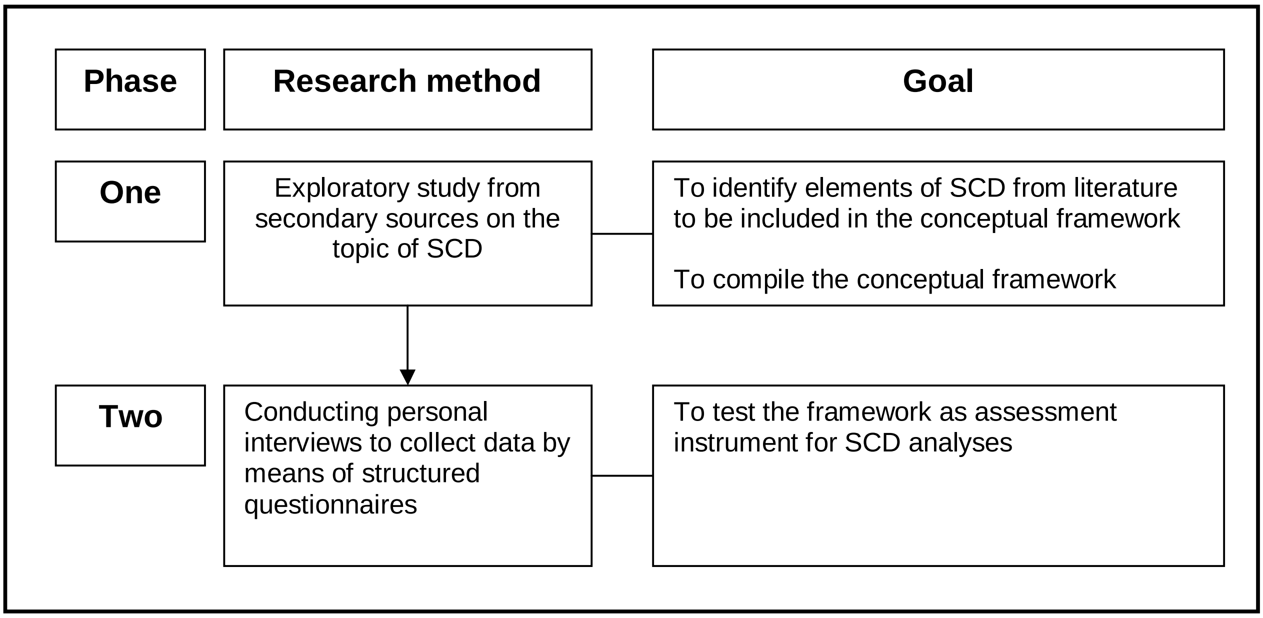

Figure 7.1: The broad phases of research conducted in this study

Chapter 7 starts by defining and illustrating the business research process. In this process, the problem statement as well as the research objectives, is stated. The chapter covers the research design and the selection of the respondents through a sample design. The business research process concludes by discussing how the data were collected and analysed and are to be included in the preparation of a business report (last step in business research).

7.2 DEFINING BUSINESS RESEARCH

Business research can be defined as the application of the scientific method in searching for the truth about business phenomena. These activities include defining business opportunities and problems, generating and evaluating ideas, monitoring performance and understanding the business process (Zikmund, Babin, Carr & Griffin, 2010:5). When conducting research, researchers gather data which are then analysed and interpreted. Data are raw, unanalysed facts. It is only when the data have been processed that they become information (Hair, Bush & Ortinau, 2000:32).

Data can be classified as either secondary or primary and may also be quantitative or qualitative. Secondary data comprise information that has already been collected, assembled and interpreted at least once for some or other specific situation as seen in Chapters 2 to 5 in this study. Primary data, on the other hand refer to first-hand information, facts or estimates that are derived through a formalised research process for a specific current problem or opportunity situation (Hair *et al*., 2000:663, 661). These issues are elaborated on later in this chapter.

Business research involves a sequence of highly interrelated activities. The stages of the research process overlap continuously. Also, every research process has a different ordered sequence of activities. Nevertheless, business research often follows a general pattern of the following stages (Zikmund *et al*., 2010:61), which are illustrated in Figure 7.2:

- stage one: defining the research objectives;
- stage two: planning the research design;
- stage three: planning a sample;
- stage four: gathering the data;
- stage five: processing and analysing the data; and
- stage six: drawing conclusions and reporting the research.

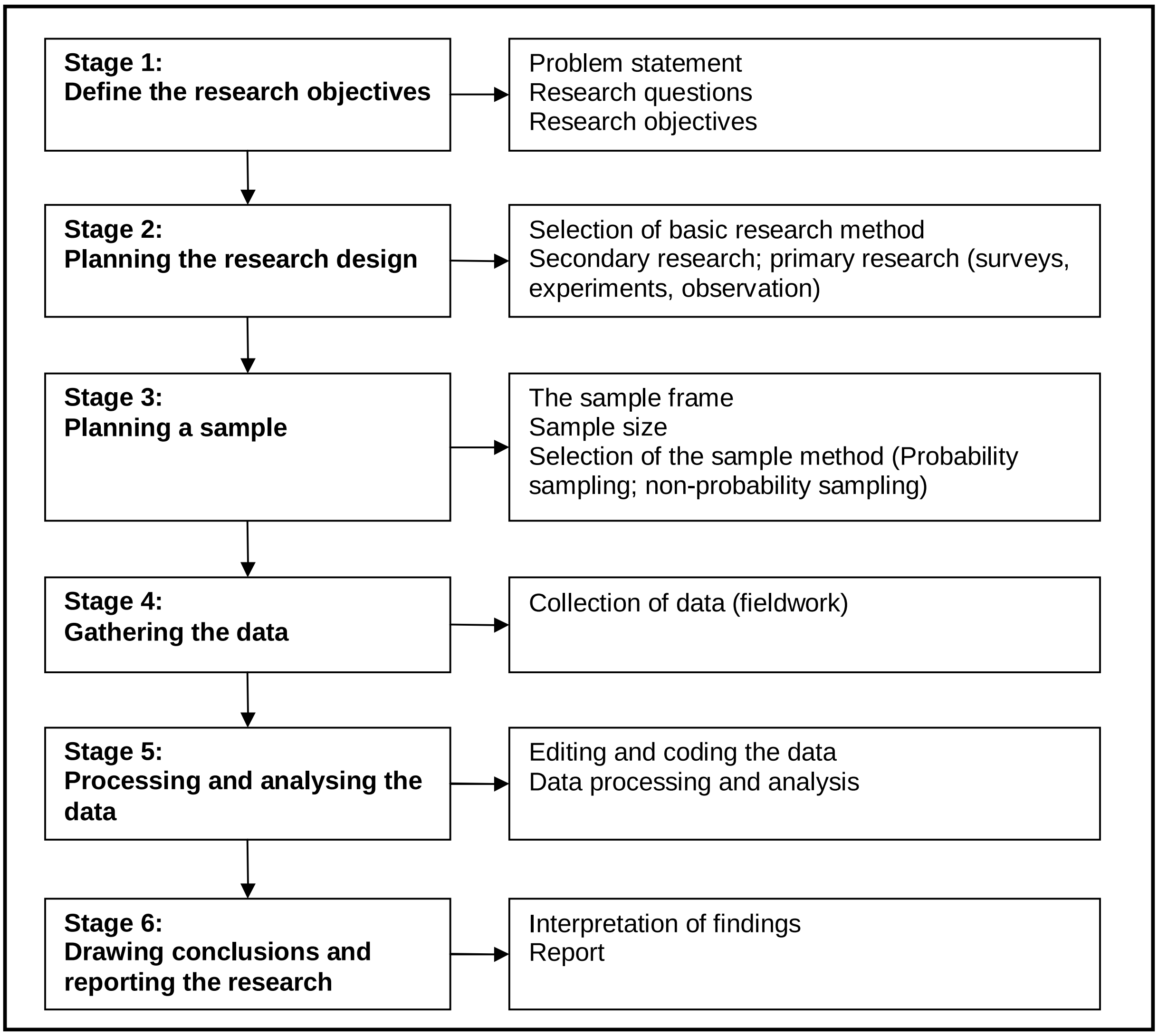

Figure 7.2: The business research process
Source: Adapted from Zikmund *et al*. (2010:61).

7.3 STAGE ONE: DEFINING THE RESEARCH OBJECTIVES

The research process starts with defining research objectives. Research objectives are the goals to be achieved by conducting the research (Zikmund *et al*., 2010:63). However, defining the research objectives frequently happen once a problem area has been discovered (Zikmund *et al*., 2010:64). Problems arise where there is some discrepancy between an actual, current or anticipated future performance and a desired performance (Kent, 2007:13). A problem thus occurs when there is a difference between the current conditions and a more preferable set of conditions (Zikmund *et al*., 2010:112). Such a problem has to be identified and defined.

7.3.1 The problem statement

The problem definition is the process of defining and developing a decision statement and the steps involved in translating it into more precise research terminology, including a set of research objectives (Zikmund *et al*., 2010:108). This may be the most important stage in the research process (Wegner, 2000:16). If the problem or opportunity is not properly defined, the data gathered may result in findings that do not answer the research question(s).

In Chapter 1 of this study it was made clear that one of the greatest opportunities that organisations face today is SCM as it has the potential to enable continued growth and success (Timme, 2004:5). However, SCM is also one of the biggest challenges facing organisations (Hugos, 2006:ix) and it is difficult to master (Taylor, 2004:21) because of its complex nature (Wu & O'Grady, 2005:444; Childerhouse & Towill, 2004:586). SCD forms an integral part of SCM (refer to section 1.2) and involves an important decision (Santoso *et al*, 2004:96). The design (or structure) of a supply chain is an important core capability of an organisation because it enables or limits the organisation's competitiveness. However, SCD is a demanding and complex process (Fawcett *et al*, 2007: 337) and it has become a major challenge for organisations (Shen & Daskin, 2005:188). In fact, the big challenge in evaluating possible improvements in the supply chain lies in the complex structure of the supply chain (Reiner & Trcka, 2003:219).

7.3.2 The research questions of the study

Problem definitions result in the formulation of research questions and research objectives (Zikmund *et al*., 2010:120). Research questions express the research objectives in terms of questions that can be addressed by research (Zikmund *et al*., 2010:121). The research question should be a fact-oriented, information gathering question. It is a more specific management question that must be answered (Cooper & Schindler, 2003:73). The problem statement of this study was therefore formulated in the main research question, which was:

What are the elements of SCD and how can these elements be included in a *framework to analyse organisations' SCD practices with the aim of improving supply chain performance?*

Based on the problem statement of this study, the following research questions (RQ) were asked:

RQ 1: Which elements (or characteristics) can be identified for designing supply chains?

RQ 2: Can the elements of SCD be used to develop a conceptual framework to be used by organisations to analyse their SCD practices?

RQ 3: Will the conceptual framework help organisations to determine:

3.1 the extent to which they understand the needs of the supply chain's end customers and show them how to improve related practices, if necessary?
3.2 the extent to which they know how to meet the needs of their customers and show them how to improve related practices, if necessary?
3.3 the supply chain strategy they are focusing on and whether the supply chain strategy is aligned towards meeting the needs of their supply chain's end customers?
3.4 the extent to which they are managing their supply chain partners and show them how to improve related practices, if necessary?
3.5 how they are managing their supply chain drivers and whether it is aligned with their supply chain strategy and make recommendations, if necessary?
3.6 whether they are focusing on the correct supply chain KPIs to measure supply chain performance based on their supply chain strategy and make recommendations, if necessary?

7.3.3 The research objectives of the study

Research objectives are the goals to be achieved by conducting research (Zikmund *et al*., 2010:63). Such objectives spell out what the research itself is designed to explore, describe, investigate or explain (Kent, 2007:17). After identifying and clarifying the problem statement, the research objectives must be formally stated (Zikmund *et al*., 2010:66) in terms of the precise information required. The objectives of the study were formulated with regard to the above-mentioned and were met. The main objective of this study was to develop a conceptual framework from literature that could be used by organisations to analyse their SCD practices with the aim of improving performance. To achieve the main objective, the study also comprised of several secondary objectives. The secondary objectives of the study were therefore to:

- determine the elements of SCD by means of an extensive literature study about SCD;
- exploratively test the conceptual framework to determine whether it was a usable assessment instrument in terms of helping organisations to determine:

- the extent to which they understand the needs of their supply chain's end customers;
- the extent to which they know how to meet the needs of their customers;
- the supply chain strategy on which they are focusing ;
- whether their supply chain strategy is aligned towards meeting the needs of the end customers in the supply chain;
- the extent to which supply chain partners are managed;
- how supply chain drivers are managed and whether it is aligned with their supply chain strategy;
- whether their focus is on the correct supply chain KPI categories for their supply chain strategy; and
- whether the conceptual framework contributed to improvement of these practices by offering recommendations, if necessary, within each component of the framework.

Several SCD elements identified from the literature study were used to develop a conceptual framework for assisting organisations in analysing their SCD practices. Empirical research was conducted to determine answers to the abovementioned research questions and to exploratively test the identified SCD elements (as identified from literature). The problem statement and main objectives of this study can be illustrated as follows:

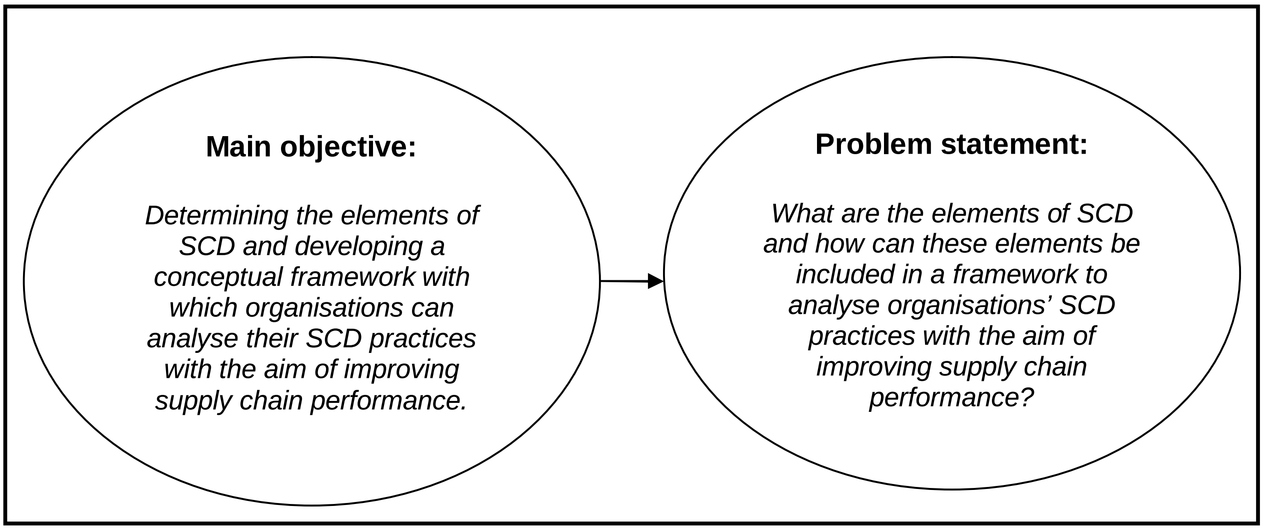

Figure 7.3: Problem statement and main objective of the study

7.4 STAGE TWO: PLANNING THE RESEARCH DESIGN

After research objectives are formulated, the research design must be developed. The purpose of the research design is to ensure that the evidence to be obtained will enable the researcher to address the objectives for which the research is to be undertaken (Kent, 2007:252). Therefore, the research design is the plan to be followed to realise the research objectives (Tustin, Ligthelm, Martins & Van Wyk, 2005:82; Cooper & Schindler, 2003:81). The research design is a preliminary plan for conducting research. The research design is the master plan that specifies the methods and procedures for collecting and analysing the needed information. As the research design provides a framework or plan of action for the research to address the research problems or opportunities, the objectives of the study determined during the early stages of research are included in the design to ensure that the information collected is appropriate for solving the problem. The sources of information, the design techniques and the sampling methodology must be determined (Zikmund *et al*., 2010:66). There is no single best research design. Ultimately trade-offs between, for example, research costs and the quality of the research information provided, or time constraints and type of research design are typically involved (Tustin *et al*., 2005:82). The various research approaches and the data collection methods that accompany each design are shown in Figure 7.4.

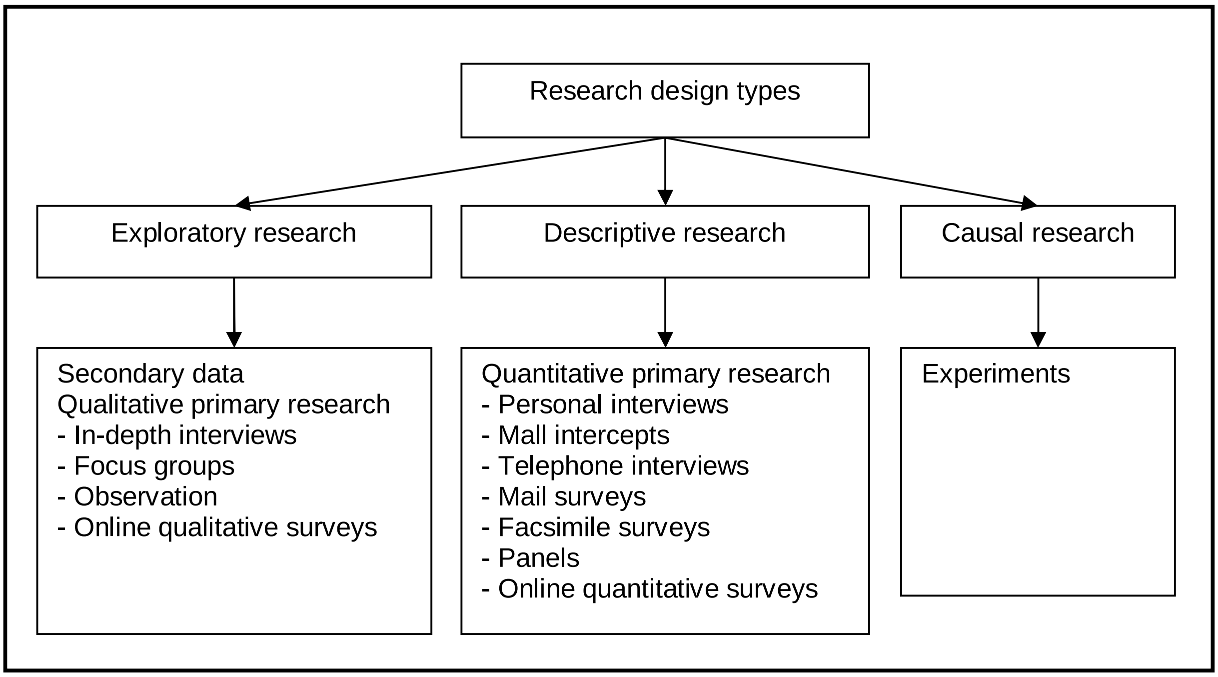

Figure 7.4: Classification of research approaches and data collection methods
Source: Adapted from Tustin *et al*. (2005:83).

Figure 7.4 shows that research designs can be classified under three main categories, namely exploratory, descriptive and causal research. There are thus three basic types of business research.

Exploratory research is conducted to clarify ambiguous situations or discover potential business opportunities (Zikmund *et al*., 2010:54). It is used when searching for insights into the general nature of the problem, the possible alternative decisions and relevant variables that need to be considered (Tustin *et al*., 2005:84). Exploratory research is thus research aimed at generating ideas, insights or hypotheses (Kent, 2007:17); it is not intended to provide conclusive evidence from which to determine a particular course of action. In this sense, exploratory research is not an end unto itself. Usually exploratory research is a first step, conducted with the expectation that additional research will be needed to provide more conclusive evidence. It is often used to guide and refine these subsequent research efforts (Zikmund *et al*., 2010:54). Exploratory research is particularly useful in new product development (Zikmund *et al*., 2010:55). The research methods used under an exploratory research design are qualitative, which includes literature reviews as well as in-depth interviews (Tustin *et al*., 2005:84), which may be unstructured or semi-structured (Wright, 2008:165).

Descriptive research is usually characterised as being concerned with measuring or estimating the sizes, quantities, or frequencies of things (Kent, 2007:18). It therefore describes characteristics of objects, people, groups, organisations or environments, addressing the who, what, when, where and how questions of research. Descriptive research is conducted after the researcher has gained a firm grasp of the situation being studied and directs the study toward specific issues. Research questions help to design and implement a descriptive study (Zikmund *et al*., 2010:55). The research methods used in a descriptive research design are structured and quantitative. In-house personal interviews, intercept surveys, telephone interviewing, mail surveys, and on-line qualitative surveys are typical descriptive approaches (Tustin *et al*., 2005:86). For exploratory and descriptive research, the objective may simply be to collect the information that has been specified at the research design stage (Kent, 2007:18).

Causal research seeks to identify cause-and-effect relationships. When something causes an effect it means it brings it about or makes it happen. The effect is the outcome (Zikmund *et al*., 2010:57). The researcher thus investigates whether one variable causes or determines the value of another variable. Experiments can be used to measure causality (Tustin *et al*., 2005:87).

From this, it is evident that the nature of this study was exploratory and descriptive. A literature study was conducted to identify the elements of SCD and thus to gain insight into improving SCD practices. It was a first step in developing a conceptual framework to analyse SCD practices. Exploratory research, as mentioned above, is often used to develop new products such as the conceptual framework, which is a new theoretical instrument developed from literature. In-depth interviews conducted in practice contributed to the testing of the instrument. The study also included descriptive research. The characteristics of organisations' SCDs were determined by means of structured questions. The literature study and in-depth interviews are characteristic of exploratory research while the structured questions are characteristic of descriptive research.

7.4.1 Conducting secondary research

There are two main groupings when collecting data. These options are secondary and primary data. Secondary data involve information that already exists, while primary data refer to primary information that has been collected for a specific purpose (Wilson, 2008:147; Hair *et al*., 2000:39; Cant, 2005b:48). Primary data collection methods are discussed in the next section.

Secondary data is used in many studies because it can be obtained at a fraction of the cost and time involved in primary data collection (Wilson, 2008:148). The secondary objectives of this research clearly necessitated a thorough literature study on the topic of SCD. The topic of SCD was discussed in three sections (refer to Chapters 2 to 5). These sections are: (1) understanding the needs of the supply chain's end customers and determining how to meet them, (2) selecting a supply chain strategy and (3) the scoping the supply chain structure. From the literature study, a conceptual framework was proposed to assist organisations in analysing their SCD practices (refer to Chapter 6).

Numerous sources were consulted in the literature study. The main sources included books written by authors specifically on the topics of SCM and SCD, relevant articles in journals or accessed from the Internet, as well as supply chain-focused papers delivered at conferences. Other sources included talks and meetings with supply chain practitioners and academics.

7.4.2 Conducting primary research

Primary data are data gathered for the first time. It is collected specifically to address the research objectives, and if the secondary research is assessed as being inadequate for the research objectives. When conducting primary research, the researcher needs to decide on the most appropriate research method (qualitative or quantitative research) as well as the primary method of collection (Tustin *et al*., 2005:89).

7.4.2.1 Quantitative and qualitative research

Quantitative research generally involves the collection of primary data from large numbers of individuals with the intention of projecting the results to a wider population. The aim is to generalise about a specific population, on the basis of results obtained from a representative sample of that population. The research findings may then be subjected to mathematical or statistical manipulation to produce broadly representative data of the total population and forecasts of future events under different conditions (Tustin *et al*., 2005:89). Quantitative research is thus carried out to determine, for example, how many people have similar characteristics and views about something. Quantitative research is appropriate for the examination of specific data from large numbers and entails large samples of the target population answering structured questions. The findings can then be statistically analysed with precise estimations which means that the results are considered to be valid and reliable (Pellissier, 2007:19).

Qualitative research generates data that are frequently difficult to quantify. This research approach is often expressed as personal value judgments from which it is difficult to draw any collective general conclusions. Typical methods include in-depth interviews which are based on small purposive samples. Analysis of the data is more plainly interpretive and subjective than in quantitative research (Tustin *et al*., 2005:90). The validity of qualitative research can be questioned because of the different opinions of experts who take different stances towards the research approach that was selected. However, validity is proven when the concept or characteristic in question can be measured in a systematic way by means of the method used (Pellissier, 2007:20).

The difference between quantitative and qualitative research methods is based on sampling methodology and not the type of data generated from the survey. Qualitative research can generate quantitative information but this information cannot be generalised to the total population. Because small samples are drawn, this is applicable only to the sample population (Tustin *et al*., 2005:91). The differences between qualitative and quantitative research is presented in Table 7.1.

Table 7.1: Quantitative and qualitative research

Comparison dimension	Qualitative research	Quantitative research
Types of questions	Probing	Limited probing
Sample size	Small	Large
Information per respondent	Much	Varies
Administration	Requires interviewer with special skills	Fewer special skills required
Type of analysis	Subjective, interpretive	Statistical, summarisation
Hardware	Tape recorders, projection devices, videos, pictures, discussion guides	Questionnaires, computers, printouts
Ability to replicate	Low	High
Researcher training	Psychology, sociology, social psychology, consumer behaviour, marketing, marketing research	Statistics, decision models, decision support systems, computer programming, marketing, marketing research
Type of research	Exploratory	Descriptive or causal

Source: McDaniel and Gates (2001:109).

Several quantitative and qualitative methods may be combined in the same research project. A hybrid of these methodologies where quantitative and qualitative research is combined is often considered to maximise the strengths and overcome the weaknesses of the two approaches. This method is known as triangulation. Qualitative interviews may be conducted in a small number of in-depth interviews at the same time when or in the same place where the questionnaire is being administered (Tustin *et al*., 2005:91).

This study used triangulation, a combination of both quantitative and qualitative research methods. Qualitative research was used to compile the conceptual framework from literature and in-depth personal interviews were conducted using a small sample. A questionnaire was developed to cover all the areas of the framework. A structured questionnaire was necessary to ensure that various respondents would respond in the same manner for similar scenarios. This was necessary to ensure that the conceptual framework can be used reliably to analyse similar SCD practices. Quantitative research was thus used in the form of a structured questionnaire.

7.4.2.2 Primary research collection methods

There are three basic primary research collection methods, namely observational, experimental and survey research (Malhotra, 2004:187). No particular method is the best method in all cases. Depending on the problem, or opportunity, one or more methods may be appropriate. The different methods that can be used to conduct primary research are illustrated in Figure 7.5. The methods used in this study are highlighted.

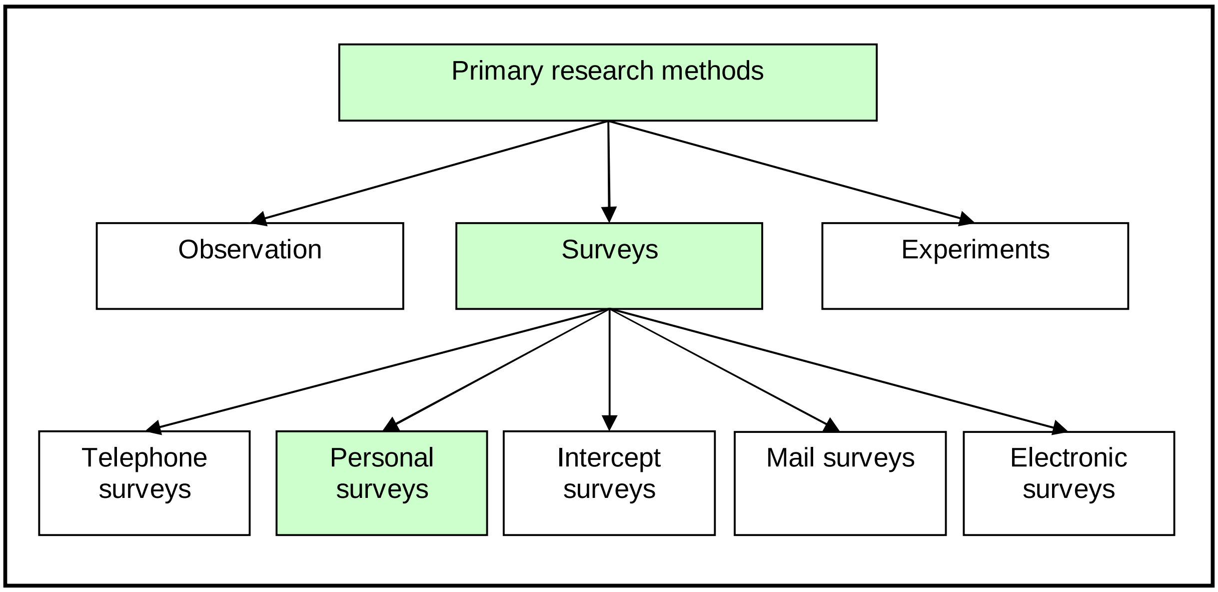

Figure 7.5: Primary research methods
Source: Compiled from Malhotra (2004:170, 187); McDaniel & Gates (2001:223) and Tustin (2005:95).

Observation research is descriptive research that monitors respondents' actions without direct interaction with the respondents (Cant, 2005b:50). It is a data gathering approach where information is collected on the behaviour of people, objects and organisations without any questions being asked of the participants. Researchers can use equipment or humans to observe people and situations (Wilson, 2008:148). Observation has several advantages. The researcher can observe what people are doing, rather than rely on what they say, which will reduce interviewer and respondent errors. The researcher is also not subject to problems associated with the respondent's willingness and ability to answer questions (McDaniel & Gates, 2001:46), therefore there are no distortions or inaccuracies because of memory error or social desirability bias (Wilson, 2008:148). One of the disadvantages of observation as primary research method is that usually only the respondent's behaviour and physical personal characteristics can be examined while the research is being conducted (McDaniel & Gates, 2001:46). In this study, the SCD of organisations had to be analysed and tested, which needed specific information that could not necessarily be gathered by means of observation. Observation could thus not be used as primary research method.

Experimental research measures causality (Cant, 2005b:50). The researcher changes one or more variables and the effect of the changes on another variable is observed. Variables are tested under controlled situations. In this study, variables were not manipulated.

Survey is a form of research where the researcher interacts with respondents to obtain facts, opinions and attitudes (McDaniel & Gates, 2001:30). In business research, the most common method of generating primary data is the survey. A survey is a research technique in which a sample is interviewed in some form, or the behaviour of respondents is observed and described in some way (Zikmund *et al*., 2010:67). The survey as primary research method was deemed to be the most appropriate method of conducting the primary research on organisations' SCD practices. Surveys may be done via the telephone, mail, on the Internet or in person (Zikmund *et al*., 2010:67). In this study, personal interviews were used as survey method. Table 7.2 provides a comparison of the different forms of the survey research method.

Table 7.2: Comparing different survey methods

	Mail survey	**Telephone survey**	**Intercept survey**	**Personal survey**
Questionnaire issues				
Length	Restrict to 4 pages	20 minutes or more	Restrict to 5 minutes	An hour or more
Open-ended responses	Serious problem	Some problem	Some problem	No problem
Probing	Not possible	Possible	Possible	Most appropriate
Complex questions	Serious problem	Some problem	Some problem	No problem
Number of response categories	No limit	Restrict to 4	No limit if cards are shown	No limit if cards are shown
Branching	Serious problem	No problem	No problem	No problem
Question order	No control	Controlled	Controlled	Controlled
Sampling issues				
Population coverage	No problem if sample frame exists	Usually no problem	May be a problem	Usually no problem
Response rate	10-60%	50-70%	<50%	50-90%
Identity of respondent	Not known	Known	Known	Known
Cost				
Cost per interview	$5-10	$10-25	$10-20	>$200

Source: Tustin *et al*. (2005:95)

Individual in-depth interviews are interviews that are conducted face-to-face, in which the subject matter of the interview is explored in detail using an unstructured and flexible approach. As with all qualitative research, in-depth interviews are used to develop a deeper understanding of attitudes and the reasons behind specific behaviours (Wilson, 2008:149). Unlike quantitative research which collects data for statistical analysis, the data gathered in qualitative research ranges from the unstructured to the semi-structured kind. Unstructured qualitative research relies on innumerable tangible and intangible forms of self-expression by respondents. Semi-structured qualitative research normally involves a questionnaire as the research instrument by which respondents are asked to tick boxes to indicate their preference and to rate or rank a product, service, or corporate entity, usually in terms of whether the respondents think favourably or not towards these. It gives flexibility where numbers are required for coding, either manually or electronically by qualitative software (Wright, 2008:165). In this study, semi-structured qualitative research was conducted by means of in-depth interviews using a structured questionnaire.

7.4.2.3 The assessment instrument (questionnaire)

The questionnaire was compiled from the conceptual framework. The purpose of the questionnaire was to communicate with the respondents about the SCD elements. From their responses on the questionnaire certain conclusions were drawn regarding their SCD practices. Where the response was unsatisfactory or misaligned (refer to section 6.5), the conceptual framework could identify possible problem areas and provide possible recommendations.

Due to the nature of the conceptual framework, the questionnaire used in the study will be referred to as the assessment instrument. In essence, the assessment instrument design involves the construction of questions and response options based on the research objectives. The main purpose of the assessment instrument design is to collect information that will resolve the management research problems (Tustin *et al*., 2005:98). The purpose of the assessment instrument design is to ensure that (Tustin *et al*., 2005:387):

- relevant data are collected;

- data can be compared;
- bias is minimised; and
- respondents are motivated to participate in the survey.

The structure of the assessment instrument used in this study did comply with these matters. The assessment instrument design is influenced by the type of research being conducted, namely exploratory, descriptive or causal, as well as by the way in which it is concluded (observations, experiments or surveys). Important issues to consider with questionnaire design are (Kent, 2007:155-169):

- question formats;
- question content;
- question wording;
- questions sequence;
- the length of the assessment instrument; and
- the layout of the assessment instrument.

In essence, the assessment instrument design is based on the amount of freedom that respondents have in answering. Assessment instruments can be open ended or closed ended (Zikmund *et al*., 2010:338). Open-ended questions ask respondents to reply in their own words, whereas closed-ended questions ask respondents to choose between two or more answers (McDaniel & Gates, 2001:295, 298; Tustin *et al*., 2005:98). Some of the close-ended questions include non-comparative scales such as the Likert scale (Cant, 2003:112-113). The Likert response format presents a series of attitudes toward an object, which are assigned numerical values ranging from, for example, favourable to unfavourable (McDaniel & Gates, 2001:274). Structured questions are designed prior to interviewing and are used to conduct, for example, face-to-face home interviews, mail surveys, e-mail surveys, mall intercepts, and observational studies. Unstructured questions are derived from structured questions and are altered or designed during the interview (Tustin *et al*., 2005:98).

At this stage it is also important to think about how the data will be processed. Because SPSS was used as statistical analysis package, it was necessary to be clear as to which variables needed to be metric and which variables could be categorical

(Kent, 2007:153). The wording of the assessment instrument is important. It is frustrating when respondents misunderstand a question because of incorrect wording (Cooper & Schindler, 2003:369). Changing one word in an assessment instrument can make a difference to how respondents respond to a question. Three conditions need to be satisfied to maximise the possibility of obtaining valid responses, namely (Kent, 2007:161):

- Respondents must understand the questions;
- Respondents must be able to provide the answers; and
- Respondents must be willing to provide the information.

Therefore, long words, leading questions, and complex (or vague) questions must be avoided (Kent, 2007:161).

The question sequence may serve several functions for the researcher (Zikmund *et al*., 2010:349). In general, the assessment instrument should begin with simple questions that relate clearly to the topic that the respondent has been led to believe the survey is about (Kent, 2007:163). If the length of the assessment instrument is too long, it may have an impact on the respondent's willingness to complete the assessment instrument (Kent, 2007:164). To keep the assessment instrument within reasonable limits the researcher must make sure that every question is necessary (Kent, 2007:165). Good layout of the assessment instrument is important (Zikmund *et al*., 2010:352) because space is at a premium in an assessment instrument. If space is wasted, the assessment instrument will seem too long (Kent, 2007:167).

Due to the complex nature of this study, an extensive assessment instrument was developed to serve as basis for the conceptual framework. The functioning of the conceptual framework entails the usage of an assessment instrument which uses questions as a basis for gathering information from which organisations' SCD practices can be analysed. This made the use of a structured assessment instrument a necessity in this research. The assessment instrument was developed over a period of three months to ensure that the above-mentioned issues were in place. The question formats, content and wording were revised continually by the researcher and a statistician to try and ensure that respondents would understand exactly what was being asked (or referred to) in the assessment instrument. Definitions and relevant supply chain concepts were included, where necessary, to ensure that respondents understood exactly what was implied in each question of the assessment instrument. The question sequence in the assessment instrument was based on the sequence of the phases of SCD, and thus also the conceptual framework.

Initially, the length of the assessment instrument was more than twice the length of the final assessment instrument design. However, it would have required at least two hours of respondents' time to complete the instrument. After numerous revisions, the length of the assessment instrument was finalised to its current length. The assessment instrument could not be too long as this could have resulted in even fewer respondents participating in the study. On the other hand, the assessment instrument could not be too short as this could have resulted in important information not being gathered. An example of the final assessment instrument is provided in Annexure B at the end of the study. The assessment instrument consisted of six broad categories (refer to Annexure B). The majority of the questions in the assessment instrument that was used in this study were structured and closed-ended questions. However, some open-ended questions were also included to ensure that specific information that might have had an effect on the responses of the respondents was included.

Since the aim of the study was the development of a conceptual framework to analyse SCD practices, measurement scales were included to enable assessment. The following scales were used in the questionnaire of this study (Malhotra, 2004:236-237):

- Nominal scales. A nominal scale uses numbers to identify and classify objects (e.g. yes or no).
- Ordinal scales. In an ordinal scale, the numbers assigned indicate the relative positions of the objects but not the magnitude of differences between them (e.g. 1= little extent; 2= average extent; 3= high extent and 4= very high extent).
- Interval scales. In an interval scale, the differences between objects can be compared and the zero point is arbitrary.

The measurement scales that were used in this study for each section of the assessment instrument (for each phase of SCD) are presented in Table 7.3.

Table 7.3: Measurement scales used in the research questionnaire

	Section in the assessment instrument	Measurement scale
	Section a: Broad supply chain planning practices	Nominal
1	Phase 1 of SCD	Ordinal
2	Phase 2 of SCD	Ordinal
3	Phase 3 of SCD	Ordinal
4	Supply chain performance	Ordinal
5	Demographic information	Nominal

An essential step prior to collecting the data was to pilot test the draft assessment instrument. Pilot testing of assessment instruments identifies the shortcomings which can be resolved before the full study commences (Wegner, 2000:95). The weaknesses in design and format can be detected and improved with a pilot test (Cooper & Schindler, 2003:86). The assessment instrument used in this research was pilot tested with three respondents, who were from the manufacturing, distribution and retail sectors. The responses of the respondents were included in the findings of the study. Each question in the assessment instrument was carefully scrutinised to make sure that the concepts in the questions were understood and to make sure that the research objectives were not compromised. The average length of each of the three interviews to pilot test the assessment instrument was about ninety minutes.

7.5 STAGE THREE: PLANNING A SAMPLE

Determining the sample involves specifying the types of respondent to be included in the research; the numbers of respondents required; and the method by which individual respondents will be selected (Wilson, 2008:153). When conducting primary research it is important for researchers to select respondents who are representative of all the elements (the total group of people) from whom the information is needed. This is known as the population or universe (McDaniel & Gates, 2001:328). Depending on the problem or opportunity, the researcher will conduct the research using a census or a sample. In a census, data are obtained from about every member of the population of interest (Hair *et al.*, 2000:39). Sampling involves any procedure that draws conclusions based on measurements of a portion of the population. A sample is thus a subset from a larger population (Zikmund *et al*., 2010:68). Because census research is costly, researchers usually draw a sample from the population in which they are interested (Hair *et al*., 2000:39). Important questions to ask during the sampling process concern who is to be sampled, what the sample size should be and how the sample should be selected (Zikmund *et al*., 2010:69). In this study, a sample was drawn.

7.5.1 The sample frame

The sample frame is a list of elements from which the sample is actually drawn (Cooper & Schindler, 2003:188), while a research frame refers to all the elements from which information can be gathered to solve a research problem or opportunity (McDaniel & Gates, 2001:328). The target population for the research from which relevant respondents have to be selected has to be identified (Cooper & Schindler, 2003:82). The research population for the current research included all South African organisations involved in supply chains of products. Therefore it was really obvious that a sample had to be drawn and that it was a complicated and difficult process to decide which organisations to include in the research frame due to the vast numbers of products available to customers. Each product has a supply chain which forms part of an organisation's supply chain design. As already mentioned, the main contribution of this study was the development of the conceptual framework from literature sources and the objective of the empirical research was to test the conceptual framework exploratively. Further research needs to be conducted to verify the assessment instrument as a reliable instrument.

The selection of specific supply chains (of tangible products) to test the conceptual framework was based on specific functional and innovative products. Supply chain designs are based on the nature of their product offerings (refer to Chapter 2), which can be functional or innovative. Examples of categories of functional products are groceries, food, basic apparel and gas (or petrol). Examples of categories of innovative products are fashion apparel, computers and telecommunications (Lee, 2002:108).

Any SCD should start with the needs of end customers in mind. For this reason, the selection of products (and SCDs) with which the conceptual framework was to be tested was based on end customers' needs. The Sunday Times Top Brands surveys of 2009 and 2008 were used as points of departure to determine which brands of products were popular in the minds of end customers. Each of these brands was also rated in different brand categories. Table 7.4 shows the top brands of 2009 according to the Sunday Times top brands survey, as well as the brand categories in which they were rated individually during the past two years as well.

Table 7.4: Top 2009 Brands (Sunday Times brands survey)

Rating	Brand	Brand category	Functional/ innovative product (according to literature)
1	Coca-Cola	Soft drinks	Functional
2	Vodacom	Network provider	Innovative
3	Koo	Food kept on the shelf	Functional
4	Nike	Sports clothing; coolest brand	Innovative
5	Clover	Food kept in the fridge; fruit juices	Functional
6	KFC	Fast foods	Functional
7	SAB	Beers	Functional
8	Nokia	Cellular phones	Innovative
9	Levi's	Coolest brand	Innovative
10	BMW	Cars	Innovative

Source: Compiled from Doke (2009:3); Gillingham (2009a:4); Gillingham (2009b:26); Peacock (2009a:11); Peacock (2009b:14); Anonymous (2009a:29); Doke (2008:3) and Anonymous (2008:24).

By considering the examples of product categories of functional and innovative products (as mentioned earlier), as well as the categories in which the top brands were rated according to the Sunday Times Top brands survey, the top brands of 2009 can be regrouped together into four groups. These groups are presented in Table 7.5. The categories in which the brands were rated are indicated in brackets.

Table 7.5: Top brands and brand categories

Functional products	*Innovative products*		
Food (and drinks)	*Telecommunication*	*Fashion apparel*	*Automobiles*
Coca-Cola (soft drinks) **Koo** (food kept on the shelf) **Clover** (Food kept in the fridge and fruit juices) **KFC** (fast foods) **SAB** (Beers)	**Vodacom** (Network provider) **Nokia** (Cellular phones Consumer)	**Nike** (Sports clothing and coolest brand) **Levi's** (coolest brand)	**BMW**[7]* (Cars - consumer)

Source: Compiled from Doke (2009:3); Gillingham (2009a:4); Gillingham (2009b:26); Peacock (2009a:11); Peacock (2009b:14); Anonymous (2009a:29); Doke (2008:3) and Anonymous (2008:24).

[7] BMW was considered an innovative product due to the product characteristics of innovative products (refer to Chapter two).

The top three brands of functional products thus were *Coca-Cola*, *Koo* and *Clover* (Doke 2009:3). *Coca-Cola* and *Koo* were rated in specific brand categories, namely soft drinks and food kept on the shelf (refer to Table 7.5). However, *Clover* was rated in two categories. No specific brand of *Clover* was rated in the *'food kept in the fridge*' category, while *Clover fruit juices* and *Tropika* were specific brands of *Clover* rated in the *fruit juices* category according to the *Sunday Times Top Brands Survey* of 2009 (Anonymous, 2009a:29). This resulted in the selection of *drinks* and *food kept on the shelf* as brand categories for the empirical research. To specify the sample frame from which organisations (respondents) could be drawn, *drinks* were sub-divided into *soft drinks*, *fruit juices* and *beers,* while *food kept on the shelf* was divided into (1) *rice and maize meal*, (2) *canned food* and (3) *sugar, tea and coffee* (as determined by brand categories according to the Sunday Times Top brands survey of 2008 and 2009). (Gillingham, 2009a:4; Anonymous, 2009a:29; Anonymous, 2008:24).

Similarly, the top three brands for innovative products were *Vodacom*, *Nike* and *Nokia* (Doke, 2009:3). *Vodacom* is a service provider (Peacock, 2009a:11). Service providers could not be selected due to the nature of the research and the research instrument which focused on products. The other top brands for innovative products were *Levi's* and *BMW* (Doke, 2009:3). The brand categories that were selected for the empirical research therefore were *sports clothing*, *cellular phones* and *automobiles (*Anonymous, 2009a:29; Peacock, 2009a:11; Peacock, 2009b:14). Although *Levi's* can also be classified as fashion apparel, it was rated under coolest brand in the Top Brands Survey. Therefore *sports clothing* was selected to represent the *fashion apparel* category. The reasoning was also to include another product category other than automobiles (BMW) and cellular phones (Nokia) as part of the empirical research.

Retailers have increasingly taken a leadership position in their respective supply chains (Levy & Weitz, 2007:269), therefore the retailers of these brands were also included in the sample frame of the empirical research. The top retail brands that sell soft drinks, fruit juices and food kept on the shelf were Pick 'n Pay, Shoprite, Spar and Woolworths (Anonymous, 2009a:29). Other retail brands that won awards during the 2009 Sunday times retail awards that could be included in the research frame were

Liquor City, Edgars, Totalsports, and Game (Anonymous, 2009b:1). The other retailers were determined via snowballing techniques where the manufacturer or assembler indicated who their major retailers are. The final sample frame of the empirical research is illustrated in Table 7.6 and all the top brands within the selected categories are included in this table. The table shows the sample frame. The research sample was drawn from these different categories by means of purposive, judgmental and convenience sampling (based on position, availability, location and knowledge of respondents), which is discussed in a later section.

Table 7.6: Sample frame for the empirical research

	Functional products		Innovative products		
	Drinks	Food kept on the shelf	Sports clothing	Cellular phones	Cars
Manufacturers, Assemblers, Distributors	**Soft drinks** Coca-Cola Fanta Sprite Appletiser Stoney Ginger beer Grapetiser **Fruit juices** Liqui fruit Tropika Clover fruit juice Fruitree Ceres Minute Maid **Beers** Carling Black label Hansa Heineken Castle lager Amstel lager	**Rice and maize meal** Tastic Ace White Star Iwisa **Canned food** Koo **Sugar, coffee and tea** Huletts Joko Five Roses Frisco	Nike Adidas Puma Reebok Quiksilver Billabong	Nokia Samsung Sony Ericsson Motorola LG	Mercedes Benz Toyota BMW Volkswagen Mazda Opel
Retailers, Wholesalers	**Soft drinks and fruit juices** Shoprite Pick 'n Pay The Spar group Woolworths **Beers** Liquor City	Shoprite Pick 'n Pay The Spar group Woolworths	Totalsports Edgars Other retailers will be determined by manufacturers/ assemblers	Game Other retailers will be determined by manufacturers/ assemblers	Dealers

Source: Compiled from Doke (2009:3); Gillingham (2009a:4); Gillingham (2009b:26); Peacock (2009a:11); Peacock (2009b:14); Anonymous (2009a:29); Anonymous (2009b:1); Doke (2008:3) and Goldman (2008:24).

7.5.2 Sample size

Sample size refers to how many respondents should be included in the research (Cant, 2005b:52). It is a complex issue that needs to take into account a large number of factors. Issues of resource availability in terms of time, money and personnel also have an impact on the size of the sample (Kent, 2007:236). The size of the sample also depends on the variability of the population characteristics and on the purpose of the research. The more variable the characteristics, the larger the sample will need to be. Furthermore, if the purpose of the research is accurate assessment of quantitative variables, larger samples will be required. If the purpose is to generate ideas for new products, a small sample of product category users may well be sufficient (Kent, 2007:236). The size of the sample drawn affects the quality and generalisation of the data. If the sample is too small, the data obtained may not be representative (Cant, 2005b:52).

Due to the complexity of the research, only thirteen respondents were included in the sample. The initial sample size was set on thirty respondents. However, due to constraints regarding time and availability, this objective could not be achieved. The respondents who were targeted in the research included CEOs, supply chain managers, logistics managers and supply managers. Due to the position of these respondents in their organisations, time and availability was a concern and was a major problem in this study. Interviews were scheduled and rescheduled and even cancelled due to these constraints in some cases. In the end, a total of thirteen respondents participated in the study and formed the sample of the study. This was deemed satisfactory because the contribution of the study focused on the development of the conceptual framework. The empirical research was conducted to test the conceptual framework exploratively across the three different types of supply chain strategies. The aim of the empirical research was to test whether the conceptual framework is a usable instrument to analyse SCD practices.

7.5.3 Selecting a sampling method

There are two options when selecting a sample, namely probability and non-probability sampling. In the former, all the subsets of the population have a nonzero chance of being selected, whereas in the latter, certain subsets of the population have little or no chance of being selected in the sample (Tustin *et al*., 2005:344; Blanche & Durrheim, 2002:276-281). Probability sampling methods include simple random sampling, systematic sampling, stratified sampling and cluster sampling (Cant, 2005b:53). Non-probability sampling methods include convenience sampling, judgment sampling, purposive sampling, quota sampling, snowball sampling and Internet sampling (Tustin *et al*., 2005:346; McDaniel & Gates, 2001:347-350; Cant, 2005b:53).

This study used non-probability sampling. More specifically, a combination of purposive, judgmental and convenience sampling methods was used. The researcher and field worker had several meetings concerning the sample frame and the sample that was eventually drawn. The field worker had vast experience in the field of SCM and on the fieldwork that was to be conducted. This experience was used in discussions with the researcher to select the respondents who were eventually used in this study from the sample frame.

Purposive samples are generated when the selection of units is made by the researcher using his or her own judgment about cases that are important to the research or can be used for the research (Kent, 2007:230). The sample members are chosen with a specific purpose or objective in mind. The sample is thus intentionally selected to be non-representative (Tustin *et al*., 2005:346). Purposive sampling is the most important kind of non-probability sampling. Researchers rely on their experience, ingenuity and/or previous research findings to deliberately obtain units of analysis in such a manner that the sample they obtain may be regarded as being representative of the relevant population (Welman & Kruger, 2001:63). Judgmental sampling is a type of purposive sampling (Cooper & Schindler, 2003:201).

Judgmental sampling occurs when a researcher selects sample members to conform to some criterion (Cooper & Schindler, 2003:201). When judgmental sampling is used, members are chosen on the basis of the researcher's judgment on what constitutes a representative sample of the population of interest. Potential sample members are screened judgmentally on whether they should be included in the sample. The amount of error in a judgmental sample depends on the degree of expertise of the person who is making the selection (Tustin *et al*., 2005:346). When used in the early stages of exploratory research, a judgmental sample is appropriate. When a biased group of respondents have to be selected for screening purposes, judgmental sampling is also good (Cooper & Schindler, 2003:201), hence the usefulness of judgmental sampling for this study. It was necessary to select respondents that met certain criteria. Respondents with lean supply chains had to be selected in the sample. Similarly, respondents with agile supply chains as well as respondents with leagile supply chains had to be selected in the sample.

Convenience sampling is useful in the exploratory phase of a research project. Members for the sample are chosen on the basis of being readily available or accessible. Therefore, selection is done on the basis of convenience (Tustin *et al*., 2005:346). Interviewers approach people who happen to be conveniently around in the right place at the right time (Kent, 2007:235).

As already mentioned, the respondents selected for this research sample were selected by means of purposive, judgmental and convenience sampling. In the first stage, purposive sampling was used to draw the sample from the different categories in the sample frame (refer to Table 7.6). After the initial stage, judgmental sampling was used to ensure that different organisations were included that, amongst them, implement lean, agile or leagile supply chain strategies. Each of these supply chain strategies needed to be tested exploratively and this could be ensured through purposive and judgmental sampling. Due to several constraints such as time and the availability of respondents, convenience sampling was used in the next stage of sampling to ensure that organisations, amongst them, implemented lean, agile and leagile supply chain strategies were included.

7.6 STAGE FOUR: GATHERING THE DATA

The gathering of the data may range from a simple observation at one location to a survey in different parts in the world. The method selected largely determines how the data are collected (Cooper & Schindler, 2003:87). The data gathering process is often referred to as the fieldwork (Tustin *et al*., 2005:99). The data gathering stage begins once the sampling plan has been formalised. Data gathering is the process of gathering or collecting information. Data may be gathered by human observers or interviewers, or may be recorded by machines (Zikmund *et al*., 2010:69). Data gathering involves all the functions related to conducting interviews. With face-to-face interviews, the interviewers must be familiar with the scope and the methodology of the research (Tustin *et al*., 2005:99). Quality control is critical at this stage, to ensure that the research approach is implemented in a manner in which will ultimately address the research objectives (Wilson, 2008:153). Wherever the interview is carried out, the interviewer has a number of key tasks to perform. These include (Kent, 2007:186):

- preparing for the interview;
- locating the respondents;
- obtaining the agreement to conduct the interview;
- asking the questions and noting down the answers; and
- completing records of interview assignments and returning completed questionnaires.

The primary data collected in this research were gathered over a period of ten weeks by an independent field worker with a thorough understanding of and background in SCM. The duration of each of the interviews was approximately sixty minutes. All the interviews conducted in this research were prepared thoroughly. A fieldwork plan was compiled to determine how respondents would be approached. This plan included identifying the right person for the interview (which resulted in many phone calls and e-mails to find the right person). These phone calls included several phases in some cases where regional and head offices were contacted. The fieldwork plan also included recording the scheduling and acknowledging of appointments by the selected respondents. This process continued until the eventual respondents were selected to represent the sample of this study. As already mentioned, the position of the respondent in the organisation was important to ensure that the right person with the right knowledge about SCM and its application in the organisation was selected.

Once the respondents were selected, an interview had to be scheduled. This was done by means of telephone calls, as well as e-mail contact. These appointments were then verified by means of e-mail. In some cases the interviews were cancelled and rescheduled at the last moment. In some cases the appointments were cancelled. As mentioned, thirteen interviews were eventually conducted by means of the structured assessment instrument.

7.7 STAGE FIVE: PROCESSING AND ANALYSING THE DATA

After the fieldwork has been completed, the data must be converted into a format that will answer the research questions. This is part of the data processing and analysis stage. Data processing generally begins with editing and coding the data. Editing involves checking the data collection forms for omissions, legibility, and consistency in classification. The editing process corrects problems such as interviewer errors (Zikmund *et al*., 2010:70). The types of analysis undertaken in a project depend on the nature of the data and the specific data collection method used, as well as on the use to be made of the findings. There are significant differences, in particular between the analysis approaches adopted for qualitative and those used for quantitative research (Wilson, 2008:153). In this study, interviewer errors were reduced by recording the responses onto a computer immediately. Duplication of effort was thus reduced. Key concepts were included in the questionnaire to reduce misunderstanding and these concepts were explained when necessary.

Before the data can be tabulated, meaningful categories and character symbols must be established for groups and responses. The rules for interpreting, categorising, recording and transferring the data to the data storage media are called codes. The coding process facilitates computer or hand tabulation (Zikmund *et al*., 2010:70).

Data analysis is the application of reasoning to understand the data that have been gathered (Zikmund *et al*., 2010:70). Data analysis usually involves reducing accumulated data to a manageable size, developing summaries, looking for patterns and applying statistical techniques (Cooper & Schindler, 2003:87). The purpose of data analysis is to interpret and draw conclusions from the mass of collected data (Tustin *et al*., 2005:102). In its simplest form, analysis may involve determining consistent patterns and summarising the relevant details revealed in investigation. The appropriate analytical technique for data analysis will be determined by the information requirements, the characteristics of the research design and the nature of the data gathered. Statistical analysis may range from portraying a simple frequency distribution to more complex multivariate analyses approaches such as multiple regression (Zikmund *et al*., 2010:70). SPSS and Exel software packages were used to analyse the gathered data in this study.

Research must be reliable and valid. Reliability deals with the extent to which the research findings can be replicated. It is the degree to which an assessment or instrument consistently measures an attribute (Pellissier, 2007:12). Reliability therefore has to do with the accuracy and precision of a measurement procedure. Validity is the extent to which a measure accurately reflects the concept that it is intended to measure (Cooper & Schindler, 2003:231). A distinction is made between internal and external validity. Internal validity refers to how the research findings match the reality, while external validity refers to the extent to which the research findings can be replicated to other environments (Pellissier, 2007:12).

When qualitative research is conducted it is sometimes difficult to justify the reliability of the research that is undertaken. Some researchers have argued that the concepts of validity and reliability are derived from quantitative, positivist approaches to research and are not appropriate to qualitative data (Kent, 2007:277). However, Wright (2008:162) argues that reliability can be justified as long as there is some relationship to one or more types of validity and provided that the processes of research and results can be extrapolated to other groups. Reliability presupposes that a particular theoretical approach to inform a given method has taken place and that the findings uncovered by such a method can be duplicated if the study were repeated with other groups (Wright, 2008:162). In qualitative research, validity may refer to (Kent, 2007:277):

- the goodness of the data – the kind, accuracy, relevance, richness, colourfulness of the data derived from individual sample units, be they single individuals or groups; or
- the status of the qualitative findings – their hardness, generalisability, truth, or the extent to which they are scientific.

Some studies have shown that the smallness of a sample is not a great impediment to the conclusions that are arrived at and that qualitative samples can and do satisfy the theoretical requirements for making generalisations (Kent, 2007:278). Therefore, for qualitative research, validity can be applied only to the validity of the analyses and the interpretations performed by the researcher on the data. However, these analyses and interpretations may be performed in a number of different ways, focusing on different aspects of the data. There is no one correct way of performing qualitative analysis. Accordingly, there is no agreed way of assessing validity (Kent, 2007:238).

Similar recommendations (or potential solutions) will be prompted by the conceptual framework for similar responses, no matter who the respondent is. The results of the empirical research, however, can not be used to make general conclusions of SCDs across various organisations in the research population, due to the nature and size of the realized sample. The sample size has to be much larger to test reliability. Reliability is tested by means of Cronbach's coefficient alpha. The literature suggests that a sample size for coefficient alpha should include at least 200 respondents for reliability purposes (Yurdugül, 2008:405).

7.8 STAGE SIX: DRAWING CONCLUSIONS AND REPORTING THE RESEARCH

One of the most important phases in the business research process is the communication of the research results (Wilson, 2008:153). This is the final stage of the process. The conclusion and report preparation stage consist of interpreting the research results, describing the implications and drawing the appropriate conclusions. These conclusions should answer the research questions asked earlier in the business research process (Zikmund *et al*., 2010:70). The conclusions and recommendations of this study are presented in Chapter 9.

7.9 CONCLUSION

Chapter 7 looked at the research methodology used in this study. In the current chapter, business research has been defined and the stages in the business research process were discussed. The business research process starts by defining the research objectives. In stage two, the research design is planned. In stage three the sample is planned. The data are then collected and analysed. The business research process closes with the formulation of the conclusions and the preparation of the report.

The main objective of the study was to develop a conceptual framework with which organisations can analyse their SCD practices. The SCD elements that needed to be included in the conceptual framework had to be identified. The research design comprised exploratory research into secondary sources, from which a conceptual framework for SCD was developed. A questionnaire or assessment instrument was also developed from the conceptual framework to communicate SCD elements to the respondents with in-depth interviews.

Due to the complex nature of the target population, the sample was drawn by means of non-probability sampling. The data was collected over a period of ten weeks and prepared for analysis by means of SPSS and MS Excel software programmes. Chapter 8 of this study looks at the findings of the primary research.

CHAPTER 8
EMPIRICAL FINDINGS OF THE RESEARCH

8.1 INTRODUCTION

Chapter 8 reports on the empirical findings of this research. As already mentioned, a conceptual framework with which organisations can analyse their SCD practices was developed from the literature. This framework needed to be tested. An assessment instrument in the form of a questionnaire was therefore developed from the framework. As mentioned in Chapter 7, thirteen respondents were involved to empirically test the conceptual framework (by means of the assessment instrument) that is proposed in this study to analyse the SCD practices of organisations. It must be emphasised once again that the main contribution planned for this study was the development of the conceptual framework from literature and the aim of the empirical research was to exploratively test the conceptual framework. The aim was thus to assess the pilot use of the conceptual framework. The thirteen respondents who were included (refer to Chapter 7) were therefore necessary to exploratively test the framework. The important prerequisite for the sample was to include respondents who represented the three different supply chain strategies. This prerequisite was met during the empirical research. Further empirical research will have to be conducted with regard to establishing the framework as a reliable instrument to assess and analyse SCD practices in organisations.

The empirical findings are reported in two broad parts in this chapter. The first part reports the findings of the research in general. In the second part the responses of each individual respondent will be presented. In the analysis, clusters were formed according to SCD strategies. The organisations that implement a lean supply chain strategy were analysed together. Similarly, the organisations that implement an agile supply chain strategy and those who implement a leagile supply chain strategy were also analysed together per cluster within each supply chain strategy grouping. The conceptual framework is broadly tested by means of the assessment instrument. The assessment instrument contains the elements of SCD practices according to the conceptual framework. This instrument was utilised to test the SCD practices for each of the thirteen respondents across the three supply chain strategies. For reference,

Figure 8.1 illustrates the broad conceptual framework.

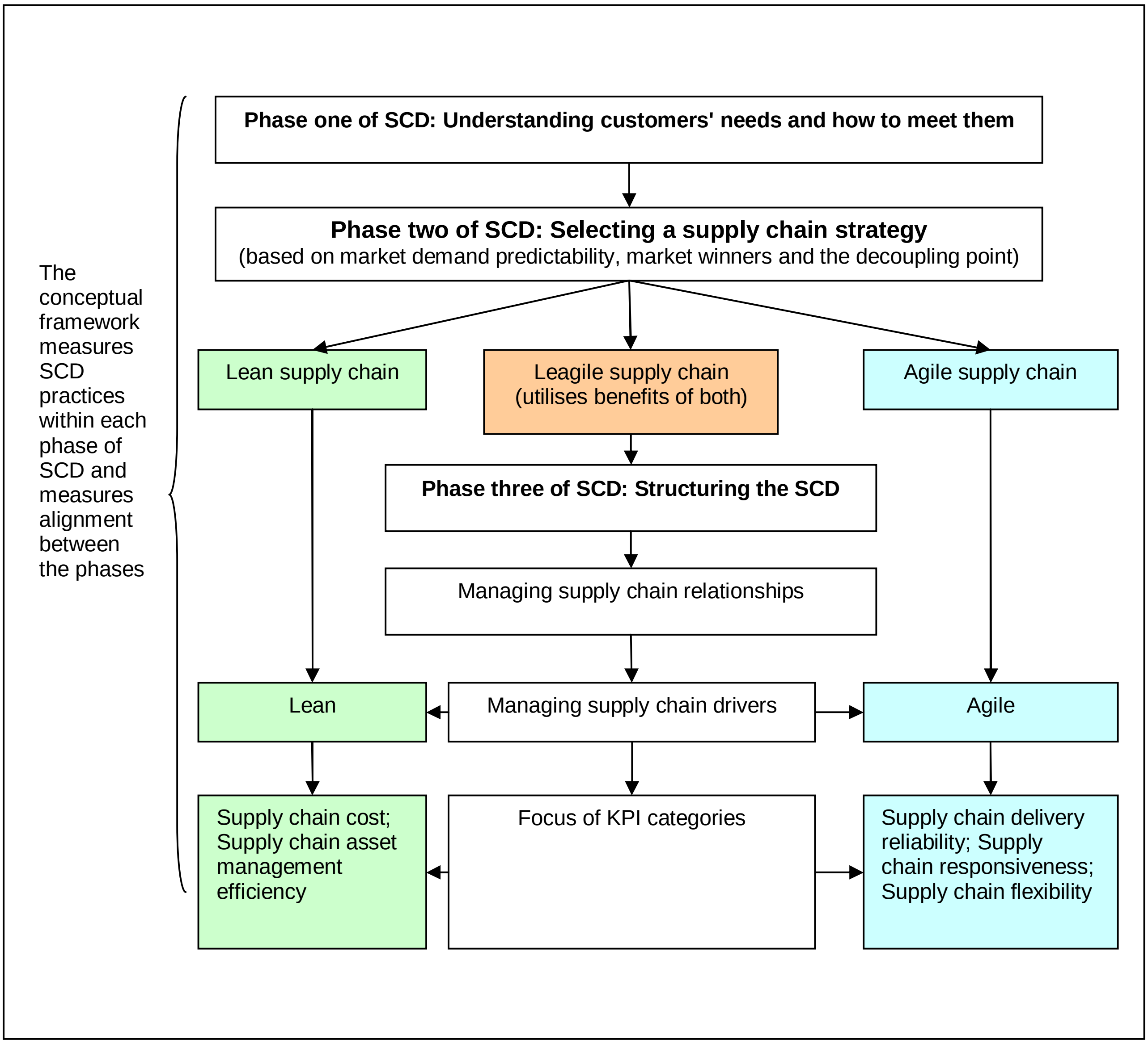

Figure 8.1: Broad conceptual framework for SCD analyses
Source: Researcher's own.

8.2 GENERAL FINDINGS OF THE RESEARCH

The assessment instrument that was used to conduct the empirical research was divided into two main sections. Section A was designed to collect information about the SCD practices of the respondents, while section B collected demographic information about the respondents (refer to Annexure B at the end of this study). Questions in section A covered the organisations' supply chains in general and the various phases of SCD and specifically gathered information about (1) the needs of the organisations' customers and the extent to which organisations met these needs; (2) supply chain strategies being implemented (which included information about market demand predictability, market winners and the decoupling points in organisations); (3) the supply chain structures of organisations, which included the organisations' supply chain partners, supply chain drivers and KPI categories and (4) supply chain integration practices.

8.2.1 Demographic information of the respondents

Table 8.1 shows the job function of the individuals with whom the interviews were conducted and the industry in which the organisations reside.

Table 8.1: Job function of individuals and sector (n = 13)

Industry/ sector	**Frequency**
Wholesale/ retail	4
Assembly/ distribution	2
Manufacturing	2
Job function	
CEO/ owner	1
Supply chain manager	5
Logistics manager	2
Supply/ procurement manager	1
Marketing/ sales manager	1

Table 8.1 shows that four organisations were in the retail (or wholesale) industries. Two organisations were in assembly or distribution and two organisations were in the manufacturing sector. Five organisations did not indicate in which industry or sector they were operating. Table 8.1 also shows that one respondent was the CEO or owner of the organisation. Five supply chain managers, two logistics managers, one supply/ procurement manager and one marketing/ sales manager participated in the research on behalf of their organisations. Three respondents did not indicate their position within the organisation.

8.2.2 Findings on general SCM aspects

The first part of section A concerned the organisations' supply chains in general and was further divided into four subsections. The first introductory section collected information about the following issues:

- Organisations' supply chain planning
- Product category focused on (for purposes of this research)
- Organisations' market share
- Organisations' positions in terms of being market leaders

8.2.2.1 Supply chain planning

In this subsection, respondents were asked to report on planning practices regarding their supply chain. The respondents had to indicate whether they made use of a formal documented supply chain strategy, often mapped their supply chains and consciously designed their supply chains. The findings are shown in Table 8.2.

Table 8.2: Supply chain planning practices (*n* = 13)

The organisation:	Frequency
Has a formal documented supply chain strategy	12
Often maps (or models) its supply chain	12
Consciously designs its supply chain	12

Twelve of the thirteen respondents indicated that they have a formal, documented supply chain strategy. The same number of respondents often map or model their supply chains and also consciously design their supply chains. From Table 8.2 it seems as though all (excepting one) of the respondents in the research have sound supply chain planning practices.

8.2.2.2 Product category

The aim of the product category subsection was to ensure that supply chains from different product categories were included in the research. The product categories were selected to ensure that the three broad supply chain strategies were covered and analysed in the empirical research (refer to Chapter 7). Respondents had to indicate on which product category supply chain they focused when completing the questionnaire.

Table 8.3: Product category (*n* = 13)

Product category	**Frequency**
Drinks	6
Food kept on the shelf	4
Cars	3

Table 8.3 reports on the product category that was used to analyse the organisations' SCD practices. Six of the thirteen respondents were from the drinks category; four in the 'food kept on the shelf' category and three respondents were in the automobile industry. There were no respondents in the *sports clothing* and *cellular phones* categories. This is not a limitation to the study because the SCD of all three supply chain strategies, namely lean, agile and leagile were included amongst the thirteen respondents. As explained in Chapter 7, the main reason for this question was to ensure that the conceptual framework is tested across the three possible supply chain strategies. As will become evident later in the chapter, this goal was achieved.

8.2.2.3 Information about organisations' markets

Two questions were asked about organisations' market share and their position in terms of being market leaders. The responses are tabled in Tables 8.4 and 8.5.

Table 8.4: Organisations' market share (*n* = 13)

Market share (%)	**Frequency**
0-10%	5
11-20%	1
21-30%	2
More than 30%	3

Five of the respondents in the research had more than 20 per cent of the market share in their markets. Five respondents had a market share of between 0 and 10 per cent. They were thus competing in a highly competitive market. Two organisations did not respond to this question.

Table 8.5: Organisations' position in terms of market leadership (*n* = 13)

Market leadership position- The organisation is:	**Frequency**
the market leader	5
among the top three organisations in its market	6

Two respondents did not respond to this question. Table 8.5 shows that five organisations indicated that they were market leaders in the selected product category and that the other six respondents indicated that they were among the top three organisations in their markets for the specific product category.

8.2.3 General findings of phase one of SCD

There were five assessment questions to determine the extent to which organisations understand their customers' needs and how to meet them. A five-point Likert response format *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)* was used to measure each assessment question. Organisations had to indicate the extent to which they:

- knew who their end customers were;
- knew the needs of their end customers;
- had identified a formal value proposition to meet end customer needs;
- possessed a core competency to deliver the value proposition; and
- had identified how to win customers' orders.

This was discussed in depth in Chapter 6. The findings are reported in Table 8.6.

Table 8.6: Understanding customer needs and how to meet these needs[8] (*n* = 13)

The extent to which the organisation *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)*:	Frequency of responses		
	Average extent	Good extent	Very good extent
Knows who its customers are		4	9
Knows what the needs of customers are		7	6
Has identified a value proposition to meet these needs	1	5	7
Possesses a core competency	1	8	4
Has identified how to win customers' orders	1	5	7

Most of the organisations that took part in the research have a good or very good idea of who their customers are and how to meet the needs of their customers. This is indicated by the areas shaded green. All the organisations have a good or very good

[8] For purposes of the testing of the conceptual framework, a response of at least 3 (average extent) was deemed satisfactory for these assessment questions.

idea of who their end customers are and how to meet the needs of their customers. Twelve of the thirteen respondents identified a value proposition, possessed a core competency to meet these needs and have identified how to win their customers' orders to a good or very good extent. Not one of the respondents gave a response that indicated a very limited or limited extent regarding these issues.

8.2.4 General findings of phase two of SCD

Four SCD elements were identified for inclusion in the conceptual framework as part of phase two of SCD (refer to Chapter 6). The first SCD element was market demand predictability.

8.2.4.1 Market demand predictability

To analyse the level of market demand predictability, organisations were requested to indicate the extent to which the demand for their product was predictable as opposed to being unpredictable. A continuum was used for the measurement instrument where a score of one (or two) indicated high levels of predictability and a score of four (or three) indicated a low level of predictability. Table 8.7 reports on the findings of organisations' market demand predictability.

Table 8.7: Organisations' market demand predictability (*n* = 13)

Product category characteristics:	Frequency of responses			
	Predictable			**Unpredictable**
	Response of 1	Response of 2	Response of 3	Response of 4
Market demand predictability	5	4	3	1

It is evident from Table 8.7 that nine organisations have a predictable market demand (with a response of one or two). Four organisations indicated an unpredictable market demand. The majority of the organisations therefore have a predictable market demand.

8.2.4.2 Market winners

Similarly, to analyse specific market winners for the product, organisations were requested to indicate what the specific market winners for their products were. A continuum was also used for this measurement instrument, according to which a score of one indicated that the market winner for the product was low costs, while a score of four indicated that the market winner was agility in the form of short lead times; availability of products; high service levels and high quality. Table 8.8 reports on the findings. A score of two would indicate that the market winner is still low cost, but less so than when a score of one is indicated. Similarly, a score of three would indicate that the market winner is agility but less so than when a score of four is indicated.

Table 8.8: Organisations' market winners (*n* = 13)

Product category characteristics:	Frequency of responses			
	Low cost			**Agility**
	Response of 1	Response of 2	Response of 3	Response of 4
Market winner	1	2	6	4

From Table 8.8 it is clear that three organisations indicated that their market winner was low cost (with a response of one or two) while the other ten organisations indicated that their market winner was agility (with a response of three or four).

As already mentioned, a lean supply chain strategy should be used where products have a predictable market demand and where low cost is the market winner (refer to Chapter 6). An agile supply chain strategy should be used where the market demand for a product is not predictable and where agility is the market winner, as indicated in Chapter 6. The results of the findings are indicated in Figure 8.2. However, some of the respondents indicated that the market demand for their products was predictable and that agility was their market winner. One respondent indicated that the market demand for their product is not predictable and that low cost was the market winner. When these options are grouped together and analysed, they can be categorised into one of four quadrants, as indicated in Figure 8.2.

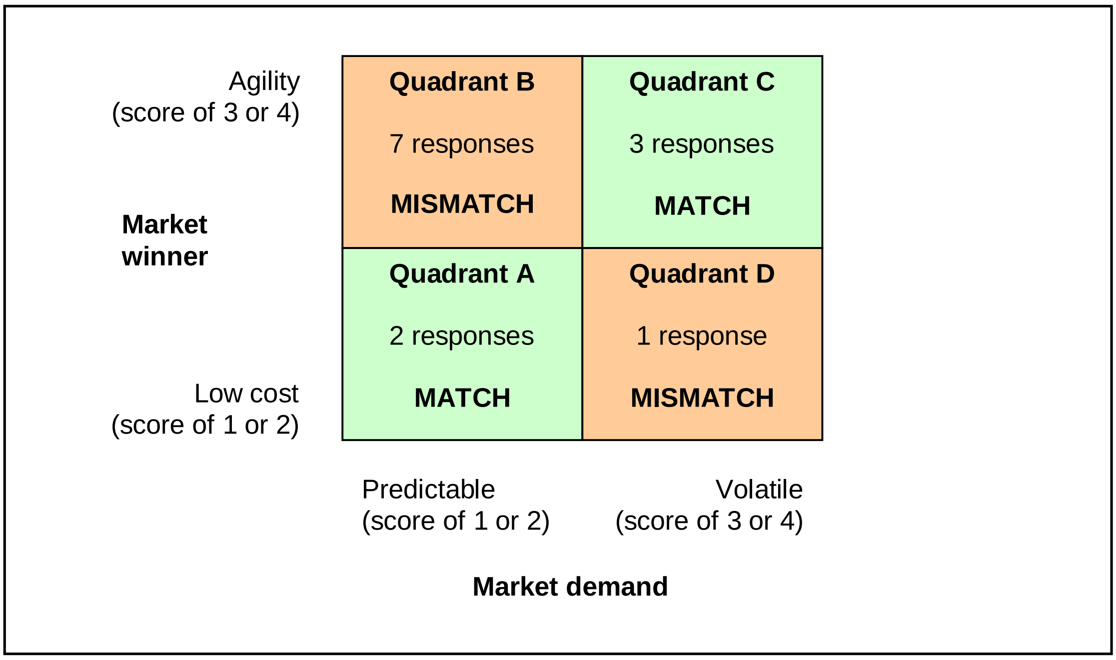

Figure 8.2: Matrix categorising products according to market demand predictability and market winner characteristics

Therefore, a lean supply chain strategy can be suggested for the two respondents in quadrant A and an agile supply chain strategy can be suggested for the three respondents in quadrant C. This is indicated by the quadrants shaded green. However, the seven respondents in quadrant B need to further analyse their responses because they have indicated that their market winner is agility and that their market demand is predictability. This seems to contradict what theoretical principles in the literature suggest (refer to Chapter 2). Similarly, the one respondent in quadrant D also needs to further analyse the response because it indicated that the market winner was low cost and that the market demand was volatile. This is also in contradiction to what the literature suggests. These findings will be addressed later in the chapter under the broad analysis of phase two of SCD. If these eight organisations were satisfied with their responses after exploring them, their position in terms of the decoupling point in their supply chain would be used to suggest the right supply chain strategy for them as indicated in Chapter 6.

8.2.4.3 Position of the organisation in terms of the decoupling point

The organisation’s position in terms of the decoupling point in the supply chain was also determined by means of an assessment question. The organisation’s position in terms of the decoupling point would be used to suggest a supply chain strategy in the case of misalignment between the organisation's market demand predictability and the market winners. Eight organisations fell into this category, with their market demand predictability and their market winners being misaligned. The decoupling point in the supply chain of these eight organisations would be used to suggest the correct supply chain strategy for them. Organisations were requested to indicate where they were positioned in terms of the decoupling point. Table 8.9 reports on the respondents' position in terms of the decoupling point within their supply chains.

Table 8.9: Position of the organisation in terms of the decoupling point (*n* = 13)

Position of the decoupling point	Frequency
Decoupling point is towards suppliers	6
Decoupling point is at the organisation	7

According to Table 8.9, respondents from six of the organisations reported that suppliers for their organisation were positioned at the decoupling point. Seven respondents indicated that their organisation was positioned at the decoupling point. None indicated that the decoupling point in the supply chain was downstream towards their customers. The results of these findings will be used in the SCD analysis of the organisations later in the chapter.

8.2.4.4 Supply chain strategy

In the next part, organisations were requested to indicate, on a continuum, what the primary focus of their supply chain strategy was. On this continuum, a response of 1 indicated a focus on achieving the lowest cost; achieving economies of scale and reducing waste within minimum acceptable service levels and a response of 5 indicated a focus on being agile, ie being responsive and flexible to customers' demands and providing high service levels within acceptable cost levels. The organisation could have provided a response of 3 along the continuum (refer to previous section). A response of 3 indicated that the focus of the supply chain strategy was a combination of a lean and an agile supply chain strategy and that a leagile supply chain strategy was therefore being used.

Table 8.10: Focus of organisations' supply chain strategy (*n* = 13)

	Frequency of responses				
	Lean		**Leagile**	**Agile**	
	Response of 1	Response of 2	Response of 3	Response of 4	Response of 5
Focus of supply chain strategy	2	1	7	3	

According to Table 8.10, three respondents indicated that the focus of their supply chain strategies was aimed at being lean (low cost) (with a response of 1 or 2). Seven respondents indicated that the focus of their supply chain strategies were aimed at a leagile supply chain strategy (response of 3) and three respondents indicated that the focus of their supply chain strategies was on agility (response of 4 or 5).

Table 8.11 was compiled from the focus of organisations' supply chain strategies as well as the organisations' market demand predictability and market winners. The areas in red show where organisations need to explore their responses and make sure that they are implementing the correct supply chain strategy. It was suggested that organisations in quadrant A (refer to Figure 8.2) use a lean supply chain strategy and that organisations in quadrant C (refer to Figure 8.2) use an agile supply chain strategy. From the responses, only one of the two respondents in quadrant A is using a lean supply chain strategy. The other organisation in quadrant A indicated that it was using a leagile supply chain strategy. The organisation also has to explore the selected supply chain strategy further. Only two of the respondents in quadrant C were using an agile supply chain strategy. The other respondent in quadrant C was using a leagile supply chain strategy, which also needs further analysis.

Table 8.11: Cross table of the focus of organisations' supply chain strategy and matrix categorising products according to market demand predictability and market winner characteristics (*n* =13)

	Lean	Leagile	Agile
Quadrant A (Predictable market demand and low cost as market winner)	1	1	
Quadrant B (Predictable market demand and agility as market winner)	2	4	1
Quadrant C (Volatile market demand and agility as market winner)		1	2
Quadrant D (Volatile market demand and low cost as market winner)		1	

8.2.5 General findings of phase three of SCD

8.2.5.1 Supply chain relationships

Respondents were asked to respond on the state of their supply chain relationships. They had to indicate the extent (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable) to which their organisation:

- knew who its critical supply chain partners were (where supply chain relationships needed to be managed concerning processes, information, technology, and so on);
- had made an effort to get in contact with the their most important direct 1st-tier supply chain partners (identified, evaluated and selected their most important direct suppliers and customers) based on capability considerations;
- managed their critical direct (1st-tier) supply chain relationships;
- was able to manage their critical supply chain relationships beyond the 1st tier (2nd tier to *n*th tier); and
- managed their critical supply chain relationships beyond the 1st tier (2nd tier to *n*th tier).

The findings in terms of the organisations' relationships with their customers will be discussed separately from the findings of the organisations' relationships with their suppliers. Table 8.12 shows the results of the empirical findings in terms of organisations' relationships with their customers and table 8.13 shows the results of the empirical findings in terms of organisations' relationships with their suppliers.

Table 8.12: Organisations' relationships with their important customers[9] (*n* = 13)

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable):	Frequency of responses			
	limited extent	average extent	good extent	very good extent
knows who its supply chain partners are	1		2	10
has made an effort to get in contact			4	9
manages critical direct (1st tier) partners			6	7
is able to manage critical SC relationships (2nd tier to *n*th tier)	5	2	3	2
manages 2nd tier to *n*th tier relationships	6	3	2	1

[9] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

From Table 8.12 it becomes evident that the organisations could effectively manage their 1st-tier supply chain relationships with their customers. Only one organisation indicated that it had a limited knowledge of who its supply chain partners were (at a 1st-tier level). However, when the situation is analysed beyond the 1st tier, it seems that the relationships with customers were more difficult to manage. In fact, six organisations indicated that they were managing their supply chain relationships with their customers beyond the 1st tier to a limited extent. One organisation did not respond to the assessment question for its 2nd tier relationships.

Table 8.13: Organisations' relationships with their important suppliers[10] (*n* = 13)

The extent to which the organisation (where 1 limited; 2 = average; 3 = good; 4 = very good and NA = not applicable):	Frequency of responses			
	limited extent	average extent	good extent	very good extent
knows who its supply chain partners are			1	12
has made an effort to get in contact			1	12
manages critical direct (1st tier) partners			4	9
is able to manage critical SC relationships (2nd tier to *n*th tier)	2	5	1	2
manages 2nd tier to *n*th tier relationships	4	5		1

Table 8.13 shows that organisations are managing their relationships with their 1st-tier suppliers effectively. In fact the organisations' management of relationships with their suppliers was successful to a higher extent than with their customers (refer to Tables 8.12 and 8.13). Nine organisations were managing their suppliers (1st tier) to a very good extent. The situation changed when organisations' relationships with their 2nd-tier suppliers were considered. From the responses it was clear that it is difficult to manage supply chain relationships beyond the 1st tier. Three organisations did not respond to the assessment question regarding their 2nd-tier relationships.

8.2.5.2 Supply chain drivers

Organisations were also asked to indicate where they would position their organisation in terms of how they manage their supply chain drivers along a continuum (where 1 = a strong focus on efficiency and 4 = a strong focus on responsiveness). A score of 1 on the one side of the continuum would indicate that

[10] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

the supply chain drivers were managed according to lean principles while a score of 4 would indicate that the supply chain drivers were managed with agility in mind. A score of 2 would indicate that the supply chain driver was being managed according to lean principles, but to a lesser extent than when a score of 1 was provided. Similarly, a score of 3 would indicate that the supply chain driver was being managed according to agile principles but less so than when a score of 4 was provided. The nine assessment questions ranged across the six supply chain drivers of facilities, inventory, transportation, information, sourcing and pricing. The nine assessment questions covered the areas of:

- SCD element #3.2.1: Capacity utilisation in facilities;
- SCD element #3.2.2: Location of facilities;
- SCD element #3.2.3: Inventory levels;
- SCD element #3.2.4: Lead times;
- SCD element #3.2.5: Transportation cost;
- SCD element #3.2.6: Transportation frequency;
- SCD element #3.2.7: Information collection;
- SCD element #3.2.8: Supplier selection criteria; and
- SCD element #3.2.9: Pricing/ profit margins.

The findings of the responses were categorised according to the focus of the supply chain strategy of the organisations. The findings of the three different groups of supply chain strategies are tabled in Tables 8.14, 8.15 and 8.16. Table 8.14 thus reports on the organisations with lean supply chain strategies, while Table 8.15 reports on the organisations with agile supply chain strategies. Table 8.16 reports on the organisations with leagile supply chain strategies.

Table 8.14: Responses from organisations (with a lean supply chain focus) in terms of the management of their supply chain drivers (*n* = 3)

SCD element (as identified in the supply chain drivers)	Frequencies in terms of organisations with a lean supply chain focus			
	Lean		Agile	
	Response of 1	Response of 2	Response of 3	Response of 4
Capacity utilisation	2	1		
Location of facilities			2	1
Inventory	2	1		
Lead time	2		1	
Transportation cost	2	1		
Transportation frequency		1	1	1
Information		1	1	1
Supplier selection criteria		1	1	1
Pricing/ profit margins		1	1	

The areas shaded green show where there is alignment according to theoretical principles in the literature on how the supply chain drivers should be managed for lean supply chains. However, it becomes evident from Table 8.14 that there are several areas where organisations who have lean supply chain strategies are not managing their supply chain drivers according to what is suggested in the literature for lean supply chains (areas shaded red). These issues will also be addressed later in the chapter in the section where a broad analysis of the SCD practices of phase three is presented.

Table 8.15: Responses from organisations (with an agile supply chain focus) in terms of the management of their supply chain drivers (*n* = 3)

SCD element (as identified in the supply chain drivers)	Frequencies in terms of organisations with an agile supply chain focus			
	Lean		Agile	
	Response of 1	Response of 2	Response of 3	Response of 4
Capacity utilisation		1	2	
Location of facilities	1	2		
Inventory		3		
Lead time		3		
Transportation cost	2			1
Transportation frequency			2	1
Information			2	1
Supplier selection criteria				3
Pricing/ profit margins	2		1	

The areas shaded green show where there is alignment according to theoretical principles in the literature on how the supply chain drivers should be managed for agile supply chains. However, in Table 8.15 it also is evident that there are several areas where organisations with a supply chain strategy focused on agility are not managing their supply chain drivers according to what is suggested in the literature for agile supply chains. These issues will also be addressed later in the chapter in the section where a broad analysis of the SCD practices of phase three is presented.

Table 8.16: Responses from organisations (with a leagile supply chain focus) in terms of the management of their supply chain drivers (*n* = 7)

SCD element (as identified in the supply chain drivers)	Frequencies in terms of organisations with a leagile supply chain focus			
	Lean		Agile	
	Response of 1	Response of 2	Response of 3	Response of 4
Capacity utilisation	4	3		
Location of facilities	3	1		3
Inventory	2	5		
Lead time	2	3	1	1
Transportation cost	5	1	1	
Transportation frequency		2	2	3
Information		1	2	4
Supplier selection criteria		4	1	1
Pricing/ profit margins	2	4	1	

From Table 8.16 it seems as though the majority of the responses for capacity utilisation, location of facilities, inventory, lead times, transportation cost, supplier selection criteria and pricing policies are managed according to lean principles. Transportation frequency and information systems are managed according to agile principles. One organisation did not respond to the assessment question on information systems. Due to the nature of leagile supply chain strategies, each supply chain driver will have to be analysed individually for leagile supply chain strategies. Organisations will have to determine where they need to implement lean strategies and where agility is required. These issues will also be addressed later in the chapter, in the broad analysis of the SCD practices of phase three.

8.2.5.3 Supply chain key performance indicators

Organisations were also requested to rate their most important KPI categories. Tables 8.17, 8.18 and 8.19 report on these findings. Once again, the findings are categorised according to the focus of the organisations' supply chain strategies. Therefore Table 8.17 reports on the findings of the organisations with a lean supply chain strategy, while Table 8.18 reports on the findings of organisations with an agile supply chain strategy and Table 8.19 reports on the findings of organisations with a leagile supply chain strategy.

Table 8.17: Top two KPI categories for organisations with a lean supply chain strategy (*n* = 3)

KPI category	Frequency in terms of importance	
	Most important KPI category	2nd most important KPI category
Supply chain reliability	1	1
Supply chain responsiveness		1
Supply chain flexibility		
Cost measures in organisation	2	
Cost across the supply chain		1
Supply chain asset management efficiency	1	

Organisations could rate more than one KPI as equally important to others. Organisations could thus rate more than one KPI category as being most important to them. Organisations with a lean supply chain strategy should definitely have cost measures as a priority in their organisation. This is highlighted by the areas shaded green. Two of the three organisations indicated that cost measures within their organisation presented the most important category. One organisation indicated that asset management efficiency was the most important category. These issues will also be addressed later in the chapter, in the section where a broad analysis of the SCD practices of phase three is presented.

Table 8.18: Top two KPI categories for organisations with an agile supply chain strategy (*n* = 3)

KPI category	Frequency in terms of importance	
	Most important KPI category	2nd most important KPI category
Supply chain reliability	2	1
Supply chain responsiveness	1	1
Supply chain flexibility	1	
Cost measures in organisation	3	
Cost across the supply chain		
Supply chain asset management efficiency		3

Organisations with an agile supply chain strategy should focus on supply chain reliability, supply chain responsiveness and supply chain flexibility. This is highlighted by the areas shaded green. Two organisations rated supply chain reliability as most important, while only one respondent rated each of supply chain responsiveness and supply chain flexibility as most important KPI. These issues will also be addressed later in the chapter, in the broad analysis of the SCD practices of phase three.

Table 8.19: Top two KPI categories for organisations with a leagile supply chain strategy (*n* = 7)

KPI category	Frequency in terms of importance	
	Most important KPI category	2nd most important KPI category
Supply chain reliability	7	
Supply chain responsiveness	3	3
Supply chain flexibility		2
Cost measures in organisation	3	1
Cost across the supply chain	2	1
Supply chain asset management efficiency	3	

Organisations with a leagile supply chain strategy should focus on all the supply chain KPI categories, according to the theoretical principles in the literature. Seven organisations were focusing on supply chain reliability KPIs, while only three organisations rated supply chain responsiveness KPIs as most important KPI categories. Only three organisations rated cost measures within the organisation and supply chain asset management efficiency KPIs as most important KPI categories, while only two organisations rated cost measures across the supply chain as most important KPI category. Due to the complex nature of leagile supply chains, these issues will have to be addressed later in the chapter, when a broad analysis is made of the SCD practices of phase three.

8.2.6 Supply chain integration

As already mentioned, supply chain integration (SCI) is fundamental to SCM and involves integrating organisations with other important supply chain members across relationships and processes (Cagliano *et al*., 2006:283; Lambert, 2006:1; Fawcett *et al*., 2007:8). The extent to which SCI takes place will have an effect on the relationships of organisations with their supply chain partners. The higher the degree of SCI, the better the supply chain relationship will be. Although the general findings of the responses on SCI are discussed in this section, these findings will be elaborated on in the individual analyses of individual organisations to explain how their relationships with their supply chain partners can be improved. A response of at least 2 (average extent) was deemed satisfactory for the explorative testing of the conceptual framework.

8.2.6.1 Internal supply chain integration

Organisations were requested to indicate the extent to which the various functions (or departments such as procurement, logistics, operations, marketing, and so on) within their organisation are internally integrated with regard to:

- planning and making decisions towards achieving overall organisational (and not functional/ departmental) objectives (ie sharing common organisational objectives);
- collaborating internally to integrate all internal processes across the organisation to achieve organisational (and not functional or departmental) objectives; and
- collaborating internally to build relationships across the different functions (or departments) to achieve organisational objectives.

Organisations had to indicate this in using a Likert response format (where 1 = limited extent; 2 = average extent; 3 = good extent and 4 = very good extent). The results are tabled in Table 8.20.

Table 8.20: Organisations' internal supply chain integration practices[11] (*n* = 13)

The extent to which organisations' internal functions work together in terms of (where 1 = limited extent; 2 = average extent; 3 = good extent and 4 = very good extent):	Frequency of responses		
	average extent	good extent	very good extent
planning and making decisions	2	5	6
collaborating internally to integrate internal processes	4	4	5
collaborating internally to build internal relationships	2	5	6

Table 8.20 shows that most organisations have at least a good extent of internal supply chain integration. However, two organisations recorded an average extent in terms of planning and making decisions, as well as for collaborating internally to build

[11] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

internal relationships. Four organisations recorded an average extent in terms of collaborating internally to integrate internal processes. Not one of the respondents recorded a response that indicated a limited extent on these issues. The majority of the respondents recorded a very good extent of internal supply chain integration.

8.2.6.2 External supply chain integration: Relationship issues

Table 8.21 reports on the relationship issues of organisations with their *customers* involved in external SCI and Table 8.22 reports on these SCI relationship issues with *suppliers*. External SCI was measured across relationship issues as well as supply chain processes. Respondents had to evaluate each of the following areas with a response that indicated the extent to which they experienced each area (where 1 = limited, 2 = average, 3 = high and 4 = very high). The areas were:

- the level of interdependence between supply chain partners;
- the long-term commitment in the relationship from both parties;
- the level of trust between the supply chain partners;
- the reliability of the organisation's partners in terms of eliminating supply uncertainties;
- sharing supply chain risks;
- sharing benefits/ rewards amongst supply chain partners;
- the degree of collaboration achieved;
- the development of supply chain capabilities;
- measuring and sharing supply chain performance with supply chain partners to improve the supply chain's performance; and
- adhering to predetermined payment conditions.

Table 8.21: Supply chain relationship issues with customers[12] (*n* = 13)

Supply chain relationship issues with suppliers (where 1 = limited extent; 2 = average extent; 3 = good extent and 4 = very good extent):	Frequency of responses			
	limited extent	average extent	high extent	very high extent
Level of interdependence	1	1	7	2
Long-term commitment from both parties		1	4	6
Level of trust		3	4	4
Reliability of supply chain partners in terms of eliminating supply uncertainties			7	4
Sharing supply chain risks	2	4	2	3
Sharing benefits/ rewards	2	4	4	1
Degree of collaboration achieved		1	7	3
Development of supply chain capabilities to optimise the supply chain	2	1	7	1
Measuring and sharing supply chain performance with partners to improve supply chain performance			8	3
Adhering to predetermined payment conditions	1		4	5

Table 8.21 shows that most of the organisations involved in the research experienced a cooperative relationship with their customers to at least an average extent. However, some organisations experienced cooperation to a limited extent in the following areas (highlighted by the areas shaded red):

- level of interdependence (one organisation);
- sharing supply chain risks (two organisations);
- sharing benefits/ rewards (two organisations);
- development of supply chain capabilities to optimise the supply chain (two organisations); and
- adhering to predetermined payment conditions (one organisation).

These are areas where there may be room for improvement for the organisations in their relationships with their customers.

[12] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

Table 8.22: Supply chain relationship issues with suppliers[13] (*n* = 13)

Supply chain relationship issues (where 1 = limited extent; 2 = average extent; 3 = good extent and 4 = very good extent):	Frequency of responses			
	limited extent	average extent	high extent	very high extent
Level of interdependence	1	6	1	5
Long-term commitment from both parties		2	5	6
Level of trust		2	4	7
Reliability of supply chain partners in terms of eliminating supply uncertainties		4	6	3
Sharing supply chain risks	3	1	5	4
Sharing benefits/ rewards	1	5	6	1
Degree of collaboration achieved		3	9	1
Development of supply chain capabilities to optimize the supply chain	1	3	7	2
Measuring and sharing supply chain performance with partners to improve supply chain performance			7	6
Adhering to predetermined payment conditions			6	7

Table 8.22 shows that most organisations in the research experienced at least an average extent of cooperation in their relationships with their suppliers. However, some organisations experienced cooperation with their suppliers to a limited extent in the following areas (highlighted by the areas shaded red):

- level of interdependence (one organisation);
- sharing supply chain risks (three organisations);
- sharing benefits/ rewards (one organisation); and
- development of supply chain capabilities to optimize the supply chain (one organisation).

These are areas where there may be room for improvement for the organisations in their relationships with their suppliers. These issues will also be addressed later in the chapter in the section where a broad analysis of the SCD practices of phase three is presented.

8.2.6.3 External supply chain integration: Supply chain processes

Table 8.23 reports on organisations' integration of supply chain processes with *customers* and Table 8.24 reports on organisations' integration of supply chain processes with *suppliers*. Respondents had to evaluate each of the stated areas by

[13] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

means of a response indicating the extent to which they experienced each area (where 1 = limited, 2 = average, 3 = high and 4 = very high). The areas in supply chain processes were:

- compatibility of essential technologies to ensure seamless flow of materials/ goods between supply chain partners;
- contribution to new product development;
- compatibility of essential technologies to ensure the mutual sharing of accurate relevant information between supply chain partners;
- focus on total supply chain costs (across the supply chain);
- focus on continuous improvement across processes;
- focus on adhering to predetermined quality levels; and
- level of supply chain integration.

Table 8.23: Supply chain process issues with customers[14] (*n* = 13)

Supply chain process issues (where 1 = limited extent; 2 = average extent; 3 = good extent and 4 = very good extent):	Frequency of responses			
	limited extent	average extent	high extent	very high extent
Compatibility of essential technologies to ensure the seamless flow of materials between partners	3	4	3	2
Contribution towards new product development	6	3	1	
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	2	3	6	1
Focus on total supply chain costs across the supply chain	3	3	5	1
Focus on continuous improvement across processes	3		6	3
Focus on adhering to predetermined quality levels		1	8	3
Level of supply chain integration between organisation and supply chain partners	1	6	4	1

Some respondents did not respond to this assessment question. Table 8.23 shows that most organisations experienced the integration of their processes with their customers to an average extent, at least. However, some organisations experienced integration of processes to a limited extent in the following areas:

- compatibility of essential technologies to ensure the seamless flow of materials between partners (three organisations);
- contribution towards new product development (six organisations);

[14] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

- compatibility of essential technologies to ensure the mutual sharing of accurate relevant information (two organisations);
- focus on total supply chain costs across the supply chain (three organisations);
- focus on continuous improvement across processes (three organisations); and
- level of supply chain integration between organisation and supply chain partners (one organisation).

These issues will be addressed more pertinently in the individual analysis of each organisation at the end of the chapter.

Table 8.24: Supply chain process issues with suppliers[15] (*n* = 13)

Supply chain process issues (where 1 = limited extent; 2 = average extent; 3 = good extent and 4 = very good extent):	Frequency of responses			
	limited extent	average extent	high extent	very high extent
Compatibility of essential technologies to ensure the seamless flow of materials between partners	2	3	5	3
Contribution towards new product development	4	1	2	4
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information		4	7	2
Focus on total supply chain costs across the supply chain	3	3	5	2
Focus on continuous improvement across processes		2	6	5
Focus on adhering to predetermined quality levels			5	8
Level of supply chain integration between organisation and supply chain partners		4	5	4

Two respondents did not respond to their suppliers' contribution towards new product development. Table 8.24 shows that most organisations experienced integration of processes with their suppliers to an average extent, at least. However, some organisations experienced integration of processes to a limited extent in the following areas:

- compatibility of essential technologies to ensure the seamless flow of materials between partners (two organisations);
- contribution towards new product development (four organisations); and
- focus on total supply chain costs across the supply chain (three organisations).

Once again, these are areas where the organisations may have room for

[15] For purposes of the testing of the conceptual framework a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

improvement regarding their integration of processes with their suppliers. These issues will be addressed more pertinently in the individual analysis of each organisation at the end of the chapter. This concludes the general findings of the research.

Responses from individual organisations regarding the different phases of SCD will be analysed in sections 8.3 to 8.5 of this chapter. The organisations will be grouped together according to the three supply chain strategies, namely lean, agile and leagile. As already mentioned, thirteen organisations participated in the research. Three of these organisations indicated that they were using a lean supply chain strategy; three indicated that they were using an agile supply chain strategy and seven indicated that they were using a leagile supply chain strategy. The identity of the organisations will not be disclosed for confidentiality purposes and will be identified by letters of the alphabet. A summary of the organisations and the supply chain strategies that they follow is provided in Table 8.25. This table groups organisations with similar supply chain strategies together and is appropriate to the discussion in the remainder of the chapter.

Table 8.25: Organisations and their supply chain strategies

Supply chain strategy	Organisation
Lean	A, B, C
Agile	F, H, L
Leagile	D, E, G, I, J, K, M

8.3 BROAD ANALYSIS OF PHASE ONE OF SCD

In phase one of SCD, five SCD elements were analysed by means of five assessment questions using a five-point Likert response format (where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good). An ideal (or satisfactory) response is also indicated in some of the tables that follow. Organisations had to indicate the extent to which they:

- had knowledge of who their end customers are;
- had knowledge of the needs of their end customers;
- had identified a value proposition;

- possessed a core competency; and
- had identified a market winner.

Three organisations indicated that they were using a lean supply chain strategy (refer to Table 8.25). The SCD practices of phase one of these organisations will be discussed first.

8.3.1 Organisations with a lean supply chain strategy

The findings for organisations A, B and C are tabled in Table 8.26.

Table 8.26: Responses of organisations with a lean supply chain strategy for phase one in SCD[16]

The extent to which the organisation *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)*:	Ideal response	Individual organisation's response		
		A	B	C
Knows who their customers are	≥ 3	5	5	4
Knows the needs of their customers	≥ 3	5	5	4
Has identified a formal value proposition	≥ 3	5	4	5
Possesses a core competency	≥ 3	5	3	4
Has identified how to win customers' orders	≥ 3	5	5	4

Table 8.26 shows that all three organisations recorded satisfactory responses. This is indicated by the areas shaded green. Organisation B has a core competency to an average extent. On further analysis, it was found that the product is a commodity and that it was difficult to differentiate the product from those of competitors.

8.3.2 Organisations with an agile supply chain strategy

Three organisations (F, H and L) indicated that they were using an agile supply chain strategy (refer to Table 8.25). Their responses are tabled in Table 8.27. Table 8.27 shows that each of the three organisations with an agile supply chain strategy indicated satisfactory to very good responses for phase one of their SCD analysis. Organisation L identified a formal value proposition to an average extent and organisation F identified its market winner to an average extent.

[16] For purposes of the testing of the conceptual framework, a response of at least 3 (average extent) was deemed satisfactory for these assessment questions. This is indicated as the ideal response.

Table 8.27: Responses of organisations with an agile supply chain strategy for phase one in SCD[17]

The extent to which the organisation *(where 1= very limited; 2= limited; 3= average; 4= good and 5= very good)*:	Ideal response	Individual organisation's response		
		F	H	L
Knows who their customers are	≥ 3	4	4	5
Knows the needs of their customers	≥ 3	4	4	5
Has identified a formal value proposition	≥ 3	4	4	3
Possesses a core competency	≥ 3	4	4	4
Has identified how to win customers' orders	≥ 3	3	4	4

8.3.3 Organisations with a leagile supply chain strategy

Seven organisations indicated that they were using a leagile supply chain strategy. They are organisations D, E, G, I, J, K and M (refer to Table 8.25). Their responses are tabled in Table 8.28.

Table 8.28: Responses of organisations with a leagile supply chain strategy for phase one in SCD[18]

The extent to which the organisation *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)*:	Ideal response	Individual organisation's response						
		D	E	G	I	J	K	M
Knows who their customers are	≥ 3	4	5	5	5	5	5	5
Knows the needs of their customers	≥ 3	4	5	5	4	4	5	4
Has identified a formal value proposition	≥ 3	5	4	4	5	5	5	5
Possesses a core competency	≥ 3	5	4	4	4	5	4	5
Has identified how to win customers' orders	≥ 3	5	4	5	5	5	5	4

Table 8.28 shows that all the organisations with a leagile supply chain strategy have satisfactory responses in terms of the elements of phase one of SCD. This is indicated by the areas shaded green.

8.4 BROAD ANALYSIS OF PHASE TWO OF SCD

In phase two of SCD organisations had to indicate their market demand predictability and their specific market winners. They also had to indicate what the organisation's position was in terms of the decoupling point and what the focus of their supply chain strategy was. This discussion will also involve three main sections according to the groups of organisations with similar supply chain strategies (refer to Table 8.25). An

[17] For purposes of the testing of the conceptual framework, a response of at least 3 (average extent) was deemed satisfactory for these assessment questions. This is indicated as the ideal response.
[18] For purposes of the testing of the conceptual framework, a response of at least 3 (average extent) was deemed satisfactory for these assessment questions. This is indicated as the ideal response.

ideal (or satisfactory) response is indicated for each assessment question.

8.4.1 Organisations with a lean supply chain strategy

The responses of organisations with a lean supply chain strategy (A, B and C) in terms of phase two of SCD are shown in Table 8.29.

Table 8.29: Responses of organisations with a lean supply chain strategy for phase two in SCD

SCD elements in phase two of SCD analysis:	Ideal response	Organisation's response		
		A	B	C
Market demand for the product	≤ 2	1	1	2
Market winner	≤ 2	4	2	3
Position of decoupling point	3	2	2	2
Focus of supply chain strategy	≤ 2	1	1	2

A response of 1 or 2 for market demand predictability, market winners and focus of the supply chain strategy indicated compatibility with a lean supply chain strategy, according to theoretical principles. Table 8.29 shows that market demand predictability for organisation B and its market winners were aligned. However, organisations A and C recorded misaligned responses. This is indicated by the areas shaded red. Organisations A and C were referred to Tables 6.5 and 6.8 to confirm their responses about their market demand predictability and their market winners. If they are satisfied with their initial responses, the position of the decoupling point will be used to suggest the appropriate supply chain strategy to them. All three organisations were positioned at the decoupling point (response of 2). To continue with the analysis, it was assumed that a lean supply chain strategy was appropriate for all three organisations.

8.4.2 Organisations with an agile supply chain strategy

The responses of the three organisations (F, H and L) with an agile supply chain strategy in terms of phase two of SCD are illustrated in Table 8.30.

Table 8.30: Responses of organisations with an agile supply chain strategy for phase two in SCD

SCD elements in phase two of SCD analysis:	Ideal response	Organisation's response		
		F	H	L
Market demand for the product	≥ 3	4	3	2
Market winner	≥ 3	3	3	3
Position of decoupling point	1	1	1	1
Focus of supply chain strategy	≥ 4	4	4	4

A response of 3 or 4 for market demand predictability, market winners and focus of the supply chain strategy indicated compatibility with an agile supply chain strategy (according to theoretical principles). Table 8.30 shows that all the organisations had satisfactory (or aligned) responses for phase two of their SCD analysis (except one response indicated in red). Organisation L's response in terms of its market demand predictability is not ideal and needs to be confirmed. This can be done by means of Table 6.8. All three organisations were positioned downstream from the decoupling point (response of 1). However, only organisation L's position in terms of the decoupling point will be used to suggest a supply chain strategy because organisations F and H have aligned responses in terms of their market demand predictability and market winners. To continue with the analysis it was assumed that an agile supply chain strategy was appropriate for all three organisations.

8.4.3 Organisations with a leagile supply chain strategy

The responses of the seven organisations (D, E, G, I, J, K and M) with a leagile supply chain strategy is shown in Table 8.31.

Table 8.31: Responses of organisations with a leagile supply chain strategy for phase two in SCD

SCD elements in phase two of SCD analysis:	Ideal response	Individual organisation's response						
		D	E	G	I	J	K	M
Market demand for the product		3	1	1	2	1	3	2
Market winner		2	1	4	3	3	4	4
Position of decoupling point	2	1	1	1	2	2	2	2
Focus of supply chain strategy	3	3	3	3	3	3	3	3

A response of 1 or 2 for market demand predictability and market winners indicated compatibility with a lean supply chain strategy while a response of 3 or 4 for the same variables indicated compatibility with an agile supply chain strategy (according to theoretical principles). Alignment between market demand predictability and market winners is indicated by the areas shaded green while misalignment is indicated by the areas shaded red. Only two organisations (E and K) had alignment between these variables. The organisations' with misaligned responses for market demand predictability and market winners (D, G, I, J and M) will be referred to their position in terms of their decoupling point to suggest a supply chain strategy for the organisations. Three organisations (D, E and G) were positioned downstream from the decoupling point (response of one) while organisations I, J, K and M were positioned at the decoupling point (response of two).

8.5 BROAD ANALYSIS OF PHASE THREE OF SCD

In phase three, three broad SCD elements were analysed. These elements were supply chain partners, supply chain drivers and supply chain KPI categories.

8.5.1 Supply chain partners

Supply chain partners were sub divided further into five elements. Five assessment questions were used to establish how well organisations had identified and managed these relationships. These assessment questions are illustrated in Table 6.13. Organisations were asked to indicate the extent (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable) to which their organisation:

- knew who its critical supply chain partners were (where supply chain relationships needed to be managed concerning processes, information and technology);
- had made an effort to get into contact with the 'right' direct 1st-tier supply chain partners (identified, evaluated and selected their most important direct suppliers and customers) based on capability considerations;
- managed their critical direct (1st-tier) supply chain relationships;
- was able to manage their critical supply chain relationships beyond the 1st tier (2nd tier to *n*th tier); and
- managed their critical supply chain relationships beyond the 1st tier (2nd tier to *n*th tier).

8.5.1.1 Organisations with a lean supply chain strategy

The responses for organisations A, B and C are presented in Tables 8.32 and 8.33. There are two tables for this section to distinguish between relationships with suppliers and relationships with customers. An ideal/ satisfactory response is indicated in each table.

Table 8.32: Organisations' relationships with suppliers (lean supply chains)[19]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Organisation's response		
		A	B	C
Knows who their critical suppliers are	≥ 2	4	4	4
Has made an effort to get into contact with the right direct 1st-tier suppliers	≥ 2	4	4	4
Manages their direct 1st-tier suppliers	≥ 2	4	4	3
Is able to manage critical suppliers beyond 1st tier	≥ 2	2	2	3
Manages critical suppliers beyond 1st tier	≥ 2	2	2	2

Table 8.32 clearly shows that all three organisations have sound relationships with their suppliers. All three organisations managed their critical suppliers beyond the 1st tier to an average extent.

Table 8.33: Organisations' relationships with customers (lean supply chains)[20]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable):	Ideal response	Organisation's response		
		A	B	C
Knows who their critical customers are	≥ 2	4	4	4
Has made an effort to get into contact with the right direct 1st-tier customers	≥ 2	3	3	4
Manages their direct 1st-tier customers	≥ 2	3	3	3
Is able to manage critical customers beyond 1st tier	≥ 2	1	1	3
Manages critical customers beyond 1st tier	≥ 2	1	1	3

It is clear from Table 8.33 that all three organisations manage their first-tier customers to at least a good extent. However, when the relationship moves downstream beyond the first tier it is managed to a limited extent by two of the organisations (A and B). The conceptual framework will refer these two organisations to Table 6.14 for further analysis and to identify potential areas where these relationships can be improved.

[19] For purposes of the testing of the conceptual framework a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

[20] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

The responses of organisations A and B for Table 6.14 in terms of their integration practices with their customers are provided in Table 8.34. After analysis of the organisations' SCI practices, the potential areas for improvement for organisations A and B are highlighted in areas shaded red in Table 8.34.

Table 8.34: Potential areas for improvement with customers (lean supply chains)[21]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response	
		A	B
Level of interdependence	≥ 2	4	3
Long-term commitment from both parties	≥ 2	4	4
Level of trust	≥ 2	2	2
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	4	4
Sharing supply chain risks	≥ 2	1	1
Sharing benefits/ rewards	≥ 2	1	1
Degree of collaboration achieved	≥ 2	3	3
Development of supply chain capabilities to optimise the supply chain	≥ 2	1	1
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	4	4
Adhering to predetermined payment conditions	≥ 2	4	4
Supply chain processes:			
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	1	1
Contribution towards new product development	≥ 2	1	1
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	2	2
Focus on total supply chain costs across the supply chain	≥ 2	1	1
Focus on continuous improvement across processes	≥ 2	1	1
Focus on adhering to predetermined quality levels	≥ 2	3	3
Level of supply chain integration between organisation and supply chain partners	≥ 2	2	2

From Table 8.34 the following areas (indicated by the areas shaded red) were identified as possible areas for improvement beyond the first tier:

- sharing supply chain risks;
- sharing benefits/ rewards;
- development of supply chain capabilities to optimise the supply chain;
- compatibility of essential technologies to ensure the seamless flow of materials between partners;
- contribution towards new product development;

[21] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

- focus on total supply chain costs across the supply chain; and
- focus on continuous improvement across processes.

8.5.1.2 Organisations with an agile supply chain strategy

The responses of the three agile organisations (F, H and L) in terms of their supply chain relationships are provided in Tables 8.35 and 8.37. The two tables for this section distinguish between relationships with suppliers and relationships with customers. An ideal/ satisfactory response is indicated in each table.

Table 8.35: Organisations' relationships with suppliers (agile supply chains)[22]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Organisation's response		
		F	H	L
Knows who their critical suppliers are	≥ 2	4	4	4
Has made an effort to get into contact with the right direct 1st-tier suppliers	≥ 2	4	4	4
Manages their direct 1st-tier suppliers	≥ 2	3	3	4
Is able to manage critical suppliers beyond 1st tier	≥ 2	1	1	-
Manages critical suppliers beyond 1st tier	≥ 2	1	1	-

From Table 8.35 it is clear that all three organisations manage their first-tier suppliers at least to a good extent. However, when the relationship moves beyond the first tier upstream it is managed to a limited extent by organisations F and H. Organisation L did not have relationships with suppliers beyond the first tier (indicated by the yellow areas). Organisations F and H should analyse their relationships with their suppliers further to determine potential areas where these relationships can be improved because of their response of 1 for the two assessment questions. The conceptual framework will refer these two organisations to Table 6.14 for further analysis and to identify potential areas where these relationships can be improved. The responses of organisations F and H for Table 6.14 in terms of their integration practices with their suppliers and where there may be potential areas for improvement are presented in Table 8.36.

[22] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

Table 8.36: Potential areas for improvement with suppliers (agile supply chains)[23]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response		
		F	H	L
Level of interdependence	≥ 2	2	2	4
Long-term commitment from both parties	≥ 2	3	3	4
Level of trust	≥ 2	3	3	3
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	2	2	2
Sharing supply chain risks	≥ 2	1	1	4
Sharing benefits/ rewards	≥ 2	2	2	3
Degree of collaboration achieved	≥ 2	2	2	3
Development of supply chain capabilities to optimise the supply chain	≥ 2	2	2	3
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	3	3	4
Adhering to predetermined payment conditions	≥ 2	3	3	4
Supply chain processes:				
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	2	2	4
Contribution towards new product development	≥ 2	1	1	3
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	2	2	3
Focus on total supply chain costs across the supply chain	≥ 2	1	1	3
Focus on continuous improvement across processes	≥ 2	2	2	4
Focus on adhering to predetermined quality levels	≥ 2	3	3	4
Level of supply chain integration between organisation and supply chain partners	≥ 2	2	2	4

From Table 8.36, the following areas (indicated by the areas shaded red) can be identified for trying to improve relationships with suppliers beyond the first tier for organisations F and H:

- sharing supply chain risks;
- contribution towards new product development; and
- focus on total supply chain costs across the supply chain.

The responses of the three organisations (F, H and L) in terms of their relationships with their customers are provided in Table 8.37.

[23] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

Table 8.37: Organisations' relationships with customers (agile supply chains)[24]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Organisation's response		
		F	H	L
Knows who their critical customers are	≥ 2	4	4	3
Has made an effort to get into contact with the right direct 1st-tier customers	≥ 2	4	4	3
Manages their direct 1st-tier customers	≥ 2	4	4	3
Is able to manage critical customers beyond 1st tier	≥ 2	1	1	1
Manages critical customers beyond 1st tier	≥ 2	1	1	1

From Table 8.37 it is clear that all three organisations manage their first tier customers to at least a good extent. Organisations F and H manage these relationships to a very good extent. However, when the relationship moves downstream beyond the first tier it is managed to a limited extent.

All three organisations should analyse their relationships with their customers further to determine potential areas where these relationships can be improved because of their response of 1 for the two assessment questions. Organisations F, H and L were referred to Table 6.14 for further analysis. The responses of the organisations for Table 6.14 in terms of their integration practices with their customers and where there may be potential areas for improvement are presented in Table 8.38. Table 8.38 shows that there are no obvious reasons for organisations F and H to improve their supply chain relationships with their customers beyond the first tier. Organisation L can consider improving its relationship with its customers beyond the first tier in the following areas (indicated by areas shaded red):

- adhering to predetermined payment conditions; and
- compatibility of essential technologies to ensure the seamless flow of materials between partners.

[24] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

Table 8.38: Potential areas for improvement with customers (agile supply chains)[25]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response		
		F	H	L
Level of interdependence	≥ 2	3	3	2
Long-term commitment from both parties	≥ 2	4	4	2
Level of trust	≥ 2	4	4	3
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	3	3	3
Sharing supply chain risks	≥ 2	2	2	4
Sharing benefits/ rewards	≥ 2	3	3	3
Degree of collaboration achieved	≥ 2	4	4	2
Development of supply chain capabilities to optimise the supply chain	≥ 2	3	3	3
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	3	3	3
Adhering to predetermined payment conditions	≥ 2	3	3	1
Supply chain processes:				
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	3	3	2
Contribution towards new product development	≥ 2	2	2	2
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	3	3	1
Focus on total supply chain costs across the supply chain	≥ 2	3	3	2
Focus on continuous improvement across processes	≥ 2	3	3	3
Focus on adhering to predetermined quality levels	≥ 2	3	3	3
Level of supply chain integration between organisation and supply chain partners	≥ 2	3	3	2

8.5.1.3 Organisations with a leagile supply chain strategy

The responses of the seven organisations that have a leagile supply chain strategy in terms of their supply chain relationships are provided in Tables 8.39 and 8.41. There are two tables in this section to distinguish between relationships with suppliers and relationships with customers. An ideal/ satisfactory response is indicated in each table.

[25] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

Table 8.39: Organisations' relationships with suppliers (leagile supply chains)[26]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Individual organisation's response						
		D	E	G	I	J	K	M
Knows who their critical suppliers are	≥ 2	3	4	4	4	4	4	4
Has made an effort to get into contact with the right direct 1st-tier suppliers	≥ 2	3	4	4	4	4	4	4
Manages their direct 1st-tier suppliers	≥ 2	3	4	4	4	4	4	4
Is able to manage critical suppliers beyond 1st tier	≥ 2	4	-	-	2	2	2	4
Manages critical suppliers beyond 1st tier	≥ 2	4	-	-	1	1	2	2

From Table 8.39 it is clear that six of the seven organisations manage their first-tier suppliers to a very good extent. Only organisation D manages their first-tier suppliers to a good extent. However, when the relationship moves upstream beyond the first tier, organisations I and J manage these relationships to a limited extent. The conceptual framework will refer these two organisations to Table 6.14 for further analysis and to identify potential areas where these relationships can be improved. The responses of organisations I and J for Table 6.14 in terms of their integration practices with their suppliers are provided in Table 8.40. Organisations E and G do not have relationships with suppliers beyond the first tier.

[26] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

Table 8.40: Potential areas for improvement with suppliers (leagile supply chains)[27]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response	
		I	J
Level of interdependence	≥ 2	4	4
Long-term commitment from both parties	≥ 2	3	3
Level of trust	≥ 2	4	4
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	3	3
Sharing supply chain risks	≥ 2	3	3
Sharing benefits/ rewards	≥ 2	3	3
Degree of collaboration achieved	≥ 2	3	3
Development of supply chain capabilities to optimise the supply chain	≥ 2	4	4
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	4	4
Adhering to predetermined payment conditions	≥ 2	3	3
Supply chain processes:			
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	3	3
Contribution towards new product development	≥ 2	4	4
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	3	3
Focus on total supply chain costs across the supply chain	≥ 2	3	3
Focus on continuous improvement across processes	≥ 2	3	3
Focus on adhering to predetermined quality levels	≥ 2	4	4
Level of supply chain integration between organisation and supply chain partners	≥ 2	3	3

Table 8.40 shows no obvious areas where there may be room for improvement for organisations I and J. These organisations will have to carefully decide whether these relationships in fact can be improved, if necessary.

Table 8.41: Organisations' relationships with customers (leagile supply chains)[28]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Individual organisation's response						
		D	E	G	I	J	K	M
Knows who their critical customers are	≥ 2	4	4	1	4	4	3	4
Has made an effort to get into contact with the right direct 1st-tier customers	≥ 2	4	4	4	4	4	3	4
Manages their direct 1st-tier customers	≥ 2	3	4	4	4	4	3	4
Is able to manage critical customers beyond 1st tier	≥ 2	4	-	3	2	2	3	4
Manages critical customers beyond 1st tier	≥ 2	4	-	1	2	2	3	2

[27] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.
[28] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

Table 8.41 shows that most of the seven organisations (with the exception of one) manage their first-tier customers at least to a good extent. When the relationship moves downstream beyond the first tier it is managed to a limited extent by organisation G. Organisation G can analyse its relationships with their customers further to determine potential areas where these relationships can be improved. The responses of organisation G in terms of its integration practices with customers and where there may be potential areas for improvement are tabled in Table 8.42.

Table 8.42: Potential areas for improvement with customers (leagile supply chains)[29]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response G
Level of interdependence	≥ 2	3
Long-term commitment from both parties	≥ 2	3
Level of trust	≥ 2	3
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	3
Sharing supply chain risks	≥ 2	4
Sharing benefits/ rewards	≥ 2	2
Degree of collaboration achieved	≥ 2	4
Development of supply chain capabilities to optimise the supply chain	≥ 2	3
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	3
Adhering to predetermined payment conditions	≥ 2	4
Supply chain processes:		
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	3
Contribution towards new product development	≥ 2	1
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	2
Focus on total supply chain costs across the supply chain	≥ 2	2
Focus on continuous improvement across processes	≥ 2	4
Focus on adhering to predetermined quality levels	≥ 2	4
Level of supply chain integration between organisation and supply chain partners	≥ 2	3

Table 8.42 shows one area where there may be room for improvement for organisation G. This area is the customers' contribution towards new product development. Organisation G will also have to carefully decide whether this relationship in fact can be improved in this area and whether it, in fact, is necessary (or viable) to improve the relationship.

[29] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

8.5.2 Supply chain drivers

Concerning supply chain drivers, organisations were asked to indicate where they would position their organisation in terms of how they manage their supply chain drivers along a continuum (where 1 = a strong focus on efficiency and 4 = a strong focus on responsiveness). A response of 1 on the one side of the continuum will indicate that the supply chain drivers are managed according to lean principles while a response of 4 will indicate that the supply chain drivers are managed with agility in mind. The nine assessment questions cover the six supply chain drivers of facilities, inventory, transportation, information, sourcing and pricing. The nine assessment questions cover the areas of (refer to Table 6.15):

- SCD element #3.2.1: Capacity utilisation in facilities;
- SCD element #3.2.2: Location of facilities;
- SCD element #3.2.3: Inventory levels;
- SCD element #3.2.4: Lead times;
- SCD element #3.2.5: Transportation cost;
- SCD element #3.2.6: Transportation frequency;
- SCD element #3.2.7: Information collection;
- SCD element #3.2.8: Supplier selection criteria; and
- SCD element #3.2.9: Pricing/ profit margins.

8.5.2.1 Organisations with a lean supply chain strategy

The responses of organisations A, B and C are shown in Table 8.43. The ideal response for the management of each of these SCD elements according to a lean supply chain strategy is also indicated in the table.

Table 8.43: Management of supply chain drivers (lean supply chains)

SCD element (in terms of the management of supply chain drivers):	Ideal response	Organisation's response		
		A	B	C
Capacity utilisation	≤ 2	1	1	2
Location of facilities	≤ 2	4	3	3
Inventory	≤ 2	1	1	2
Lead times	≤ 2	1	1	3
Transportation cost	≤ 2	1	1	2
Transportation frequency	≤ 2	4	2	3
Information	≤ 2	4	2	3
Supplier selection criteria	≤ 2	4	2	3
Pricing/ profit margins	≤ 2	3	2	-

Table 8.43 shows that organisation B is managing eight of the nine SCD elements associated with supply chain drivers according to lean supply chain principles. Organisation A (four SCD elements) and organisation C (three SCD elements) are managing very few of the nine SCD elements according to lean supply chain principles. Organisation C did not respond to the assessment of its pricing policies. According to Table 8.43, all three organisations (A, B and C) are managing some of the supply chain drivers according to an agile supply chain strategy. These possible contradictions are highlighted by areas shaded red. For this section, the conceptual framework suggests further analysis by means of suggestions or recommendations. Organisations can re-evaluate the management of their supply chain drivers by using the framework suggestions in Table 6.16. The further analysis will cover the following SCD elements (as highlighted by the areas shaded red in Table 8.43):

- Location of facilities (organisations A, B and C). Generally, if facilities are centralised, costs can be reduced.
- Lead times (organisation C). If lead times do not need to be short, transportation costs can be reduced because slower and cheaper modes of transport can be used. This is possible because of a predictable market demand (refer to Table 8.29).
- Transportation frequency (organisations A and C). If less frequent shipments are used, costs can be reduced. Once again, this should be possible because both organisations indicated that their market demand was predictable (refer to Table 8.29).
- Information management (organisations A and C). These organisations have to determine whether they are not investing too much in their information systems.

- Supplier selection criteria (organisations A and C). It is unclear why organisations A and C select suppliers based on speed and flexibility if the market demand is predictable. Organisation A and C should consider suppliers that offer lower costs.
- Pricing/ profit margins (organisation A). Organisation A should consider whether sales volumes will not increase if price margins are reduced to ultimately increase profits.

8.5.2.2 Organisations with an agile supply chain strategy

The responses of organisations F, H and L are shown in Table 8.44. The ideal response for the management of each of these supply chain drivers according to an agile supply chain strategy is also indicated in the table.

Table 8.44: Management of supply chain drivers (agile supply chains)

SCD element (in terms of the management of supply chain drivers):	Ideal response	Organisation's response		
		F	H	L
Capacity utilisation	≥ 3	3	3	2
Location of facilities	≥ 3	2	2	1
Inventory	≥ 3	2	2	2
Lead times	≥ 3	2	2	2
Transportation cost	≥ 3	1	1	4
Transportation frequency	≥ 3	3	3	4
Information	≥ 3	3	3	4
Supplier selection criteria	≥ 3	4	4	4
Pricing/ profit margins	≥ 3	1	1	3

Table 8.44 shows that organisations F and H are managing four of the SCD elements associated with supply chain drivers according to agile principles. Organisation L is managing five of the nine elements according to agile principles. This is indicated by the areas shaded green. According to Table 8.44, the three organisations with an agile supply chain strategy are managing some of their supply chain drivers according to a lean supply chain strategy. These areas are indicated by the areas shaded red. For this section, the conceptual framework suggests further analysis. Organisations can re-evaluate their SCD practices concerning these issues by using suggestions from Table 6.16. The analysis covers:

- Capacity utilisation (organisation L). Organisation L will have to establish whether it has enough available capacity (that is not being utilised) to allow for flexibility in terms of unexpected customer demand.

- Location of facilities (organisations F, H and L). If facilities are decentralised, agility is enhanced in terms of customer service, reduced lead times and so on.
- Inventory management (organisations F, H and L). Organisations must determine whether they are meeting their customers' demands in terms of product availability with their current inventory management policies.
- Lead times (organisations F, H and L). Organisations must determine whether they cannot reduce lead times slightly to improve their customer service. If lead times are reduced, customer service is improved.
- Transportation cost (organisations F and H). Organisations F and H must determine whether they are meeting their customers' demands with their current transportation service. If not, they will have to use faster (but more expensive) means of transport.
- Pricing/ profit margins (organisations F and H).

8.5.2.3 Organisations with a leagile supply chain strategy

The responses of the seven organisations with a leagile supply chain strategy are shown in Table 8.45. Due to the complex nature of leagile supply chains, each organisation will have to analyse each of its supply chain drivers individually. The areas shaded green indicate where the supply chain drivers are managed according to lean principles and the areas shaded blue indicate where the supply chain drivers are managed according to agile principles.

Table 8.45: Management of supply chain drivers (leagile supply chains)

SCD element (in terms of the management of supply chain drivers):	Individual organisation's response						
	D	E	G	I	J	K	M
Capacity utilisation	2	1	2	1	1	2	1
Location of facilities	1	1	4	4	4	2	1
Inventory	2	2	2	1	1	2	2
Lead times	1	4	3	2	2	2	1
Transportation cost	1	1	3	1	1	2	1
Transportation frequency	3	2	3	4	4	2	4
Information	3	4	3	4	4	2	4
Supplier selection criteria	3	4	-	2	2	2	2
Pricing/ profit margins	2	2	2	1	1	3	2

Table 8.45 shows that organisations D, E, I, J, K and M are managing most of the

SCD elements associated with their supply chain drivers according to lean supply chain principles. Only organisation G is managing most of the SCD elements associated with supply chain drivers according to agile supply chain principles. Each organisation will use Table 6.16 to further analyse each of these supply chain drivers to determine whether they are optimising their supply chains. They will have to consider the trade-offs that exist between these drivers carefully.

8.5.3 Supply chain KPIs

Organisations were asked to rate the relative importance of the following supply chain KPI categories (where 1 = most important KPI category and 6 = least important KPI category). The assessment question to analyse supply chain KPI categories is illustrated in Table 6.17. If two or more KPI categories are of equal importance, then organisations had to indicate it as such. Organisations had to rate the following KPI categories:

- supply chain delivery reliability;
- supply chain responsiveness;
- supply chain flexibility;
- cost measures within the organisation;
- cost measures across the supply chain; and
- supply chain asset management efficiency.

8.5.3.1 Organisations with a lean supply chain strategy

The responses of organisations A, B and C are shown in Table 8.46. According to theoretical principles, organisations with a lean supply chain strategy must rate *cost measures* and *asset management efficiency* as important KPI categories.

Table 8.46: Rating of supply chain KPI categories (lean supply chains)

Supply chain KPI category	Ideal rating	Rating of organisation		
		A	B	C
Supply chain delivery reliability		1	2	3
Supply chain responsiveness		2		4
Supply chain flexibility				5
Cost reductions within the organisation	1st	3	1	1
Cost reductions across the entire supply chain	1st			2
Supply chain asset management efficiency	1st			1

Table 8.46 shows that organisations B and C are focusing on some of the correct KPI categories. This is indicated by the areas shaded green. Organisation A also focuses on cost measures but they may consider placing more emphasis on their cost measures because they are using a lean supply chain strategy which aims at reducing cost. All three organisations may also consider looking at cost reduction across the entire supply chain.

8.5.3.2 Organisations with an agile supply chain strategy

The responses of organisations F, H and L are shown in Table 8.47. According to theoretical principles, organisations with an agile supply chain strategy must rate supply chain *reliability*, *responsiveness* and *flexibility* as important KPI categories. The important KPI categories for agile supply chains are highlighted by the areas shaded green.

Table 8.47: Rating of supply chain KPI categories (agile supply chains)

Supply chain KPI category	Ideal rating	Rating of organisation		
		F	H	L
Supply chain delivery reliability	1ST	1	1	2
Supply chain responsiveness	1st	1		2
Supply chain flexibility	1st	1		3
Cost reductions within the organisation		1	1	1
Cost reductions across the entire supply chain			4	4
Supply chain asset management efficiency		2	2	2

Table 8.47 shows that organisation F is focusing on the correct KPI categories. This is shown by the areas shaded green. Organisation H focuses on supply chain reliability, but can place more emphasis on supply chain responsiveness and flexibility measures. Organisation L can place more emphasis on all three the KPI categories that are important for agile supply chains.

8.5.3.3 Organisations with a leagile supply chain strategy

The responses of the seven organisations with a leagile supply chain strategy are shown in Table 8.48. According to theoretical principles, organisations with a leagile supply chain strategy must focus on all the KPI categories.

Table 8.48: Rating of supply chain KPI categories (leagile supply chains)

Supply chain KPI	Ideal rating	Rating of organisation						
		D	E	G	I	J	K	M
Supply chain delivery reliability	1st	1	1	1	1	1	1	1
Supply chain responsiveness	1st	1	1	2	2	2	4	1
Supply chain flexibility	1st	3		3	6	6	2	2
Cost reductions within the organisation	1st	1	1	2	3	3	3	1
Cost reductions across the entire supply chain	1st	1	1	3	3	3	6	2
Supply chain asset management efficiency	1st	1	6	1	3	3	5	1

Table 8.48 shows that organisations D, E and M are focusing on many of the right KPI categories. This is highlighted by the areas shaded green. However, organisations G, I, J and K will have to consider whether they are focusing on the correct KPI categories. Table 6.18 can be used for this purpose.

8.6 CONCLUSION

Chapter 8 has reflected on the empirical findings of this study. The chapter started with the general findings of the research. In this section, all the respondents' responses across all the SCD elements as a whole were discussed. In the latter section of this chapter, a broad analysis across each of the three supply chain design phases was undertaken. The broad analysis was done by categorising the organisations with similar supply chain strategies together. Therefore, the findings as well as a broad analysis was presented for organisations with lean, agile and leagile supply chain strategies. The study concludes with Chapter 9, which presents the conclusions that have been drawn and makes recommendations with regard to the study.

CHAPTER 9
CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

In this chapter, the conclusions arrived at and recommendations derived from the study are presented. More specifically, conclusions are drawn about the conceptual framework proposed in this study for analysing the SCD practices of organisations. The conclusions in the chapter are organised according to the research objectives stated for this study. In the first section, the conclusions concern the compilation of the conceptual framework from literature. In the second section, the conclusions concern the explorative assessment of the conceptual framework across the three phases of SCD that tested its usability as an instrument. The chapter and study closes with general recommendations concerning the conceptual framework. To ensure that the research objectives are met, they are mentioned again: The main objective of this study was to develop a conceptual framework from the literature for the use of organisations to analyse their SCD practices with the aim of improving performance. To achieve the main objective, the study also comprised several secondary objectives. The secondary objectives of the study were to:

- determine the elements of SCD by means of an extensive study of literature about SCD;
- exploratively test the conceptual framework to determine whether it is a usable assessment instrument in terms of helping organisations to determine:
    - the extent to which they understand the needs of their supply chain's end customers;
    - the extent to which they know how to meet the needs of their customers;
    - the supply chain strategy on which they are focused;
    - whether their supply chain strategy is aligned towards meeting the needs of the supply chain's end customers;
    - the extent to which supply chain partners were managed;
    - how supply chain drivers were managed and whether this was aligned to their supply chain strategy;

- whether their focus was on the correct supply chain KPI categories for their supply chain strategy; and
- whether the conceptual framework contributed to improvement of these practices by offering recommendations, if necessary, within each component of the framework.

9.2 THE DEVELOPMENT OF THE CONCEPTUAL FRAMEWORK FROM LITERATURE

The main objective of this study was to develop a conceptual framework from the literature that could be used by organisations to analyse their SCD practices with the aim of improving supply chain performance. The first secondary objective was to determine the elements of SCD by means of an extensive literature study about SCD. These objectives were met.

A literature study on SCD was done. From the literature study, the phases of SCD as well as the essential elements thereof were identified. These phases and SCD elements formed the basis of the development of the conceptual framework for analysing SCD practices. Assessment questions were developed for each SCD element to assess organisations' SCD practices across the three phases of SCD. A summary of the complete conceptual framework is provided in Annexure A.

9.2.1 The three phases of SCD

From the literature it was concluded that SCD essentially consists of three phases. These are illustrated in Figure 9.1. Firstly, supply chains must understand the nature of the needs of their end customers (Taylor, 2004:259) and how these needs can be met by some value proposition (Christopher, 2005:57). Each organisation must know how it can contribute value to meet the demands of its supply chain's end customers (Fawcett *et al*., 2007:222; Christopher, 2005:57). Secondly, organisations must select a supply chain strategy to be able to deliver value to their end customers (Taylor, 2004:279). Thirdly, once a supply chain strategy has been selected, the supply chain structure needs to be configured (Sharifi *et al*., 2006:1078; Fawcett *et al*., 2007:222). This includes deciding which supply chain partners to partner with, as well as assigning roles and responsibilities to each of the supply chain members. It also includes managing the supply chain drivers, as well as selecting the correct supply chain KPIs according to the selected supply chain strategy (Fawcett *et al.*, 2007:335; Taylor, 2004:284). Phases two and three have to be aligned towards meeting the first phase, which is meeting the end customers' needs (Sharifi *et al*., 2006:1078).

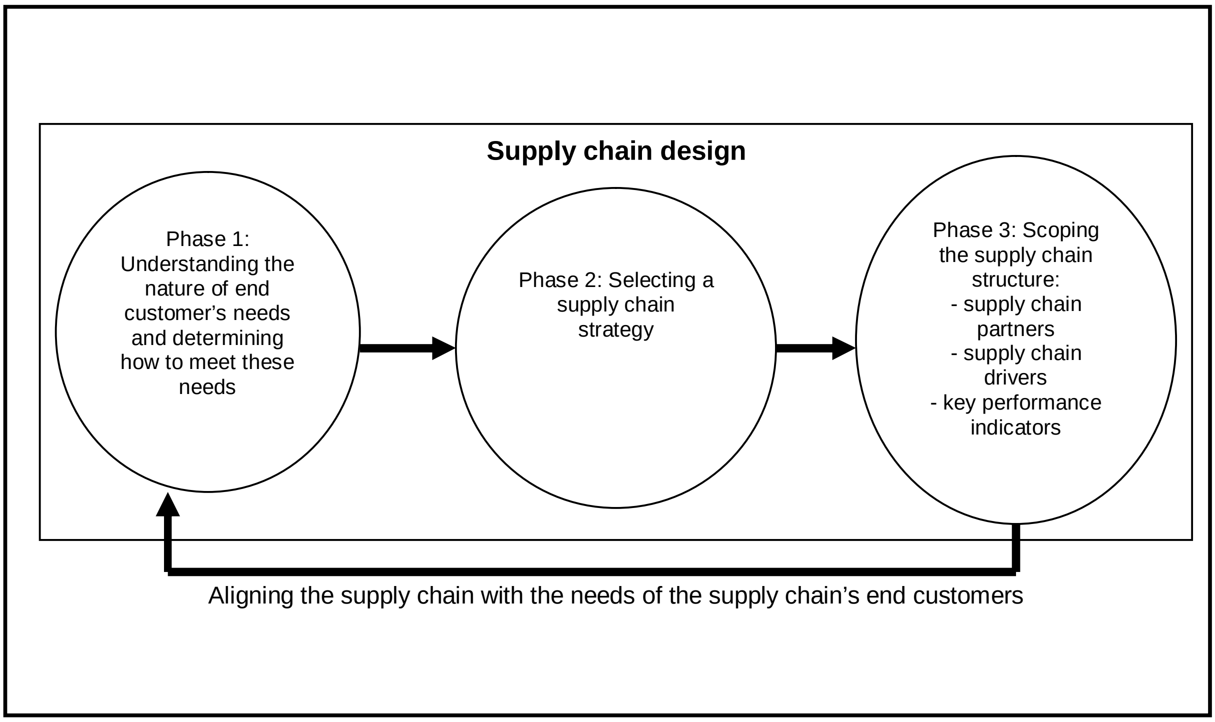

Figure 9.1: The three phases of supply chain design
Source: Compiled from Taylor (2004:259, 279, 284), Fawcett *et al*. (2007:20) and Christopher (2005:57).

In conclusion, SCD therefore consists of the following three phases that have to be aligned with each other:

- Phase 1: Understanding the needs of end customers and how to meet these needs;
- Phase 2: Selecting a supply chain strategy; and
- Phase 3: Structuring the supply chain.

9.2.2 Summary of the SCD elements identified for inclusion in the conceptual framework

Twelve broad supply chain design elements across the three phases of SCD were identified from the literature study. These SCD elements were included in the conceptual framework to form the basis on which SCD practices can be analysed. Five SCD elements were identified for inclusion in phase one of SCD. These elements were discussed in depth in Chapter 2 and are:

- SCD element #1.1: Knowing who the end customers are;
- SCD element #1.2: Knowing the needs of the end customers;
- SCD element #1.3: Identifying a formal value proposition to meet end customers' needs;
- SCD element #1.4: Possessing a core competency to deliver the value proposition; and
- SCD element #1.5: Identifying market winners.

Once organisations understand the needs of their end customers and how to meet these needs (in terms of a broad value proposition and core competencies based on market winners), they have to select an appropriate supply chain strategy (phase two of SCD). However, before selecting a supply chain strategy, organisations have to determine how predictable the market demand is. They also have to determine what the exact market winners are. Therefore, the market demand predictability and specific market winners were identified as SCD elements #2.1 and #2.2. The organisation's position in terms of the decoupling point was identified as supply chain design element #2.3 and the supply chain strategy was identified as supply chain design element #2.4. The SCD elements of phase two of SCD thus are:

- SCD element #2.1: Market demand predictability;
- SCD element #2.2: Market winners;
- SCD element #2.3: Position of the decoupling point; and
- SCD element #2.4: Supply chain strategy.

The SCD elements of phase three of SCD were identified as:

- SCD element #3.1: supply chain partners;
- SCD element #3.2: supply chain drivers; and
- SCD element #3.3: supply chain KPIs being used to measure performance.

SCD element #3.1 (supply chain partners) was further divided into five sub elements. These are:

- SCD element #3.1.1: Knowledge of supply chain partners;
- SCD element #3.1.2: Effort to get in touch with the right supply chain partners;
- SCD element #3.1.3: Management of supply chain partners (first tier);
- SCD element #3.1.4: Potential for managing supply chain partners (beyond the first tier); and
- SCD element #3.1.5: Management of supply chain partners (beyond the first tier).

SCD element #3.2 (supply chain drivers) was also further divided into nine sub elements. They are:

- SCD element #3.2.1: Capacity utilisation in facilities;
- SCD element #3.2.2: Location of facilities;
- SCD element #3.2.3: Inventory levels;
- SCD element #3.2.4: Lead times;
- SCD element #3.2.5: Transportation cost;
- SCD element #3.2.6: Transportation frequency;
- SCD element #3.2.7: Information collection;
- SCD element #3.2.8: Supplier selection criteria; and
- SCD element #3.2.9: Pricing/ profit margins.

A summary of these SCD elements is provided in Figure 9.2.

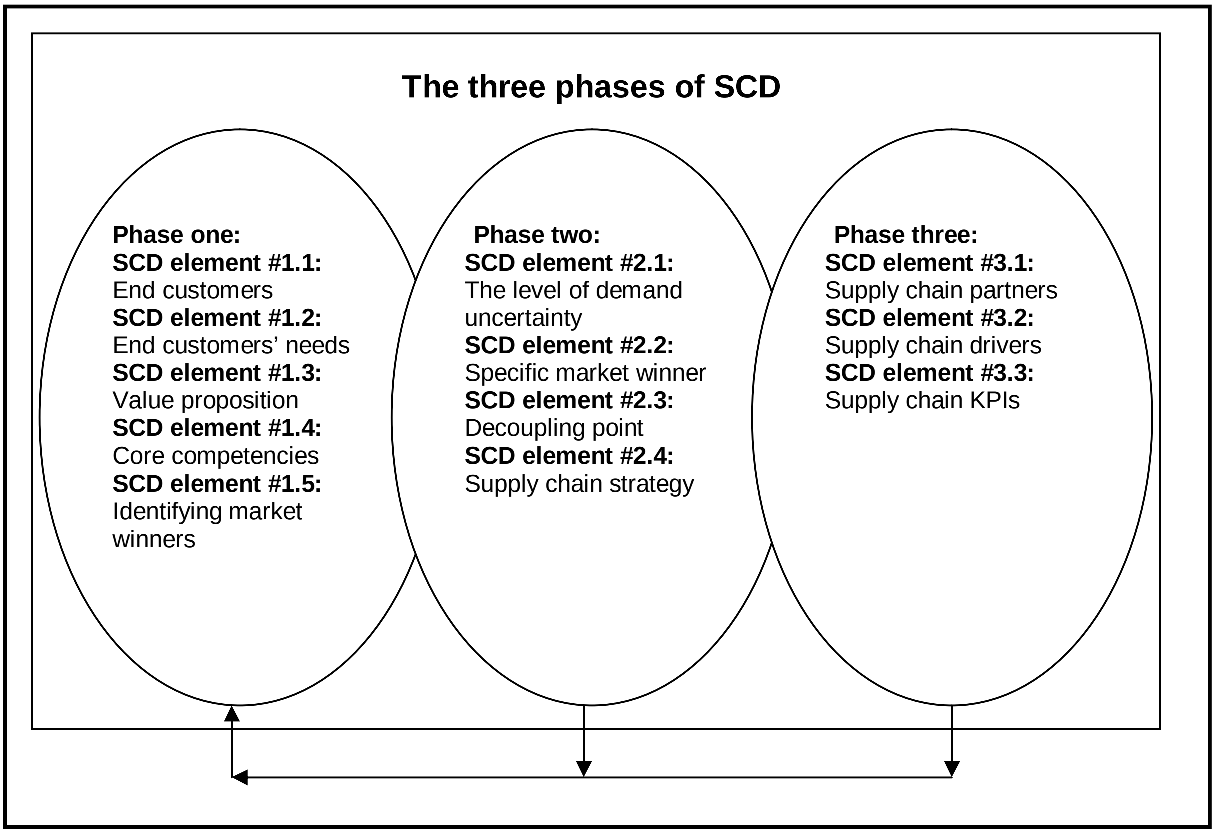

Figure 9.2: Summary of SCD elements in SCD (as derived from the literature)
Source: Researcher's own.

9.2.3 Assessment questions for each SCD element

Assessment questions were developed for each one of the supply chain design elements (as well as for the sub elements). The assessment questions were used to gather information to measure organisations' SCD practices for each of the SCD elements. Organisations SCD practices can be analysed on the basis of these responses. A summary of the assessment questions is provided in Annexure A as part of the conceptual framework.

9.3 TESTING THE CONCEPTUAL FRAMEWORK

As already mentioned, the aim of this study was the development of a conceptual framework from the literature for use by organisations to analyse their SCD practices with the aim of improving performance. Empirical research was done, not to validate the conceptual framework, but to test whether the conceptual framework is a usable assessment tool for analysing SCD practices. Testing means to determine whether the conceptual framework is a usable assessment instrument in a practical situation.

The Sunday Times Top Brands survey of 2009 was used in designing the sample framework (refer to Chapter 7). Industries had to be included in the sample framework to ensure that the supply chains of different products across the three different types of supply chain strategies, namely lean, agile and leagile, were tested in the research. It was essential to test the conceptual framework for each one of the three supply chain strategies. The framework was tested with thirteen respondents across three product categories (refer to Chapter 7). These categories were:

- food kept on the shelf;
- drinks; and
- automobiles.

The respondents were selected from the manufacturing, assembling, wholesale and retail sectors. Purposive and judgmental sampling was used to select the respondents in phase one, but time and availability constraints necessitated the use of convenience sampling in the second stage of the sampling process to finalise the sample. Three of the respondents were using a lean supply chain strategy, three respondents were using an agile supply chain strategy and seven respondents were using a leagile supply chain strategy.

For the purpose of confidentiality, the thirteen respondents who participated in this study are referred to as organisations A to M. A summary of these organisations and the supply chain strategy they were using is provided in Table 9.1. Table 9.1 will be used throughout the chapter as reference for all the discussions concerning the conclusions and recommendations. In each of the sections that follow, the responses, where required, of each of the organisations are shown using the letter of the alphabet assigned to the organisation.

Table 9.1: Organisations in this study and their supply chain strategy

Organisation	Supply chain strategy
A	Lean
B	Lean
C	Lean
D	Leagile
E	Leagile
F	Agile
G	Leagile
H	Agile
I	Leagile
J	Leagile
K	Leagile
L	Agile
M	Leagile

9.3.1 Testing the conceptual framework for phase one of SCD

Phase one of SCD entails understanding the needs of customers and how to meet these needs. The objectives that were set for this phase of SCD were therefore to:

- explorativelly test the conceptual framework to determine whether it is a usable assessment instrument in terms of helping organisations to determine:
  - the extent to which they understand the needs of their supply chain's end customers;
  - the extent to which they know how to meet the needs of their customers; and
  - whether the conceptual framework contributed to improvement of these practices by offering recommendations, if necessary, within each component of the framework.

The conceptual framework succeeded to determine the SCD practices for phase one of all thirteen respondents. None of the thirteen respondents needed further analysis of or recommendations for their SCD practices in phase one. All the organisations recorded at least an average level with regard to the extent to which they:

- SCD element #1.1: Know who their customers are;

- SCD element #1.2: Know what the needs of their customers are;
- SCD element #1.3: Have identified a formal value proposition;
- SCD element #1.4: Possess a core competency; and
- SCD element #1.5: Have identified market winners.

A summary of the research findings for phase one of SCD is provided in Figure 9.3. For purposes of this testing, a response of at least an average extent was deemed to be satisfactory. However, most organisations satisfied the above-mentioned criteria to a good or very good extent. The results of these findings should not be surprising. All the respondents who responded to the question about their position in their industries concerning market leadership indicated that they were at least in the top three organisations in their industries. It would only be fair to conclude that organisations in this position should know who their end customers are and should also know how to meet the needs of their end customers. It was not necessary for any organisation to refer to Table A1a or A1b (refer to Annexure A). The satisfactory responses are highlighted by areas shaded green.

The framework shows how organisations will commence by analysing SCD element #1.1 and move on to SCD element #1.2 and so on until they have analysed all the SCD elements in phase one of SCD. If organisations record a response of 3, 4 or 5 for these issues, they have at least an average knowledge of these issues. If organisations score 2 or less for these sections, it implies that they have a limited or very limited knowledge of the abovementioned issues and it is suggested that they address these issues by referring to Tables A1a and/or A1b.

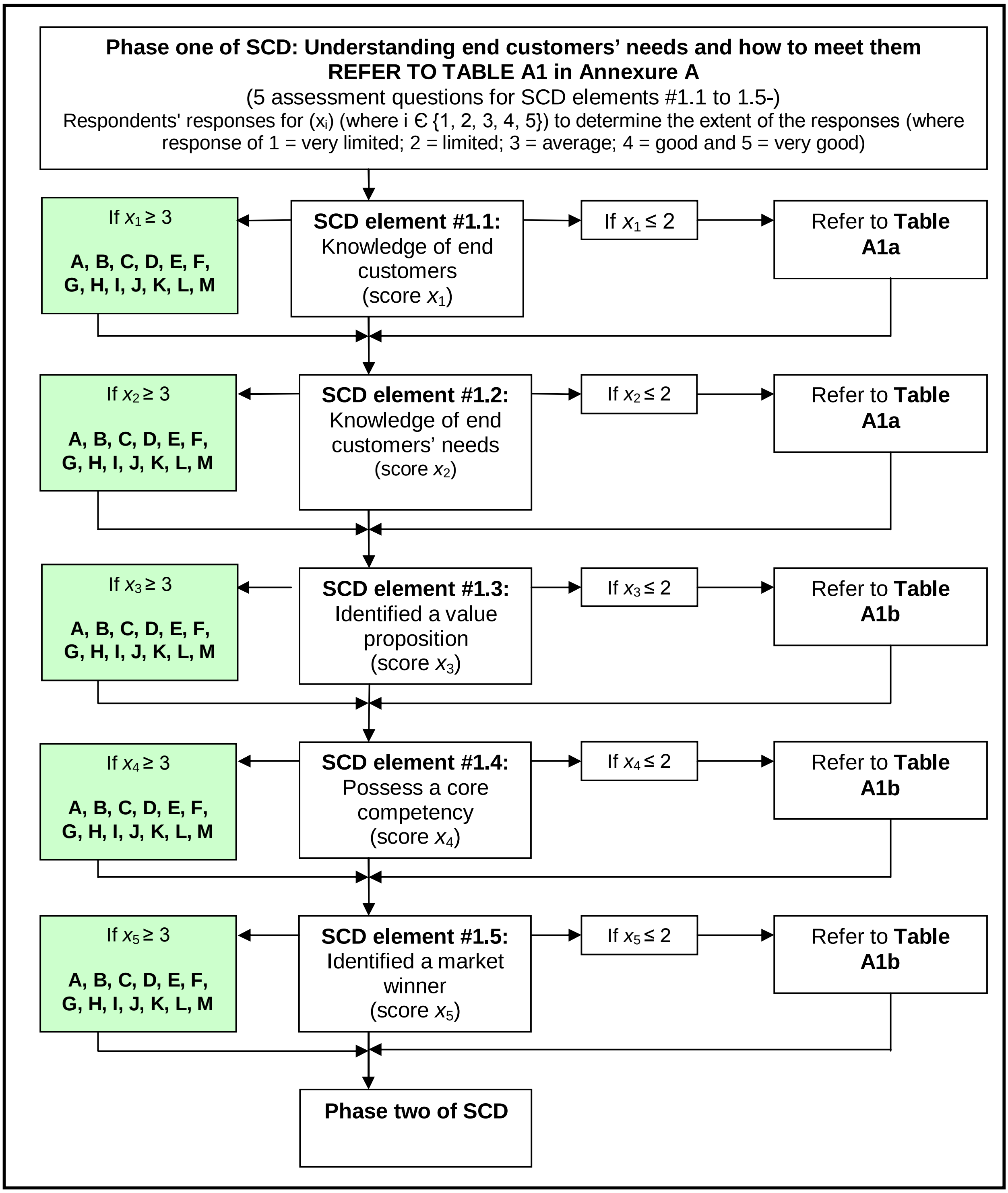

Figure 9.3: Summary of research findings of phase one of SCD

9.3.2 Testing the conceptual framework for phase two of SCD

The testing of the conceptual framework for phase two of SCD was done across four SCD elements. These SCD elements comprise:

- SCD element #2.1: Market demand predictability;

- SCD element #2.2: Market winner;
- SCD element #2.3: Decoupling point ; and
- SCD element #2.4: Supply chain strategy.

The objectives that were set for this phase of SCD were therefore to:

- exploratively test the conceptual framework to determine whether it is a usable assessment instrument in terms of helping organisations to determine:

    - the supply chain strategy on which they are focused;
    - whether their supply chain strategy is aligned towards meeting the needs of the supply chain's end customers; and
    - whether the conceptual framework contributed to improvement of these practices by offering recommendations, if necessary, within each component of the framework.

A summary of the research findings for phase two of SCD is provided in Figure 9.4.

9.3.2.1 Market demand predictability and market winners

SCD elements #2.1 and #2.2 are included in this section. Nine organisations (A, B, C, E, G, I, J, L, M) indicated that their market demand was predictable. Therefore, according to theoretical principles derived from the literature, these organisations can implement lean supply chain principles. Four organisations (D, F, H, K) indicated that their market demand was unpredictable. According to the theoretical principles, these organisations can apply agile principles. Three organisations (B, D, E) indicated that their market winner was low cost and ten organisations (A, C, F, G, H, I, J, K, L, M) indicated that their market winner was agility (refer to Figure 9.4). If the market winner is low cost, an organisation should implement a lean supply chain strategy and when the market winner is agility, the organisation should implement an agile supply chain strategy. With this in mind the conceptual framework can be used to suggest a lean supply chain strategy for organisations B and E and an agile supply chain strategy for organisations F, H and K (refer to Figure 9.4).

The conceptual framework suggests that further analysis is required for the other eight organisations (A, C, D, G, I, J, L, M). Seven of these organisations (A, C, G, I, J, L, M) indicated that agility was their market winner and that their market demand was predictable. The one remaining organisation (D) indicated that low cost was its market winner and that its market demand was volatile (refer to Figure 9.4). These responses were not in line with accepted theoretical principles and seemed to contradict one another. These responses needed further analysis, which could be done by using tables A2.1a and A2.2a (refer to Annexure A). The first step for each organisation was to justify (or establish) its response in terms of its market demand predictability. Thereafter, organisations could justify (or establish) their responses in terms of their market winners. The conceptual framework thus referred organisations to Tables A2.1a and A2.2a (refer to Annexure A) for further analysis if they recorded a predictable market demand and agility as a market winner or an unpredictable market demand and low cost as a market winner.

The conceptual framework did therefore test each organisation’s responses in terms of their market demand predictability and their market winners. Where necessary, the conceptual framework also referred organisations to recommendations (and/ or suggestions) on how to improve these practices.

9.3.2.2 Decoupling point and supply chain strategy

SCD elements #2.3 and #2.4 are included in this section. As mentioned in the previous section, according to theoretical principles, if an organisation's market demand is predictable and its market winner is low cost, then a lean supply chain strategy is suggested. If an organisation's market demand is unpredictable and its market winner is agility, then an agile supply chain strategy is suggested. The organisation's position in terms of the decoupling point is then irrelevant. However, if an organisation's market demand is predictable and its market winner is agility or an organisation's market demand is unpredictable and its market winner is low cost, then the responses seem to be misaligned. The organisation's position in terms of the decoupling point will then be used to determine the supply chain strategy.

As mentioned in the previous section, eight organisations (A, C, D, G, I, J, L and M) recorded contradicting responses that were not aligned in terms of their market demand predictability and market winners. If it were assumed that their initial responses were indeed correct (after viewing Tables A2.1a and A2.2a in Annexure A) then these organisations would need to establish their organisation's position in terms of the decoupling point. The position of the organisation in terms of the decoupling point would then suggest a clear supply chain strategy to be followed. Five of these organisations (A, C, I, J and M) were positioned at the decoupling point. A leagile supply chain strategy could be suggested for them. The other three organisations (D, G and L) were positioned downstream from the decoupling point. An agile supply chain strategy could be suggested for them. This is illustrated in Figure 9.4. The organisations indicated in red are organisations that are implementing a different supply chain strategy to what theoretical principles in literature suggest. Therefore organisations A, C, D, E, G and K are implementing different supply chain strategies to those that are suggested by the conceptual framework.

If organisations' responses concerning their market demand predictability, market winners, and their position in terms of the decoupling point are analysed, then certain supply chain strategies can be considered (or suggested) by each organisation on the basis of their responses. These are tabled in Table 9.2. The supply chain strategies that the organisations have selected are also indicated. The areas shaded green indicate where the suggested supply chain strategies and selected supply chain strategies are the same. If the selected and suggested supply chain strategies differ, organisations are referred to Table A2.3a in Annexure A.

Table 9.2: Suggested (and selected) supply chain strategies based on market demand predictability, market winners and decoupling point position

Organisation	Market demand predictability	Market winner	Decoupling point	Suggested supply chain strategy	Selected supply chain strategy
A	Lean	Agile	Leagile	Leagile	Lean
B	Lean	Lean	Leagile	Lean	Lean
C	Lean	Agile	Leagile	Leagile	Lean
D	Agile	Lean	Agile	Agile	Leagile
E	Lean	Lean	Agile	Lean	Leagile
F	Agile	Agile	Agile	Agile	Agile
G	Lean	Agile	Agile	Agile	Leagile
H	Agile	Agile	Agile	Agile	Agile
I	Lean	Agile	Leagile	Leagile	Leagile
J	Lean	Agile	Leagile	Leagile	Leagile
K	Agile	Agile	Leagile	Agile	Leagile
L	Lean	Agile	Agile	Agile	Agile
M	Lean	Agile	Leagile	Leagile	Leagile

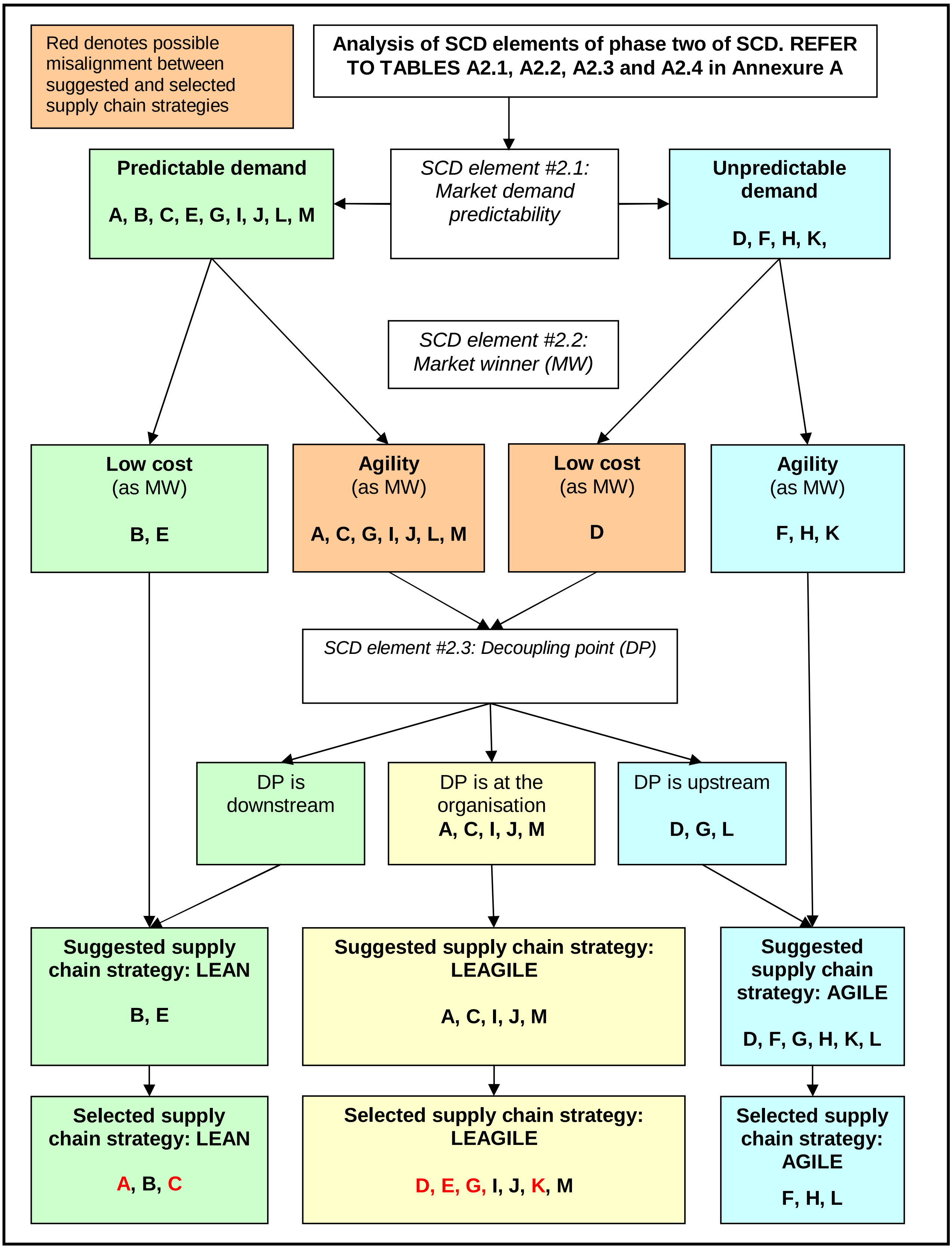

Figure 9.4: Summary of research findings of phase two of SCD[30]

[30] Adapted from Figure 6.10

In summary, the following conclusions can be drawn in terms of the research objectives formulated for phase two of SCD. These conclusions are based on Table 9.2. The conceptual framework offers suggestions to organisations with regard to which supply chain strategies they should consider. These suggestions are based on organisations' responses concerning market demand predictability, market winners and the organisation's position in terms of the decoupling point. Seven of the thirteen organisations (B, F, H, I, J, L and M) had a clear, aligned supply chain strategy (refer to Table 9.2). The other organisations will have to consider all the issues referred to in Table A2.3a to justify their selected supply chain strategy, as they may be implementing a supply chain strategy that is not best suited for their supply chains. The conclusion can therefore be drawn that phase two of the conceptual framework was successfully tested in a practical situation.

9.3.3 Testing the conceptual framework for phase three of SCD

The testing of the conceptual framework for phase three of SCD was applied across three SCD elements. The SCD elements of phase three of SCD were identified as:

- SCD element #3.1: Supply chain partners;
- SCD element #3.2: Supply chain drivers; and
- SCD element #3.3: Supply chain KPIs being used to measure performance.

SCD element #3.1 (supply chain partners) was further divided into five sub elements. These were:

- SCD element #3.1.1: Knowledge of supply chain partners;
- SCD element #3.1.2: Effort to get in touch with the right supply chain partners;
- SCD element #3.1.3: Management of supply chain partners (first tier);
- SCD element #3.1.4: Potential for managing supply chain partners (beyond the first tier); and
- SCD element #3.1.5: Management of supply chain partners (beyond first tier).

SCD element #3.2 (supply chain drivers) was also further divided into nine sub elements. They were:

- SCD element #3.2.1: Capacity utilisation in facilities;
- SCD element #3.2.2: Location of facilities;
- SCD element #3.2.3: Inventory levels;
- SCD element #3.2.4: Lead times;
- SCD element #3.2.5: Transportation cost;
- SCD element #3.2.6: Transportation frequency;
- SCD element #3.2.7: Information collection;
- SCD element #3.2.8: Supplier selection criteria; and
- SCD element #3.2.9: Pricing/ profit margins.

The research objectives set for phase three of SCD were therefore to:

- explorativelyely test the conceptual framework to determine whether it is a usable assessment instrument in terms of helping organisations to determine:

    - the extent to which supply chain partners were managed;
    - how supply chain drivers were managed and whether this was aligned to their supply chain strategy;
    - whether their focus was on the correct supply chain KPI categories for their supply chain strategy; and
    - whether the conceptual framework contributed to improvement of these practices by offering recommendations, if necessary, within each component of the framework.

The broad findings were discussed in Chapter 8. The conclusions for each of these three objectives will now be discussed, starting with conclusions about organisations' relationships with their supply chain partners.

9.3.3.1 Supply chain partners

This section includes SCD element #3.1 and its sub elements. The conceptual framework successfully determined what organisations' supply chain relationships with their most important customers and suppliers were. A summary of the research findings is provided in Figure 9.5.

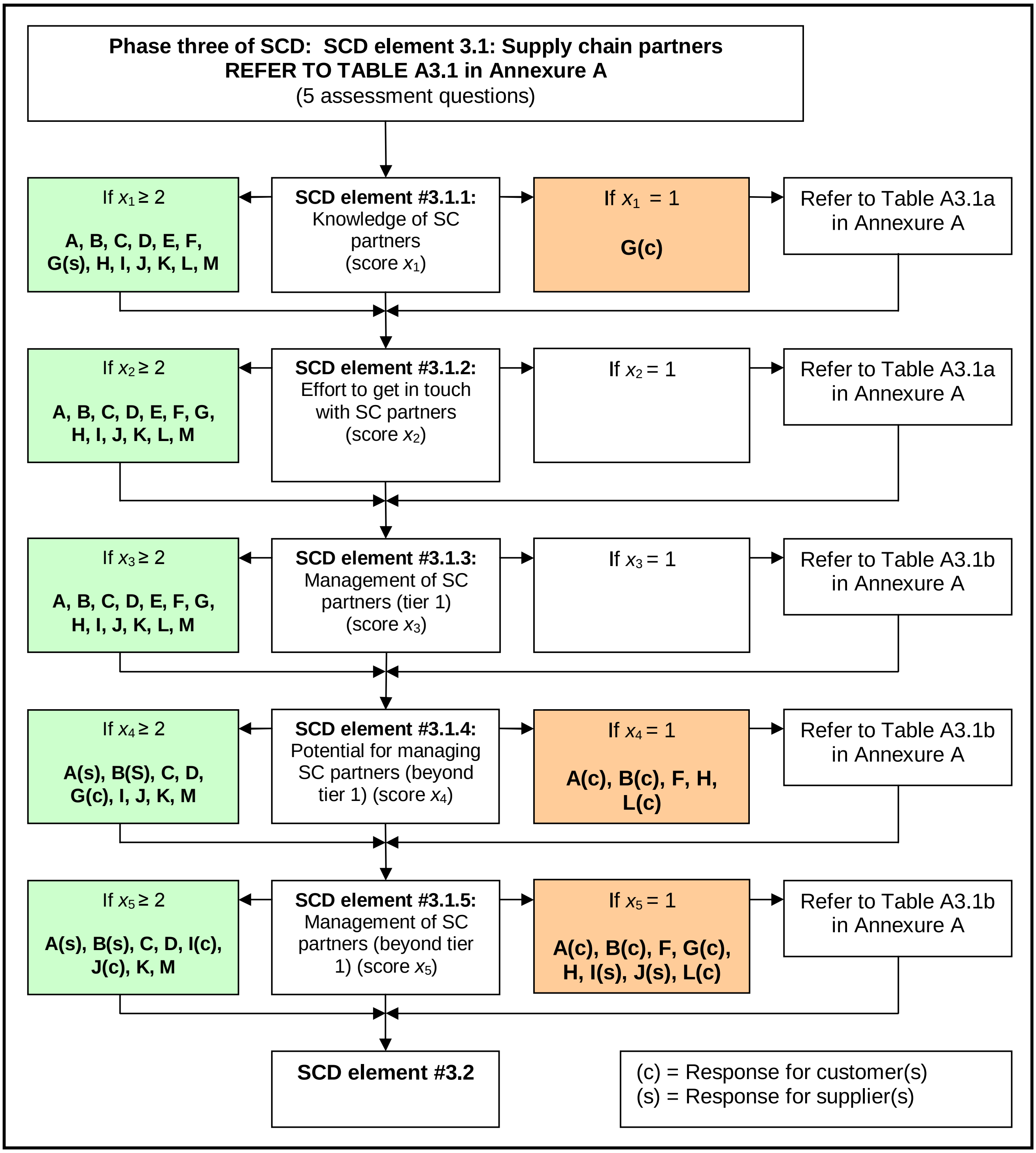

Figure 9.5: Summary of research findings for SCD element #3.1

Most of the organisations managed their relationships with their most important customers and suppliers to at least an average extent. At the first-tier level, it was only organisation G that managed customers to a limited extent. It was at the second-tier level that more organisations were able to manage the relationships to a limited extent only. This is highlighted by the areas shaded red in Figure 9.5. The conceptual framework could highlight potential areas for improvement in most of the cases where organisations managed the relationships to a limited extent.

The potential areas for improvement for each of these organisations are highlighted in Table 9.3 below. Some organisations (A, B, G and L) were only able to manage their important customers beyond the first tier to a limited extent, while two other organisations (I and J) were only able to manage their important suppliers beyond the first tier to a limited extent. Organisations F and H could only manage both their important customers and suppliers beyond the first tier to a limited extent. The potential areas for improvement of these relationships are indicated in Table 9.3 below. The research objective for this part of phase three of SCD was therefore met.

Table 9.3: Potential areas for improvement for organisations that manage their supply chain relationships to a limited extent

Organisation	Supply chain relationship (customer/ supplier)	Potential areas for improvement by means of Table A3.1b in Annexure A)
A	Customers	Sharing supply chain risks; Sharing benefits/ rewards; Development of supply chain capabilities to optimise the supply chain; Compatibility of essential technologies to ensure the seamless flow of materials between supply chain partners; Contributions towards new product development; Focus on total supply chain costs; Focus on continuous improvement across processes
B	Customers	Sharing supply chain risks; Sharing benefits/ rewards; Development of supply chain capabilities to optimise the supply chain; Compatibility of essential technologies to ensure the seamless flow of materials between supply chain partners; Contributions towards new product development; Focus on total supply chain costs; Focus on continuous improvement across processes
F	Customers/ Suppliers	Sharing supply chain risks; Contributions towards new product development; Focus on total supply chain costs
G	Customers	Contributions towards new product development
H	Customers/ Suppliers	Sharing supply chain risks; Contributions towards new product development; Focus on total supply chain costs
I	Suppliers	No obvious areas for improvement
J	Suppliers	No obvious areas for improvement
L	Customers	Adhering to predetermined payment conditions; Compatibility of essential technologies to ensure the seamless flow of materials between supply chain partners

9.3.3.2 Supply chain drivers

This section includes SCD element #3.2 and its sub elements. The conceptual framework successfully tested organisations' management of their supply chain drivers. A summary of the research findings is provided in Table 9.4 and Figure 9.6. Three organisations (A, B and C) selected a lean supply chain strategy. The responses of these organisations are summarised on the left in Figure 9.6, in the areas shaded green. Alignment with lean supply chain strategy practices is highlighted by the green areas. The areas shaded red show cases in which alignment was not achieved.

Three organisations (F, H and L) selected an agile supply chain strategy. The responses of these organisations are summarised on the right in Figure 9.6, in the areas shaded blue. Alignment with agile supply chain strategy practices is highlighted by the blue areas. Table 9.4 shows the supply chain strategy that was selected, as well as the drivers managed by each organisation, according to both lean and agile supply chain strategies.

The conceptual framework therefore successfully determined how organisations were managing their supply chain drivers. As can be seen from Table 9.4, all the organisations were managing some of their supply chain drivers according to a lean supply chain strategy and some of their supply chain drivers according to an agile supply chain strategy. All the organisations were thus referred to Table A3.2a to consider the issues mentioned there. The organisations could also use the suggested guidelines to guide their decisions. As already mentioned, organisations D, E, G, I, J. K and M were utilising a leagile supply chain strategy. These organisations therefore had to make sure that they were managing their supply chain drivers optimally. Due to the nature of leagile supply chains they have to consider each supply chain driver carefully to ensure that they are managing their supply chains optimally. Due to their position in terms of the decoupling point in their supply chains, these organisations should manage their supply chain drivers according to lean principles upstream and according to agile principles downstream. This should guide these organisations' decisions concerning their supply chain drivers.

Table 9.4: Management of supply chain drivers

Org	Selected supply chain strategy	Supply chain drivers managed according to lean supply chain strategy	Supply chain drivers managed according to agile supply chain strategy
A	Lean	Capacity utilisation; Inventory; Lead times; Transport costs; Pricing	Facility location; Transport frequency; Information; Supplier selection
B	Lean	Capacity utilisation; Inventory; Lead times; Transport costs; Transport frequency; Information; Supplier selection; Pricing	Facility location
C	Lean	Capacity utilisation; Inventory; Transport costs	Facility location; Lead times; Transport frequency; Information; Supplier selection
D	Leagile	Capacity utilisation; Facility location; Inventory; Lead times; Transport costs; Pricing	Transport frequency; Information; Supplier selection
E	Leagile	Capacity utilisation; Facility location; Inventory; Transport costs; Transport frequency; Pricing	Lead times; Information; Supplier selection
F	Agile	Facility location; Inventory; Lead times; Transport costs; Pricing	Capacity utilisation; Transport frequency; Information; Supplier selection
G	Leagile	Capacity utilisation; Inventory; Pricing	Facility location; Lead times; Transport costs; Transport frequency; Information
H	Agile	Facility location; Inventory; Lead times; Transport costs; Pricing	Capacity utilisation; Transport frequency; Information; Supplier selection
I	Leagile	Capacity utilisation; Inventory; Lead times; Transport costs; Supplier selection; Pricing	Facility location; Transport frequency; Information;
J	Leagile	Capacity utilisation; Inventory; Lead times; Transport costs; Supplier selection; Pricing	Facility location; Transport frequency; Information;
K	Leagile	Capacity utilisation; Facility location; Inventory; Lead times; Transport costs; Transport frequency; Information; Supplier selection	Pricing
L	Agile	Capacity utilisation; Facility location; Inventory; Lead times	Transport costs; Transport frequency; Information; Supplier selection; Pricing
M	Leagile	Capacity utilisation; Facility location; Inventory; Lead times; Transport costs; Supplier selection Pricing	Transport frequency; Information

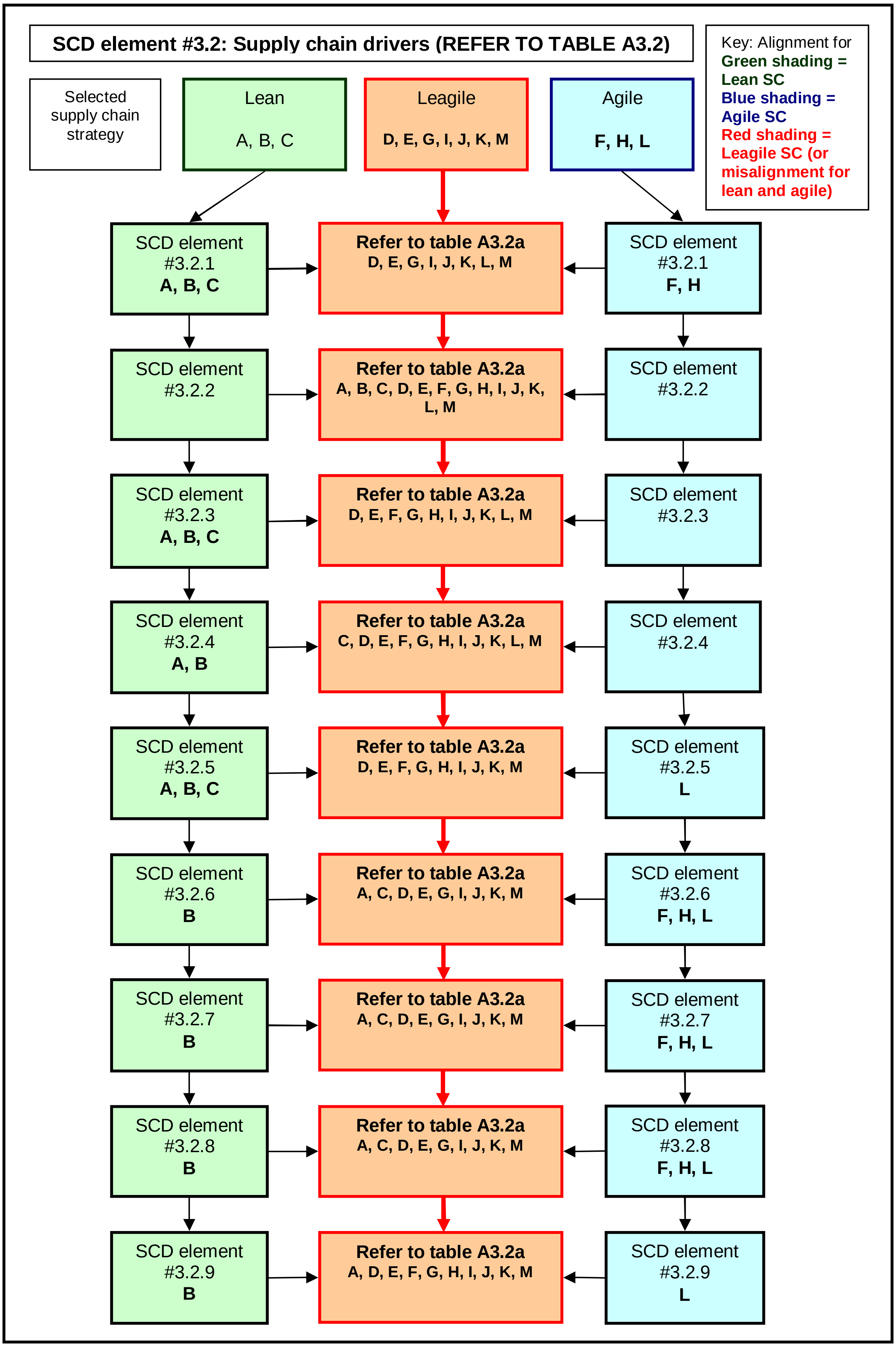

Figure 9.6: Summary of research findings for SCD element #3.2

9.3.3.3 Supply chain KPIs

This section includes SCD element #3.3. The conceptual framework also successfully tested the focus of organisations' supply chain KPIs. A summary of the responses are provided in Table 9.5 and Figure 9.7.

Table 9.5: Organisations' supply chain KPI focus

Org	Supply chain strategy	Ideal supply chain KPI focus	Selected KPI focus
A	Lean	Cost reductions within and across the supply chain; Supply chain asset management	Supply chain reliability;
B	Lean	Cost reductions within and across the supply chain; Supply chain asset management	Cost reductions within organisation
C	Lean	Cost reductions within and across the supply chain; Supply chain asset management	Cost reductions within organisation; Supply chain asset management
D	Leagile	All 6 mentioned KPI categories	Cost reductions within and across the supply chain; Supply chain reliability; Supply chain responsiveness; Supply chain asset management
E	Leagile	All 6 mentioned KPI categories	Cost reductions within and across the supply chain; Supply chain reliability; Supply chain responsiveness
F	Agile	Supply chain reliability; Supply chain responsiveness; Supply chain flexibility	Supply chain reliability; Supply chain responsiveness; Supply chain flexibility
G	Leagile	All 6 mentioned KPI categories	Supply chain reliability; Supply chain asset management
H	Agile	Supply chain reliability; Supply chain responsiveness; Supply chain flexibility	Supply chain reliability; Cost reductions within organisation
I	Leagile	All 6 mentioned KPI categories	Supply chain reliability;
J	Leagile	All 6 mentioned KPI categories	Supply chain reliability;
K	Leagile	All 6 mentioned KPI categories	Supply chain reliability;
L	Agile	Supply chain reliability; Supply chain responsiveness; Supply chain flexibility	Cost reductions within organisation
M	Leagile	All 6 mentioned KPI categories	Cost reductions within organisation; Supply chain reliability; Supply chain responsiveness; Supply chain asset management

The majority of the KPI categories of six organisations (B, C, D, E, F, and M) are aligned with their supply chain strategies. This is indicated by the areas shaded green. Even though these organisations are focusing on the correct KPI categories, they may need to consider table A3.3a in Annexure A to determine whether there are other KPI categories on which they also should concentrate. The other seven organisations (A, G, H, I, J, K, L) may need to reconsider the focus of their KPI categories (as indicated by the areas shaded red). This can be done with the aid of Table A3.3a. The research objective for this part of SCD analysis was also met because the conceptual framework could determine the alignment of KPI categories with supply chain strategies and could make recommendations for these seven organisations based on Table A3.3a in Annexure A.

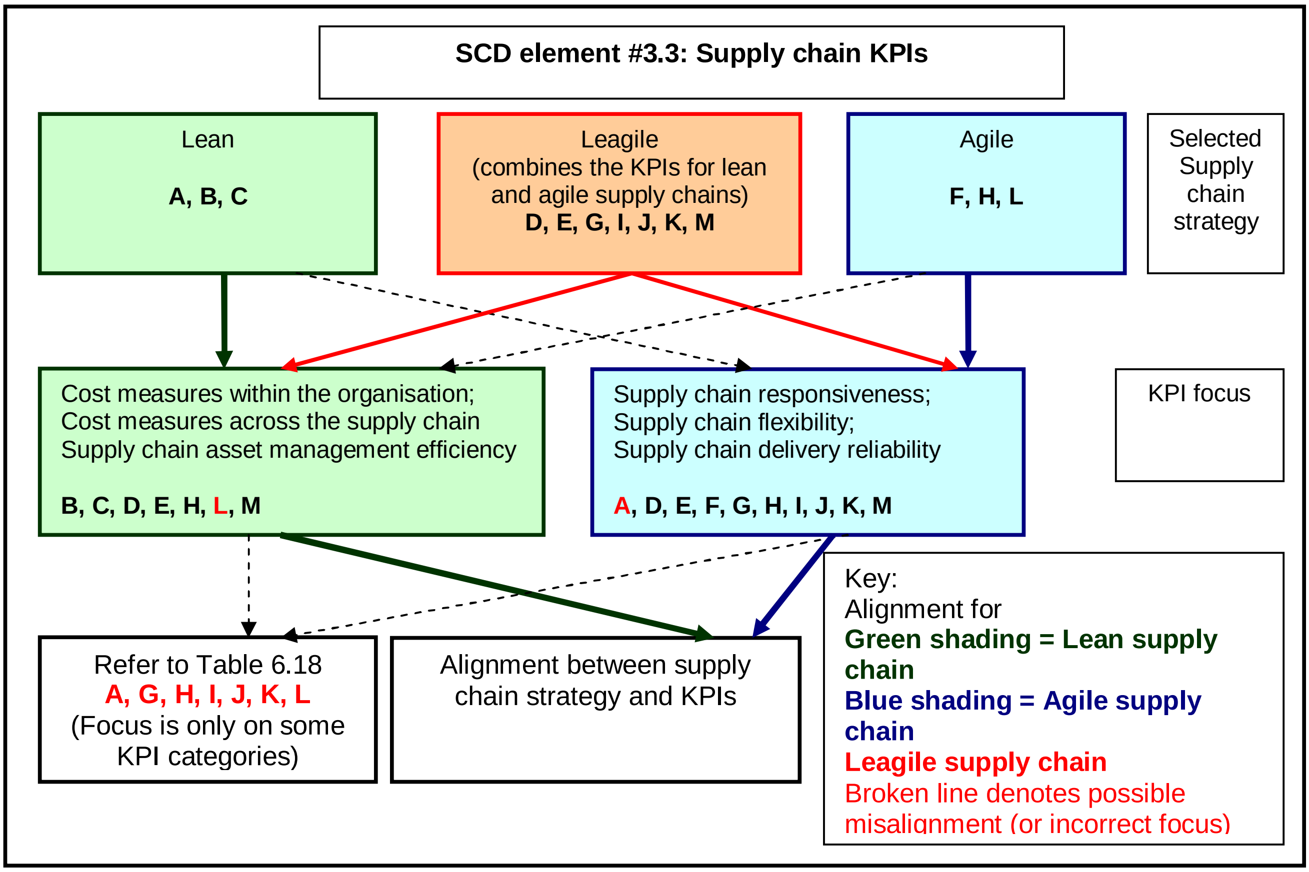

Figure 9.7: Summary of research findings for SCD element #3.3

9.4 GENERAL CONCLUSIONS AND RECOMMENDATIONS

The main objective of this study was to develop a conceptual framework from the literature for use by organisations to analyse their SCD practices with the aim of improving performance. To achieve the main objective, the study also required several secondary objectives. The secondary objectives of the study therefore were to:

- determine the elements of SCD by means of an extensive study of literature on SCD;
- exploratively test the conceptual framework to determine whether it is a usable assessment instrument in terms of helping organisations to determine:

- the extent to which they understand the needs of their supply chain's end customers;
- the extent to which they know how to meet the needs of their customers;
- the supply chain strategy on which they are focused;
- whether their supply chain strategy is aligned towards meeting the needs of the supply chain's end customers;
- the extent to which supply chain partners were managed;
- how supply chain drivers were managed and whether this was aligned to their supply chain strategy;
- whether their focus was on the correct supply chain KPI categories for their supply chain strategy; and
- whether the conceptual framework contributed to improvement of these practices by offering recommendations, if necessary, within each component of the framework.

9.4.1 General conclusions about the main objective of the study

The elements of SCD were identified by means of an exploratory literature search. Twelve elements were identified and included in the proposed conceptual framework. These SCD elements are:

- SCD element #1.1: Knowing who the end customers are;
- SCD element #1.2: Knowing the needs of the end customers;
- SCD element #1.3: Identifying a formal value proposition to meet the needs of end customers;
- SCD element #1.4: Possessing a core competency to deliver the value proposition;
- SCD element #1.5: Identifying market winners;
- SCD element #2.1: Market demand predictability;
- SCD element #2.2: Market winner;
- SCD element #2.3: Position in terms of the decoupling point;
- SCD element #2.4: Supply chain strategy;
- SCD element #3.1: Supply chain partners;
- SCD element #3.2: Supply chain drivers; and

- SCD element #3.3: Supply chain KPIs.

SCD element #3.1 (supply chain relationships) was divided into five sub elements. These are:

- SCD element #3.1.1: Knowledge of supply chain partners;
- SCD element #3.1.2: Effort to get in touch with the right supply chain partners;
- SCD element #3.1.3: Management of supply chain partners (first tier);
- SCD element #3.1.4: Potential for managing supply chain partners (beyond the first tier); and
- SCD element #3.1.5: Management of supply chain partners (beyond first tier).

SCD element #3.2 (supply chain drivers) was also divided, into nine sub elements. They are:

- SCD element #3.2.1: Capacity utilisation in facilities;
- SCD element #3.2.2: Location of facilities;
- SCD element #3.2.3: Inventory levels;
- SCD element #3.2.4: Lead times;
- SCD element #3.2.5: Transportation cost;
- SCD element #3.2.6: Transportation frequency;
- SCD element #3.2.7: Information collection;
- SCD element #3.2.8: Supplier selection criteria; and
- SCD element #3.2.9: Pricing/ profit margins.

The conceptual framework was developed from these SCD elements (refer to Annexure A).

9.4.2 General conclusions and recommendations concerning the secondary objectives of the study

The conceptual framework was tested in terms of whether it was a workable instrument across thirteen organisations that, among them, used lean, agile and leagile supply chain strategies. The conceptual framework could successfully determine whether organisations' SCD practices were aligned with the supply chain strategy and towards meeting the needs of their customers.

9.4.2.1 General conclusions and recommendations concerning phase one of SCD

The conceptual framework could assist organisations to determine the extent to which they understood the needs of their supply chain's end customers and the extent to which they know how to meet the needs of their customers. It was not necessary to make recommendations concerning the needs of customers in this study because all thirteen respondents understood the needs of their customers and how to meet these needs within the parameters of the study.

9.4.2.2 General conclusions and recommendations concerning phase two of SCD

The conceptual framework could assist organisations to determine the supply chain strategy on which they were focused. In this study, three variables were used to determine (or suggest) a supply chain strategy. These variables were market demand predictability, market winners and the organisation's position in terms of the decoupling point. When these variables were analysed, the conceptual framework indicated that six organisations were, in fact, using the correct supply chain strategy and that seven organisations may be using the incorrect supply chain strategy. These organisations were referred to Table A2.3a.

9.4.2.3 General conclusions and recommendations concerning phase three of SCD

The conceptual framework could assist organisations to determine the extent to which they were managing their supply chain partners. In this study, the conceptual framework could also identify potential areas to which organisations could attend to improve their relationships with their most important customers and suppliers. Generally, relationships of organisations with their direct first-tier supply chain partners were good. However, in some cases the relationships beyond the first tier needed attention.

The conceptual framework could also assist organisations to determine the extent to which they were managing their supply chain drivers and whether this was aligned with their supply chain strategy. In this section, all the organisations were managing some of their supply chain drivers according to a lean strategy and some supply chain drivers according to an agile supply chain strategy. It could therefore be suggested that the organisations were not optimising their supply chain practices. The conceptual framework could identify this and made suggestions to organisations about how they should be managing their supply chain drivers according to their selected strategies.

The conceptual framework could also assist organisations to determine whether they were focusing on the correct supply chain KPI categories (to measure supply chain performance) aligned with their supply chain strategy. The conceptual framework could also highlight what the focus of an organisation should be.

9.5 LIMITATIONS OF THE STUDY AND FURTHER RESEARCH

The conceptual framework still needs to be validated. To validate this framework it needs to be tested across more supply chains. Further research into the topic of SCD must be done to continuously update and improve the conceptual framework. The conceptual framework can also become more specialised as it only focuses on broad (or meta) SCD issues in its current form. With further research, the conceptual framework could become more elaborate. Due to the many variables involved in the framework, it needs to be computerised. Further research is also required to determine whether the conceptual framework can be used in the services industry. In this study, it was only tested in the supply chains of tangible goods.

9.6 A FINAL WORD

This study proposes a conceptual framework by means of which organisations can analyse their SCD practices. The conceptual framework was developed from literature and was tested with thirteen organisations that, among them, used lean, agile and leagile supply chain strategies. The conceptual framework is included in Annexure A of this study. This study shows that the conceptual framework is a workable instrument that can be used to analyse organisations' SCD practices.

GLOSSARY

Agile supply chain	Agile supply chains utilise strategies aimed at being responsive and flexible to customer needs (Lee, 2002:114; Jacobs *et al*., 2009:364; Yusuf, Gunasekaran, Adeleeye & Sivayoganathan, 2004:381).
Core competency	Core competencies are defined as a set of skills, systems, technologies and capabilities that enable an organisation to provide a particular benefit to customers (Hines, 2004:49; Hutt & Speh, 2004:176; Handfield & Nichols, 2002:123).
Decoupling point	The push-pull boundary or the decoupling point may be termed the point at which real demand penetrates upstream in a supply chain (Christopher, 2003:288).
Demand uncertainty	Demand uncertainty can be defined as the risk of significant and unpredictable fluctuations in downstream demand (Bozarth & Handfield, 2006:417; Koh & Tan, 2006:473).
Downstream	Downstream relates to the relationship between an organisation and its customers and customers' customers (Lysons & Farrington, 2006:92).
Focal organisation	The focal organisation is the organisation that is depicting the relationships among its suppliers and customers (Fawcett *et al*., 2007:7).
Functional product	Functional products satisfy the basic needs of customers that do not change much over time, which, in turn, means that the demand for these products is stable and predictable (Fisher, 1997:2). Therefore, functional products have longer life cycles and lower demand variability (Lee, 2002:106; Seuring, 2003:183; Appelqvist, 2003:199).

Innovative product	Innovative products are new or modified products that organisations create to achieve higher margins (Raturi & Evans, 2005:208) and are the hardest to manage (Taylor, 2004:267). They are characterised by high levels of change in demand over short times and thus have a volatile demand (Lee, 2002:106; Seuring, 2003:183).
Leagile supply chain	Hybrid or leagile supply chains can be defined as the combination of the lean and agile paradigm within a total supply chain strategy and exploit the benefits of both lean and agile supply chains (Towill & Christopher, 2002:300; Mason-Jones *et al*., 2000:4065).
Lean supply chain	An efficient (or lean) supply chain is a set of organisations directly linked by upstream and downstream flows of information, products and finances that collaboratively work to reduce cost and waste (Vitasek, Manrodt & Abbott, 2005:40).
Market winner	Market winners differentiate an organisation's products from competition (Bozarth & Handfield, 2006:31) and can, for example, be low cost or high service levels (Mason-Jones, Naylor & Towill, 2000:4064).
Supply chain	The supply chain extends from the raw material extraction or raw concept origination through many processes to the ultimate sale to the consumer of the final product, whether goods or services (Quayle & Jones, 1999:5).
Supply chain design (SCD)	SCD can be regarded as the determination of how to structure a supply chain (Saxton, 2006:244; Persson & Olhager, 2002:231) and involves planning and developing supply chains to support the value proposition and goals of

	the organisation and it is a proactive approach to serving the customer rather than chasing after changing needs (Fawcett *et al*., 2007:222).
Supply chain end customer	The supply chain's end customer is the person at the end of the supply chain who makes the decision whether or not to buy the product or service offered by the supply chain (Harrison, 2001:1).
Supply chain integration (SCI)	SCI can be defined as supply chain members using techniques enabling them to work together to optimise their collective performance in the creation, distribution, and support of the end product (Sundaram & Mehta, 2002:537).
Supply chain management (SCM)	SCM is the design and management of value-added processes (or activities) and relationships within organisations and across the network of organisations that form the supply chain to meet the real needs of the end customer and to increase efficiency and value to gain a sustainable competitive advantage (Fawcett *et al*., 2007:8; Wisner *et al*., 2009:8; Bozarth & Handfield, 2006:8; Ayers, 2006:10) for all the organisations that form part of the supply chain (Mentzer, 2004:7).
Supply chain strategy	A supply chain strategy can be defined as a strategy required for managing the integration of all the supply chain activities through improved supply chain relationships to achieve a competitive advantage for the supply chain (Hines, 2004:5).
Supply chain structure	The supply chain structure implies the integration of the focal organisation and the links between supply chain members (Defee & Stank, 2005:34); the supply chain structure may depend on, for example, the maturity of the supply chain's

markets, products and supply chain relationships (Kumar & Zander, 2007:16).

Supply uncertainty	Supply uncertainty can be defined as unpredictable events that occur in the upstream supply chain (Koh & Tan, 2006:473).
Upstream	Upstream relates to the relationship between an organisation and its suppliers and suppliers' suppliers (Lysons & Farrington, 2006:92).
Value proposition	The value proposition is a statement of how, where and when value is to be created for specific customers or market segments and should form the guiding principles around which all the activities of the organisation are based (Christopher, 2004:32).

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ANNEXURE A

THE CONCEPTUAL FRAMEWORK

The conceptual framework is illustrated in Figures A1 to A6

The assessment questions for each phase are tabled in Tables A1 to A3.3.

The recommendations (or further analysis options) are tabled in Tables A1a to A3.3a.

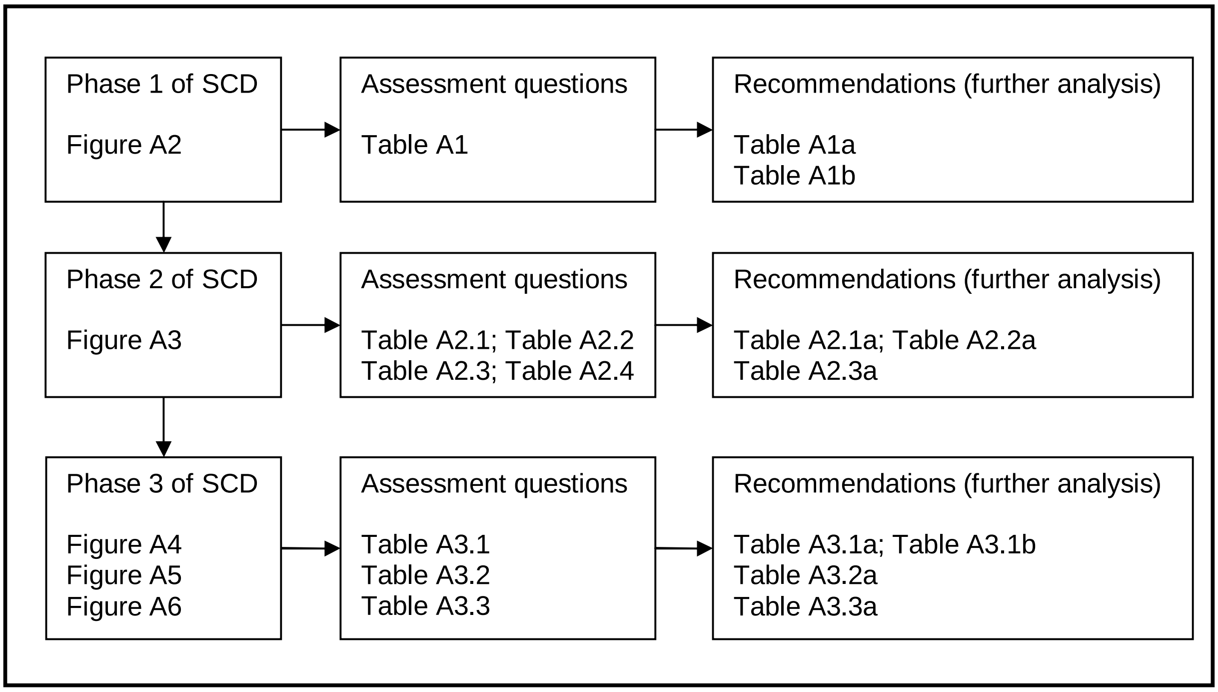

Figure A1 (Figure 6.15): Reference to tables and figures of the conceptual framework

PHASE ONE OF SCD:

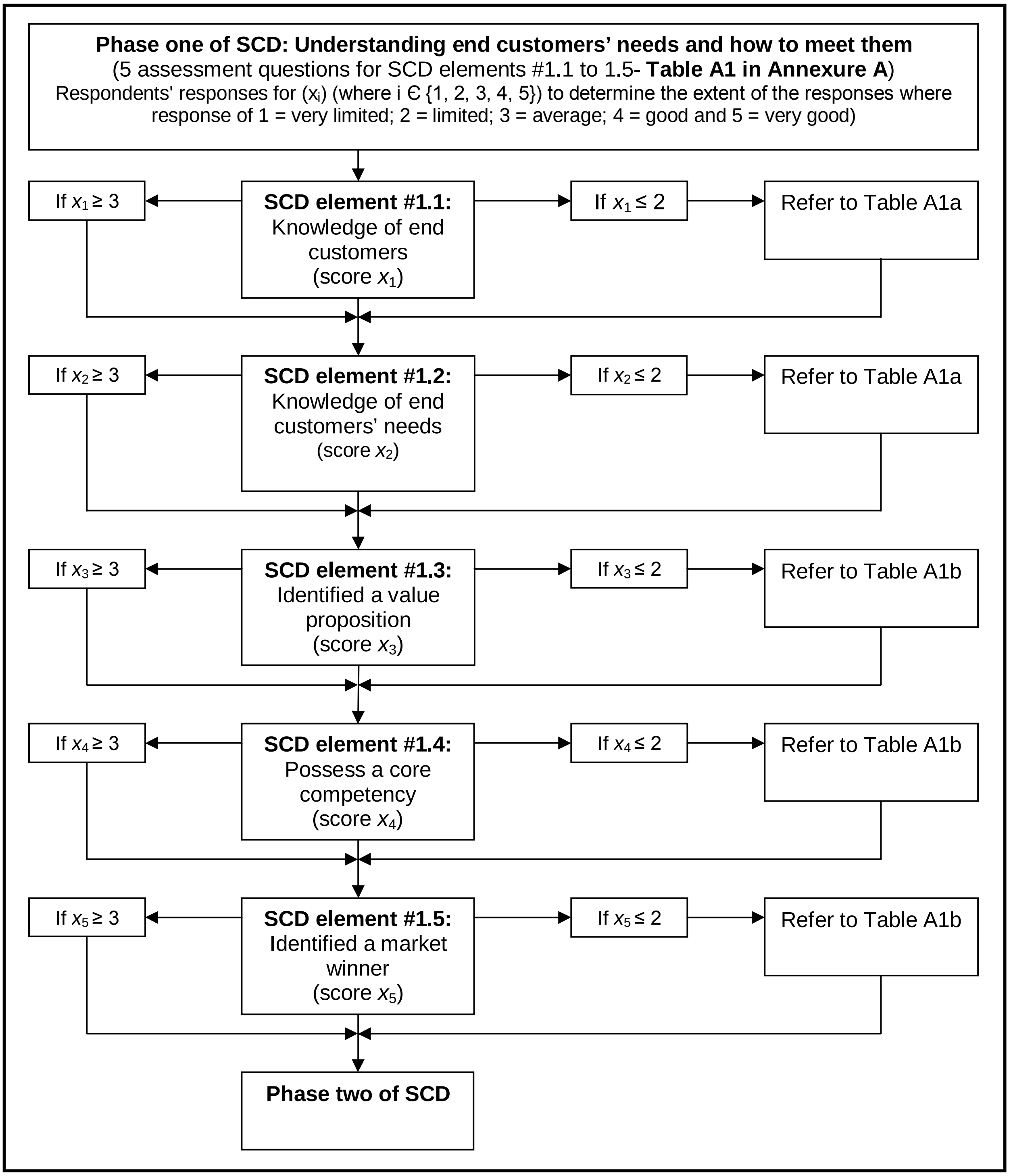

Figure A2 (Figure 6.9): Broad conceptual framework for phase one of SCD

PHASE TWO OF SCD:

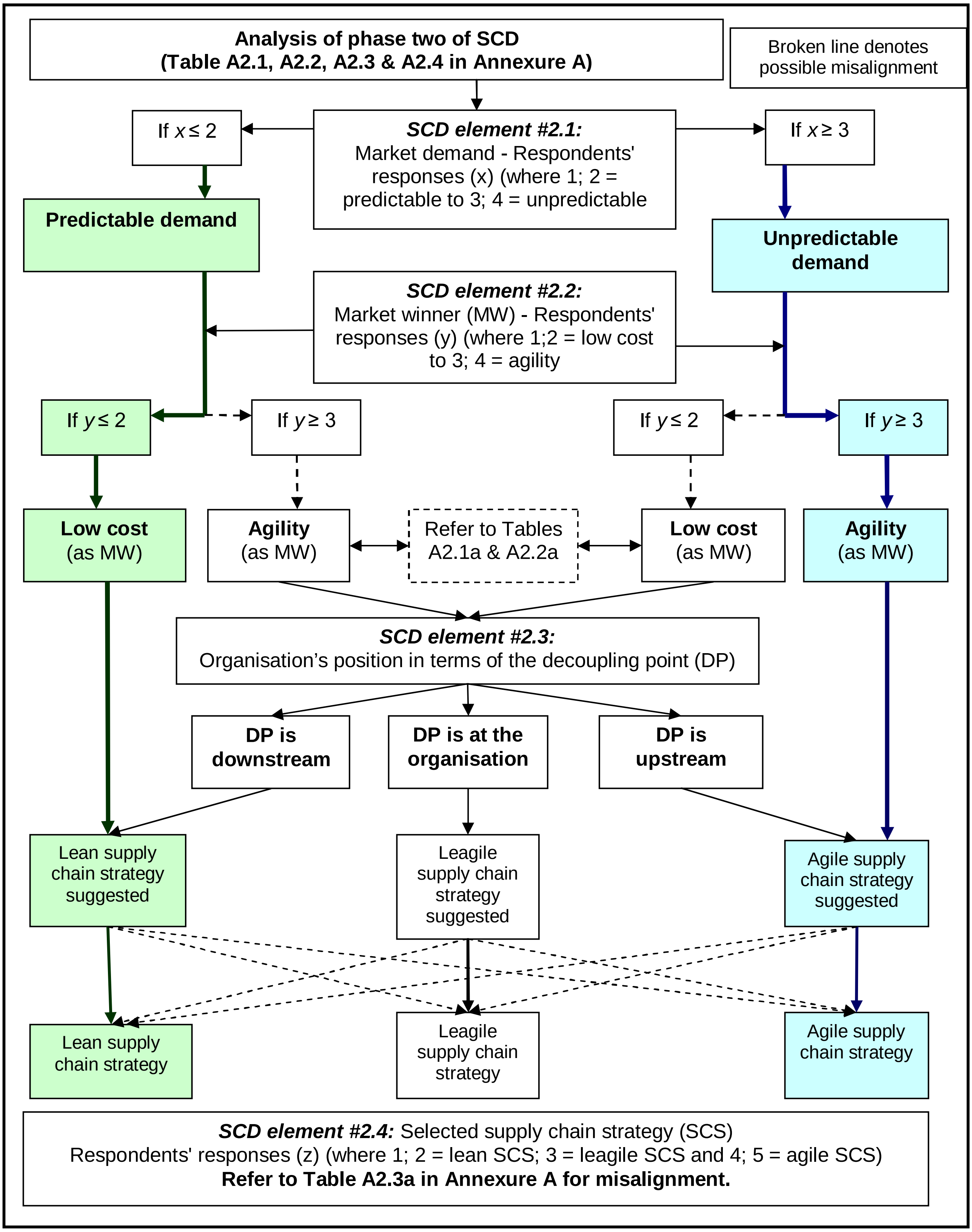

Figure A3 (Figure 6.10): Conceptual framework for analysis of SCD elements in phase two of SCD

PHASE THREE OF SCD:

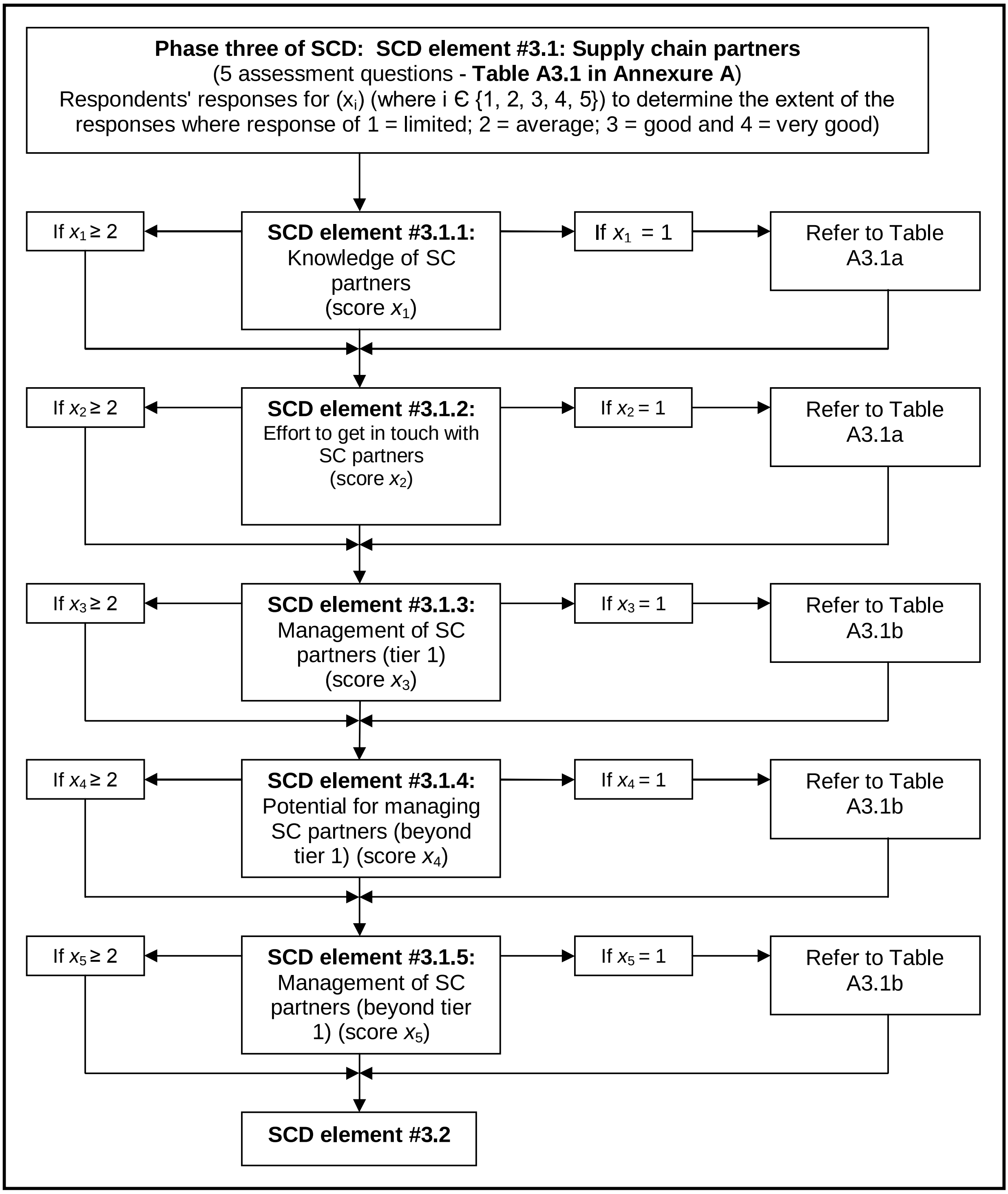

Figure A4 (Figure 6.11): Conceptual framework for analysis of SCD element #3.1 in phase three of SCD

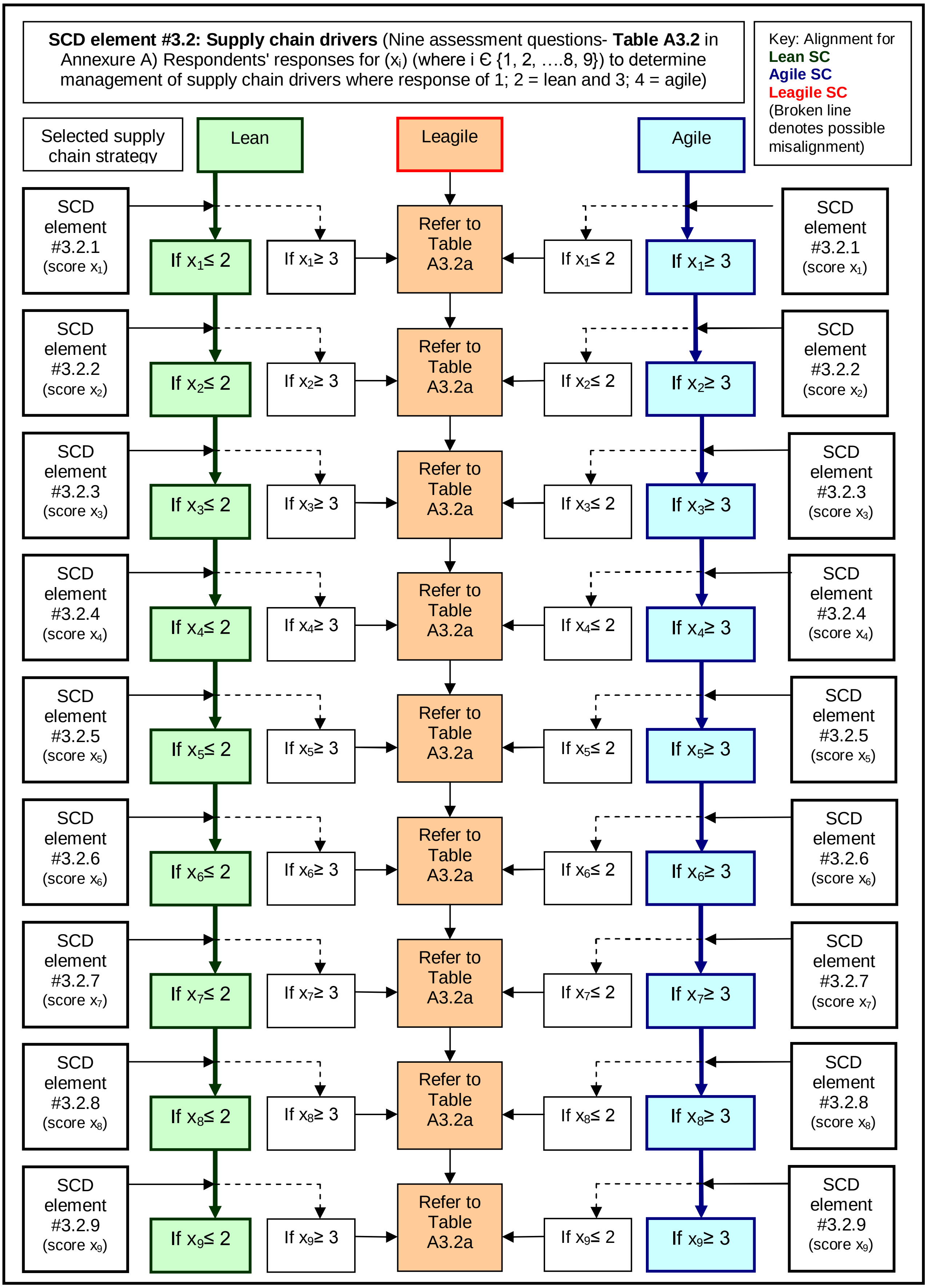

Figure A5 (Fig 6.12): Conceptual framework for analysis of SCD elements #3.2

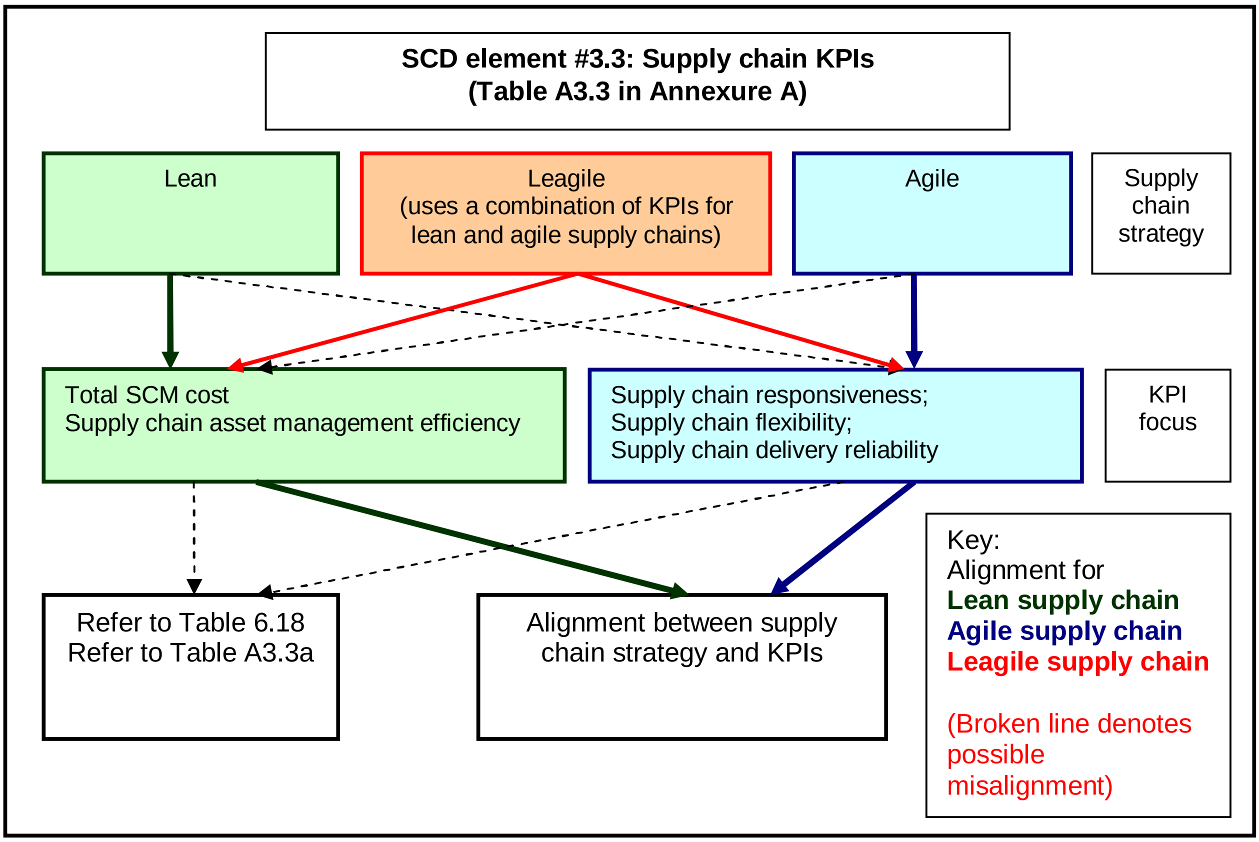

Figure A6 (Figure 6.13): Conceptual framework for analysis of SCD elements #3.3 in phase three of SCD

ASSESSMENT QUESTIONS FOR PHASE ONE OF SCD

(SCD elements #1.1 – 1.5)

Table A1 (Table 6.3): Assessment questions to analyse the SCD elements of phase one of SCD

	Organisations have to indicate to which extent their organisation: *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)*	(mark with an *x*)				
1	knows **who** their customers for this supply chain are (by means of market research/ market segmentation/ customer profitability profiles)	1	2	3	4	5
2	knows what the **needs** of their customers for this supply chain are in terms of service levels, products, prices, and so on, by means of market research; etc.	1	2	3	4	5
3	has identified a formal *value proposition* to meet customers' needs for this supply chain	1	2	3	4	5
4	possesses a *core competency* (that creates customer-perceived value and is superior to what competition does)	1	2	3	4	5
5	has identified how to win customers' orders for this product (with either low prices or by means of differentiation by being flexible and responsive to customers' demands; providing superior service and high quality)	1	2	3	4	5

RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE ONE OF SCD (SCD elements #1.1 – 1.5)

Table A1a (Table 6.4): Possible explanations (or reasons) and recommendations for SCD elements #1.1 and 1.2

Recommendation:

Conduct market research and segment the market to understand the end customer. The organisation must know who the end customers are as well as what their needs are because:

(1) The supply chain's end customer is the person at the end of the supply chain who makes the decision whether or not to buy the product or service offered by the supply chain.
(2) The customer is the ultimate judge of supply chain performance. Specific customer knowledge is achieved by segmenting the markets that were identified through market research. Segmentation can occur based on:

(i) sales territory or region,
(ii) preferred sales channel,
(iii) profitability,
(iv) products purchased,
(v) sales history,
(vi) demographic information,
(vii) desired product features, and
(viii) service preferences.

Determine the following customer attributes:

- the volume quantities demanded by the customer
- the response time the customer is willing to wait for fulfilment of the order
- the variety of products needed
- the service level required
- the price of the product
- the desired rate of innovation in the product (including new product development)

Use existing information (information can be obtained from):

- Past proprietary market research reports
- Multiclient market research reports
- Other published material pertinent to the organisation's industry, customer base, technology gathered from publications, the Web, seminars and so on.
- Competitors' Web sites, press releases, media references, and annual and quarterly reports and stock analyst reports (if available).
- Web sites of companies selling complimentary products and services
- The organisation's financial statements overall by business unit, by product category, by market, by channel, and in B2B markets and by customer
- Any tracking information on market size, market share, penetration rates, repeat purchase rates, win rates, and any other variable that measures outcome of the organisation's selling process

Obtain information from outside sources: (Outside resources will depend on the organisation, its industry, and the amount that can be invested in information collection). Sources of qualitative information include:

- *Current, lost and potential customers*
- *Potential customer groups not using the organisation's offerings due to some features*
- *End users of the industry's offering (including those who are using competitors' offerings)*
- *Key suppliers*
- *Organisations selling complimentary offerings*
- *Experts in any area*

Compiled from Plantes and Finfrock (2009:88-93); Harrison (2001:1); Jeong and Hong (2007:578); Wisner *et al*. (2009:351); Chopra and Meindl (2007:26); Hines (2004:58) and Hugos (2006:33, 34).

Table A1b (Table 6.5):
Determining a value proposition based on market winners and core competencies.

Core competencies	Possible market winners	Value proposition
Processes *Planning systems* *Technology* *People and culture* *Supply chain relationships*	*Quality (sustainability vs supremacy)* *Timeliness* *Cost* *Innovation* *Flexibility*	*A value proposition can be determined by using the list of core competencies and possible market winners*

Compiled from Bozarth and Handfield (2006:27, 28); Swink *et al*. (2011:31-34) and Lyons *et al*. (2004:659)

ASSESSMENT QUESTIONS AND RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE TWO OF SCD:

(SCD element #2.1)

Table A2.1 (Table 6.6): Assessment question to determine the level of market demand predictability

Organisations have to indicate (with an *x*) where they would position the level of market demand predictability on a continuum with two extremes on each end of the continuum (where 1 = very predictable and 4 = very unpredictable						
The market demand for the product (based on *orders/ sales fluctuations during a certain period) is:*	Predictable (low levels of uncertainty)	1	2	3	4	Volatile (high levels of uncertainty)

Table A2.1a (Table 6.8): Variables to determine market demand predictability

Demand uncertainty	Low	High
Length of product life cycle	Long	Short
Profitability	Low	High
Forecast error	Low	High
Stock-out rates	Low	High
Markdown	Low	Potentially high
Obsolescence	Low	High
Product variety	Low	High
End result: Market demand	***Stable, predictable***	***Variable, difficult to forecast***

Source: adapted from Fisher (1997:1, 2); Ayers (2006:63) and Jacobs *et al*. (2009:363).

ASSESSMENT QUESTIONS AND RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE TWO OF SCD:

(SCD element #2.2)

Table A2.2 (Table 6.7): Assessment question to determine specific market winners

Organisations have to indicate (with an *x*) what their market winner is on a continuum with two extremes on each end of the continuum (where 1 = low cost and 4 = agility in terms of short lead times; availability of products; high service levels; high quality)						
The market winner for the product category is *(what customers consider as essential)*	Low cost (within acceptable levels of service, availability and quality)	1	2	3	4	Agility (short lead times; availability of products; high service levels; high quality) within acceptable costs

Table A2.2a (Table 6.5): Determining a value proposition based on market winners and core competencies

Core competencies	**Possible market winners**	**Value proposition**
Processes *Planning systems* *Technology* *People and culture* *Supply chain relationships*	*Quality (sustainability vs supremacy)* *Timeliness* *Cost* *Innovation* *Flexibility*	*A value proposition can be determined by using the list of core competencies and possible market winners*

Compiled from Bozarth and Handfield (2006:27, 28); Swink *et al*. (2011:31-34) and Lyons *et al*., (2004:659).

ASSESSMENT QUESTIONS AND RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE TWO OF SCD:

(SCD element #2.3)

Table A2.3 (Table 6.9): Assessment question to determine the organisation's position in terms of the decoupling point

The organisation has to indicate which ONE of the following statements best fits its organisation in terms of the point where final assembly of the finished product (as end customers will use it) takes place.	**Please select one option only** *(mark with an x)*
The organisation's supplier(s) is/are responsible for the final assembly of the finished product as it will be distributed to end (or final) customers. The organisation merely distributes the finished product further to the end customers.	
The organisation is responsible for the final assembly of the finished product as it will be distributed to end (or final) customers The organisation receives the raw materials/ components/ work in progress parts and assembles (or compiles) the final product as it will be distributed to the end (or final) customers	
The organisation's customer(s) is/are responsible for the final assembly of the finished product as it will be distributed to end (or final) customers. The organisation merely distributes the raw materials/ components/ work in progress parts to them so that they can complete the final assembly.	

Table A2.3a (Table 6.10): Alignment between market demand predictability, market winners, position in terms of decoupling point and supply chain strategy

	Suggested supply chain strategy		
Characteristic	**Lean**	**Leagile**	**Agile**
Market demand	High predictability	Either	Low predictability
Market winner	Low cost	Either	Agility
Decoupling point (will only be used if there is contradiction between market demand predictability and market winner)	Downstream towards customers	At the organisation	Upstream towards suppliers
Characteristics	Because of high predictability, organisations can manufacture generic products at low cost. Customisation is not necessary yet because the decoupling point is downstream (and real demand is not yet known). Use make to stock.	If market demand is predictable and market winner is agility, the decoupling point should be at the organisation to use a leagile supply chain strategy *Reason*: Organisations have to manufacture at low cost upstream from the decoupling point (because generic products can be manufactured) and be agile downstream from the decoupling point (because customisation is required).	Because of low predictability, organisations cannot necessarily manufacture generic products at low cost. Customisation is necessary because the decoupling point is upstream (and real demand is known). Agility is required to provide a combination of quality, timeliness, and improved service (depending on what the customer wants). Use make to order.

Source: Compiled from Christopher (2003:289, 290).

ASSESSMENT QUESTIONS AND RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE TWO OF SCD:

(SCD element #2.4)

Table A2.4 (Table 6.11): Assessment question to determine the focus of the organisation's supply chain strategy

<table>
<tr><td colspan="8">Organisations have to indicate on a continuum what the primary focus of their organisation's supply chain strategy for a specific selected supply chain is (where 1 = a focus on achieving the lowest cost; achieving economies of scale, reducing waste and so on within acceptable service levels and 5 = a focus on being agile, ie being responsive and flexible to customers' demands and providing high service levels within acceptable costs levels)</td></tr>
<tr><td>All things considered, the focus of your organisation's supply chain strategy for the selected supply chain is:</td><td>Cost-efficiency; economies of scale reduction of waste</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Agility (responsiveness; flexibility, high service levels)</td></tr>
</table>

ASSESSMENT QUESTIONS AND RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE THREE OF SCD:

(SCD element #3.1)

Table A3.1 (Table 6.12): Assessment questions to assess supply chain relationships

Organisations have to indicate the extent to which their organisation: *(where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)*	Most important suppliers						Most important customers				
knows who its critical supply chain partners are (where supply chain relationships need to be managed concerning processes, information, technology, etc.)	NA	1	2	3	4		NA	1	2	3	4
has made an effort to get in contact with the 'right' direct tier one supply chain partners (identified, evaluated and selected their most important direct suppliers and customers) based on capability considerations	NA	1	2	3	4		NA	1	2	3	4
manages their critical direct (tier one) supply chain relationships	NA	1	2	3	4		NA	1	2	3	4
is able to manage their critical supply chain relationships beyond tier 1 (tier 2 to tier n)	NA	1	2	3	4		NA	1	2	3	4
manages their critical supply chain relationships beyond tier 1 (tier 2 to tier n)	NA	1	2	3	4		NA	1	2	3	4

ASSESSMENT QUESTIONS AND RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE THREE OF SCD:

(SCD element #3.1)

Table A3.1a (Table 6.13): Recommendations for the identification, evaluation and selection of supply chain partners

Identify supply chain partners by means of gathering information through: - current suppliers including supplier information files, supplier websites and supplier catalogues - sales representatives - information databases - experience about dealing with suppliers in general - trade journals, trade directories and trade shows - second parties or indirect information such as other supply management departments or professional organisations - internal sources - Internet searches - phone directories Evaluate and select supply chain partners based on their compliance with the following factors and how these factors fit into the organisation's strategic objectives: - Operations and logistics processes and systems capabilities (including production scheduling, control systems, delivery frequencies, supply flexibility and capacity capabilities such as minimum lot sizes) - Technological capabilities (including information coordination capability such as e-commerce capabilities) - Total quality performance (including supply quality, quality processes and quality systems) - Supply management processes (in terms of replenishment lead times and on-time performance - Cost structures (including pricing terms, inbound transportation costs and exchange rates, taxes, and duties if applicable) - Design collaboration capability - Employee capabilities (including labour skills, training and morale) - Management capabilities - Financial stability - Supplier viability and thus longer-term relationship potential

Source: Compiled from Monczka *et al*., (2005:210-212; 215-221); Burt *et al*. (2010:242-243; 244-247); Chopra and Meindl (2010:420) and Swink *et al*. (2011:297).

ASSESSMENT QUESTIONS AND RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE THREE OF SCD:

(SCD element #3.1)

Table A3.1b (Table 6.14): Evaluating supply chain relationships and processes

	Organisations have to indicate the extent to which the following SCI characteristics are applied in their organisation and its <u>supply chain relationships</u> *(where 1 = limited; 2 = average; 3 = high; 4 = very high)*	**with most important suppliers**				**with most important customers**			
1	The level of interdependence between supply chain partners (dependency on each other - can a partner opt out easily?)	1	2	3	4	1	2	3	4
2	The long-term commitment in the relationship from both parties	1	2	3	4	1	2	3	4
3	The level of trust between supply chain partners	1	2	3	4	1	2	3	4
4	The reliability of the organisation's supply chain partners in terms of eliminating supply uncertainties such as unnecessary breakdowns, disruptions, and so on	1	2	3	4	1	2	3	4
5	Sharing supply chain risks amongst supply chain partners (are risks each party's responsibility or not?)	1	2	3	4	1	2	3	4
6	Sharing benefits/ rewards amongst supply chain partners (are direct benefits shared or is it to the advantage of the individual organisation?	1	2	3	4	1	2	3	4
7	The degree of collaboration achieved (to what extent is purposeful cooperation achieved to maintain the relationship over time?)	1	2	3	4	1	2	3	4
8	Development of any supply chain capabilities (in organisations where it is necessary) to optimise the supply chain	1	2	3	4	1	2	3	4
9	<u>Measuring and sharing</u> supply chain performance with partners to improve the supply chain's performance (of all relevant organisations across the supply chain)	1	2	3	4	1	2	3	4
10	Adhering to predetermined payment conditions	1	2	3	4	1	2	3	4

	Organisations have to indicate the extent to which the following SCI characteristics are applied in their organisation and its <u>supply chain processes</u> *(where 1 = limited; 2 = average; 3 = high; 4 = very high)*	**by/ towards most important suppliers**				**by/ towards most important customers**			
1	The compatibility of essential technologies to ensure the seamless flow of materials/ goods between supply chain partners	1	2	3	4	1	2	3	4
2	Contribution towards new product development (NPD)	1	2	3	4	1	2	3	4
3	The compatibility of essential technologies to ensure the mutual sharing of accurate relevant information between supply chain partners	1	2	3	4	1	2	3	4
4	The focus on total supply chain costs (and not only price) across the supply chain	1	2	3	4	1	2	3	4
5	A focus on continuous improvement across processes	1	2	3	4	1	2	3	4
6	A focus on adhering to predetermined quality levels (albeit with product or service features)	1	2	3	4	1	2	3	4
7	The level of supply chain integration between the organisation and its supply chain partners with regards to essential processes, technologies, information sharing, etc.	1	2	3	4	1	2	3	4

ASSESSMENT QUESTIONS AND RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE THREE OF SCD:

(SCD element #3.2)

Table A3.2 (Table 6.15): Assessment questions to assess supply chain drivers

Organisations have to indicate where they would position their organisation (with regards to a selected supply chain) along a continuum (where 1 = a strong focus on efficiency and 4 = a strong focus on responsiveness).

	SCD element						
1	Capacity utilisation in facilities	On the organisations there is little excess capacity. Organisations have high utilisation rates to maintain lower costs and run or stock their facilities at full capacity because of predictable demand	1	2	3	4	Organisations allow for excess capacity to allow for flexibility (to meet unexpected customer demand). Organisations even place orders with suppliers if necessary to meet varying demands
2	Location of facilities	Organisations have one or a few central facilities to serve wide areas	1	2	3	4	Organisations have many smaller facilities closer to their customers
3	Inventory levels	Because of predictable demand organisations try to minimise their inventory levels throughout the supply chain to lower cost	1	2	3	4	Organisations/ their supplier(s) maintain significant buffer (or safety) stocks of parts or finished goods to meet unexpected customer demand at short notice if necessary
4	Lead times	Short lead times are not essential, but organisations try to shorten their lead times as long as it doesn't increase cost	1	2	3	4	Short lead times are essential and organisations even invest aggressively in ways to reduce lead times if necessary (even if it means incurring higher costs)
5	Transportation cost	Organisations select the lowest acceptable cost mode of transport	1	2	3	4	Organisations select fast (flexible) means of delivery depending on their customers' needs regardless of cost
6	Transportation frequency	Organisations have less frequent shipments (to save cost) (and because demand is predictable organisations can plan the frequency easier)	1	2	3	4	Organisations have frequent shipments (to adhere to customers' flexible demands) (Organisations will ensure availability and timeliness even it means more frequent shipments)
7	Information collection	Organisations place low emphasis on collecting and sharing accurate and timely data between supply chain members (forecasts are used without consulting other supply chain members)	1	2	3	4	Organisations place high emphasis on collecting and sharing accurate and timely data between supply chain members (determining real market demand and exactly what the customers want is important)
8	Supplier selection criteria	Organisations select their suppliers based on low prices and acceptable quality standards (cost considerations are most important)	1	2	3	4	Organisations select their suppliers based on speed, flexibility, superior quality and dependability (cost considerations are important but of secondary importance)
9	Pricing/ profit margins	Organisations base their profit margins on lower margins and higher volumes	1	2	3	4	Organisations base their profit margins on higher margins and lower volumes

Table A3.2a (Table 6.16): Recommendations and considerations for management of supply chain drivers (SCD element #3.2)

SCD element	Lean SC strategy	Agile SC strategy
Facilities: Capacity and location (SCD elements #3.2.1 & 3.2.2)	**Utilise full capacity because then lower costs will be achieved due to economies of scale.** Therefore, organisations have to know what their maximum capacity and effective capacity is. **Utilise make-to-stock production strategy** because product characteristics should be highly standardised with high volumes. Process flexibility is low and a key resource is equipment and materials. **Centralise facilities to serve wide areas.** However, if centralisation is used, transportation must be reliable. Customer service is lower than with decentralisation. Lead times are longer. Inward transport costs consist of fewer larger deliveries and cost is low. Facilities are however further from customers which means that outward transport costs are higher Operating costs are also lower with bigger facilities because of economies of scale. Safety stock is lower. **Consolidation and cross docking can be considered** if products have a continuous flow; suppliers are reliable; there are no unpredictable fluctuations in the sales and products have uniform handling methods.	**Allow for excess capacity to be flexible to meet unexpected customer demands.** **Utilise make-to-order production strategy** because product characteristics should be low standardisation and low volumes. Process flexibility is high and a key resource is skilled labour. **Decentralise with many smaller facilities closer to customers** This increases customer service and substitutability of products because of shorter lead times and less lost sales. However consider that inward transportation costs may be high because of many smaller deliveries, but outward transportation costs can be low because of closer proximity to customers. Safety stocks will be higher and overhead costs are higher. **Direct shipments** can be considered to reduce lead times and inventory carrying costs.
Inventory (SCD element #3.2.3)	**Minimise inventory levels** throughout the supply chain because market demand is predictable. Determine why inventory levels are not minimised. Determine stockout frequency if organisation runs out of stock (and if stockouts are crucial). Provide tight management of usage rates, lead times, and safety stock. Inventory levels (including safety stocks) can be minimised with centralised facilities. Requirements for low inventory levels are reliable suppliers with reliable lead times. Product features for lean supply chains are components and standard	**Maintain significant buffer (or safety) stocks** (in supply chain) of parts or finished goods to meet unexpected customer demand at short notice if necessary because market demand is unpredictable (volatile) This will be necessary with decentralised facilities. Invest into more responsive order processing and transportation resources to improve responsiveness Product features for agile supply chains are customised and differentiated products

	products If suppliers are reliable then consider JIT systems	
Transportation Lead times, cost & frequency (SCD elements #3.2.4, 3.2.5 & 3.2.6)	**Select the lowest acceptable cost mode of transport.** **Use less frequent shipments.** Shorten lead times as long as it does not increase cost. Eliminate excessive movement of parts to various facilities. Transportation costs can be reduced with consolidation and cross docking systems.	**Select fast (flexible) means of delivery depending on customers' needs regardless of cost.** Use more frequent shipments (to adhere to customers' flexible demands and to ensure availability and timeliness. Short lead times are essential. Invest aggressively in ways to reduce lead times if necessary (even if it means incurring higher costs). Reduce distances travelled. Eliminate waiting times by scheduling transportation effectively. Direct shipments reduce lead times and cuts down on warehousing and DC costs. However, risk pooling is also eliminated.
Information (SCD element #3.2.7)	**Use forecasts** because lower emphasis is placed on collecting and sharing accurate and timely data between supply chain members. When using forecasts, beware of the bullwhip effect. To reduce the bullwhip effect, communicate with suppliers. Try to reduce forecast errors because accurate forecasts mean bigger economies of scale which reduce costs. Use information systems to reduce costs and time involved in receiving goods and services.	**Invest in information systems** to collect real time market demand because high emphasis is placed on collecting and sharing accurate and timely data between supply chain members. Ensure visibility with reliable supply chain partners. This will enable organisations to synchronise supply and demand to increase flexibility and reduce variability in demand.
Sourcing (SCD element #3.2.8)	Select suppliers based on low prices and acceptable quality standards (cost considerations are most important).	Select suppliers based on speed, flexibility, superior quality and dependability (cost considerations are important but of secondary importance).
Pricing (SCD element #3.2.9)	Base profit margins on lower margins and higher volumes.	Base profit margins on higher margins and lower volumes.

Source: Compiled from Raturi and Evans (2005:209); Simchi-Levi *et al*. (2003:52); Simchi-Levi *et al.* (2008:201, 202); Hugos (2006:35, 37); Chopra and Meindl (2007:35, 44, 45); Chopra and Meindl (2010:389); Waters (2009:213, 384, 429); Wisner *et al*. (2009:325); Langley *et al*. (2009:348, 422); Jonsson (2008:228); Bozarth and Handfield (2006:344); Bowersox *et al*. (2010:249); Cohen and Roussel (2005:12); Swink *et al*. (2011:428); Cronje (2009:237); Pienaar (2009:306); Christopher (2003:285); Webster (2008:352); Hines (2004:63); Lambert (2006:14) and Bruce *et al*. (2004:155)..

ASSESSMENT QUESTIONS AND RECOMMENDATIONS (FURTHER ANALYSIS) FOR PHASE THREE OF SCD:

(SCD element #3.3)

Table A3.3 (Table 6.17): Assessment question to analyse supply chain KPIs

Organisations have to rate the relative importance of the following supply chain KPI categories within their organisation in terms of a selected supply chain (where 1 = most important KPI and 6 least important KPI).		
	Supply chain key performance indicator category *(with examples of measures for each category in brackets)*	*Rating (1-6)*
1	**Supply chain delivery reliability** (in terms of fill rates, delivery performance, perfect orders) (with these KPIs it is all about being reliable with the quality and completeness of orders)	
2	**Supply chain responsiveness** (in terms of order fulfilment lead times) (with these KPIs it is all about being on time with orders)	
3	**Supply chain flexibility** (to adapt to changing customer needs in terms of supply chain response time, production flexibility) (with these KPIs it is all about being flexible to changing needs and being able to deliver whatever the customer wants in the required time)	
4	**Cost measures within the organisation** (includes all costs and is measured to see where reductions can be made as well as to ensure that the organisation is not over spending and staying within budget)	
5	**Cost measures across the supply chain** (sharing cost information with other supply chain members about total supply chain costs which includes ordering, inventory and distribution costs across all the supply chain members with the aim of reducing supply chain costs of the entire supply chain as a whole)	
6	**Supply chain asset management efficiency** (reduction of inventory levels; cash-to-cash cycle times, asset turns) (with these KPIs it is all about measuring how overall asset management objectives such as increasing asset turns, reducing inventory levels and reducing cash-to-cash cycle times are being met)	

Table A3.3a (Table 6.18): KPI and specific measures for selected supply chain strategies (SCD element #3.3)

	Lean supply chain strategy	**Agile supply chain strategy**
KPI category	Supply chain cost Supply chain asset management efficiency	Supply chain delivery reliability Supply chain responsiveness Supply chain flexibility
Market winners measured	Cost	Service level (availability, timeliness, flexibility, innovation quality, supremacy)
Specific measures	*Cost*: Cost of goods sold Total supply chain costs *Supply chain asset management efficiency:* Cash-to-cash cycles Inventory turns Asset turns	*Reliability*: Delivery performance (such as on-time delivery) (percentage) Fill rates (percentage) Perfect order fulfilment (percentage) *Responsiveness*: Order fulfilment lead times (days) *Flexibility*: Supply chain response time (days) Production flexibility (days)

Source: compiled from Agarwal and Shankar (2002:32); Christopher and Towill (2001:237); Reiner and Schodl (2003:312); Taylor (2004:184-189) and Bolstorff and Rosenbaum (2003:51-53, 68).

ANNEXURE B

THE ASSESSMENT INSTRUMENT

Dear Respondent

Thank you kindly for agreeing to participate in my DCom Research.

The aim of the study is to develop a conceptual framework with which organisations can analyse their supply chain design practices. The framework which was developed from literature is now at a point where information from organisations like your own is required to test the framework and ultimately complete it. All the information provided will be dealt with in the strictest confidence and as aggregation of results will occur in the data analysis your response will not be uniquely identifiable. If so required you will be provided with a report on the analysis of your data through utilisation of the conceptual framework. The report will be made available in approximately six months from the date of the interview.

Your contribution will no doubt have a positive impact on the insight into supply chain design practices in South Africa.

Kind regards

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ASSESSMENT INSTRUMENT (QUESTIONNAIRE)

The **aim of this questionnaire is to determine supply chain design practices across different product categories**. The questionnaire consists of two sections. Section A comprises questions about supply chain design practices and in section B demographic information is asked.

SECTION A: SUPPLY CHAIN DESIGN PRACTICES

a) Supply chain planning

	Your organisation:	(mark with an *x*)		
1	Has a **formally documented** supply chain strategy	Yes	Not sure	No
2	often **maps (or models)** its supply chain to analyse it	Yes	Not sure	No
3	**consciously designs** its supply chain (in terms of selecting supply chain strategies, selecting and managing critical suppliers and customers and determining how to manage and measure specific supply chain drivers)	Yes	Not sure	No

b) Product category focus of the study

Please select one of the following product categories and complete this questionnaire based on the supply chain practices of your organisation for this product category. THIS PRODUCT CATEGORY IS TO BE USED AS REFERENCE FOR EACH SECTION IN THIS QUESTIONNAIRE.

	Please select one product category as reference for this entire questionnaire	**Please select one** (mark with an x)
1	Drinks (soft drinks, fruit juices and beer)	
2	Food kept on the shelf (Rice and maize meal; Canned food; Sugar, coffee and tea)	
3	Sports clothing (specifically a fashionable or trendy line of shirts)	
4	Cellular phones (with very specific novelty features)	
5	Cars (with very specific novelty features)	

Please specify the product:

____

c)

	What is your approximate market share for this product category?	*(mark with an x)*
1	0-10%	
2	11-20%	
3	21-30%	
4	More than 30%	

d)

	Are you the market leader in this product category?	*(mark with an x)*
1	Yes	
2	Top 3	
3	Top 5	
4	Top 10	

1 UNDERSTANDING CUSTOMERS' NEEDS AND HOW TO MEET THEM

	With reference to the product category selected in section b, indicate to which extent your organisation: *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)*	(mark with an *x*)				
1	knows **who** their customers for this product category are (by means of market research/ market segmentation/ customer profitability profiles)	1	2	3	4	5
2	knows what the **needs** of their customers for this product category are in terms of service levels, products, prices, and so on, by means of market research; etc.	1	2	3	4	5
3	has identified a formal *value proposition* to meet customers' needs for this product category	1	2	3	4	5
4	possesses a *core competency* (that creates customer perceived value and is superior to what competition does)	1	2	3	4	5
5	has identified how to win customers' orders for this product (with either low prices or by means of differentiation by being flexible and responsive to customers' demands; providing superior service and high quality)	1	2	3	4	5

A value proposition is the value in the form of the programme of products, services ideas and solutions that an organisation offers its customers.
A core competency is the bundle of skills, and capabilities that enable an organisation to provide benefits to customers (for example, skilled workforce, advanced technologies, excellent quality control techniques, and so on).

2 SELECTING A SUPPLY CHAIN STRATEGY

2.1 Product category characteristics

Indicate (with an *x*) where you would position the product category (refer to section b) on a continuum with two extremes on each end of the continuum (where 1 = characteristics of a functional product as indicated on the left hand side of the continuum and 4 = characteristics of an innovative product as indicated on the right hand side of the continuum)

	Characteristic						
1	The market demand for the product category is *Do orders/ sales fluctuate significantly from what you expect it to be during a certain period?*	Predictable (low levels of uncertainty)	1	2	3	4	Volatile (high levels of uncertainty)
2	The market winner for the product category is *(what customers consider as essential)*	Low cost (within acceptable levels of service, availability and quality)	1	2	3	4	Agility (short lead times; availability of products; high service levels; high quality) within acceptable costs

2.2 The organisation's position in the supply chain in terms of the final assembly of the product category (refer to section b) as it will be used by end customers

	Which ONE of the following statements best fits your organisation in terms of the point where final assembly of the finished product (as end customers will use it) takes place?	**Please select one option only** *(mark with an x)*
1	Your organisation's supplier(s) is/are responsible for the final assembly of the finished product as it will be distributed to end (or final) customers. Your organisation merely distributes the finished product further to the end customers.	
2	Your organisation is responsible for the final assembly of the finished product as it will be distributed to end (or final) customers. Your organisation receives the raw materials/ components/ work in progress parts and assembles (or compiles) the final product as it will be distributed to the end (or final) customers.	
3	Your organisation's customer(s) is/are responsible for the final assembly of the finished product as it will be distributed to end (or final) customers. Your organisation merely distributes the raw materials/ components/ work in progress parts to them so that they can complete the final assembly.	

2.3 Supply chain strategy

The following definitions will be used as point of departure for this section in the questionnaire.

Lean supply chains utilise strategies aimed at creating the highest cost efficiencies in the supply chain.
Agile supply chains utilise strategies aimed at being responsive and flexible to customers' needs.

Indicate on a continuum what the primary focus of your organisation's supply chain strategy for this product category (refer to section b) is
(where 1 = a focus on achieving the lowest cost; achieving economies of scale, reducing waste and so on within acceptable service levels and 5 = a focus on being agile, ie being responsive and flexible to customers' demands and providing high service levels within acceptable costs levels)

	All things considered, the focus of your organisation's supply chain strategy for this product category is:	Cost-efficiency; economies of scale reduction of waste	1	2	3	4	5	Agility (responsiveness; flexibility, high service levels)

If response is three (3) OR if your organisation uses a different strategy for your suppliers and customers please explain why.

3 SUPPLY CHAIN STRUCTURE

3.1 Supply chain partners (suppliers and customers)

The term 'supply chain partners' refers to the members in the supply chain who work with your organisation.
Tier one refers to the direct partners and tier two refers to your partners' direct partners (ie your suppliers' direct suppliers and your customers' direct customers).

	Indicate the extent to which your organisation: *(where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)*	Most important suppliers					Most important customers				
1	*knows who its critical supply chain partners are (where supply chain relationships need to be managed concerning processes, information, technology, etc.)*	NA	1	2	3	4	NA	1	2	3	4
2	*has made an effort to get in contact with the 'right' direct tier one supply chain partners (identified, evaluated and selected their most important direct suppliers and customers) based on capability considerations*	NA	1	2	3	4	NA	1	2	3	4
3	*manages their critical direct (tier one) supply chain relationships*	NA	1	2	3	4	NA	1	2	3	4
4	*is able to manage their critical supply chain relationships beyond tier 1 (tier 2 to tier n)*	NA	1	2	3	4	NA	1	2	3	4
5	*manages their critical supply chain relationships beyond tier 1 (tier 2 to tier n)*	NA	1	2	3	4	NA	1	2	3	4

3.2 Supply chain drivers

Indicate where you would position your organisation (with regard to the product category selected in section b) along a continuum (where 1 = a strong focus on efficiency and 4 = a strong focus on responsiveness). If you select 1 as your response, you fully agree with the statement on the left and if you select 4 as your response, you fully agree with the statement on the right.

	Supply chain drivers	In our organisation:					
1	Capacity utilisation in facilities	there is little excess capacity (we have high utilisation rates to maintain lower costs) (we run or stock our facilities at full capacity because of predictable demand	1	2	3	4	we allow for excess capacity to allow for flexibility (to meet unexpected customer demand) (we even place orders with suppliers if necessary to meet varying demands)
2	Location of facilities	we have one or a few central facilities to serve wide areas	1	2	3	4	we have many smaller facilities closer to our customers
3	Inventory	because of predictable demand we try to minimise our inventory levels throughout the supply chain to lower cost	1	2	3	4	we/our supplier(s) maintain significant buffer (or safety) stocks of parts or finished goods to meet unexpected customer demand at short notice if necessary
4	Lead time	short lead times are not essential, but we try to shorten our lead times as long as it doesn't increase cost	1	2	3	4	short lead times are essential and we even invest aggressively in ways to reduce lead times if necessary (even if it means incurring higher costs)
5	Transportation cost	we select the lowest acceptable cost mode of transport	1	2	3	4	we select fast (flexible) means of delivery depending on our customers' needs regardless of cost
6	Transportation frequency	we have less frequent shipments (to save cost) (and because demand is predictable we can plan the frequency easier)	1	2	3	4	we have frequent shipments (to adhere to customers' flexible demands) (we will ensure availability and timeliness even it means more frequent shipments)
7	Information	low emphasis is placed on collecting and sharing accurate and timely data between supply chain members (forecasts are used without consulting other supply chain members)	1	2	3	4	high emphasis is placed on collecting and sharing accurate and timely data between supply chain members (determining real market demand and exactly what the customers want is important)
8	Supplier selection criteria	we select our suppliers based on low prices and acceptable quality standards (cost considerations are most important)	1	2	3	4	we select our suppliers based on speed, flexibility, superior quality and dependability (cost considerations are important but of secondary importance)
9	Pricing/ profit margins	we base our profit margins on lower margins and higher volumes	1	2	3	4	we base our profit margins on higher margins and lower volumes

3.3 Supply chain key performance indicators (KPIs)

Rate the relative importance of the following supply chain KPI categories within your organisation in terms of the product category selected in section b (where 1= most important KPI and 6 least important KPI). If two or more KPIs are of equal importance, then indicate it as such. Please use NA to indicate that your organisation does not use the KPI to measure the product category's performance.

	Supply chain key performance indicator category *(with examples of measures for each category in brackets)*	*Rating (1-6)*
1	**Supply chain delivery reliability** (in terms of fill rates, delivery performance, perfect orders) (with these KPIs it is all about being reliable with the quality and completeness of orders)	
2	**Supply chain responsiveness** (in terms of order fulfilment lead times) (with these KPIs it is all about being on time with orders)	
3	**Supply chain flexibility** (to adapt to changing customer needs in terms of supply chain response time, production flexibility) (with these KPIs it is all about being flexible to changing needs and being able to deliver whatever the customer wants in the required time)	
4	**Cost measures within the organisation** (includes all costs and is measured to see where reductions can be made, as well as to ensure that the organisation is not over spending and staying within budget)	
5	**Cost measures across the supply chain** (sharing cost information with other supply chain members about total supply chain costs which includes ordering, inventory and distribution costs across all the supply chain members with the aim of reducing supply chain costs of the entire supply chain as a whole)	
6	**Supply chain asset management efficiency** (reduction of inventory levels; cash-to-cash cycle times, asset turns) (with these KPIs it is all about measuring how overall asset management objectives such as increasing asset turns, reducing inventory levels and reducing cash-to-cash cycle times are being met)	

4 SUPPLY CHAIN INTEGRATION (SCI)

4.1 Internal supply chain integration

	With reference to the product selected in section b, indicate the extent to which the various functions (or departments such as procurement, logistics, operations, marketing, and so on) are internally integrated with regards to: *(where 1 = limited; 2 = average; 3 = good and 4 = very good)*	(mark with an *x*)			
1	<u>Planning and making decisions</u> towards achieving overall organisational (and not functional/ departmental) objectives (ie sharing common organisational objectives)	1	2	3	4
2	Collaborating internally to <u>integrate all internal processes</u> across the organisation to achieve organisational (and not functional or departmental) objectives	1	2	3	4
3	Collaborating internally to <u>build relationships across the different functions</u> (or departments) to achieve organisational objectives	1	2	3	4

4.2 External supply chain integration

4.2.1 Supply chain relationships

	With reference to the product selected in section b, indicate the extent to which the following SCI characteristics are applied in your organisation and its supply chain relationships *(where 1 = limited; 2 = average; 3 = high; 4 = very high)*	**with most important suppliers**				**with most important customers**			
1	The level of interdependence between supply chain partners (dependency on each other - can a partner opt out easily?)	1	2	3	4	1	2	3	4
2	The long-term commitment in the relationship from both parties	1	2	3	4	1	2	3	4
3	The level of trust between supply chain partners	1	2	3	4	1	2	3	4
4	The reliability of your organisation's supply chain partners in terms of eliminating supply uncertainties such as unnecessary breakdowns, disruptions, and so on	1	2	3	4	1	2	3	4
5	Sharing supply chain risks amongst supply chain partners (are risks each party's responsibility or not?)	1	2	3	4	1	2	3	4
6	Sharing benefits/ rewards amongst supply chain partners (are direct benefits shared or is it to the advantage of the individual organisation?	1	2	3	4	1	2	3	4
7	The degree of collaboration achieved ((to what extent is purposeful cooperation achieved to maintain the relationship over time?)	1	2	3	4	1	2	3	4
8	Development of any supply chain capabilities (in organisations where it is necessary) to optimise the supply chain	1	2	3	4	1	2	3	4
9	Measuring and sharing supply chain performance with partners to improve the supply chain's performance (of all relevant organisations across the supply chain)	1	2	3	4	1	2	3	4
10	Adhering to predetermined payment conditions Do we pay and are we paid accordingly?)	1	2	3	4	1	2	3	4

4.2.2 Supply chain processes

	With reference to the product selected in section b, indicate the extent to which the following SCI characteristics are applied in your organisation and its supply chain processes *(where 1 = limited; 2 = average; 3 = high; 4 = very high)*	**by/ towards most important suppliers**				**by/ towards most important customers**			
1	The compatibility of essential technologies to ensure the seamless flow of materials/ goods between supply chain partners	1	2	3	4	1	2	3	4
2	Contribution towards new product development (NPD)	1	2	3	4	1	2	3	4
3	The compatibility of essential technologies to ensure the mutual sharing of accurate relevant information between supply chain partners	1	2	3	4	1	2	3	4
4	The focus on total supply chain costs (and not only price) across the supply chain	1	2	3	4	1	2	3	4
5	A focus on continuous improvement across processes	1	2	3	4	1	2	3	4
6	A focus on adhering to predetermined quality levels (albeit with product or service features)	1	2	3	4	1	2	3	4
7	The level of supply chain integration between your organisation and its supply chain partners with regard to essential processes, technologies, information sharing, etc.	1	2	3	4	1	2	3	4

SECTION B: DEMOGRAPHIC INFORMATION

1 JOB FUNCTION

	What is your job function?	*(mark with an x)*
1	CEO/MD/ Owner	
2	Supply chain manager	
3	Logistics manager	
4	Supply/ procurement manager	
5	Production/ operations manager	
6	IT manager	
7	Marketing/ sales manager	
8	Finance manager	

Other (please specify): ____

2 INDUSTRY

	In which industry is your organisation?	*(mark with an x)*
1	Retail	
2	Assembly/ Distribution	
3	Manufacturing	

Other (please specify) ____

3 CONTACT DETAILS (for follow up purposes)

Name of organisation	
Contact number	

THANK YOU VERY MUCH FOR YOUR COOPERATION

ANNEXURE C

RESPONSES OF ORGANISATIONS WITH A LEAN SUPPLY CHAIN STRATEGY (A, B & C)

Responses for phase one of SCD: SCD elements #1.1 to 1.5

Table 8.26: Responses of organisations with a lean supply chain strategy for phase one in SCD[31]

The extent to which the organisation *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)*:	Ideal response	Individual organisation's response		
		A	B	C
Knows who their customers are	≥ 3	5	5	4
Knows the needs of their customers	≥ 3	5	5	4
Has identified a formal value proposition	≥ 3	5	4	5
Possesses a core competency	≥ 3	5	3	4
Has identified how to win customers' orders	≥ 3	5	5	4

Responses for phase two of SCD: SCD elements #2.1 to 2.4

Table 8.29: Responses of organisations with a lean supply chain strategy for phase two in SCD

SCD elements in phase two of SCD analysis:	Ideal response	Organisation's response		
		A	B	C
Market demand for the product	≤ 2	1	1	2
Market winner	≤ 2	4	2	3
Position of decoupling point	3	2	2	2
Focus of supply chain strategy	≤ 2	1	1	2

[31] For purposes of the testing of the conceptual framework, a response of at least 3 (average extent) was deemed satisfactory for these assessment questions. This is indicated as the ideal response.

RESPONSES OF ORGANISATIONS WITH A LEAN SUPPLY CHAIN STRATEGY (A, B & C)

Responses for phase three of SCD: SCD element #3.1

Table 8.32: Organisations' relationships with suppliers (lean supply chains)[32]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Organisation's response		
		A	B	C
Knows who their critical suppliers are	≥ 2	4	4	4
Has made an effort to get into contact with the right direct 1st-tier suppliers	≥ 2	4	4	4
Manages their direct 1st tier suppliers	≥ 2	4	4	3
Is able to manage critical suppliers beyond 1st tier	≥ 2	2	2	3
Manages critical suppliers beyond 1st tier	≥ 2	2	2	2

[32] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

RESPONSES OF ORGANISATIONS WITH A LEAN SUPPLY CHAIN STRATEGY (A, B & C)

Responses for phase three of SCD: SCD element #3.1

Table 8.33: Organisations' relationships with customers (lean supply chains)[33]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable):	Ideal response	Organisation's response		
		A	B	C
Knows who their critical customers are	≥ 2	4	4	4
Has made an effort to get into contact with the right direct 1st-tier customers	≥ 2	3	3	4
Manages their direct 1st-tier customers	≥ 2	3	3	3
Is able to manage critical customers beyond 1st tier	≥ 2	1	1	3
Manages critical customers beyond 1st tier	≥ 2	1	1	3

Table 8.34: Potential areas for improvement with customers (lean supply chains)[34]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response	
		A	B
Level of interdependence	≥ 2	4	3
Long-term commitment from both parties	≥ 2	4	4
Level of trust	≥ 2	2	2
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	4	4
Sharing supply chain risks	≥ 2	1	1
Sharing benefits/ rewards	≥ 2	1	1
Degree of collaboration achieved	≥ 2	3	3
Development of supply chain capabilities to optimise the supply chain	≥ 2	1	1
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	4	4
Adhering to predetermined payment conditions	≥ 2	4	4
Supply chain processes:			
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	1	1
Contribution towards new product development	≥ 2	1	1
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	2	2
Focus on total supply chain costs across the supply chain	≥ 2	1	1
Focus on continuous improvement across processes	≥ 2	1	1
Focus on adhering to predetermined quality levels	≥ 2	3	3
Level of supply chain integration between organisation and supply chain partners	≥ 2	2	2

[33] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

[34] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

RESPONSES OF ORGANISATIONS WITH A LEAN SUPPLY CHAIN STRATEGY (A, B & C)

Responses for phase three of SCD: SCD element #3.2

Table 8.43: Management of supply chain drivers (lean supply chains)

SCD element (in terms of the management of supply chain drivers):	Ideal response	Organisation's response		
		A	B	C
Capacity utilisation	≤ 2	1	1	2
Location of facilities	≤ 2	4	3	3
Inventory	≤ 2	1	1	2
Lead times	≤ 2	1	1	3
Transportation cost	≤ 2	1	1	2
Transportation frequency	≤ 2	4	2	3
Information	≤ 2	4	2	3
Supplier selection criteria	≤ 2	4	2	3
Pricing/ profit margins	≤ 2	3	2	-

Responses for phase three of SCD: SCD element #3.3

Table 8.46: Rating of supply chain KPI categories (lean supply chains)

Supply chain KPI category	Ideal rating	Rating of organisation		
		A	B	C
Supply chain delivery reliability		1	2	3
Supply chain responsiveness		2		4
Supply chain flexibility				5
Cost reductions within the organisation	1st	3	1	1
Cost reductions across the entire supply chain	1st			2
Supply chain asset management efficiency	1st			1

ANNEXURE D

RESPONSES OF ORGANISATIONS WITH AN AGILE SUPPLY CHAIN STRATEGY (F, H & L)

Responses for phase one of SCD: SCD elements #1.1 to 1.5

Table 8.27: Responses of organisations with an agile supply chain strategy for phase one in SCD[35]

The extent to which the organisation *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)*:	Ideal response	Individual organisation's response		
		F	H	L
Knows who their customers are	≥ 3	4	4	5
Knows the needs of their customers	≥ 3	4	4	5
Has identified a formal value proposition	≥ 3	4	4	3
Possesses a core competency	≥ 3	4	4	4
Has identified how to win customers' orders	≥ 3	3	4	4

Responses for phase two of SCD: SCD elements #2.1 to 2.4

Table 8.30: Responses of organisations with an agile supply chain strategy for phase two in SCD

SCD elements in phase two of SCD analysis:	Ideal response	Organisation's response		
		F	H	L
Market demand for the product	≥ 3	4	3	2
Market winner	≥ 3	3	3	3
Position of decoupling point	1	1	1	1
Focus of supply chain strategy	≥ 4	4	4	4

[35] For purposes of the testing of the conceptual framework, a response of at least 3 (average extent) was deemed satisfactory for these assessment questions. This is indicated as the ideal response.

RESPONSES OF ORGANISATIONS WITH AN AGILE SUPPLY CHAIN STRATEGY (F, H & L)

Responses for phase three of SCD: SCD element #3.1

Table 8.35: Organisations' relationships with suppliers (agile supply chains)[36]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Organisation's response		
		F	H	L
Knows who their critical suppliers are	≥ 2	4	4	4
Has made an effort to get into contact with the right direct 1st-tier suppliers	≥ 2	4	4	4
Manages their direct 1st-tier suppliers	≥ 2	3	3	4
Is able to manage critical suppliers beyond 1st tier	≥ 2	1	1	-
Manages critical suppliers beyond 1st tier	≥ 2	1	1	-

Table 8.36: Potential areas for improvement with suppliers (agile supply chains)[37]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response		
		F	H	L
Level of interdependence	≥ 2	2	2	4
Long-term commitment from both parties	≥ 2	3	3	4
Level of trust	≥ 2	3	3	3
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	2	2	2
Sharing supply chain risks	≥ 2	1	1	4
Sharing benefits/ rewards	≥ 2	2	2	3
Degree of collaboration achieved	≥ 2	2	2	3
Development of supply chain capabilities to optimise the supply chain	≥ 2	2	2	3
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	3	3	4
Adhering to predetermined payment conditions	≥ 2	3	3	4
Supply chain processes:				
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	2	2	4
Contribution towards new product development	≥ 2	1	1	3
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	2	2	3
Focus on total supply chain costs across the supply chain	≥ 2	1	1	3
Focus on continuous improvement across processes	≥ 2	2	2	4
Focus on adhering to predetermined quality levels	≥ 2	3	3	4
Level of supply chain integration between organisation and supply chain partners	≥ 2	2	2	4

[36] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.
[37] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

RESPONSES OF ORGANISATIONS WITH AN AGILE SUPPLY CHAIN STRATEGY (F, H & L)

Responses for phase three of SCD: SCD element #3.1

Table 8.37: Organisations' relationships with customers (agile supply chains)[38]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Organisation's response		
		F	H	L
Knows who their critical customers are	≥ 2	4	4	3
Has made an effort to get into contact with the right direct 1st-tier customers	≥ 2	4	4	3
Manages their direct 1st-tier customers	≥ 2	4	4	3
Is able to manage critical customers beyond 1st tier	≥ 2	1	1	1
Manages critical customers beyond 1st tier	≥ 2	1	1	1

Table 8.38: Potential areas for improvement with customers (agile supply chains) [39]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response		
		F	H	L
Level of interdependence	≥ 2	3	3	2
Long-term commitment from both parties	≥ 2	4	4	2
Level of trust	≥ 2	4	4	3
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	3	3	3
Sharing supply chain risks	≥ 2	2	2	4
Sharing benefits/ rewards	≥ 2	3	3	3
Degree of collaboration achieved	≥ 2	4	4	2
Development of supply chain capabilities to optimise the supply chain	≥ 2	3	3	3
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	3	3	3
Adhering to predetermined payment conditions	≥ 2	3	3	1
Supply chain processes:				
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	3	3	2
Contribution towards new product development	≥ 2	2	2	2
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	3	3	1
Focus on total supply chain costs across the supply chain	≥ 2	3	3	2
Focus on continuous improvement across processes	≥ 2	3	3	3
Focus on adhering to predetermined quality levels	≥ 2	3	3	3
Level of supply chain integration between organisation and supply chain partners	≥ 2	3	3	2

[38] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.
[39] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

RESPONSES OF ORGANISATIONS WITH AN AGILE SUPPLY CHAIN STRATEGY (F, H & L)

Responses for phase three of SCD: SCD element #3.2

Table 8.44: Management of supply chain drivers (agile supply chains)

SCD element (in terms of the management of supply chain drivers):	Ideal response	Organisation's response		
		F	H	L
Capacity utilisation	≥ 3	3	3	2
Location of facilities	≥ 3	2	2	1
Inventory	≥ 3	2	2	2
Lead times	≥ 3	2	2	2
Transportation cost	≥ 3	1	1	4
Transportation frequency	≥ 3	3	3	4
Information	≥ 3	3	3	4
Supplier selection criteria	≥ 3	4	4	4
Pricing/ profit margins	≥ 3	1	1	3

Responses for phase three of SCD: SCD element #3.3

Table 8.47: Rating of supply chain KPI categories (agile supply chains)

Supply chain KPI category	Ideal rating	Rating of organisation		
		F	H	L
Supply chain delivery reliability	1st	1	1	2
Supply chain responsiveness	1st	1		2
Supply chain flexibility	1st	1		3
Cost reductions within the organisation		1	1	1
Cost reductions across the entire supply chain			4	4
Supply chain asset management efficiency		2	2	2

ANNEXURE E

RESPONSES OF ORGANISATIONS WITH A LEAGILE SUPPLY CHAIN STRATEGY (D, E, G, I, J, K & M)

Responses for phase one of SCD: SCD elements #1.1 to 1.5

Table 8.28: Responses of organisations with a leagile supply chain strategy for phase one in SCD[40]

The extent to which the organisation *(where 1 = very limited; 2 = limited; 3 = average; 4 = good and 5 = very good)*:	Ideal response	Individual organisation's response						
		D	E	G	I	J	K	M
Knows who their customers are	≥ 3	4	5	5	5	5	5	5
Knows the needs of their customers	≥ 3	4	5	5	4	4	5	4
Has identified a formal value proposition	≥ 3	5	4	4	5	5	5	5
Possesses a core competency	≥ 3	5	4	4	4	5	4	5
Has identified how to win customers' orders	≥ 3	5	4	5	5	5	5	4

Responses for phase two of SCD: SCD elements #2.1 to 2.4

Table 8.31: Responses of organisations with a leagile supply chain strategy for phase two in SCD

SCD elements in phase two of SCD analysis:	Ideal response	Individual organisation's response						
		D	E	G	I	J	K	M
Market demand for the product		3	1	1	2	1	3	2
Market winner		2	1	4	3	3	4	4
Position of decoupling point	2	1	1	1	2	2	2	2
Focus of supply chain strategy	3	3	3	3	3	3	3	3

[40] For purposes of the testing of the conceptual framework, a response of at least 3 (average extent) was deemed satisfactory for these assessment questions. This is indicated as the ideal response.

RESPONSES OF ORGANISATIONS WITH A LEAGILE SUPPLY CHAIN STRATEGY (D, E, G, I, J, K & M)

Responses for phase three of SCD: SCD element #3.1

Table 8.39: Organisations' relationships with suppliers (leagile supply chains)[41]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Individual organisation's response						
		D	E	G	I	J	K	M
Knows who their critical suppliers are	≥ 2	3	4	4	4	4	4	4
Has made an effort to get into contact with the right direct 1st-tier suppliers	≥ 2	3	4	4	4	4	4	4
Manages their direct 1st-tier suppliers	≥ 2	3	4	4	4	4	4	4
Is able to manage critical suppliers beyond 1st tier	≥ 2	4	-	-	2	2	2	4
Manages critical suppliers beyond 1st tier	≥ 2	4	-	-	1	1	2	2

Table 8.40: Potential areas for improvement with suppliers (leagile supply chains)[42]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response	
		I	J
Level of interdependence	≥ 2	4	4
Long-term commitment from both parties	≥ 2	3	3
Level of trust	≥ 2	4	4
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	3	3
Sharing supply chain risks	≥ 2	3	3
Sharing benefits/ rewards	≥ 2	3	3
Degree of collaboration achieved	≥ 2	3	3
Development of supply chain capabilities to optimise the supply chain	≥ 2	4	4
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	4	4
Adhering to predetermined payment conditions	≥ 2	3	3
Supply chain processes:			
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	3	3
Contribution towards new product development	≥ 2	4	4
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	3	3
Focus on total supply chain costs across the supply chain	≥ 2	3	3
Focus on continuous improvement across processes	≥ 2	3	3
Focus on adhering to predetermined quality levels	≥ 2	4	4
Level of supply chain integration between organisation and supply chain partners	≥ 2	3	3

[41] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.
[42] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

RESPONSES OF ORGANISATIONS WITH A LEAGILE SUPPLY CHAIN STRATEGY (D, E, G, I, J, K & M)

Responses for phase three of SCD: SCD element #3.1

Table 8.41: Organisations' relationships with customers (leagile supply chains)[43]

The extent to which the organisation (where 1 = limited; 2 = average; 3 = good; 4 = very good and NA = not applicable)	Ideal response	Individual organisation's response						
		D	E	G	I	J	K	M
Knows who their critical customers are	≥ 2	4	4	1	4	4	3	4
Has made an effort to get into contact with the right direct 1st-tier customers	≥ 2	4	4	4	4	4	3	4
Manages their direct 1st-tier customers	≥ 2	3	4	4	4	4	3	4
Is able to manage critical customers beyond 1st tier	≥ 2	4	-	3	2	2	3	4
Manages critical customers beyond 1st tier	≥ 2	4	-	1	2	2	3	2

Table 8.42: Potential areas for improvement with customers (leagile supply chains)[44]

Supply chain relationships: (where 1 = limited extent; 2 = average extent; 3 = high extent; 4 = very high extent and NA = not applicable):	Ideal response	Organisation's response
		G
Level of interdependence	≥ 2	3
Long-term commitment from both parties	≥ 2	3
Level of trust	≥ 2	3
Reliability of supply chain partners in terms of eliminating supply uncertainties	≥ 2	3
Sharing supply chain risks	≥ 2	4
Sharing benefits/ rewards	≥ 2	2
Degree of collaboration achieved	≥ 2	4
Development of supply chain capabilities to optimise the supply chain	≥ 2	3
Measuring and sharing supply chain performance with partners to improve supply chain performance	≥ 2	3
Adhering to predetermined payment conditions	≥ 2	4
Supply chain processes:		
Compatibility of essential technologies to ensure the seamless flow of materials between partners	≥ 2	3
Contribution towards new product development	≥ 2	1
Compatibility of essential technologies to ensure the mutual sharing of accurate relevant information	≥ 2	2
Focus on total supply chain costs across the supply chain	≥ 2	2
Focus on continuous improvement across processes	≥ 2	4
Focus on adhering to predetermined quality levels	≥ 2	4
Level of supply chain integration between organisation and supply chain partners	≥ 2	3

[43] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.
[44] For purposes of the testing of the conceptual framework, a response of at least 2 (average extent) was deemed satisfactory for these assessment questions.

RESPONSES OF ORGANISATIONS WITH A LEAGILE SUPPLY CHAIN STRATEGY (D, E, G, I, J, K & M)

Responses for phase three of SCD: SCD element #3.2

Table 8.45: Management of supply chain drivers (leagile supply chains)

SCD element (in terms of the management of supply chain drivers):	Individual organisation's response						
	D	E	G	I	J	K	M
Capacity utilisation	2	1	2	1	1	2	1
Location of facilities	1	1	4	4	4	2	1
Inventory	2	2	2	1	1	2	2
Lead times	1	4	3	2	2	2	1
Transportation cost	1	1	3	1	1	2	1
Transportation frequency	3	2	3	4	4	2	4
Information	3	4	3	4	4	2	4
Supplier selection criteria	3	4	-	2	2	2	2
Pricing/ profit margins	2	2	2	1	1	3	2

Responses for phase three of SCD: SCD element #3.3

Table 8.48: Rating of supply chain KPI categories (leagile supply chains)

Supply chain KPI	Ideal rating	Rating of organisation						
		D	E	G	I	J	K	M
Supply chain delivery reliability	1st	1	1	1	1	1	1	1
Supply chain responsiveness	1st	1	1	2	2	2	4	1
Supply chain flexibility	1st	3		3	6	6	2	2
Cost reductions within the organisation	1st	1	1	2	3	3	3	1
Cost reductions across the entire supply chain	1st	1	1	3	3	3	6	2
Supply chain asset management efficiency	1st	1	6	1	3	3	5	1