A CONCEPTUALISATION OF SUPPLY CHAIN EFFECTIVENESS

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A conceptualisation of supply chain effectiveness

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Abstract

With globalisation leading to increased competition within their markets, businesses face new challenges. One of these is the management and subsequent efficiency of their supply chains. Through carefully considered and implemented supply chain management, businesses can attain a competitive advantage over their competitors. However, there is evidence to suggest that in practice, success factors attributed to efficiency of supply chains are not being addressed. This is of concern, as more businesses are now competing supply chain vs supply chain rather than directly as business vs business. This study investigates the success factors related to the management of successful supply chains.

The research methodology of this study utilised a quantitative survey instrument informed by qualitative information. It encapsulates structured themes within a conceptual framework and encompasses the associated critical success factors of each theme. Responses from 307 supply chain decision makers, have enabled both exploratory and confirmatory factor analysis to take place.

Through an exploratory factor analysis (EFA) the findings firstly identified 48 variables as critical factors directly attributed to supply chain efficiency. A confirmatory factor analysis offered the plausibility of a model fit of a 7V conceptual framework when addressing supply chain efficiency. The research contributes to the relatively new field research area of supply chain management and specifically critical success factors. It develops a conceptual framework that can assist organisations when planning and managing their supply chains. In doing so it also identifies critical success factors that if managed can improve supply chain efficiency and assist organisations in attaining a competitive advantage.

Declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification at this or any other university or institute of learning.

Signed

Scott Francis Bambrick

Date

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I would also like to thank my friends, family and especially my loving wife Joanne who has been and continues to be my rock. Finally, I would like to dedicate this thesis to my late grandfather Francis Bambrick.

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Chapter 1 – Introduction

It is the purpose of this chapter to offer an overall understanding of the thesis. Firstly, it will give the context and background of the research area. Secondly, the chapter will highlight the knowledge gap that the research will address. Thirdly, the contribution to knowledge the thesis will offer will be discussed. Fourthly, the chapter will explore the aims and objectives of the research. Fifthly and finally, the structure of the thesis will be explained to assist the reader.

1.1 Background of the research

Supply chain management (SCM) is viewed within practice and academic domains as an emergent field (Burgess, Singh et al. 2006). In both instances, it is yet to fully mature. It is suggested that in order for either to progress, both domains will need to be intrinsically linked to each other (Storey, Edberson et al. 2006). The conceptualisation of the term supply chain management was first phrased in the early 1980s (Oliver 1982). Throughout the 1990s SCM research and practice became more prominent. In part this was due to the increased globalisation of markets that organisations were operating within (Li and Liu 2006, Thoo, Huam et al. 2011). An underlying issue with SCM research is the narrow functional areas from which it draws its knowledge. Although a broader organisational perspective has been sought, SCM research is in the main eclectic with little in the way of consensus in relation to its conceptualisation (Burgess, Singh et al. 2006). There is a clear need for organisations undertaking supply chain initiatives to develop core competencies and be aware of what and where things can go wrong. The proper management of supply chains when issues arise helps to lower costs and in turn make organisations more competitive (Rao, Phillips et al. 2006).

Globalisation of markets, increased competition, increased emphasis on customer needs and the seeking of competitive advantage are all seen as prominent in the increased interest in supply chain management (Gunasekaran, Patel et al. 2001, Webster, Sugdern et al. 2004, Shepherd and Gunter 2006). Therefore, organisations should look to improve efficiency where it is possible to do so. Efficiency in supply chains has always had its place. History has shown the importance of supply chains in relation to successful delivery of organisational objectives and in turn achieving a competitive advantage over ones rivals (Chen, Lin et al. 2006). Supply chains are key to organisational profit and success and are continually dealing with logistical problems related to goods and services (Power 2005). These problems, are noted as among the most complex operational issues that supply chain managers need to address (Aykagan 2014). The well-planned and strategically managed supply chain, will lead to improved performance in relation to controlling demand. Additionally this could also assist in ensuring a consistency when it comes to quality products and services (Rao, Phillips et al. 2006).

Historically, focus from organisations was inward as they addressed issues surrounding procurement of supplies, management of their inventories and subsequent deliveries to their customers (Hines 2013). This operational perspective was considered inadequate and more focus began to be given to the externalities associated to managing supplies, such as external suppliers and in turn their suppliers and so on (Christopher 1992).

Although, this study starts with the premise that all organisations have supply chains of sorts. It is also acknowledged that supply chains have many tiers of suppliers and relationships between suppliers and customers can at times overlap and lack clarity.

1.1.1 Drivers for Research

Current Practice

Issues arise in the management of supply chains, such as transportation which, within the literature is focused upon physical logistics, others include communication; tariffs and planning (Christopher 2011). In the context of the current business environment, one may ask why the management of supply chains is so important. In the first instance, it is the increased level of customer choice; failure of a supplier to deliver could lead to the customer looking elsewhere for either a similar or substitute product.

Secondly, focus should be given to an organisation's internal balance sheet, for example, a common occurrence is that 50 per cent of a retailers total value of assets is located within its inventories (Hines 2013). The key point here is that keeping inventories as low as possible should improve upon cash flow.

Thirdly looking at the external environment, in 2013 the world investment report stated "60 per cent of global trade, which today amounts to more than $20 trillion, consists of trade in intermediate goods and services that are incorporated at various stages in the production process of goods and services for final consumption" (Taylor 2013). This point is not lost on organisational strategic decision makers. A recent survey of 400 retail CEOs highlighted that over 50 per cent believed that supply chains can be the difference between success and failure. Interestingly, in the same survey 87 per cent highlighted that their own supply chains were not at optimal levels of efficiency (Reporter 2014). Seminal research continues to highlight that successful implementation of SCM is key to an organisations competing in a global market place (Gonzalez-Loureiri, Dabic et al. 2014).

Existing SCM Discussions

SCM theoretical boundaries are not always clearly delineated (Tan, Lyman et al. 2002). There are also suggestions that in practice there are generic issues arising around the implementation and management of supply chains (Power 2005). To address such issues organisations are bestowing more decision-making authority onto their supply chain executives in an attempt to increase efficiency and gain competitive advantage (Douglas 2011). This increased authority has supply chain decision makers managing processes from the initial design, through to the raw material and eventually delivering to the end user. However, even with this management focus on supply chain processes there continues to be issues in practice surrounding efficiency. Hines (2004) suggests that the implementation of supply chain strategies can be assisted through careful consideration of success factors that in turn, can assist in attaining the efficiency organisations seek.

In practice, organisations are going to great lengths to ensure that their supply chains are as efficient as possible (Hines 2004, Rao, Phillips et al. 2006). For example, Apple has its own distinctive supply chain model which is structured to allow maximum control of product design and production. By investing in the manufacturing of key component parts, they have sought to strengthen control over their supply chains by controlling every part possible. To increase efficiency, they have actively recruited supply chain managers who they believe will speed up operations in key areas (Williams 2014). However, a discussion has arisen that Apple is over controlling and this is starting to affect levels of flexibility within their supply chain. Improvements to competitors supply chains and increased flexibility is enabling them to bring their products to market quicker (Williams 2014).

Due to the increase in globalisation organisations need to be better equipped to deal with issues surrounding the management and expansion of their supply chains (Lambert and Cooper 2000, Li and Liu 2006). With these changes, new challenges to businesses will continue to occur in relation to their supply chains (Power 2005, Christopher 2011). This means that they need to establish delivery systems that add value and in turn are more responsive to constantly changing demands placed upon them from their markets (Christopher 2011). To offer more effective responsiveness and efficiency, organisations need no longer act as stand-alone separate entities but rather as part of a larger integrated supply chain (Lambert and Cooper 2000, Chen and Paulraj 2004). Integration and cooperation between supply chain members is not a new idea and was previously highlighted by Cooper and Ellram (1993) as being key to success. More recently Chen, Lin et al. (2006) suggested that firms within supply chains should stop seeking to be single autonomous units and come together with a view to helping each other to improve the overall competitiveness. Historically, rather than collaboration to gain a competitive advantage, organisations would instead rely upon aggressive selling of strong brand products and the utilisation of large advertising budgets. Over time, in order for organisations to compete they have looked inward to their own capabilities and competences (Lambert and Cooper 2000, Hines 2004, Li and Liu 2006). Primarily organisations need to address and improve their core processes. These core processes are that of product and supplier development; order fulfilment and customer management (Christopher 2011).

Another suggestion, that their supply chains need to be more agile and structured in a manner that they can be both proactive and reactive to changes in demand (Gattorna 2010). It is important to note that in today’s product based markets, life cycles are shortening. In turn, this leads to customers demanding just-in-time supply attitudes, as clearly buyers are becoming increasingly more demanding. With increased pressure on delivery of products, it is fundamental that organisations have the ability to identify issues within their supply chain to ensure demand is met (Hines 2004). This assists in a competitive advantage being maintained and/or profit being achieved. Christopher (2011) suggests that there is a fine line between profit and loss for an individual product, the extent of which is related to how a supply chain is optimised. In essence, if the costs involved in production are high, then for a company to achieve a competitive advantage they must continually develop and manage their supply chains. Further to this, they must do so in a manner that minimises disruption and offers maximum efficiency.

The research contained in this thesis is concerned with the development and management of supply chains, specifically factors that affect the successful management of supply chains. This research focussed on the critical success factors (CSFs) associated with the management of supply chains. It sought to add clarity to a research area that does not take a holistic view of all supply chains and critical factors associated to them. This research investigated the conceptualization offered up by Hines (2004) 7V framework. This framework identified seven themes: value, volume, velocity, variety, variability, visibility and virtuality. The understanding and management of these themes could be critical to the efficiency of supply chains.

The ability of organisations to successfully manage their supply chains is crucial. However, in order for this to happen organisations must be in a position to fully understand the critical factors that need to be addressed to ensure delivery of their product/service through their respective supply chains (Power, Sohal et al. 2001). By focusing on the themes associated to the 7V Framework, this study attempted to identify the CSFs attributed to each of them in order to gain a greater understanding of them from both a theoretical and operational perspective.

1.2 Knowledge gap

Two clear knowledge gaps have been identified, which will be addressed throughout this research. Firstly, there is acknowledgement that businesses face challenges in developing their supply chain strategy in a manner that will continue to give them competitive advantages (Hines 2004, Power 2005, Fawcett, Magnan et al. 2008). The importance of supply chains to organisations is clearly highlighted in the literature, especially in helping them to gain a competitive advantage (Ayers 1999, Fawcett, Magnan et al. 2008). This means the efficient manner in which organisations plan a supply chain in conjunction with the speed that they implement changes has never been more critical. This planning and subsequent management must be responsive to the customer's needs, especially in the changing face of business environments (Hines 2004). It is not only of interest to supply chain scholars to know how, when and why supply chains fail but also practitioners who have to manage the daily tasks associated with them (Fawcett, Magnan et al. 2008).

There is a surge of interest in SCM research, in part this is due to the savings that can be made through efficiency (Shepherd and Gunter 2006). It is also noted that research in this area is still developing (Wang, Huang et al. 2004). As the area is still developing, there are few models that focus on the critical factors that need addressed when planning and managing supply chains. Although conceptualizations have moved from integration and synthesis of earlier informing disciplines towards a strategic systems view, limited frameworks are apparent (Gunasekaran, Patel et al. 2003).

Evidence would suggest there is no framework which brings together the extended seven themed areas, suggested by Hines (2004) as being key to the strategic delivery of supply chains.

An additional gap leading on from the above mentioned leads on from the first. Although, SCM literature relating to CSFs has increased in recent years. It still falls short of offering a framework to address potential CSFs with supply chains. At present, research into the identification of CSFs within supply chains is more prominent than at any time previously, as researchers and practitioners examine ways to better understand them. However, current research is focusing on specific operational and organisational areas. These include Humanitarian Aid (Pettit and Beresford 2009); Sustainable foods (Grimm, Hofstetter et al. 2014); National Health Service (Cullen and Taylor 2009); Enterprise implementation (Koh, Gunasekaran et al. 2011); Sustainable supply chains (Kim and Rhee 2011, Wittstruck and Teuteberg 2012, Jabbour, Neto et al. 2015); Manufacturing (Routroy and Pradhan 2011, Thoo, Huam et al. 2011, Patil and Kany 2014); Fashion and Clothing (Thomassey 2010, Castelli and Sianesi 2015).

Unfortunately, with such eclectic research into CSFs there is a lack of generalisability within the area. Very few researchers have taken a holistic view of supply chains when identifying CSFs. This offers an opportunity for new research. The research in this thesis intentionally takes a more holistic view of supply chains. It develops a framework that can be utilised in differing types of supply chains and offers a clear contribution to knowledge in this area as will be discussed in the following section.

1.3 Contribution to knowledge

This research contributes to the existing knowledge in the field of SCM in relation to theory and empirical research. It also has a clear potential contribution to practice as well as to the knowledge of this discipline. Firstly, in relation to theory this study contributes to the understanding of the individual themes located within the 7Vs conceptual framework. In addition, the research develops the framework through the findings of its empirical research. It is the understanding of the themes and the identification of the CSFs associated to them that is the second contribution to theory.

The CSFs attributed to the developed framework, could assist operational decision-making in the field of practice. This study supports offers evidence that themes within the 7V framework have potential relationships, as previously highlighted in the extant literature. Prior to this research the main focus of these relationships were discussed as single relationships such as virtuality and visibility (Lancioni, Smith et al. 2003) or in smaller clusters such as variety, volume and variability when discussing Agile type supply chains (Christopher 2011). At most, themes are grouped into four themes such as variety, virtuality, variability and volume (Christopher 2000, Reichart and Holweg 2007). The current study offers a plausible model that validates seven themes that can be brought together. Up until this point no research identified within the literature, brings together all of the 7V themes within Hines (2004) 7V conceptual framework. Therefore, a further contribution offered is in the development the 7Vs conceptual framework. In turn, the framework will include CSFs associated to the successful delivery of supply chains. These contributions in their entirety offer a contribution to practice, in that SCM decision makers will be able to utilise the framework to better plan and manage their supply.

1.4 Research aim and objectives

There is not any evidence within the literature of frameworks that have been utilised to identify and bracket factors critical to the effective delivery of supply chains. It is believed that it would be possible to utilise Hines (2004) 7V Conceptual Framework in the identification and managing of critical factors that are suggested will make supply chains more effective.

The more efficiency of supply chains will contribute to their effectiveness at gaining organisations a competitive advantage. There is clear evidence that organisations see a competitive advantage being gained through the improved operational effectiveness of their supply chains (Lambert and Cooper 2000, Power 2005, Li and Liu 2006, Patnayakuni, Ral et al. 2006, Sengupta, Heiser et al. 2006). Discussions surrounding supply chain management quite often brings the terms 'efficiency of supply chains' and 'effectiveness of supply chains' together, when highlighting factors that focus on supply chain operations. In order for a supply chain to be as effective in it delivery, it must in turn be efficient in its processes.

The aim of this study is to gain a greater understanding of key factors related to the effective delivery of supply chains through the development of the 7V Conceptual Framework.

From this overall aim, five research objectives emerge, which are:-

1. Identify critical success factors (CSFs) influencing supply chain effectiveness.
2. Analyse findings from the empirical study with a view to confirming or disconfirming CSFs.
3. Incorporate CSFs into the 7V conceptual framework

4. Reconceptualise how supply chains can be more effective on the evidence from the study.
5. Evaluate implications for supply chain practice.

Other models were considered in relation to the research objectives of this study. The first of which was the Supply Chain Operations Reference Model (SCOR). Developed by the Supply Chain Council, this cross-industry framework assists organisations in better understanding both the performance of and areas to improve within their supply chains (Harrison and Hoek, 2011). It is utilised by organisations worldwide and can describe both simple and complex supply chains by using what is noted as common sets of definitions. The current iteration of the SCOR model has six overlapping management processes of 'Plan, Source, Make, Deliver, Return and Enable' (APICS, 2016). According to the Supply Chain Council, the SCOR Model covers aspects from customer interaction, physical material transaction and market interactions. Focusing on three process levels (Harrison and Hoek, 2011), the model offers support to various supply chains across many industries (APIC, 2016). Although the SCOR Model does support areas such as, information management, forecasting and risk amongst other practices, it does not include the operational themes or business challenges highlighted within the 7V Conceptual Framework.

Through the implementation of the SCOR model process, consideration is given to a wide range of factors. However, factors critical to their success are not offered in any real depth. Although risk is discussed under the 'Enable' management process, it does not give direction on what risks should be considered in relation to what supply chain operation is being assessed. From a theoretical perspective, assumptions are made through the implementation of the SCOR model. This leads to questions being raised and gaps identified that the objectives of this research seeks to fill specifically around the area of Critical Success Factors.

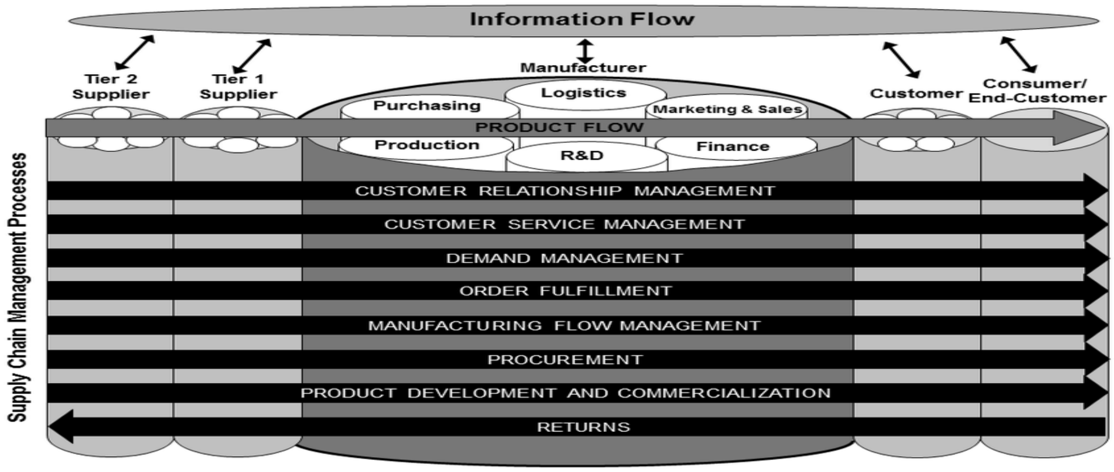
For example, issues such as Information Technology (Virtuality) within the supply chain. In relation to supplier's capabilities, what are they? Do the downstream suppliers have the same level of IT capabilities as upstream suppliers, thus allowing for visibility throughout the supply chain, reducing blockages and in turn allowing the supply chain to be managed and coordinated effectively? Furthermore, what are the critical factors that need to be addressed when considering issues related to IT? SCOR does not offer clarity around such operational issues.

If the aim and objectives of this study are met, the 7V Conceptual Framework could contribute knowledge and complement the SCOR model in its management process of 'Enable', specifically when it focuses on the 'Manages Supply Chain Risk' section. This would be possible, if risk identification was to take into consideration the themed areas of the conceptual framework and the CSFs associated to them.

Another model to be considered in relation to the aims and objectives of this research is Lamberts (1998). This model focuses on 'Customer and Supplier Relationship Management' and aims to improve upon cross-functional integration of suppliers within any particular supply chain as shown in figure 1.1.

In addition to focusing on these relationships, the model offers six further business related processes of customer service management; demand management; order fulfilment; manufacturing flow management; product development and commercialisation; and finally returns management as part of the supply chain management process. These business related processes are then managed through business functions such as marketing, sales, research and development, logistics, production, purchasing and finance.

Figure 1.1: Lamberts Model



Source: Lambert (1998)

In relation to the aim of this study, like the SCOR model, Lamberts Model also highlights areas similar to that of the 7V Framework, in which CSFs could be identified. These are apparent in the first instance within the business process of 'Demand management', where forecasting, increasing flexibility and reducing variability seeks to reduce uncertainty and improve efficiency of the supply chain. Additionally, the process of 'Manufacturing Flow Management' focuses on the efforts to ensure that manufacturing flexibly is centre to the movement of products throughout the supply chain. Although, Lamberts Model does focus on integration and information flow, it is not specific in highlighting how this should be attained or indeed what are the specific factors that may need to be managed. Additionally, Lamberts Model does not offer the opportunity to identify CSFs in areas such as quality, information technology, supply chain other key areas related to supply chain effectiveness that the 7V Conceptual Framework Conceptual seeks to address.

Based on the stated research aim and objectives, it is the purpose of this research to identify the underlying factors that need to be addressed in order to successfully manage supply chains. The focus of the research will be the identification of these factors and the categorisation of them within the 7V conceptual framework.

1.5 Structure of the thesis

From this point forward, this thesis will discuss and reflect upon the literature surrounding each individual theme within the 7V conceptual framework and the identification of associated CSFs. It will follow this by rationalising the research design, highlighting the findings of the empirical research and a discussion surrounding the interpretation of the findings.

Chapter 2 provides a comprehensive review of the literature in the selected field. It will firstly seek to define effective SCM. Secondly, it will contextualise the 7 individual themes from the framework. Thirdly, it will identify existing relationships between themes, as suggested by the literature. Finally, it will identify CSFs attributed to of the themes within the framework. This will initiate the research process and assist in attaining research objective 1.

Chapter 3 describes the methodology and the individual phases of the research process. The chapter explains how the survey instrument was structured around the 7Vs conceptual framework and discusses the philosophical grounding of this research, as well as the research design and strategy. The chapter then justifies the sampling strategy and data collection method undertaken and finally introduces in detail the data analysis technique, response rates to the survey instrument and data treatment.

Chapter 4 focuses on the results of the data analysis and sets the foundations for the attainment of research objectives 2 and 3. Firstly, in relation to research objective 2 it presents the results from the analysis of the exploratory factor analysis (EFA) with a view to confirming or disconfirming CSFs. Secondly, the chapter investigates the plausibility of Model-Fit of the 7Vs conceptual framework. This assists in identifying specific CSFs influencing supply chains whilst applying a 7V conceptual framework for the purpose of its development in research objective 3.

Chapter 5 presents the initial discussion of the results of the empirical study. In the first instance it focuses on how research objectives 1-3 have been met. The chapter then reconceptualises effective supply chain strategies on the evidence from the study (objective 4). The chapter also discusses and interprets the results from the analysis along with its theoretical contribution and empirical implications. Finally an evaluation of the implications for supply chain strategy in practice is presented (objective 5).

Chapter 6 links the contribution of the study back to the overall aim of the research and presents the conclusions of the research. Potential areas for further research that were identified in this study are discussed. The chapter also discusses the limitations of this research study and offers reflections on the process.

Chapter 2 – Review of supply chain literature

The review of supply chain literature conceptualises the themes within the 7V framework. The chapter confirms the existence of the themes associated to the framework within the body of literature. The chapter takes the first step in the attainment of research objective 1, in that it allows the researcher to identify from the extant literature possible critical success factors (CSFs) influencing supply chain operations.

The chapter highlights possible relationships between themes within the framework. In addition, the chapter contextualises and identifies specific CSFs related to the successful management of supply chains.

2.1 Literature study

The rationale of the strategic management of supply chains is to remove communication barriers in order to coordinate, monitor and control the process of supply goods (Power 2005). Hines (2004) emphasises the importance of supply chains being efficient with the ability to satisfy the demands of the customer and its markets. Within the literature, aspects of SCM are discussed as stand-alone individual factors such as ‘technology’ (Simatupang, Wright et al. 2002); ‘flexibility’ (Ketchen Jr, Thomas et al. 2007) and ‘forecasting’ (Saeed 2008).

Historically, a number of authors conceptualise supply chains differently (Brown and Hendry 1997, Harland 1997, Christopher 2000, Mentzer, DeWitt et al. 2001). These conceptualisations fall into definable clusters with a thematic focus, for example on logistics (Ellram 1990, Cooper and Ellram 1993, Christopher 2000), operations (Lamming 1996, Harland 1997), marketing and strategy (Mentzer, DeWitt et al. 2001, Hines 2004).

These boundaries have historically informed debates within this field. However, the field around the understanding of CSFs is eclectic and at times lacks generalizable views across differing supply chains. In turn, the themes contained within the framework are mostly discussed in isolation or in small groups. To gain clarity around this area, the review of the literature will seek to address the following questions:

i) How are the 7V themes conceptualised within the literature?

ii) Is there evidence of relationships between any of the 7V themes?

iii) What are the factors critical to the successful delivery of supply chains?

iv) Can the 7V themes can assist in identifying and bracketing CSF?

The themes discussed within this chapter relate directly to operational effectiveness of supply chains in achieving a competitive advantage. The discussion within the chapter focuses primarily on the 7 themes within Hines (2004) conceptual framework (value, volume, velocity, variety, variability, visibility and virtuality). As supply chains are evident across many industries, sectors, and countries, the literature pertaining to differing types of supply chains is included.

Although, supply chains can effectively be sub-divided into categories such as: agile supply chains (ASC), lean supply chains (LSC) and hybrid supply chains (HSC) this review takes a holistic view of all literature when identifying possible CSF's.

Literature Search

The purpose of the literature search was to gain an understanding of current issues and discussions surrounding supply chain literature. Additionally, it served to contextualise the 7V Themes within the framework and identify critical success factors associated to each theme. The contextualisation of the themes from the literature was important, as it would justify the grounding of the research and offer evidence that the themes existed outside the conceptual framework offered by Hines (2004). It is the identification of these Critical Success Factors attributed to the themes, that would contribute to the attainment of research objective 1 and offer a grounding from which to develop the study.

Table 2.0: Phases of literature search

Phase	Type of search	Knowledge sought
1	Traditional/General	Generalised – Understanding of general supply chain management literature
2	Thematic/Partial Systematic – Key word searches – 7 V Themes	Specific – Ability to contextualise each theme of the 7V Framework in order to confirm their existence within the extant literature
3	Thematic / Partial Systematic – Key word Searches – Critical Success Factors	Specific – The identifications of critical success factors attributed to each theme of the conceptual framework
4	Trail of references type search	Specific to certain themes and CSFs where saturation had not yet been achieved

As highlighted in table 2.0 the literature search was broken down into four distinct phases. The review was conducted in a traditional/general manner, however, it should be highlighted that it does have elements of a systematic review informing it. The systematic process was not adhered to in the strictest sense as discussed by Pittaway, et al (2004) but was used more as a guide.

Phase 1 of the literature search took a general approach as the researcher sought to gain clarity surrounding the research area. This phase assisted in understanding the way in which supply chain management is defined and contextualised. It also highlighted that the literature surrounding the themes associated to the conceptual framework was eclectic and required a more systematic approach to key word searches as highlighted in how the review was conducted. This allowed for a grounding of understanding in the area of supply chain operations. In addition, it also introduced the researcher to specific sources of literature in which to carry out a more systematic type search in phases 2 and 3.

The literature search was conducted by:

1. The use of key words in searching general supply chain management books, academic journals and online sources
2. Throughout the phase 2 and 3 the literature search utilised keywords in various combinations such as:
    i. Supply Chain Management (SCM) and/or Effective SCM
    ii. SCM and/or logistics
    iii. SCM and/or logistics and Critical Success Factors (CSFs)
    iv. SCM and Individual themes from framework:
        - Virtuality
        - Value
        - Velocity
        - Variety
        - Variability
        - Visibility
        - Volume
    v. Themes from framework together in various combinations for example;
        - Value and/or Variety and or Volume
        - Velocity and/or Volume and or Virtuality

    vi. CSF and individual themes from framework for example;
        - CSF and Virtuality
        - CSF and Value

    vii. CSF and SCM and key words associated to each theme for example;
        - CSF and SCM and Information Technology (virtuality)
        - CSF and SCM and Quality (Variability)

Principle Sources searched were:

- MMU Library electronic databases by title
- Web if knowledge
- Web of science
- Online aggregate website – Google Scholar
- MMU Library catalogue of academic books (both online and hard copies)

In phase 4, the researcher followed a trail of references from relevant journal articles in order to expand the search. Due to a lack of sources related to certain themes and CSFs, this final phase assisted in targeting specific themes to support their contextualisation. Not all literature identified was utilised, for example, if the research had been superseded by more recent studies. A clear theme that focused on more recent literature was that of virtuality, the changing nature of Information Technology meant that all but two seminal papers pre-2001 were discarded. In analysing, the literature related to the themes of the framework, when it was apparent that there was enough evidence to support Hines (2004) contextualisation's of a particular theme then the next theme was addressed.

In relation to the search of the literature associated to CSFs, it was of primary importance to the study that these variables were identified. Lists of CSFs associated to each theme were compiled and tabulated, where possible multiple sources were identified as a way to support the existence of each CSF. Both the contextualisation of the themes and identified CSFs came from reputable academic sources.

2.2 Definition and Challenges

Before this chapter goes onto contextualise themes and identify possible critical factors, this section will firstly attempt to define SCM and highlight supply chain challenges.

<u>Defining Supply Chain Management</u>

Fieldman and Muller (2003) suggest that there is no universally agreed definition of SCM. Whilst Burgess, Singh et al. (2006) agree there is a lack of consensus on what the term 'supply chain management' actually means. Others such as Mentzer, DeWitt et al. (2001) state that due to the poor way in which SCM has been defined it has led to varying views as to what it actually consists of.

However some clarity has been offered. The Global Supply Chain Forum (GSCF) defines SCM as “the integration of key business processes from end user through original suppliers that provides a product, services and information that add value for customers and other stakeholders” (Lambert and Cooper 2000). In turn the Council of Logistic Management (CLM) sees SCM as the coordination of traditional business strategies across the entirety of the organisation’s functions. Focusing this effort between businesses in a manner, that improves the long-term performance of the organisation and the supply chain is imperative to attaining success (Management 2000). Others state that the main goal of SCM is to integrate material and information seamlessly between all members of the supply chain as a way to create a competitive weapon (Li, Ragu-Nathan et al. 2004).

A clear and succinct definition is offered by Hines (2013), who states that the management of a supply chain incorporates all activities that move and transform products and services (goods). This occurs throughout the design stage, procurement of raw materials and finally ends up with the end user. It also takes into account additional activities such as the flow of cash and information which form part of the management of supply chains. Hines (2013) sees supply chains as service systems that deliver value to consumers and customers and in turn contribute value to suppliers, producers and distributors.

The Supply Chain Challenges

Although definitions may vary, it is clear that organisations which are developing supply chain strategies face challenges. These challenges consist of ensuring that they are able to identify and manage critical factors as a way to ensure a successful outcome. Historically, senior managers were at times oblivious to the importance of SCM to their organisations competitive advantage. However, Leach (2013) states organisations have now realised that a well-run supply chain can be critical in giving them a competitive advantage, especially in new and emerging markets. Taylor (2013) highlights the importance of which can be seen in economic terms; since the turn of the 21st century, there has been a rise of 10 per cent of goods sold worldwide that are derived from purchased materials. Further to this, the research of Degun (2013) offers an opinion that 70 per cent of business leaders believe supplier risk will become more complex as organisations expand into new global markets. To address this perceived risk, organisations have been focusing more on their capabilities of being able to build relationships through networks of suppliers and business, as a way to survive in a competitive market (Drucker 2011). This recognised high level of supplier risk, highlights the importance of a well-run supply chain to organisations.

The importance of gaining a competitive advantage through a supply chain is highlighted throughout the literature as being key to organisational strategy (Porter 1985, Ayers 1999, Reichart and Holweg 2007).

It has also been suggested that it is not companies that compete but rather supply chains (Christopher and Towill 2000). Gaining a competitive advantage through the relationships with suppliers may force organisations to constantly seek cost reductions; with little or no care for the consequences.

Christopher (2011) stated that historically suppliers were kept at a distance and this minimised the opportunities for competitive advantage through the speeding up of the processes through improved lead times. Now it seems more focus is given to collaboration and sharing of resources and information as all members seek to make the supply chain as competitive as possible (Benavides 2013). This is in contrast to earlier practices, when organisations tended to focus their efforts on making internal business functions as effective and efficient as possible (Shepherd and Gunter 2006). It is in this attempt to be efficient that organisations are thinking strategically when it comes to their supply chains (Burgess, Singh et al. 2006).

Ayers (1999) suggested that managers have the same core concerns regarding supply chains at the turn of the 20th century as they did over the 50 years beforehand. These include products, people operations, finance and markets. More recently these concerns have become more focused on specific issues related to the increased globalisation of their markets. Hines (2004) is not alone in suggesting that organisations face challenges from the external environment in which they operate.

These challenges come from continuous incremental changes or from even breakthrough-innovations better known as discontinuous change (Zammuto 2008). This means that managers are continually dealing with impacts upon their supply chain operations (Fawcett, Magnan et al. 2008). These impacts can be due to changes in their organisations, markets they operate within, industrial change through competition, individuals, and innovations. All these can have an influence on the way that supply chain decision makers plan and implement strategies. So much that changes within key areas will influence the way that organisations structure their supply chains to increase efficiency (Gattorna 2010). It is this drive for the efficiency of supply chains in practice, which leads to a competitive advantage and subsequent customer satisfaction that has seen a recent increase in research into CSFs throughout supply chain management literature.

2.3 Contextualising the 7V Framework

The 7V conceptual framework offers a tool that could be utilised to help ‘identify’ and ‘bracket’ factors that are critical to the effectiveness of supply chains. The themes highlighted within the framework are that of value, variability, variety, velocity, volume (volatility) visibility and virtuality. The definitions of the 7V themes are highlighted in table 2.1 and should be seen as “a useful conceptual framework from which organisations can examine their own potential to meet complex challenges of developing appropriate supply chain strategies” (Hines, 2004, p. 361).

Table 2.1: The 7Vs themes - Definitions, Concepts and Business Challenges

Theme	Definition	Concepts	7Vs – Business challenges
Value	The relationship between what the customers want and expects against what the supplier can offer	Reduce cost, meeting customer expectations, continuous improvement, Value chain, Value streams, Reduce risks, Economic value, Value for all parties	Offer value for money to customers based on what they want. Value not just at point of exchange by through time and use
Volume (Volatility)	Ensuring that customers have the flexibility to increase decrease volume as their demands dictate	Flexibility to adjust demand, Bullwhips identified, Lead time gap addressed, Forecasting accuracy based on real time data, SC competence, dynamic systems	Customers want to order as late as possible to ensure they have ‘best forecast’ of demand. Reduced likelihood of standard orders in many sectors. Requirement to facilitate changes in order quantities
Velocity	The ability for customers to utilise speed through their supply chain as a competitive advantage	Speed of delivery, Proactive practices, Time-based competition, Adapting to changes in the market	The speed of response in adapting to change in areas such as demand conditions, market structures, production technology and suppliers capabilities
Variety	The ability to customise or standardise a product as per consumer demands or even in anticipation of changes in demand	Local Customisation, Product/Service variety increasing over varying sectors, Increased outsourcing, Shorter product life cycles, Reduced complexity of customisation	Being able to customize the product/service offered. This may mean moving from economies of scale to economies of scope or economies of value to customer
Variability	The products/services have no varying levels of quality and that they are delivered in a manner that is of a level that is acceptable to the customers	Value adding process, Quality of product/service to end user, Total Quality Management	The business must be able to reduce variability and offer standard quality.
Visibility	Ensure that the supply chain is transparent and all parties are able to see and avoid blockages and issues surrounding bottom heavy inventories	Transparency between members, Bullwhip reduced, IT systems communicate, Information sharing, Pipeline visible to members, reduction in transaction risk	Enabling all parts of the supply chain to be transparent and avoid blockages, ‘ice berg’ inventories and hidden costs; keeping the customer informed.
Virtuality	The ability to manage and coordinate the supply chain using information technology	Multi-dimensional systems, improved communication	Coordinating of both intangible and tangible assets within SC. Facilitated by ICT give customer confidence and ensure dependability.

Source: Adapted from (Hines 2004)

It is the inclusion of the concepts and challenges to business in table 2.1, that highlights the additional outputs that are required to ensure the 7V framework can assist in delivering what the customer wants. The following subsections will take the definitions of each theme within the 7V framework and conceptualise them within the extant literature. It is important that there is a clear understanding of the definitions, concepts and overall conceptualisations of each theme prior to the identification of relevant CSFs. This is to ensure that each CSF identified is located within the correct theme within the framework.

2.3.1 Value

‘The relationship between what the customers want and expects against what the supplier can offer’

It is imperative that if organisations want to develop strategic capabilities in areas related to the effectiveness of their supply chains, they must address ongoing specific issues. In essence when it comes to supply chains, organisations must learn to ‘work smarter, not harder’ (Christopher 2011). As shown in table 2.1, the challenges that business’s face in ensuring customers gain value for money, is not just focused at the point of sale but through time and use (Hines 2004).

Sengupta, Heiser et al. (2006) states that customers are demanding value and it is essential that organisations ensure that this is delivered throughout the product and/or services lifetime. It is the challenge to compete in today’s markets that organisations anticipate what the customer accepts as value in relation to products and/or services. What is clear is that value can change over time and Tracy and Tan (2001) suggest that this can be due to external influences; therefore, it is crucial that organisations are aware of what their customers see as value.

Power, Sohal et al. (2001) support the view that, value is likely to be found within the relationship between benefits and cost to the end user. Value in this context is linked to 'customer expectations' and encompasses in part literature related to Total Quality Management (TQM). What can be derived from this is the notion of continuous improvement. Meaning that organisations must seek to understand 'what are their customer value expectations'. Within supply chain literature, it is easy to get confused between the terminology value and quality. The concept of quality is found within the 7V framework and is conceptualised as the theme variability. Within the Framework value, takes a more holistic view as a concept as it focuses reducing costs, meeting the customers' expectations reducing risks and ensuring value for all parties (Hines 2004).

Bowersox and Calantone (1998) book highlighted the importance of a continuous improvement philosophy being crucial to organisations. They also suggest that continued monitoring is crucial. The reasoning they give is that what may have satisfied a customer one year ago might not be seen as acceptable to them a year later. When attempting to conceptualise the theme value using supply chain literature, is important to acknowledge how it is linked to various theoretical and operational buzzwords.

These variations include 'value streams' and 'value chain management' (Soon and Udin 2013); 'value chain segmentation' and 'supply value chain' (Lee, So et al. 2000, Kayakutlu and Buyukozkan 2011); 'value creation' (Hoyt and Huq 2000, Gunasekaran, Patel et al. 2003).

This study suggests that a definitive definition of the theme 'value' within SCM literature is one that is difficult to capture. The reason for this is firstly in part due to the subjective nature of the term, in that value to one party in a transaction does not necessitate that the other party believes value has been obtained for them. Secondly as previously mentioned within SCM literature, it is used to describe various phenomenon. Value could simply be termed, as ‘what one believes is an acceptable outcome or agreement between certain parties at the completion of a transaction of sorts’. Within the 7vs conceptual framework, it is simply suggested that value is ‘the relationship between what the customer wants and expects against what the supplier can offer.

Additionally, Hines (2004) highlights a clear focus in relation to supplier strategy in seeking value is the ability to reduce costs and risk whilst meeting customer demands. In turn, this offers value to the customer based on their preferences not only in initial exchange but also through time and use. Whilst the main customer driver for suppliers strategy relating to value is to attain the right customer focus (Hines 1994, Narasimham and Das 2000, Kumar 2001). Although a precise contextualisation of theme value within the literature is in part problematic, there is clear evidence of its existence in the delivery of what customer’s expectation are against what suppliers can deliver. With that in mind, the literature surrounding the theme value has been highlighted in table 2.2.

Table 2.2 is not an exhaustive list of the literature in which the theme value is apparent within discussions. However, it is indicative of the types of research that has been carried out and utilised to contextualise the theme. There is evidence to suggest that qualitative research methods are common in this area. Due to the term value being associated to many operational areas, it can also be shown that research is not just restricted to supply chain management. However, in most cases the common denominator is that the focus of the research is encompassed in different types of manufacturing processes.

In summary, the literature highlights that the expectations of customers is a key element to achieving a competitive advantage. Although, the term value is seen throughout the literature in differing form and is clearly subjective in nature. It has still been possible to contextualise this theme as it is constructed by Hines (2004) but not without difficulty. In contextualising the theme value, it was crucial that it was not confused with the literature surrounding variability. Importantly, the theme variability focuses on the quality of delivery and is conceptualised clearly as the quality of the end product delivered. This differs somewhat from the theme value in that it is clearer to define it as the actual end product.

Table 2.2: Evidence of discussion - Value

Theme & Concept	Evidence of Discussion	Journal/Book	Research Method	Sample Size & Analysis	Organisation or Industry
Value - The relationship between what the customers want and expects against what the supplier can offer **Concept -** Reduce cost, meeting customer expectations, continuous improvement, Value chain, Value streams, Reduce risks, Economic value, Value for all parties.	Bowersox and Closs (1996)	Book - Logistical Management: The integrated Supply Chain Process	N/A	N/A	Various
	Hines (1994)	Book - Creating world-class suppliers	N/A	N/A	Various
	Naylor, Naim et al. (1999)	International Journal of Production Economics	Qualitative – Case Study	Two Cases	Boeing and Hewlett Packard
	Hoyt and Huq (2000)	International Journal of Physical Distribution & Logistics Management	Literature Review	N/A	N/A
	Narasimham and Das (2000)	The Journal of Enterprise Resource Management	Quantitative - Survey	75 Respondents National Association of Purchasing Management Discriminant Analysis	N/A
	Power, Sohal et al. (2001)	International Journal of Physical Distribution and Logistics	Quantitative - Survey	962 Respondents Factor Analysis	Australian Manufacturing Companies
	Gunasekaran, Patel et al. (2003)	International Journal of Production Economics	Quantitative - Survey	21 Respondents (CEO's) Descriptive Statistics	UK Industries (Using Kompass Registers)
	Hines (2004)	Book - Supply Chain Strategies: Customer-driven and customer-focussed	N/A	N/A	Various
	Sengupta, Heiser et al. (2006)	Journal of Supply Chain Management	Quantitative – Survey	145 Respondents Exploratory Factor Analysis	Manufacturing - Various
	Zammuto (2008)	Academy of Management Learning & Education Journal	Conceptual	N/A	N/A
	Christopher (2011)	Book -Logistics & supply chain management	N/A	N/A	Various
	Kayakutlu and Buyukozkan (2011)	Supply Chain Management: An International Journal	Quantitative – Case Study	Analytical Hierarchy Process (AHP)	Literature
	Soon and Udin (2013)	Journal of Manufacturing Technology	Qualitative – Case Study	Exploratory Cross Case Study (4 Organisations)	Manufacturing Companies
	Tracy and Tan (2001)	Supply Chain Management: International Journal	Quantitative – Survey	249 Respondents Confirmatory Factor Analysis	High Level Management Manufacturing
	Lau (2012)	Supply Chain Management: International Journal	Quantitative – Case Study	6 Retail Stores (Accounts) Descriptive Statistics	Retail

2.3.2 Volume-Volatility

'Ensuring that customers have the flexibility to increase decrease volume as their demands dictate'

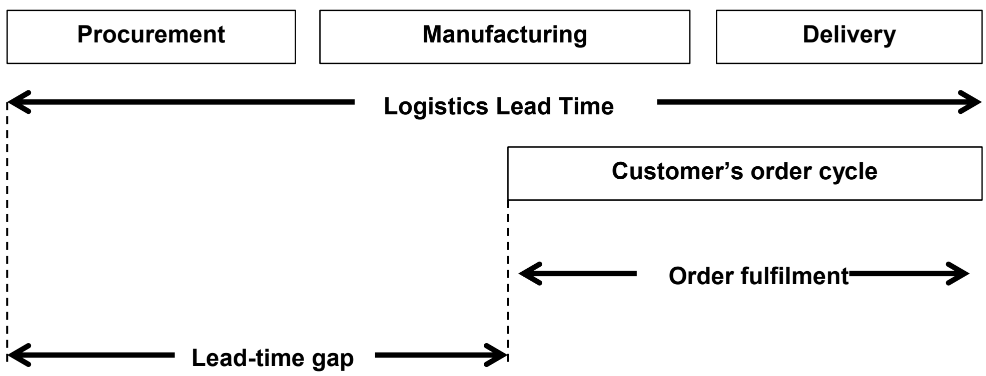
The second theme of volume-volatility occurs, as customers place specific demands on their downstream suppliers. The challenge that is set, is the flexibility customers have to increase and lower their demand in relation to their own customer demands. It is suggested that in today's business environment customers are less likely to purchase the maximum quantities the suppliers can offer, more specifically at a time and delivery schedule dictated by those downstream (associated to mass production runs) (Hines 2004). It is highlighted that customers wish to do this without incurring additional costs. Both Christopher (2011) and Harrison and Hoek (2011) published works agree that this is the challenge that downstream suppliers need to address in relation to volume – volatility. Historically suppliers keeping high levels of inventory would be seen as the way this would be addressed. However, due to the operational and financial pressures associated to this option, it is proving to be less popular course of action in recent times.

Christopher (2011) states that at its very basic core principle, the primary goal of SCM is to attempt to match supply with demand. However, with the external uncertainties organisation face in practice, this not always easy. Gattorna (2010) suggests that volume is managed easier when there is stability within markets and in turn is more difficult to manage with fluctuations in demand. Christopher, Tatham et al. (2011) reaffirms this by highlighting issues suppliers are constantly addressing. These include the time that is used to procure, produce and deliver a product to a customer is usually much longer than a customer would be prepared to wait.

As highlighted by Hines (2004) in essence what is being discussed here is what Forrester (1961) first discussed as the 'bullwhip' effect when dealing with inventories in relation to supply matching demand. The bullwhip effect is created through demand uncertainty and poor forecasting. The further up the supply chain from the end user the greater the margin for error is for the over and under supply of items. The margin for error is exasperated the larger the supply chain as Gattorna (2010) highlights, there is a direct correlation between the length of the supply chain, its complexity and in turn its increased potential for bullwhip effect to occur.

It is noted within SCM literature, volume-volatility can be seen as a close match to more historic theme of volume-flexibility (Hayes and Wheelwright 1979, Garfamy 2006). Similar to volume-volatility, volume-flexibility is defined as organisations being able to increase or decrease orders for customers. In turn, it allows for spikes in demand for services and products to be met. In today's business environment the speed of delivery through the lead-time gap is seen as a 'given' by customers (Christopher 2011).

Figure 2.1: The lead-time gap



(Christopher, 2011)

The lead-time gap show in figure 2.1 highlights the issue within a customer's order cycle in relation to a suppliers manufacturing cycle. Christopher, Tatham et al. (2011) state that this is the time that a customer is prepared to wait from the moment their order is placed. In certain cases some, if not all the product is part way through production. Lau (2012) discusses that in a conventional organisation the only way to address the gap between lead-time and the customer's order cycle is for them to carry inventory. This suggests that organisations need to forecast in a manner that calculates market/clients requirements, thus allowing inventory to be sourced ahead of fluctuations in demand. This in itself causes issues, as forecasting is not always accurate and mistakes will happen (Fisher, Hammond et al. 1994, Elmuti 2002, Christopher 2011).

Constant improvement in forecasting accuracy is always sought. It may be that the answer lies more in the reduction of the lead-time gap and in addressing the critical factors within this period of the process. Lau (2012) suggest that visibility of real demand (final market place demand) is a problem that organisations continually face. This demand is different from the 'derived' demand that is passed upstream through the individual supply chain members.

The challenge to organisations in relation to volume volatility is to ascertain a way in which they can identify the customer's requirements. More specifically this must be done at the earliest opportunity and thus reduce the lead-time gap. Gattorna (2010) suggests that this can be managed in part with close collaboration between customer and supplier.

Table 2.3 highlights the literature in which there was evidence of a discussion related to volume-volitility. The theme in essence is an attempt to address the 'bullwhip' affect, first highlighted by Forrester (1961) and is discussed in many books and conceptual papers since its conception. In summary, volume focuses on the sub-themes of flexibility, just in time, bullwhip forecasting, real-time information and the importance of accurate demand forecasts. The value to customer is in essence flexibility. This has a customer driver of 'right product right service'. With a holistic view of volatility Hines (2013) offers three key themes of system volatility, which focuses on external factors. Demand volatility which concerns itself with market conditions and which effects volume. Finally, disruptive technologies related to innovation and a series of risks factors are the sub-themes that conceptualise volatility. In essence the value propositions for a customer whose supplier addresses volatility are reliability, trustworthiness and continuity of service with the overriding customer driver in relation to volatility is the right quantity (Hines 2013).

In summary, whilst the flexibility offered to customers through volume-volatility allows organisations to assist customers in addressing their own demand issues (Gattorna 2010). It is clear that the management of ongoing supply and demand issues related to volatile markets is key to achieving a competitive advantage (Christopher 2011). Encompassed within the theme velocity is the opportunity for demand issues raised within the to be addressed through the management of the lead time gap (Harrison and Hoek 2011). However, in dealing with volume-volatility issues through velocity can restrict an organisations ability to offer variety and gain a subsequent competitive advantage in this manner (Lee, Ha et al. 2001). The literature highlights clearly that the ability to customise and offer variety is key for some organisations and in part this can be addressed through local customisation, however, this is not an option available on all products (Christopher 2000).

Table 2.3: Evidence of discussion – Volume Volatility

Theme & Concept	Evidence of Discussion	Journal/Book	Research Method	Sample Size & Analysis	Organisation/Industry
Volume Volatility – Ensuring that customers have the flexibility to increase decrease volume as their demands dictate **Concept** - Flexibility to adjust demand, Bullwhips identified, Lead time gap addressed, Forecasting accuracy based on real time data, SC competence, dynamic systems	Forrester (1961)	Book – Industrial Dynamics	N/A	N/A	N/A
	Hayes and Wheelwright (1979)	Journal – Harvard Business Review	Conceptual	N/A	N/A
	Fisher, Hammond et al. (1994)	Journal – Harvard Business Review	Conceptual	N/A	N/A
	Elmuti (2002)	The Journal of Supply Chain Management	Quantitative - Survey	402 Respondents Regression & Descriptive Statistics	Senior Management American Organisations (Randomly Selected)
	Hines (2004)	Book - Supply Chain Strategies: Customer-driven and customer-focussed	N/A	N/A	N/A
	Garfamy (2006)	Journal of Enterprise Information Management	Qualitative – Case Study	Data Envelope Analysis	Hypothetical Cases
	Gattorna (2010)	Book - Dynamic Supply Chains - Delivering Value Through People	N/A	N/A	Various
	McCullen and Towill (2002)	Supply Chain Management: An International Journal	Qualitative - Case Study	Not specified	Various
	Christopher (2011)	Book Logistics & supply chain management	N/A	N/A	Various
	Christopher, Tatham et al. (2011)	Book - Humanitarian logistics [electronic resource] : meeting the challenge of preparing for and responding to disasters	N/A	N/A	Various
	Harrison and Hoek (2011)	Book – Logistics Management and Strategy	N/A	N/A	Various
	Lau (2012)	Supply Chain Management: An International Journal	Conceptual	N/A	N/A
	Coman and Ronen (2009)	International Journal of Project Management	Conceptual	N/A	N/A

There is a sizable body of research and literature associated to the theme volume-volatility but it could be argued as being eclectic. This could be due to the theme definition, which covers key issues such as bullwhip (McCullen and Towill 2002); flexibility (Tachizawa and Thomsen 2007, Stevenson and Spring 2009); responsiveness (Holweg 2005) and forecasting (Oke 2003, Saeed 2008). These issues all come under the theme definition of volume-variability and each in their own right has a sizable body of literature within supply chain management research. It should be acknowledged, that the grounding of the literature is focused upon earlier research surrounding the previously discussed bullwhip effect. There is no lack of research within these specific areas and it is the bringing together of these areas that assisted in the conceptualisation of the theme volume-volatility.

2.3.3 Velocity

‘Enabling the customer to utilise speed as a competitive advantage, by ensuring prompt delivery’

The third theme to be contextualised is that of velocity which is defined as ‘enabling the customer to utilise speed as a competitive advantage, by ensuring prompt delivery’ (Hines 2004). The ability of an organisation or manufacturing system to adapt to changes in the marketplace through responsiveness is according to Holweg (2005) a constant, as they seek a competitive advantage**.** Harrison and Hoek (2011) state that in relation to customers, increased responsiveness is a fundamental reason why organisations are investing in new approaches to enhance performance within supply chains. Reichart and Holweg (2007) go further and suggest that the concept of responsiveness is now a key theme within supply chain research.

This responsiveness/speed of delivery from suppliers to customers is clearly defined as velocity within SCM literature (Christopher 2000, Hines 2004, Power 2005). Customers are continually placing demands on suppliers as they look for ways to improve upon speed of delivery. Li, Ragu-Nathan et al. (2004) highlight the pressure is increasing to assist in getting products to market. According to Harrison and Hoek (2011) this is linked to the enhanced possibility of competitive advantage being achieved through velocity. It should be noted that there are increased risks associated to practices related to velocity, these are mostly born by the supplier and not the customer (Hines 2013). T

he importance for downstream suppliers to achieve velocity for their upstream customers should not be underestimated. The reasoning is that upstream customers that have responsive suppliers regarding speed of delivery, are in turn loyal to that supplier Harrison and Hoek (2011).

In essence, they become locked into the service that is provided as they can then pass these short lead times onto their clients and so forth. This increases the competitiveness of the supply chain. Min and Mentzer (2000) suggests that this is possible through a process of increasing stock levels and reduced order cycle times. However, as previously stated with volume-volatility this can bring its own problem with increased inventory levels that can effect supplier’s cash flows.

In conceptualising velocity Hines (2013) suggests that the main sub-themes are that of responsiveness, anticipation and time-based competition. Further to this there is a clear agreement with Christopher and Towill (2000) that the value proposition offered to a customer from a supplier, who addresses velocity, is a heightened level of responsiveness known as either quick response (QR) or efficient consumer response (ECR).

Table 2.4: Evidence of discussion - Velocity

Theme & Concept	Evidence of Discussion	Journal/Book	Research Method	Sample Size & Analysis	Organisation/Industry
Velocity - Ensuring that customers have the flexibility to increase decrease volume as their demands dictate. **Concept -** Speed of delivery, Proactive practices, Time-based competition, Adapting to changes in the market	Christopher (2000)	Journal - Industrial Marketing Management	Conceptual	N/A	N/A
	Mentzer, DeWitt et al. (2001)	Journal of Business Logistics	Conceptual	N/A	N/A
	Christopher and Towill (2000)	Supply Chain Management: An International Journal	Conceptual	N/A	N/A
	Min and Mentzer (2000)	International Journal of Physical Distribution & Logistics	Qualitative	Literature Review	Various
	Hines (2004)	Book - Supply Chain Strategies: Customer-driven and customer-focussed	N/A	N/A	N/A
	Li, Ragu-Nathan et al. (2004)	Journal of Operations Management	Quantitative – Survey	196 Respondents Confirmatory Factor Analysis	Members of – Society for Manufacturing Engineers and Council of logistics management
	Holweg (2005)	International Journal of Operations and Production Management	Qualitative - Case Study – Interviews & Site Visits	Literature - Conceptual model building	Manufacturing
	Power (2005)	Supply Chain Management: An International Journal	Literature review	N/A	N/A
	Reichart and Holweg (2007)	International Journal of Operations and Production Management	Qualitative	Literature Review	Various
	Harrison and Hoek (2011)	Book - Logistics Management & Strategy	N/A	N/A	N/A

Table 2.4 highlights a body of literature where a discussion related to theme velocity is evident. What is clear in relation to this theme, is that there is a prominence of conceptual papers, although there are key seminal papers such as Li, Ragu-Nathan et al. (2004) that have quantitative methodologies. The amount of conceptual works could lead to an argument of a gap in empirical research directly attributed to this theme. However, it could also highlight that similar to the other themes within the 7V Framework the literature is not always predominantly focused on the actual theme.

2.3.4 Variability

‘The products/services have no varying levels of quality and that they are delivered in a manner that is of a level that is acceptable to the customers’

Quality is a crucial factor in the value-adding process attributed to the delivery of products throughout a supply chain (Sila, Ebrahhimpour et al. 2006). The importance of quality in this context will go a long way to ascertaining the length of relationship between customer and supplier. Kannan and Tan (2007) research highlighted the need for organisations to address issues regarding quality and ensure that goods and services meet standardised quality levels that are acceptable to a customer. Within the 7Vs Framework, the quality challenge is defined as the theme variability. It is discussed by Hines (2004), as the challenge for management to ensure that the quality of a service or product is delivered to the required standard. Gattorna (2010) highlights the importance of quality within supply chains as it is emphasised as being the most visible aspect of supply chain performance. With quality, being of such a subjective nature it is key, that organisations do everything they can to understand their customers’ requirements concerning acceptable standards.

Within the literature pertaining to SCM, it is clear that when discussing quality, Total Quality Management (TQM) is closely linked (Forker, Mendez et al. 1997, Siddiqui, Haleem et al. 2009, Talib and Rahman 2011). It is suggested that both TQM along with SCM are considered to be the most important strategies to be implemented to assist manufacturers in attaining global success (Talib, Rahman et al. 2011). The importance of the role of quality control when supply differing markets should not be overlooked (Croom, Romano et al. 2000).

The link between the theme variability and quality control is clear in that, the later can be defined as 'a function which measures and looks to improve the production, marketing processes and information flow' (Hazen, Boone et al. 2014). Within SCM literature quality is also encompassed in phrases such as quality performance and quality of service (Gattorna 2010). This issue was clearly identified by the research of Sila, Ebrahhimpour et al. (2006). They state that manufacturing companies use both supply chain management and total quality management as tools to achieve competitive advantages. However, a main outcome of their research highlights that although manufacturers will include customers in quality initiatives, this is not always the case with their suppliers.

In the conceptualisation of the theme variability, it is clear from the literature that the customer is the deciding factor on acceptable levels of quality. According to Silvestro (2001) all quality levels should be based on customer requirements. What is apparent is that companies need to focus upon the quality they receive from their suppliers, in order to pass on an acceptable level to their customers.

However, there is a view by Kannan and Tan (2007) that the research around quality in a supply chain context is somewhat limited. They argue that although research has been carried out highlighting the importance of quality within supply chains, the perspective of chain-wide quality is somewhat lacking in depth. Historically, research regarding quality at the firm level, has been given particular attention around the areas of quality management systems (Saraph, Benson et al. 1989, Black and Porter 1996).

While more recent research highlights the development in quality strategies and the importance of organisation in focusing its quality efforts (Kannan and Tan 2007). It seems that this is largely centred on strategic quality management (SQM) and a result of this is that literature around that of quality practices within a supply chain in a broader sense lacks depth. When focusing of strategies surrounding attainment of variability, Hines (2013) suggests that the sub-themes of reducing variability, lowering cost, improve efficiencies and ensuring quality. In addition world-class total quality management (TQM) is sought. Overall, the contextualisation of the theme sits comfortably within the extant literature. Table 2.5 highlights literature where the discussion around the theme variability is prominent. There is clear evidence of large scale quantitative surveys that have taken place. In addition, participants involved in research can be classed as key decision makers within supply chains. There is also evidence that both exploratory and confirmatory factor analysis has been undertaken.

Table 2.5: Evidence of discussion - Variability

Theme & Concept	Evidence of Discussion	Journal/Book	Research Method	Sample Size & Analysis	Organisation/Industry
Variability - The products/services have no varying levels of quality and that they are delivered in a manner that is of a level that is acceptable to the customers. **Concept** - Value adding process, Quality of product/service to end user, Total Quality Management	Saraph, et al (1989)	A Journal of the Decision Sciences Institute	Qualitative	162 Participants	General Managers - Various
	Black and Porter (1996)	A Journal of the Decision Sciences Institute	Quantitative – Survey	204 Respondents Factor Analysis	Members of European Foundation for Quality Management
	Forker, Mendez et al. (1997)	International Journal of Production Research	Quantitative - Survey	292 Respondents Factor Analysis	Electronics components industry
	Croom, Romano et al. (2000)	European Journal of Purchasing and Supply Management	Literature Review	N/A	N/A
	Sila, Ebrahhimpour et al. (2006)	Supply Chain Management: An International Journal	Quantitative – Survey	107 Respondents Descriptive statistics	Manufacturing Companies in USA
	Kannan and Tan (2007)	Supply Chain Management: An International Journal	Quantitative - Survey	243 Respondents Exploratory Factor Analysis	Senior Managers (Members of Institute for Supply Management)
	Siddiqui, Haleem et al. (2009)	Global Journal of Flexible Systems Management	Qualitative	Literature Review	Various Sources
	Gattorna (2010)	Book - Dynamic Supply Chains - Delivering Value Through People	N/A	N/A	Various
	Talib and Rahman (2011)	International Journal of Productivity and Performance Management	Literature Review	N/A	N/A
	Silvestro (2001)	The International Journal of Quality & Reliability Management	Hypothesis testing	N/A	N/A
	Talib, Rahman et al. (2011)	International Journal of Productivity and Performance Management	Qualitative	Literature Review	Various Sources
	Hines (2013)	Book - Supply Chain Strategies - Demand Driven and Customer Focused	N/A	N/A	Various
	Hazen, Boone et al. (2014)	International Journal of Production Economics	Conceptual	N/A	N/A

2.3.5 Variety

'The ability to customise or standardise a product as per consumer demands or even in anticipation of changes in demand'

Within the modern consumer environment, it is becoming increasingly common for products and services to be customised. Harrison and Hoek (2011) state suppliers will attempt to drive customers demand through the introduction of new products and or services. Literature surrounding the theme variety suggests that the same suppliers must be ready to customize products on the basis that customer requirements may vary. This has led to organisations finding innovative ways to increase product variety and more customer-adapted products (Lee, So et al. 2000). It is clear that with the customization of products, managers face complex and challenging tasks. Lee, Ha et al. (2001) suggest this is in part due to the ongoing trend of offering product variety, in conjunction with increased outsourcing and shorter product life cycles. There is prominent research where investigations have focused upon the relationship between variety, product design and how these influence supply chain operations (Fisher 1997, Randall and Ulrich 2001). It is the understanding of these relationships that are crucial to operations. According to Pero, Abdelkafi et al. (2010) their research offers two main points to focus upon. Firstly, changes in design creates changes to supply chain processes, which can increase cost. Secondly, the extent in which supply chains are effected, will depend upon the implementation of supply chain practices, such as structure, supply choice and production sites.

The challenge of achieving this variety is for organisations to stay competitive. Bennett and Klug (2012) state that manufacturing organisations find themselves needing to ensure they continuously seek ways of updating their products. Believing that this will assist them in attaining the required customer satisfaction and in turn loyalty. However, the manner and speed in which the ever-increasing innovations and changes to products are being produced, means that managers are faced with issues surrounding the delivery of these products through their supply chains whilst ensuring a competitive advantage.

Literature also highlights that organisations offering product variety are increasing across varying sectors. In an operational context, being able to offer product variety in conjunction with the availability of customised products, can again be utilised to enhance the probability of providing a competitive advantage that can assist or lead to gaining customers (Helo 2004, Scarvarda, Reichhart et al. 2010, Bennett and Klug 2012).

In defining the theme variety Hines (2004), suggests it is when organisations vary what they offer to suit the customer in accordance with their demands in relation to the customization of products. Within SCM literature variety focuses upon the prefix of what is on offer to customers in relation to the range of products and services. Scarvarda, Reichhart et al. (2010) research into car manufacturing highlights the issue that any form of variety to a final product, will in some way add complexity to a supply chain’s operations. Their case study research focused upon attaining variety to products in emerging and developed markets, with the findings highlighting the inability to attain parity in what is offered to clients in different markets. This should be seen as an important focus due to the previously mentioned globalisation of markets. Organisations need to be aware that levels of variety offered on identical products may change depending on the market.

The consequence of this is that suppliers are required to reduce the amount in which this complexity will negatively affect the delivery of products. In turn, this will determine their operational efficiency (Harrison and Hoek 2011). There are key elements highlighted in relation to ensuring the theme variety can be operationally achieved. For example, the correct match between product design and the operational supply chain is crucial (Fisher 1997, Randall and Ulrich 2001, Pero, Abdelkafi et al. 2010). This relationship and the importance of understanding it from an operational perspective cannot be underestimated, especially when it comes to cost efficiency. Randall and Ulrich (2001) suggest that a large portion of supply chain costs are decided at the design stage. This is due to decisions being made as to where products are sourced; manufactured and distributed throughout the supply chain process. Whilst Pero, Abdelkafi et al. (2010) highlight supply chains operational decision making will be influenced by design in that outsourcing of materials, processes, location of manufacturing and storage facilities. This in turn affects the overall supply chain structure and issues will need to be considered when addressing the implementation of product design changes.

In practice, Hines (2013) states that a particular product design needs to be paired to a correct supply chain process, thus ensuring a higher level of operational performance that can lead to a competitive advantage. Changes in what a supply chain can offer needs to be achievable, or the supply chain may not operate at the efficiency levels it was designed to achieve. When supply chain processes are discussed within the literature, the overlapping with logistics is apparent. This is evidenced within the research of Soosay, Hyland et al. (2008). The focus of their research is centred around collaboration between supply chain members that assists in increasing capabilities for continuous innovation. Although their research does focus upon collaboration and innovation between suppliers, it should be considered important to the attainment of variety. The reason for this is that it is taking an operational perspective of how to deliver the changes to products that come through variety.

These types of operations lead us to the literature associated to agile manufacturing, which is the process and/or ability of maintaining good levels of productivity in face of market uncertainty (Gattorna 2010). This uncertainty can be the external environment, but also changes in customer demand in relation to what they want from the product. According to Gunasekaran, Patel et al. (2003) and (Helo 2004) it is how an organisation reacts to uncertainty and more importantly prospers from this type of environment is again crucial to attaining a competitive advantage. With specific reference to this type of environment the theme variety comes into prominence. It is accepted that supply chain agility can be achieved if an organisation can successfully offer a broad range of products that are low costing but of high quality and delivered within a quick timescale. Vokurka and Fliedner (1998) support the notion that products need to be available in varying lot sizes and must provide value and variety for the customer. However, Coman and Ronen (2009) note that concern is growing in certain sectors that the increased levels of variety in products has a detrimental on supply chain performance. This particular concern is related to the situation when supply lead-time is long and demand has a level of uncertainty coupled together with product variety being high which result in increased flow times (Christopher 2011). Supply chain performance is impacted the greatest when critical materials cannot be sourced earlier in the production process.

Within the literature there is clear evidence that variety in products or service can lead to complexity of operations. This is apparent within the logistic process as a supply chain becomes more complex, the more difficult it is to manage. Examples of variety driving complexity are all too common. According to Harrison and Hoek (2011) organisations are warned that the variety of a product should only be increased if it adds value. Gattorna (2010) concludes that adding variety may inevitably increase costs both directly and indirectly, whilst also bring additional factors that need to be managed through strategic decision-making. In making strategic decisions in relation to variety Harrison and Hoek (2011) highlights the need for organisation to be able to manage external variety (the choice offered to the customer) and internal variety (converts external variety into changes within the supply chain) as a key process. The underlying themes highlighted by Hines (2013) in relation to suppliers strategies being able to implement variety consists of the considering phenomenon such as; cost implications, inventory holding, modular manufacturing, complexity reduction, customization and co-creation. This means that the value proposition to customers are aligned with being able to offer a variety, range and choice of product. Table 2.6 has highlighted literature where there is evidence of discussions related to the theme variety. This list is not exhaustive and is drawn from various operational backgrounds to assist in the conceptualisation of the theme.

Table 2.6: Evidence of discussion - Variety

Theme & Concept	Evidence of Discussion	Journal/Book	Research Method	Sample Size & Analysis	Organisation / Industry
Variety - The ability to customise or standardise a product as per consumer demands or even in anticipation of changes in demand. **Concept** - Local Customisation, Product/Service variety increasing over varying sectors, Increased outsourcing, Shorter product life cycles, Reduced complexity of customisation,	Fisher (1997)	Journal – Harvard Business Review	Conceptual	N/A	N/A
	Vokurka and Fliedner (1998)	Journal - Industrial Management & Data Systems	Conceptual	N/A	N/A
	Lee, So et al. (2000)	Journal -Management Science	Conceptual	Model Building	N/A
	Er and MacCarthy (2006)	Journal of Manufacturing Technology Management	Conceptual	Simulation Modelling	N/A
	Lee, Ha et al. (2001)	Journal - IEEE Transactions on Engineering Management	Conceptual	N/A	N/A
	Lambert and Cooper (2000)	Industrial Marketing Management	Conceptual	N/A	N/A
	Randall and Ulrich (2001)	Journal – Management Science	Multiple Methods – Qualitative Interviews and Quantitative Surveys	10 Companies chosen for interviews and visits. 8 Companies Surveyed. ANOVA – Hypotheses Testing	Industry Buyers
	Soosay, Hyland et al. (2008)	Supply Chain Management: An international Journal	Qualitative	23 Managers 10 Case Studies	Various
	Gunasekaran, Patel et al. (2003)	International Journal of Production Economics	Quantitative - Survey	21 Respondents (CEO's)	Various
	Helo (2004)	Journal - Industrial Management & Data Systems	Conceptual	N/A	N/A
	Hines (2004)	Book - Supply Chain Strategies: Customer-driven and customer-focussed	N/A	N/A	N/A
	Coman and Ronen (2009)	International Journal of Project Management	Conceptual	N/A	N/A
	Pero, Abdelkafi et al. (2010)	Supply Chain Management- An international Journal	Qualitative	Exploratory Case Study	Various Manufacturing
	Gattorna (2010)	Book - Dynamic Supply Chains - Delivering Value Through People	N/A	N/A	Various
	Pero, Abdelkafi et al. (2010)	Supply Chain Management: An International Journal	Qualitative – Case Study	Exploratory Case Study	N/A
	Scarvarda, Reichhart et al. (2010)	International Journal of Operations & Production Management	Multiple Methods	Descriptive Statistics- Formula Building	Car Manufacturing
	Christopher, Tatham et al. (2011)	Book - Humanitarian logistics [electronic resource] : meeting the challenge of preparing for and responding to disasters	N/A	N/A	Various
	Harrison and Hoek (2011)	Book - Logistics Management & Strategy	N/A	N/A	Various
	Bennett and Klug (2012)	International Journal of Operations & Production Management	Multi Methods – Semi Structured Interviews – Site Visits	Exploratory Case Studies – 35 Sites	Car Manufacturing

2.3.6 Visibility

‘Ensure that the supply chain is transparent and all parties are able to see and avoid blockages and issues surrounding bottom heavy inventories’

The final two themes to be conceptualised are visibility and virtuality. These two themes are closely linked within the extant literature. As highlighted in table 2.1 the concept of visibility requires transparency between members thus reducing bullwhip. In turn, the utilisation of IT systems in communicating information is crucial. In addition, information sharing ensures the pipeline is visible to all supply chain members this will assist in the reduction of transaction risk. The following section discusses these issues and introduces supporting literature that will allow the conceptualisation of the theme.

The relationship between visibility and virtuality will be discussed in section 2.4, however, to highlight the overlapping between these themes Gattorna (2010) suggests that this visibility of information within a virtual setting is vital when attempting to remove blockages (bullwhip) and excessive build-up of inventories. The reasoning is that, systems are not just based with the customer organisations, but also rather integrated throughout the supply chain (Christopher 2011). Thus ensuring visibility and sharing tangible information between all supply chain members. Hines (2004) states the importance of organisations focusing their efforts to assure that they have supply chains that are market-driven informed through information sharing.

In essence, it is the requirements of customers that must be the focus of developing strategies and delivery products in a speedy manner delivering quality and utilising standard systems. Whilst visibility in supply chains is not a new phenomenon or discussion within the literature, Caridi, Perego et al. (2013) suggest that a single definition is yet to be agreed upon. A simplistic view by

Lamming (1996) is that visibility is the ability to access and share information throughout the supply chain. In a similar manner Hines (2004) defines visibility by the capability of all the stakeholders associated to the supply chain being in a position to see the pipeline. More importantly from an operational sense he also defines visibility as being able to ensure that the supply chain is transparent and all parties are able to see and avoid any blockages and issues surrounding bottom heavy inventories. For this to be possible Li and Liu (2006) emphasise that levels of information sharing is crucial and that that two key aspects are present ‘quality’ and ‘quantity’. This sharing of information and its link to visibility is prominent with supply chain literature.

It is suggested that in order to gain a competitive advantage it is crucial that supply chains ensure undistorted (and up to date) information is available throughout the process and is widely accepted (Turner 1993, Novack, Langley Jr et al. 1995, Balsmerier and Voisin 1996, Towill 1997, Jones 1998, Childerhouse and Towill 2003). The flow of information between supply chain managers has become a critical factor in the success of supply chains (Power 2005). Traditionally supply chain members would work in the dark with lack of information and information sharing between each party and according to Patnayakuni, Ral et al. (2006), this increased transaction risk. It would also ensure a greater chance of operational issues and unnecessary costs, which could be avoided if resources had been pulled. In operational terms the information key to ensuring visibility is available includes stock/inventory, events, dates, outcomes, delivery schedules, shipping data. This information should be available to supply chain members. When in place it allows for a coordinated effort that in itself will assist in achieving performance improvements throughout the process (Patnayakuni, Ral et al. 2006).

According to both Haung and Mak (2000) and Mentzer, DeWitt et al. (2001) in order to accommodate and achieve visibility, organisations should look more outward in a manner that expands their supply chain and focus upon the communication, coordination and building closer relationship with suppliers as required. This outward looking philosophy is evident in supplier partnerships and even strategic alliances, which foster relationships between both an organisations customers and suppliers (Gunasekaran, Patel et al. 2003). This is also categorised as transforming what we would see as a traditional market-based relationship between buyer and supplier to one more akin to competition amongst cooperative sets (Patnayakuni, Ral et al. 2006). Additionally it is further suggested that increased visibility of demand related to upstream customers' requirements through data sharing, will increase the probability of continuous replenishments in a manner that reduces the possibility of blockages within the supply chain (Simatupang, Wright et al. 2002, Simatupang, Wright et al. 2002).

Whilst the research of Caridi, Perego et al. (2013) into the apparel industry highlighted that within this particular industry, companies have outsourced the majority of their production phases to a complex network of suppliers. There is clear evidence within the body of literature that value is added through the sharing of information and increased visibility, such as Li, Yan et al. (2005) research which developed a framework that offers practical guidance in evaluating the value of information sharing strategies. Table 2.7 highlights that within the literature associated with visibility; there is a focus on conceptual work. This could be seen as a gap and in turn an opportunity to add to the body of literature with empirical research.

Table 2.7: Evidence of discussion - Visibility

Theme & Concept	Evidence of Discussion	Journal / Book	Research Method	Sample Size & Analysis	Organisation / Industry
Visibility - Ensure that the supply chain is transparent and all parties are able to see and avoid blockages and issues surrounding bottom heavy inventories. **Transparency** - between members, Bullwhip reduced, IT systems communicate, Information sharing.	Novack, Langley Jr et al. (1995)	Book - Council of Logistics Management	N/A	N/A	N/A
	Balsmerier and Voisin (1996)	Journal – Industrial Management	Conceptual	N/A	N/A
	Lamming (1996)	International Journal of Operations and Production Management	Conceptual	N/A	N/A
	Towill (1997)	International Journal of the Techniques of Manufacturing	Conceptual	N/A	N/A
	Jones (1998)	Journal – Logistics Focus	Conceptual	N/A	N/A
	Caridi, Perego et al. (2013)	Bench Marking: An International Journal	Qualitative – Case Study	11 Case Studies	Apparel Industry
	Lee, So et al. (2000)	Management Science	Conceptual – Model Building	N/A	N/A
	Haung and Mak (2000)	Robotics and Computer-Integrated Manufacturing	Conceptual	N/A	N/A
	Mentzer, DeWitt et al. (2001)	Journal of Business Logistics	Conceptual Paper	N/A	N/A
	Simatupang, Wright et al. (2002)	Business Process Management Journal	Conceptual	N/A	N/A
	Childerhouse and Towill (2003)	OMEGA The International Journal of Science	Multiple Methods - Qualitative – Interviews & Site visits Quantitative – Survey	32 Participants – Interviews & Questionnaires Analysis – Correlation – ANOVA	N/A
	Li, Ragu-Nathan et al. (2004)	OMEGA The International Journal of Science	Conceptual – Methods Approaches	Crosses multiple themes	N/A
	Gunasekaran, Patel et al. (2003)	International journal of production economics	Quantitative - Survey	Descriptive Statistics – CEO	Various
	Hines (2004)	Book - Supply Chain Strategies: Customer-driven and customer-focussed	N/A	N/A	N/A
	Simatupang, Wright et al. (2002)	Supply Chain Management: An international Journal	Conceptual	N/A	N/A
	Li and Liu (2006)	International Journal of Production Economics	Conceptual	N/A	N/A
	Power (2005)	Supply Chain Management: An International Journal	Literature Review	N/A	N/A
	Patnayakuni, Ral et al. (2006)	Journal of Management Information Systems	Quantitative - Survey	110 Respondents Factor Analysis and Descriptive statistics	Manufacturing and Retail Organisations
	Gattorna (2010)	Book - Dynamic Supply Chains - Delivering Value Through People	N/A	N/A	N/A
	Christopher (2011)	Book Logistics & supply chain management	N/A	N/A	N/A

2.3.7 Virtuality

'The ability to manage and coordinate the supply chain using information technology'

Virtuality is defined by Hines (2004) as the ability to manage and coordinate the supply chain using information technology. The system goals within an operational supply chains that are attributed to virtuality and are expected to be multi-dimensional, seek to minimise cost, improve service, enhance communication between members and essentially increase flexibility in relation to delivery and response time (Lancioni, Smith et al. 2000). According to Wu, Yenigurt et al. (2006) the ability to manage the supply chains through the use of information technology, has come to prominence in the corporate world. There are also suggestions by Radjou (2003) that U.S manufacturers see the benefits of IT as improving supply chain agility, higher efficiency, improved cycle time and faster delivery of products to customers.

Bremer, Michilini et al. (2001) suggest that virtuality can be seen as an enterprise having the ability to deliver upstream customers a service or product in which the said enterprise would only have small amount of propriety competencies. Up until the 1980s this was not easily achieved. This was mainly due to the reluctance of supply chain partners to share databases (as suggested in attaining visibility) due to their concerns of sensitive information being shared or misused by competitors and handing them a competitive advantage. However, these attitudes have changed and it is acknowledged within the literature with the implementation of such systems as just-in-time (JIT) and point of sale data sharing programmes and increasing use of the term virtuality (Simatupang, Wright et al. 2002, Lancioni, Smith et al. 2003, Christopher 2011).

Ranganathan, Dhaliwal et al. (2004) suggest the impact of information technology in relation to supply chain performance has become a focal point of interest since the turn of the 20th century. There was evidence during that time of increased investment by organisations in relation to their al IT capabilities, that led directly to improved performance (Devaraj and Kohli 2003). With this increased development of information communication technology (ICT) it has become possible for companies to access real time reports related to all aspects of supply chain logistics (Hines 2004).

Organisations taking advantage of integrated supply chains has increased as the information and technology has become more easily accessible (Bowersox and Calantone 1998, Williamson, Harrison et al. 2004). Further to this, Hines (2004) suggests that in operational terms virtuality means that inventory can be replaced with information by the creation of digital supply chains which are supported by IT. According to Christopher (2011) due to the increase in information technologies (IT) organisations now have the tools to gain an overview in real time of the entire supply chain. In turn, this assists in the objective of meeting clients demands and with such use can assist in changing cost and value equation of a supply chain. Further to this, the increased use of IT as a tool to share information and data between all members of the supply chain, is in essence creating what is called a virtual supply chain (Harrison and Hoek 2011).

The levels of virtuality within organisational supply chains differ from one to another, however, the extent of how much importance they put on it can be measured against how much they embrace the concept of a networked value chain (Webster, Sugdern et al. 2004). The research by Hadaya (2009) is one of the few papers that focuses on the use of internet based IOISs to assist in the integration of supply chain members processes.

Within supply chain literature, it seems as though it is as much about the distributing of information as it is a physical product. In today's competitive market the use of the internet and again it is widely accepted that information systems are an essential part of this business practice (Lancioni, Smith et al. 2003, Christopher, Tatham et al. 2011). However, the research in this area is not evolving as fast as the technology systems currently being utilised within supply chains.

However, what can be taken from the literature is that the use of modern IT systems, it makes the contacting and collaborating of suppliers around the world more probable and allows new members to join the supply chain as and when required (Kumar 2001). The benefits of such use seems to be the reduction in supply chain costs, inventory and an improved speed of delivery and of course to be able to share information in real time within a virtual supply chain paradigm (Lee, So et al. 2000, Power, Sohal et al. 2001). The conceptualisation of the theme virtuality sits comfortable within extant literature. Table 2.9 highlights from the extant literature evidence of a discussion of virtuality. As shown there a solid grounding of work.

Table 2.8: Evidence of discussion - Virtuality

Theme & Concept	Evidence of Discussion	Journal / Book	Research Method	Sample Size & Analysis	Organisation/Industry
Virtuality - The ability to manage and coordinate the supply chain using information technology **Concept -** Multi-dimensional systems, improved communication,	Bowersox and Calantone (1998)	Journal of International Marketing	Conceptual	N/A	N/A
	Lancioni, Smith et al. (2000)	Journal – Industrial Marketing Management	Quantitative	193 Descriptive Statistics	Council of Logistics Members
	Lee, So et al. (2000)	Journal – Management Science	Conceptual – Model Building	N/A	N/A
	Bremer, Michilini et al. (2001)	Journal of Intelligent Manufacturing	Case Study		Brazilian Virtual Enterprises
	Min and Zhou (2002)	Journal – Computers and Engineering	Conceptual	N/A	N/A
	Kumar (2001)	Communications of the ACM	Conceptual Paper	N/A	N/A
	Power, Sohal et al. (2001)	International Journal of Physical Distribution and Logistics	Quantitative - Survey	962 Respondents Factor Analysis	Australian Manufacturing Companies
	Devaraj and Kohli (2003)	Journal – Management Science	Qualitative - Longitudinal Data collection	Hypothesis building – Causality & Omitted Tests	Health Care Industry
	Hines (2004)	Book - Supply Chain Strategies: Customer-driven and customer-focussed	N/A	N/A	N/A
	Ranganathan, Dhaliwal et al. (2004)	International Journal of Electronic Commerce	Conceptual	Hypotheses building	N/A
	Simatupang, Wright et al. (2002)	Supply Chain Management: An International Journal	Conceptual	N/A	N/A
	Webster, Sugdern et al. (2004)	International Journal of Operations & Production Management	Qualitative Case Study	4 Case Studies	Not Stated
	Williamson, Harrison et al. (2004)	International Journal of Information Management	Conceptual	N/A	N/A
	Christopher (2011)	Book Logistics & supply chain management	N/A	N/A	N/A
	Harrison and Hoek (2011)	Book - Logistics Management & Strategy	N/A	N/A	Various

2.3.8 In Conclusion – Contextualisation of themes

The literature in the previous section has been drawn from various sources, with the main premise of a supply chain background and offering clarity on the conceptualisation of themes within the framework. The literature embodying each of the themes is not identical and is at times drawn from differing operational perspectives. For example, volume-volatility literature is very much embedded within supply chain management literature. Contrary to that although the theme virtually is evidenced in supply chain literature, understanding has been gained from management sciences and computing literature.

Interestingly, Caridi, Perego et al. (2013) within their research associated to visibility that, although the theme has been studied by many authors, a single definition has yet to be provided. This point could be attributed to all of the themes within the framework. The literature surrounding certain themes is eclectic and open to interpretation, specifically in regards to how much it relates to each theme. By focusing on the definitions offered by Hines (2013), section 2.3 was able to identify key literature that support the conceptualisation of each theme.

The tables within the section have highlighted a sample of the research publication in which each theme is evidenced as being grounded within the extant literature. This allows the study to accept the existence of individual themes associated to the 7V Conceptual Framework. The first question sought from the literature has been addressed in that these themes do exist outside the context of the 7V Framework. This will allow the literature study to now seek clarity regarding the identification of potential relationships between themes and then identify potential CSFs. This in part will assist in the attainment of research objective 1.

2.4 Existing relationships - 7V Themes

This section identifies potential relationships between themes of the 7V Framework as is discussed within the extant literature. The purpose being that assumptions could be made of the plausibility of all themes within the framework being connected. Evidence of such relationships could offer testing the relationship between all themes in their entirety justifiable.

In searching for relationships between themes, certain questions were asked. For example, does a supply chains level of virtuality, increase the possibility of its visibility? Alternatively, does velocity depended upon the supply chains virtuality and visibility of its members? After a search of the extant literature, Table 2.9 was created to highlight where possible relationships have been identified. This list is not exhaustive, but as previously highlighted offers evidence that relationships are plausible. So what is it that facilitates this information flow and visibility between organisations working within the supply chain?

In short, it is Information Technology (Virtuality) in addition to real time communication (Visibility). Min and Zhou (2002) highlighted the clear link between both these themes when suggesting the partnerships between supply chain members cannot be fully utilised without sharing information through digital means. This philosophy of information sharing is supported by Mentzer, DeWitt et al. (2001) who state that information flows to each supply chain member facilitated by IT, will have a positive effect on production and overall outputs.

The first of these plausible relationships is that of virtuality and visibility. Hines (2013) highlights a clear link between the two in that transparency is required within the supply chain and that information technology platforms can communicate visibility to supply chain partners.

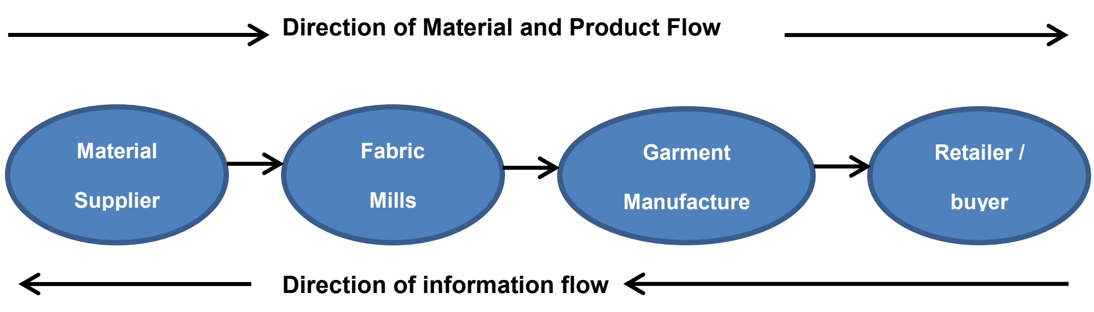
Table 2.9: Evidence of relationships between themes

Evidence of Discussion	Volume	Variety	Virtuality	Velocity	Visibility	Variability	Value
Adewole (2005)			✓		✓		
Mentzer, DeWitt et al. (2001)			✓		✓		
Mentzer, DeWitt et al. (2001)					✓		✓
Mentzer, DeWitt et al. (2001)				✓			✓
Simatupang, Wright et al. (2002)	✓				✓		
Lancioni, Smith et al. (2000)	✓		✓				
Lancioni, Smith et al. (2000)			✓		✓		
Power (2005)	✓				✓		
Power (2005)	✓		✓				
Power (2005)			✓	✓			
Christopher and Towill (2000)		✓					✓
Christopher, Tatham et al. (2011)	✓	✓				✓	
Christopher (2011)	✓	✓	✓			✓	
Reichart and Holweg (2007)	✓			✓			
Siddiqui, Haleem et al. (2009)						✓	✓
Williamson, Harrison et al. (2004)			✓		✓		
Christopher (2000)	✓	✓	✓			✓	
Coman and Ronen (2009)	✓	✓					✓
Christopher (2011)				✓	✓		
Christopher (2011)			✓		✓		
Harrison and Hoek (2011)				✓		✓	✓
Harrison and Hoek (2011)				✓		✓	
Harrison and Hoek (2011)			✓				✓
Harrison and Hoek (2011)					✓	✓	
Wu, Yenigurt et al. (2006)			✓	✓			
Min and Zhou (2002)			✓		✓		
Harrison and Hoek (2011)	✓	✓					
Tyndall, Gopal et al. (1998)			✓		✓		
Hines (2004) Naylor, Naim et al. (1999)			✓		✓		
Lee, So et al. (2000)				✓	✓		
Lancioni, Smith et al. (2003)			✓		✓		

There is a body of evidence within the literature, which demonstrates a supply chain can have the ability to coordinate itself, by utilising information technology. For this to happen both down-stream and up-stream members act in a transparent manner simultaneously (Mentzer, DeWitt et al. 2001, Min and Zhou 2002, Lancioni, Smith et al. 2003, Hines 2004, Williamson, Harrison et al. 2004, Adewole 2005, Christopher 2011, Williams 2014). The same evidence suggests clear benefits to virtuality is the visibility of data available throughout the supply chain will assist in gaining a competitive advantage being created for all members.

Historically, supply chains models for industries such as clothing and textile as shown in figure 2.4 suggest that information is only available from your direct upstream customer. The advantages of information flowing openly between all members of the supply chain was highlighted in the mid-1990s by Whitley (1998) and should not be seen as a new phenomenon.

Figure 2.4: Traditional supply chain model



(Adewole 2005)

This information flow and visibility between organisations working within the supply chain, is in essence information technology (Virtuality) in addition to real time communication (Visibility). Min and Zhou (2002) highlighted the clear link between both these themes. They suggested partnerships between supply chain members cannot be fully utilised without sharing information through digital means. Information sharing is supported by Mentzer, DeWitt et al. (2001). They state information that flows to each supply chain member facilitated by IT, will have a positive effect on production and overall outputs.

Another theme proposed to have a direct relationship with virtuality is that of velocity. Both Power (2005) and Lancioni, Smith et al. (2000) discuss the speed in which products are delivered up the supply chain with the assistance of technology can gain a competitive advantage to upstream customers if utilised correctly. Whilst, Wu, Yenigurt et al. (2006) agrees virtuality capabilities can increase velocity in which products move throughout the supply chain, they warn of restrictions, especially if technology between supply chain members is not compatible. This suggests that speed and efficiency of product movement throughout the supply chain has a direct correlation with the technology available between supply chain members.

With this probable relationship between velocity and virtuality in evidence, it is justified to assume the apparent close connection between virtuality and volume volatility. In turn, this relationship suggests a customer can take advantage of the use of volume volatility management if they have access to a virtual management system. Again both Christopher (2000) and Lancioni (2000) are in agreement when suggesting volume demand can be addressed through virtual supply chain information in real time. In addition, Power (2005) highlighted a clear link between how volume can be managed through the use of information technology.

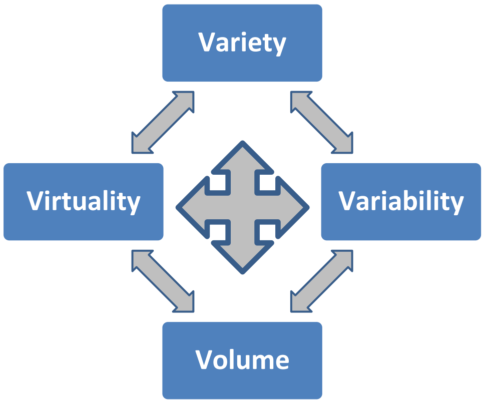
However, it should be noted that Scarvarda, Reichhart et al. (2010) warned speed of delivery can in certain instances restrict the ability of customers taking advantage of volume flexibility. This is prevalent if downstream suppliers are not able to attain or hold the required inventory within restricted time periods. The ability for customers to service demand for finished products, by identifying issues within the supply chain, suggests the relationship between volume volatility and visibility is possible.

The importance of this has been emphasized by both Simatupang, Wright et al. (2002) and Power (2005) who see the identification of issues and knowledge regarding capacity within the supply chain as being crucial for upstream customers to understand how they can best meet the demands of their clients. Helo (2004) and Scarvarda, Reichhart et al. (2010) suggest that in order to attain value in an ever changing and competitive market, organisations are having to differentiated products in smaller batches and reduce delivery times for their customers. This highlights a possible relationship between the two themes of variety and value. However, Christopher (2000) states the relationship between value and variety has restrictions, in that the latter does not always guarantee the former. In part Harrison and Hoek (2011) lend weight to the suggesting of a possible relationship between these two themes, when stating that variety should only be increased when leading to attainment of value.

It is a basic requirement of 'Just in Time' (JIT) delivery that quality of a product should not be affected, even if the speed of delivery is increased. Mentzer, DeWitt et al. (2001) support the notion that although speed is seen as a competitive advantage it is only accepted if a product is delivered defect free.

Continuing from variability, Harrison and Hoek (2011) suggest that in order to control variability, then velocity must be addressed as increased speed may affect the quality being delivered. The theme of variability is also seen as having a relationship with visibility as discussed by Wu, Yenigurt et al. (2006). This suggests that by having transparency within the supply chain and reacting to the issues highlighted causing delays, this will in turn help reduce quality defects in a product. The final paired relationship examines how it is possible to increase velocity and utilise it as a competitive advantage. There is clear evidence of the necessity to have visibility within the supply chain (Hines 2004). Christopher (2000) states that the relationship between velocity and visibility is crucial and relates directly to the ability of suppliers to improve responsiveness. Whilst Lee, So et al. (2000) highlight that the information sharing associated with visibility will assist in the lead-time delivery linked to velocity. Having highlighted single relationships thus far, next the focus turns towards suggested multiple relationships between themes. The first multiple relationship is between that of variety, variability and volume. Within the literature this relationship is discussed around agile and lean SCM (Christopher 2011, Harrison and Hoek 2011). Organisational supply chains are responding to uncertain volatility of demand. This uncertainty means that the three themes of variety, variability and volume are becoming increasingly intertwined. It is accepted that agile supply chains face challenges such as turbulence in the market place whilst, ensuring that demand for reduced lead times are met for low volume products. In essence, this type of chain can rightly be seen as a pragmatic approach of suppliers focusing their capabilities on what the demand may be from a customer (Harrison and Hoek 2011). These relationships may only be directly attributed agile supply chains, as with specific reference to product variety is more likely to seen at a higher level within this type of supply chain and in turn lower in a lean supply chain. In addition, volume volatility would be less likely an issue within a lean supply chain with long product life cycle usually associated to commodity type products that frequent them. The next stage of the three themes associated to agile supply chains as highlighted in figure 2.5 is the introduction of virtuality.

Figure 2.5: Suggested relationship between Variety, Volume, Variability and Virtuality



Coman and Ronen (2009) highlight that over specification associated to variety will, as with agile supply chains, have a negative effect on velocity. They suggest that delays will occur in delivery if the variety is addressed at source and such delays will influence upon customer satisfaction which is in turn linked to the theme value.

2.4.1 In Conclusion

Within the literature, there is clear evidence of relationships between themes. Although, not all of the relationships are evidenced as equally as others. This section has offered in part reasons as to why certain themes may be connected. The literature offers the plausibility that all themes within the 7V Conceptual Framework could be connected, whether directly or indirectly through another theme. This is an important point as it guides the analysis of this study when seeking validation of the 7V Conceptual Framework.

2.5 Contextualising CSFs within SCM

The term critical success factors (CSFs) is widely used throughout operational literature to describe key variables that are crucial to the outcome of an event. Within the project management field, researchers such as Bellasi and Tukel (1996) have undertaken seminal work in identifying which CSFs are critical to a project successful delivery. Since then a pattern has emerged where researchers have continually produced individual lists of CSFs, associated to different facets of project management (Chua, Kog et al. 1999, Fortune and White 2006, Bryde 2008, Pinto and Slevin 1988).

Within strategic management literature, CSFs such as planning, good leadership, communication, product innovation, Total Quality Management (TQM) and marketing are seen as critical issues that need addressing to ensure the overall organisational objectives are met (Black and Porter 1996, Mazzarol 1998, Appelbaum 2000, Cooper 2003).

There are difficulties in defining CSFs. The reasoning is that CSFs can be different or similar from industry to industry, project to project and in the context of this research supply chain to supply chain. At this point it is important to give contextualisation of what a CSF actually encompasses. Throughout the literature CSFs are not always described in the same manner or even discussed using the term. Although the language used can be seen as being similar, some interpretation of the literature is required. Therefore, for the purpose of this study, a 'CSF is a variable that if not managed will affect the outcome of an event or process within a supply chain'. Historically, research undertaken within the SCM directly attributed to CSFs is still developing.

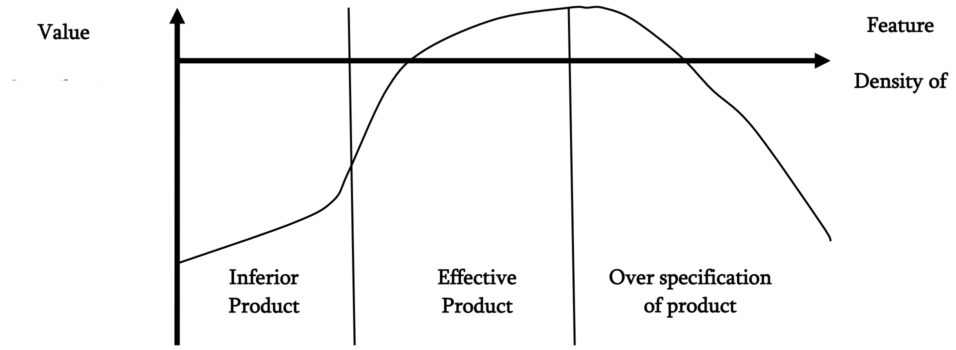
Elmuti (2002) seminal research is a rare attempt to bring some clarity to the area with SCM. Similar to the way that Bellasi and Tukel (1996) created a list of CSF in relation to project management research, Elmuti (2002) identified a list of fourteen factors attributed to the success and failure of supply chains operations. These CSFs will be discussed in relation to specific themes later in this chapter.

Within the literature CSFs are discussed from varying operational perspectives such as agile and lean supply chains (Power, Sohal et al. 2001) and TQM (Talib and Rahman 2011). These discussions are also focused around specific industries as differing case studies have been utilised for researched purposes. For example Weightman (2004) highlighted success factors in fresh produce supply chains, good staff, customer relationship, and communication as being key to the successful outcome. Similarly, Thoo, Huam et al. (2011) quantitative research within the Malaysian manufacturing industry highlighted generic CSFs such as customer relationships; Information Technology; Corporate culture and material flow management. When identifying CSFs it takes a level of interpretation from the literature. Not all CSFs are labelled as such and efforts are made to justify their inclusion. The following sub-sections identify possible CSFs associated to each of the themes within the 7V Framework. This focuses on addressing the third question asked of the literature, which was 'what are the factors critical to the successful management of supply chains'?

2.5.1 CSFs associated to Value

When defining value in relation to the 7Vs conceptual framework, Hines (2004) relates value throughout the products life cycle. This allows the study to identify CSFs beyond the point of sale and ascertain if further CSFs can be identified within the literature post-delivery. This is supported by Kumar (2001) who suggests supply chains do not terminate once the goods or services are delivered. This may be due to factors associated to post-delivery processes such as installation, help desks, maintenance, repair centres that assist in ensuring that goods are continually useful to the customer. Even after use, products can be sent back down a supply chain disassembled and reused; highlighting a 'dirt to dirt' scenario.

Figure 2.6: Over specification of product



(Coman and Ronen 2009)

The first CSFs identified are highlighted by both Coman and Ronen (2009) as well as Christopher (2000) who suggest that, value can be effected through excessive development of products. In essence, additions to a product or service can lead to the value that was once gained through the transaction is no longer there. They agree that value destruction will happen if a pathology of 'too little; too late; too costly' is allowed to manifest. They highlight key concerns surrounding over specification and design of the product; delays in development and unnecessarily features as three points that can be attributed to this phenomenon. Figure 2.6 highlights what is suggested to happen to value through excessive development of a product in that, it will eventually reduce the value contribution it is trying to achieve (Coman and Ronen 2009). It highlights a point when the feature density of a product will have a negative effect on value contribution through the over specification of an effective product.

Heikkila (2002) also warns that over development of product specification or customisation needs to be treated as a balancing act. Thus suggesting that if organisations go too far with customisation, then they run the risk of ruining efficiency. In turn, an approach that is too rigid and not offering any customisation could in fact affect the outcome of customer satisfaction. With value being a term that is widely used throughout SCM literature, there is at time overlaps with some of the other themes discussed. For example, value's importance in relation to the theme velocity in that competitive advantage is not just gained by speed of delivery but also with a reliable defect free product (Mentzer, DeWitt et al. 2001). In essence, customers seek value in products delivered at speed and on time and undamaged highlighting, that to attain value more than one variable must be present (Heikkila 2002).

It is clear that with this ever-changing business environment, more is demanded from supply chain members and as such, they must be flexible to customers' requirements in order to deliver the value required. It may be possible for customer's satisfaction to be met if a supplier can achieve the value levels that these customers demand. Therefore, focusing on the improvement of customer satisfaction can benefit an organisations competitive advantage and assist in the continual relationship between these parties (Giunipero and Brand 1996). The importance of this is that the value a firm creates, will assist in attaining the competitive advantage it seeks (Porter 1985). Key factors for supply chain strategies to be successful and attain value for customers, requires organisations at times to look beyond their own operations. These organisations need to focus upon a supply chain strategy that champions cooperation and collaboration between partners in a manner that fosters integration. This will be possible through open communication, ensuring that objectives are aligned and resources are shared (Soosay, Hyland et al. 2008).

Table 2.10: CSFs associated to the theme Value

Possible Critical Success Factor	Evidence of Discussion	Research Methods	Sample Size Analysis	Industry
• Excessive product development • Delays in development	Coman and Ronen (2009)	Conceptual	N/A	N/A
• Over specification of design	Christopher (2000)	Conceptual	N/A	N/A
• Unnecessary features • Reliable defect free product • Customer satisfaction	Mentzer, DeWitt et al. (2001)	Conceptual	N/A	N/A
• Stand-alone unique value	Giunipero and Brand (1996)			
• Flexibility of clients requirements	Heikkila (2002)	Qualitative – Case Study	Cross Case Analysis	
• Over customisation	Soosay, Hyland et al. (2008)	Qualitative – Semi Structured Interviews	23 Managers 10 – Case Studies (Cross Case Analysis)	Manufacturing

However, more often than not it is the focus of internal issues within an organisation that in the first instance needs to be addressed to assist in adding value externally to customers. Harrison and Hoek (2011) list five key areas that an organisation can use time as a way to add value, they are;

1. Increased responsiveness to customers needs
2. Managing increased variety
3. Increased product innovation
4. Improved return on new products
5. Reducing risk by relying less on forecasts.

Table 2.10 highlights 9 possible CSFs associated to the theme value from the extant literature. Most of these CSFs are taken from conceptual papers and yet to be validated through empirical research.

2.5.2 CSFs associated to Volume-Volatility

Scarvarda, Reichhart et al. (2010) discuss the characteristics of volume-volatility when using the term volume-flexibility. They see volume-flexibility as the supply chains ability to adjust and alter predetermined delivery agreements. Further to this they suggest that part of being flexible is the ability to change the location of the final output of a supply chain as and when required. This notion offers customers the flexibility to manage their own businesses in markets that may be more volatile and reduce their own risk.

The importance of this needs to be emphasized as a factor critical to a supply chains success. The reason being that subsequent changes in market conditions need to be managed as these will lead to rapid changes in demand (Narasimham and Das 2000, Power, Sohal et al. 2001). To meet these changes in demand Christopher (2000) suggests supply chains must ensure that they are synchronised to meet any peaks or troughs. Further highlighting the need for economies of scales that are volume oriented. Others, such as Fisher (1997) suggest pro-active risk avoidance strategy as a CSF, suggesting that companies employ accurate forecasting. Alternatively, Power (2005) states it is possible to mitigate potential risk, if organisations take care of the basics during the planning stage instead of hoping for the ‘silver bullet’ solution. The importance of correct decisions at the planning stage of the supply chain in relation to volume is critical as is data accuracy being supply chain members (Fieldman and Muller 2003).

There is a general opinion that a practicality of delivering volume is that of choosing the most reliable suppliers, also known as vendor selection (Wang, Huang et al. 2004, Power 2005). In order to manage this process, it is key to have selection criteria for suppliers in place before they are included in the supply chain. According to Christopher (2000) this seems to be a critical factor as one's own supply chain can only be as flexible and manoeuvrable as its suppliers will allow it to be. Narasimham and Das (2000) are in agreement with both Christopher (2000) and Power (2005) when suggesting if manufacturers themselves require rapid changes in supply, they need to have suppliers with such capabilities.

Worryingly for organisations, research by Simpson (2007) highlights that less than half have suitable evaluation processes in place to choose such suppliers. Further to this Moller (2002) warns that clear alignment of the requirements and what the system can deliver known as 'system functionality' is crucial. Due to the constant changing of the business environment, the need for organisations to become more responsive to clients' needs is critical. Power (2005) argues that organisations must look to be less lean and more agile in order to respond to customer demands. According to Naylor, Naim et al. (1999), in a volatile market an organisation that is agile and has market knowledge can take advantage and can exploit more opportunities that are profitable. This is primarily due to agile manufacturing being best placed to deal with fluctuations in demand, most notable concerning volume and variety (Harrison and Hoek 2011).

In addition, organisations that respond to specific changes in demand related to 'volume and variety' can quickly be seen as agile, which can be more beneficial to customers (Christopher 2000). Contrary to this, leanness is more akin to specifically eliminating all waste, including improving on time to develop a value stream and ensure a level schedule, which is more beneficial to the organisation (Naylor, Naim et al. 1999).

Table 2.11: CSFs associated to the theme Volume-Volatility

Possible Critical Success Factor	Evidence of Discussion	Research Methods	Sample Size & Analysis	Industry or Organisation
• Ability to alter predetermined agreements • Flexibility	Reichart and Holweg (2007)	Literature Review	N/A	N/A
• Reliable suppliers • Changes in market conditions	Power, Sohal et al. (2001)	Quantitative - Survey	962 Respondents Factor Analysis	Australian Manufacturing Companies
• Poor synchronisation • Reliable suppliers	Christopher (2000)	Conceptual	N/A	N/A
• Changes in demand • Reliable suppliers	Narasimham and Das (2000)	Quantitative - Survey	75 Respondents National Association of Purchasing Management Discriminant Analysis	N/A
• Data accuracy • System functionality	Fieldman and Muller (2003)	Conceptual	N/A	N/A
• Accurate forecasting	Fisher, Hammond et al. (1994)	Conceptual	N/A	N/A
• Integrated behaviour between customer and supplier	Elmuti (2002)	Quantitative - Survey	402 Respondents Regression & Descriptive Statistics	Senior Management American Organisations (Randomly Selected)
• Decision making in the planning stages	Tyndall, Gopal et al. (1998)	Book	N/A	N/A

It seems a balancing act of ensuring customer demand is met, but not at the detriment of the supply organisation. From the extent literature table 2.11 highlights possible CSFs associated to volume-volatility. Unlike the previous theme of value, certain CSFs associated with volume-volatility have been empirically researched. It is worth noting that quantitative research methods have been utilised on seminal research such as Power, Sohal et al. (2001), Narasimham and Das (2000) and Elmuti (2002).

This highlights to that there is evidence quantitative methods are acceptable method when undertaking research into the identification of CSF within SCM.

2.5.3 CSFs associated to Velocity

The following subsection identifies possible CSFs associated with the theme velocity. Scarvarda, Reichhart et al. (2010) research highlighted that with an ever-increasing demand on products, it is critical for organisations to respond in a timely manner to gain them that sought after competitive advantage. Tyndall, Gopal et al. (1998), state that although speed of delivery may be important it is critical that organisations put in place practicable timeframes for delivery and do not over sell what can be achieved.

Historically, reduced competition meant that it was possible for manufacturers to offer longer lead times. Due to the increasing competitive environment consumers can now demand individualised well designed products delivered promptly and directly to them. Kumar (2001) suggest additional pressure is put on supply chains to achieve speed of delivery due to the regular changes in customer tastes and demands.

According to Power (2005), the key critical factor in an organisation achieving a competitive advantage through velocity lies with the reliability of its suppliers. This suggests that a supply chain is only as fast as its slowest supplier, in the same way that a relay team is as fast as its slowest man. Both Narasimham and Das (2000) and (Power 2005) suggest that a critical issue is that the abilities of trading partners are taken into account when judging what speed of delivery can be achieved.

Within the literature, there is a clear relation between the discussion about velocity and that of physical logistics (Bowersox and Calantone 1998, Handfield and Nichols 1999, Power 2005). The management of physical inventories through logistics is crucial to supply chains and can be likened to velocity through customers demanding shorter delivery times (Power 2005).

It is clear logistics are affected by many factors such as, levels of inventory and the distance a product needs to travel as well as tariffs (Bowersox and Calantone 1998, Handfield and Nichols 1999, Power, Sohal et al. 2001). With global markets comes global shipping and that type of logistic management brings additional issues that will affect velocity, such as fragmented regulatory rules, an example of which is the amount of different trade laws within each country throughout the world (Kumar 2001).

Although, intermediaries can be utilised in such circumstances, the further down the supply chain you go from the final product being supplied, the more chance these have of being inadequate (Handfield and Nichols 1999). It is estimated that global shipments involve over 27 parties to be involved in a shipment of goods and finally complications in costs (Harrison and Hoek 2011). This is where confusion arises regarding taxes and duties as different countries can make sourcing of materials very difficult to manage.

From the extant literature, 11 CSFs have been identified and inserted into table 2.12. Interestingly, the seminal research highlighted in relation to the previous theme of volume-volatility is prominent in the identification of 5 of the CSFs identified. This overlapping of literature between these two themes is not surprising as the literature has already highlighted overlaps in table 2.9.

Table 2.12: CSFs associated to the theme Velocity

Possible Critical Success Factor	Evidence of discussion	Research Methods	Sample Size & Analysis	Industry or Organisation
• Practical timeframes	Tyndall, Gopal et al. (1998)	Book	N/A	N/A
• Abilities of trading partners • IT Capabilities of trading partners	Power (2005)	Literature review	N/A	N/A
	Christopher (2000)	Conceptual	N/A	N/A
	Narasimham and Das (2000)	Quantitative - Survey	75 Respondents National Association of Purchasing Management Discriminant Analysis	N/A
• Respond in a timely manner	Reichart and Holweg (2007)	Literature Review	N/A	N/A
• Level of inventory • Distances products need to travel • Tariffs	Bowersox and Calantone (1998)	Conceptual	N/A	N/A
	Handfield and Nichols (1999)	Book	N/A	N/A
	Power, Sohal et al. (2001)	Quantitative - Survey	962 Respondents Factor Analysis	Australian Manufacturing Companies
	Kumar (2001)	Journal – Communication of the ACM	N/A	N/A
• Fragmented regulatory rules • Inadequate intermediaries • Complications in cost	Kilgore, Joseph et al. (2007)	Journal – Conceptual	N/A	Manufacturing in India
• Reducing response times	Elmuti (2002)	Quantitative – Survey	402 Respondents Regression & Descriptive Statistics	Senior Management American Organisations (Randomly Selected)

2.5.4 CSFs associated to Variety

Whilst Haung and Mak (2000) suggest that, it is crucial for variety to be focused on product development. Others such as Christopher (2000) warn against this and highlight critical factors regarding variety are more apparent when products become over complex. However, there are suggestions that the issues around complexity in relation to variety can be managed through the process of what is known as local customisation of products (Harrison and Hoek 2011). Throughout the literature when variety is discussed, the issues surrounding complexity are never far away.

Malik, Niemeyer et al. (2011) state that it is imperative for organisations to deal with rising complexity of products, by putting greater emphasis to ensure they meet the ever-increasing diversity of customers' requirements. However, others warn organisations against the over specification and design of products insisting that it can lead to issues regarding delivery (Christopher 2000, Coman and Ronen 2009). It is clear that offering variety can be problematic to organisations; Hines (1994) states that supply chains will need to be responsive to have the ability to switch to new or varied products within a short time frame. However, this is dependent upon the supply chain and also the type of industry, as new products are rarely introduced at short notice just to offer variety (Reichart and Holweg 2007).

In an attempt to deal with complexity and take advantage of global rather than local forecasting, organisations can look to mass produce products, then customise in local markets (Christopher 2000). In doing this, organisations will be able to offer variety at a lower cost. Also, by bringing together the product in the local market at the final stages of the supply chain, it may be possible to achieve volume-oriented economies of scale. However, for this to be possible a supply chain would need to make changes to the 'product mix' (Scarvarda, Reichhart et al. 2010). Therefore, it is critical that when the supplier adjusts the product mix in an effort to suit the customer needs they do so without affecting other variables such as product quality. Another three key issues regarding variety are highlighted by Hines (1994), Randall and Ulrich (2001) and Reichart and Holweg (2007). They can be summarised as variety increasing demand uncertainty, the need for mix responsiveness and cost of using finished goods inventories. Furthermore, in relation to organisational inventories feeding supply chains, is the inherent need to keep them at a manageable level. In essence, they are required to be kept as low as is practically possible (Cooper, Lambert et al. 1997, Mentzer, DeWitt et al. 2001).

Table 2.13: CSFs associated to the theme Variety

Possible Critical Success Factor	Evidence of discussion	Research Methods	Sample Size & Analysis	Industry or Organisation
• Brands/products being too complex • Local Customisation	Christopher (2000)	Conceptual	N/A	N/A
• Ability to switch to new or varied product	Hines (2004)	Book	N/A	N/A
• Over specification	Coman and Ronen (2009)	Conceptual	N/A	N/A
• Rising complexity	Malik, Niemeyer et al. (2011)	Conceptual	Case Study	US Durables Manufacturer
• Products can be adapted to different markets	Elmuti (2002)	Quantitative – Survey	402 Respondents Regression & Descriptive Statistics	Senior Management American Organisations (Randomly Selected)
• Product development	Haung and Mak (2000)	Conceptual – Framework	N/A	N/A
• Product quality	Reichart and Holweg (2007)	Literature Review	N/A	N/A
• Need for mix responsiveness • Demand uncertainty • Cost of using finished goods inventories	Hines (1994)	Book	N/A	N/A
	Scarvarda, Reichhart et al. (2010)	Multiple Methods	Descriptive Statistics-Formula Building	Car Manufacturing
	Randall and Ulrich (2001)	Multiple Methods – Qualitative Interviews and Quantitative Surveys	10 Companies chosen for interviews and visits. 8 Companies Surveyed. ANOVA – Hypotheses Testing	Industry Buyers
• Inventories of a supply chain at a manageable level	(Lambert and Cooper 2000)	Qualitative – Semi Structured Interviews	90 Participants 15 Companies	Not Stated
	Mentzer, DeWitt et al. (2001)	Conceptual	N/A	N/A

From the extant literature table 2.13 has been created to highlight the possible CSFs associated to the theme of variety. Taking an overview of the sources it can be seen that although there are conceptual papers, there is also clear evidence of both qualitative and quantitative research methods being utilised to gather empirical data.

2.5.5 CSFs associated to Variability

According to Forker, Mendez et al. (1997), a specific CSF relating to quality is the procurement of defect-free components. They also suggest that internal operational practices and the relationship between customers and suppliers are a factor that must be considered. Looking historically, Feigenbaum (1956) suggests quality of design, incoming materials and shop-floor management are to be considered as critical to achieve standards required. Moving forward in time, management leadership, employee involvement and increased communications have been seen as potential factors in attaining quality (Crosby 1979).

Before the turn of the 20th century, it was noted that organisations should streamline supply bases when choosing suppliers. In essence, that focus should not be on getting the cheapest deal but rather the best quality of supply (Deming 1986, Garvin 1998). Since the turn of the 20th century, additional CSF relating to variability have become apparent within the literature. These include top management support; leadership; benchmarking; employee training; teamwork; technical systems; human resource management and finally customer satisfaction orientation (Brah, Wong et al. 2000, Saravanan and Rao 2004, Lakhel, Pasin et al. 2006, Samat, Ramayah et al. 2006, Al-Marri, Ahmed et al. 2007, Ueno 2008, Fotopoulos and Psomas 2009, Christopher 2011). From the literature, it has been possible to extract the possible CSFs associated to the theme variability and these are highlighted in table 2.14. The research that encompasses the literature is loaded towards quantitative methods. Key research such as Forker, Mendez et al. (1997), Ueno (2008), Brah, Wong et al. (2000) and Fotopoulos and Psomas (2009) have utilised both exploratory and confirmatory factor analysis. This would give justification to the use of such methods in the confirmation of CSFs.

Table 2.14: CSFs associated to the theme Variability

Possible Critical Success Factor	Evidence of discussion	Research Methods	Sample Size & Analysis	Industry or Organisation
• Procurement of defect free products • Relationship between suppliers and customers • Culture amongst employees	Forker, Mendez et al. (1997)	Quantitative – Survey	292 Respondents Factor Analysis	Electronics components industry
• Quality of design • Incoming materials • Shop-floor management	Feigenbaum (1956)	Journal – Conceptual	N/A	N/A
• Culture of preventing problems • Focus on planning and design • Management practices	Fraisat and Sawalha (2013)	Qualitative – Case Study	5 Cases and an interviewer administered Questionnaire	Fruit and Veg export chain in Jordan
• Management leadership • Employee involvement • Increased communications	Crosby (1979)	Book	N/A	N/A
• Streamline supply bases • Quality of supply	Garvin (1998)	Book	N/A	N/A
• Streamline supply bases • Quality of supply • Top management support • Leadership • Benchmarking • Employee Training • Technical systems • Teamwork • Human Resource Management • Customer satisfaction orientation	(Saraph, Benson et al. 1989)	Qualitative	162 Participants	General Managers - Various
	Samat, Ramayah et al. (2006)	Quantitative – Survey	175 Respondents Regression analysis	Malaysian Organisations
• Top management support • Leadership • Benchmarking • Employee Training • Technical systems • Teamwork • Human Resource Management • Customer satisfaction orientation	Talib, Rahman et al. (2011)	Literature Review	N/A	N/A
	Al-Marri, Ahmed et al. (2007)	Multiple Methods – Standardised Questionnaire open & closed questions	250 Cases/Participants – Descriptive statistics and reliability analysis	UAE Banking sector
	Ueno (2008)	Quantitative – Survey (Mailed)	371 respondents – Exploratory Factor analysis	Med-Large Tech Services UK Based
	Lakhel, Pasin et al. (2006)	Quantitative – Survey	133 Respondents - Correlations	Tunisian Organisations
	Brah, Wong et al. (2000)	Quantitative – Survey	176 Respondents - Factor Analysis	Singapore Business Services
	Fotopoulos and Psomas (2009)	Quantitative – Survey	370 Respondents - Confirmatory factor Analysis	Greek Companies

2.5.6 CSFs associated to Visibility

The following section will investigate the CSFs suggested as being related to the theme visibility. A key component related to visibility is that of relationships between supply chain members. Towill (1997) suggests organisational boundaries need to be overcome, even broken down in a manner that creates one organisation as a way to increase transparency. The importance of transparency is highlighted by Patnayakuni, Ral et al. (2006) who stress that poor information visibility, will attribute to 'bullwhip' as far as supply and demand is concerned. This is supported by Lee, So et al. (2000) suggested that 'bullwhip' may be overcome by increased transparency, in turn this would enable suppliers to be more aware of the visibility of demand.

To accomplish visibility there are those that suggest, organisations must evolve a culture of integration that encompasses both customers and suppliers (Bowersox and Closs 1996, Mentzer, DeWitt et al. 2001). Chen, Lin et al. (2006) discuss the positive side of integration; when a supplier is integrated into a well-managed supply chain, the relationship built up will contribute to the competitiveness of the supply chain in its entirety. It is clear within the literature that visibility, integration and coordination overlap, however, they all point to the same discussion. Cooper (2003) calls for the need for cooperation between management not just at the point of sale but also throughout the full supply chain. It is this cooperation that is seen as key to supply chain success and should begin with the joint planning of the supply chain through to the way that the performance of the supply chain is evaluated (Cooper, Lambert et al. 1997, Mentzer, DeWitt et al. 2001).

There is further belief that relationships between suppliers that have been built up over time, should be treated as a factor critical to success (Chen, Lin et al.

2006). Research by Mentzer, DeWitt et al. (2001) focusing on visibility, highlights supply chain members having same goal and same focus; integration of key processes; partners building and maintaining long-term relationships; strategic alliances; information sharing; shared risks and rewards; organisational compatibility; commitment from members; top management support as being key to achieving visibility. Whilst Patnayakuni, Ral et al. (2006) research suggests that the focus on collaboration of real time information between members is seen as being imperative to the delivery of effective supply chains.

Although this phenomenon is a visibility issue, it is also related to that of volume volatility, as this will allow suppliers to match supply with demand. Lee, So et al. (2000) summarise the type of relationship needed between members of the supply chain when discussing the need for ‘connectivity’. They also suggest that this should not be restricted only to information relating to demand for a product or levels of inventory, but also the interaction of multiple and collaborative working relationships between each organisation. Froehlich, Hoover et al. (1999) highlight further possible CSFs related to visibility in that certain organisations may have entrenched business practices where employees may not be used to working in such a manner.

This reiterates the stance taken by Power (2005); the ability of trading partners to interact is a CSF. In essence, it seems that the willingness of partners to openly share information that will dictate the possibility of visibility being utilised. Therefore, research by Chen, Lin et al. (2006) indicates factors when choosing supply chain partners such as close relationship, technological capacity, conflict resolution, and profitability of supplier and conformance quality should also be seen as a CSFs.

Table 2.15: CSFs associated to the theme Visibility

Possible Critical Success Factor	Evidence of discussion	Research Methods	Sample Size & Analysis	Industry or Organisation
• Closer relationship with suppliers	Mentzer, DeWitt et al. (2001)	Conceptual	N/A	N/A
	Haung and Mak (2000)	Conceptual	N/A	N/A
• Increased transparency	Towill (1997)	Conceptual	N/A	N/A
• Supplier integrated	Chen, Lin et al. (2006)	Conceptual	Model Building	N/A
• Culture of integration	Bowersox and Closs (1996)	Conceptual	N/A	N/A
	Mentzer, DeWitt et al. (2001)	Conceptual	N/A	N/A
• Cooperation between management	Lambert and Cooper (2000)	Qualitative – Semi Structured Interviews	90 Participants 15 Companies	Not Stated
• Joint planning of supply chain	Tyndall, Gopal et al. (1998)	Book	N/A	N/a
	(Lambert and Cooper 2000)	Qualitative – Semi Structured Interviews	90 Participants 15 Companies	Not Stated
	Mentzer, DeWitt et al. (2001)	Conceptual	N/A	N/A
• Relationships between members • Technological capacity • Conflict resolution • Profitability of supplier • Conformance quality	Chen, Lin et al. (2006)	Conceptual	N/A	N/A
• Entrenched business practices	Froehlich, Hoover et al. (1999)	Conceptual	N/A	N/A
• Members having same goal focus • Integration of key processes • Partners building and maintaining • Long-term relationships • Strategic alliances • Information sharing • Shared risks and rewards • Organisational compatibility • Commitment from members • Top management support	Mentzer, DeWitt et al. (2001)	Conceptual	N/A	N/A
• Integration of processes • Sharing information • Cooperation and collaboration • Clear objectives • Establishing partnerships	Elmuti (2002)	Quantitative - Survey	402 Respondents Regression & Descriptive Statistics	Senior Management American Organisations (Randomly Selected)
• Real time information	Patnayakuni, Ral et al. (2006)	Quantitative - Survey	110 Respondents Factor Analysis and Descriptive statistics	Manufacturing and Retail Organisations
• Lack of Virtual Organisations	Sharifi and Zhang (2001)	Literature review	N/A	N/A

From the literature it has been possible to identify 28 potential CSFs associated with the theme visibility as shown in table 2.15. Within this literature there is a body of conceptual work that is yet to be empirically researched.

2.5.7 CSFs associated to Virtuality

The following section identifies the CSFs related to the theme virtuality. Previously, Naylor, Naim et al. (1999) discussed virtual supply chains in the form of virtual co-operation. Lancioni, Smith et al. (2003) then stated managing vendor relations as being critical to ensuring a smooth flow of information. At the turn of the 20th century it was clear that critical issues relating to virtuality were focused around the lack of partners having the virtual capacity (Sharifi and Zhang 2001). It would be prudent when discussing virtuality to highlight that the research by Sharifi and Zhang (2001) was undertaken in the late 90s, during which time it could be argued that certain IT systems were in their infancy. However, this research are still relevant today especially when we discuss supply chains in the context of a global network with markets. It is possible that organisations in less developed countries and more likely further down the supply chain, would have varying levels of IT available to them. This is supported impart by both Christopher (2000) and Gunasekaran, Patel et al. (2001) who state that the specific issue relating to the integration of technological capabilities between organisations is key to virtuality. In addition to this Christopher (2000) further suggested that a joint strategy determination between supply team members and transparency of information is critical to implementing virtual supply chains. It is also clear within the literature that an organisation's own technology may already be in place before the IT requirements to join a new supply chain are known. This means that existing IT might not be compatible or indeed advanced enough to be integrated (Froehlich, Hoover et al. 1999). Williamson, Harrison et al. (2004)

suggest that this factor is important for organisations to be aware of in relation to the time and cost of integration of IT systems and processes. It could lead to supply chain members' inability to produce accurate data that can be utilised within a virtual supply chain. This in turn would highlight trustworthiness of information as being a problem which other members would have to manage (Froehlich, Hoover et al. 1999). It should be noted that, it is not only trustworthiness of information that is a concern between supply chain members, as Williamson, Harrison et al. (2004) highlight, but also the obvious security risks associated to opening up of internal systems to external partners that worries supply chain members.

The research by Williamson, Harrison et al. (2004) in this area primarily focuses on the increased use of electronic data interchange (EDI) that incorporates a value added network (VAN). The use of EDI systems is supplemented with other processes such as TQM and 'just in time' (JIT) as a way to continually improve the service that a customer receives. However, this process is not without its own problems as it can be argued as being costly for smaller suppliers to implement such technologies and processes. This leads to what they call an infrastructure mismatch and more worryingly for a supplier, when connected to such a system it can restrict their flexibility, especially when trying to deal with more than one customer. This is mainly due to their inability and capacity to support specific information technologies for each individual customer. Williamson, Harrison et al. (2004) highlight, a survey by IBM of 33,000 companies worldwide which found that less than 5 per cent of them could integrate their information systems with external partners. They suggest the main reasons for such a statistic could be issues surrounding contrasting or different IT operating systems and/or applications. Mills (2001) then re-iterates the point that a comprehensive evaluation of a potential members IT systems, is needed prior to joining a supply chain as being critical to its success. From the literature discussed, it has been possible to extract 12 potential CSFs associated to the theme virtuality, as highlighted in table 2.16.

Table 2.16: CSFs associated to the theme Virtuality

Possible Critical Success Factor	Evidence of discussion	Research Methods	Sample Size & Analysis	Industry or Organisation
• Managing vendor relationships	Lancioni, Smith et al. (2003)	Quantitative – Survey	181 Respondents Descriptive Statistics	Council of Logistic Managers Institute
• Joint strategy determination • Buyer supply team • Transparency of information	Christopher (2000)	Conceptual	N/A	N/A
• Security risks • Infrastructure mismatch • Differing processes	Williamson, Harrison et al. (2004)	Conceptual	N/A	N/A
• Integration issues • Comprehensive evaluation of members IT systems	Gunasekaran, Patel et al. (2001)	Quantitative - Survey	21 Respondents (CEO's) Descriptive Statistics	UK Industries (Using Kompass Registers)
	Christopher and Towill (2000)	Conceptual	N/A	N/A
• Produce accurate data • Trustworthiness of information • Entrenched business practices	Froehlich, Hoover et al. (1999)	Conceptual	N/A	N/A

2.5.8 In Conclusion – CSFs

From the extant literature, 109 possible CSFs have been identified. Table 2.17 highlights the breakdown of the literature where possible CSFs have been identified. There seems to be a spread of differing research methods undertaken in relation to identification of CSFs. This highlights a strong foundation of historic conceptual papers. Table 2.17 also shows qualitative research is prevalent within SCM literature. Within the quantitative research highlighted, key decision makers within supply chains have utilised surveys. Additionally, there is evidence to suggest that when analysing possible CSFs, it is acceptable to utilise both Exploratory and Confirmatory Factor analysis.

Table 2.17: Literature Breakdown identifying CSFs

Conceptual Papers	29
Qualitative Research Papers	7
Quantitative Research Papers	17
Literature Review Papers	6
Multiple Methods Papers	3
Published Books/Professional Bodies	7

In summary, the CSFs associated with the first theme of value key issues such as delays in development and defect free product stand out as being critical (Coman and Ronen 2009). There is a balancing act that organisations must manage between that of over specification of goods and customer satisfaction. The process of which was discussed in relation to figure 2.1, regarding over specification effecting the value contribution that can be made to a product. When discussing volume volatility the issue of an organisational supply chain being well planned and flexible enough to address the ever-changing environment is seen as critical to its success (Reichart and Holweg 2007).

Emphasis within the literature pointed towards the need for organisations to be constantly looking outwards and forwards in order to plan and forecast output of the supply chain. Issues such as data accuracy and reliable suppliers were seen as critical for an organisations supply chains to work. In relation to the theme of velocity, it was the ability and/or reliability of supply chain members that could seriously affect the performance of speed in which a product could be delivered (Elmuti 2002). There also seems to be factors to consider such as the physical distance that goods may need to travel and the issues surrounding the countries they would pass through. This highlighted factors related to tariffs, regulatory rules and complications in cost. There were also warnings that organisations should not over sell and give practicable time frames for delivery, whilst at the same time managing their inventory levels to their advantage.

The theme variety, similar to value, highlighted the issues surrounding a product having a high specification (Coman and Ronen 2009). However, unlike value more emphasis was placed on overcoming issues such as complexity with processes such as local customisation and making a product easier to adapt to local markets. There is clear evidence within the literature that product development is crucial to attaining value and the balance between this and demand uncertainty needs constant monitoring. The literature also warns that with variety comes the risk of unused inventories and that in itself is a serious consideration to organisations along with them being able to switch to new or varied products to suit demand. With variability, the literature clearly puts emphasis of quality onto management procedures (TQM) and their individual philosophy's. It highlights management issues such as organisational culture, leadership and communication as core areas critical to a supply chains success.

It further suggests that similar to volume volatility, planning is crucial along with the training of employees and the procurement of quality defect free components. The latter brings the reliability of suppliers into question in the same way that other themes seem to do. In addressing visibility, once again culture is seen as critical, whether it is regarding integration of supply chains, relationships between members or even criticising an organisation's entrenched business practices. It seems that for visibility to be possible supply chain members need to be open regarding information and trust in other members, even if these members are not directly part of the parent organisation. Finally, virtuality focuses around ICT and the supply chain member's ability to be integrated into a virtual network. With this in mind the literature highlights CSFs that focus on integration issues such as, differences in IT capability of members and lack of virtual organisations. The benefits of virtuality are clearly disseminated; however, key factors such as security of information, trustworthiness and accuracy of data supplied by members are crucial to success. Throughout the chapter, tables have been created to capture the CSFs related to each theme.

2.6 Summary of Literature

This chapter has contributed towards the attainment of research objective 1. It has identified possible CSFs from the extant literature influencing supply chain strategies. It has also contextualised the themes and variables emerging from the extant literature. The focus of the discussions were related to each of the individual themes from the 7V conceptual framework. The tables created throughout section 2.5 relating to CSFs will be utilised in part to formulate a survey instrument that will assist in addressing the remaining research objectives. This will be discussed in depth in the following methodology chapter. The tables related to CSFs are summarised in table 2.17 as a breakdown of the themes and the number of possible CSFs identified.

Table 2.17: Total CSFs associated to the 7V themes

Themes	Number of CSF's Identified in literature related to themes
Value	9
Volume (Volatility)	13
Velocity	11
Variety	12
Variability	22
Visibility	29
Virtuality	12
Total	**109**

By focusing on research objective 1 in the first instance, this chapter has highlighted issues surrounding the themes and the delivery of a successful supply chain. In turn, this process has identified and bracketed CSFs against the 7Vs themes. In total, 109 individual CSFs have been extracted from the extant literature and this has enabled a greater understanding of what the restrictions are to the successful delivery of supply chains. These CSFs are shown throughout the review, summarised in tables and will be used to assist in the designing of the survey instrument during phase 2 of the PhD thesis. Finally, the literature has identified plausible relationships between themes that justify further investigation when carrying out the data analysis.

Chapter 3 Methodology and Method

3.1 Methodology

This chapter highlights the research approach and provides a justification for the chosen methods. It addresses the issue that scientific methodology needs to be seen for what it truly is, which is in essence a way of preventing the researcher deceiving themselves.

This research is designed is based on the problem under investigation, the theoretical framework of the study, and the overall purpose of the study (Black 2009). This chapter presents detailed information that allows the reader, to replicate the research undertaken in this thesis if so required. The research process is justified in detail and in turn assists the reader in understanding the methods undertaken that will serve to support the reliability and validity of the study. For the study to achieve its overall aim and to enable confidence in its findings there should be no ambiguity regarding the stages and process it has it has employed. Therefore, this chapter provides a narrative that demonstrates consistency between the research objectives, extant literature and the methods applied throughout the study.

3.2 Discussion surrounding epistemology

This research was conducted through a process that advances the understanding of Critical Success Factors (CSFs) associated to the delivery of supply chains. It is clear that the planning and managing of supply chains is a participatory endeavour. This means that a level of involvement from key informants is required in order to gain an understanding of the phenomena and make suggested changes to it. In the case of the current research the overall aim was to identify and understand how CSFs influenced supply chains. In doing so, it investigated the suitability of a conceptual framework in relation to acceptable knowledge in the field of research. Most new researchers would consider themselves more as a practitioner than a philosopher. The considerations given to epistemology or paradigms may at best me minimal. However, the understanding of philosophy will assist the researcher in what they can say about the findings of the studies.

Epistemology

Of all of the epistemological views that this study considered, the two most prominent were those of 'objectivism' and 'constructivism'. These views framed how the current study looked at knowledge and where it comes from was key to understanding its philosophical position. Knowledge be a seen as 'a priori' which is encapsulated in philosophical beliefs that proceed and is independent of sense experience or 'a posteriori' which comes after from what is known from a sense experience (Richardson and Bowden 1983). This study sought knowledge related to the solving of a practical problem and utilised the experience of key decision makers within supply chains to answer questions previously created from the literature and developed by practitioners. These practitioners were crucial to the development of the survey instruments as they had the 'a priori' knowledge that was utilised to form the instrument to conduct this investigation.

If considering 'objectivism' as the underpinning of a study it requires the assumption that, reality exists independent of consciousness (Crotty 1998). In essence the person (researcher) and reality are separate (Webber 2004). 'Constructivism' on the other hand, is an epistemological view that argues that there is no absolute truth (Crotty 1998). This epistemic paradigm argues that knowledge is not an insight into an objective reality, instead it is constructed by humans in part through social interactions and therefore the knower and the known become interactive and inseparable (Teddie and Tashakkori 2009). In the case of this research it is the social interactions that are the key to the creation of the conceptual framework. Constructivism does not seek a universal set of laws underpinning reality (Guba and Lincoln 1989). Constructivism is a view that knowledge, and in turn reality is reliant upon human practices between other humans and their worlds being constructed, developed and transmitted within a social context (Crotty 1998). In relation to this study, constructionism sits more comfortably than objectivism. The reasoning is that, unlike the view seen in objectivism, constructionists do not believe that the world is out there to be discovered. They believe that meaning is constructed; it is not found in the object, waiting for someone to come across it. They (constructionists) will rather attempt to understand the individual formation of intangible constructions or perspectives of others rather than evaluate whether constructions are true or false.

Positivism - Considered

Positivism builds knowledge in the form of building blocks of a reality that exists beyond what we see as the human mind (Benton 2001, Denzin and Lincoln 2005, Blanche, Blanche et al. 2006, Goldman 2010). In doing so it suggests that a humans lived experience of its world will reflect an objective independent reality, and in such a paradigm the researcher and this reality provides the foundation for human knowledge (Webber 2004). Contrary to this, one of the most influential philosophers of the 20th century Kuhn (1970), suggests that interpretivist researchers believe qualities they give to objects are socially constructed.

Positivism could be seen as a sensible theoretical perspective for this research study. Especially as this study incorporates a questionnaire as a research tool, which will be used to inform a statistical data analysis technique. This research method is widely accepted as a standard research tool for quantitative researchers and links through to positivism (Webber 2004). Within a positivist framework, knowledge quality is determined by scientific rigor, benchmarks of which include internal and external validity in addition to the reliability of the research (discussed later in this chapter).

Interpretivisim Considered

The widely accepted theoretical perspective in direct opposition to positivism is interpretivisim (Crotty 1998). If the current study took an interpretivist stance, it would be acknowledging that humans build their knowledge as a reflection of their own experiences, through their interaction with the world around them. In essence, they are attempting to make sense of the world. In doing so they are acting as active agents in which they construct sensible events that bring a structure to the unknown (Weick 1995). In other words, interpretivists make sense of their world "recognizing that their sense-making activities occur within the framework of their life-worlds and the particular goals they have for their work" (Webber 2004). This can be seen as them building knowledge through social construction of their world and is a theoretical perspective that is linked comfortably to constructivism (Crotty 1998). In relation to the philosophical underpinnings of this study, it could be argued that objectivism and the paradigm of positivism are attractive offerings. From a simplistic viewpoint it could be argued the philosophical underpinnings of this study are suited to objectivism and the paradigm of positivism. It is commonly accepted that this paradigm sits comfortably with a quantitative survey and generalisations regarding knowledge.

Quantitative purists (positivists) would argue social science should be objective and this study will objectively analyse the data collected. They consider generalisation as desirable and possible and that outcomes of social science can be determined both reliably and with validity. On the other side of the argument, qualitative purists (constructivists and interpretivist) support the notion of multiple-constructed realities. However, they argue that time and context free generalisations are not possible or even desirable and they reject the notion of objective positivism (Guba and Lincoln 1989). The research undertaken in this thesis cannot dismiss the constructivist viewpoint. This research used the 7V conceptual framework as its starting point. It does not accept that this framework has been discovered, as would be the case if one was taking a purely objectivist view but that it has been constructed through social interactions.

In the case of this study, the philosophical underpinning does look in part towards social constructionism, which in turn raises issues surrounding the acceptance of generalised findings. However, the research is based on the themes of a conceptual framework in which neither they nor the framework created to include were discovered, but rather socially constructed within the world of organisational supply chains created by an individual with '*a priori'* experience within this area. By utilising a quantitative research method of collecting primary data supported through qualitative opinion that structures themes that are socially constructed, this opens the possibility that questions and confusion could arise regarding its epistemic grounding.

Pragmatism

Pragmatism is seen as a theory of meaning, knowledge, truth or even value, which, it is suggested, takes as its reason or yardstick the success of practical consequence (Harrison-Barbet 1990). Born out of the work of William James who, through a series of lectures on ‘Pragmatism: A New Name for an Old way of Thinking’ (James 2014) set the conversation to address what he saw as the dilemma in philosophy. James openly challenged the historic fundamental clash between two historic dualisms and in doing so stated that pragmatism was able to overcome this dilemma (Hookway 2013). By stating the philosophical position of pragmatism, the researcher looked for a more moderate and common sense versions of philosophical dualisms basing requirements on solving problems. Importantly for this study Pragmatism can also be seen as endorsing eclecticism and pluralism in that they see different and even conflicting perspectives and theories as being useful and moreover experience, experiments and observation are all acceptable ways to gain understanding of people and the world (Johnson and Onwuegbuzie 2004).

Pragmatism also offers the middle ground between philosophical dogmatisms and scepticism and more importantly for this researcher, ‘to find a workable solution’. In addition, the pragmatic views of philosophy denotes that its logic of inquiry includes the use of induction (or discovery of patterns), deduction (testing theories), and abduction for uncovering and relying on the best set of explanations for understanding results (Johnson and Onwuegbuzie 2004). Others such as Hookway (2013) lend weight to the argument that pragmatism and in turn, pragmatists will incorporate a methodology, which uses different types of research methods employed in differing sciences. Importantly for this research study, they suggest they do this without being, restricted by historic dualisms that might contradict otherwise. In relation to this study, accepting such a stance is in essence due to pragmatism’s flexible views related to the understanding of knowledge and the acceptance of other types methods and its freedom to not be constrained to the traditional dualisms. This then allows the researcher the opinion that such a philosophical underpinning, which attempts to put aside any apparent metaphysical disputes and allows the use socially constructed themes and generalize findings from a quantitative research method without fear of contradiction that lends weight to this study confirming such a stance.

3.3 Method

The following section explains how the research method undertaken in this study assists in attaining its overall aim, which is to gain a greater understanding of key factors related to the efficient delivery of supply chains through the development of the 7V Conceptual Framework. From this overall aim, five research objectives that have emerged are-

1. Identify potential Critical Success Factors, which could influence supply chains.
2. Analyse findings from the empirical study with a view to confirming or disconfirming CSFs.
3. Incorporate CSFs into the 7V conceptual framework
4. Reconceptualise effective supply chain strategies on the evidence from the study.
5. Evaluate implications for supply chain management practice.

In order to attain these objectives this study primarily utilised a quantitative data collection tool in the form of a survey instrument. The instrument was designed with the assistance of key supply chain decision makers. These included group and individual discussions, as well as the previously discussed literature review to gather information attaining to possible CSFs. The process undertaken and subsequent information gathered assisted in designing the questionnaire for the quantitative data collection phase of this study. This collection and analysis of the data were carried out over the 4 following distinct phases.

Phase 1. Qualitative – review of literature, discussions with members of Chartered Institute of Purchasing Supply.

Phase 2. Qualitative – Design of questionnaire from information gathered in phase 1, piloting of the questionnaire, redesigning questions.

Phase 3. Quantitative – Collection of quantitative data through questionnaire and analysis of data.

Phase 4. Writing and discussion of analysis results in relation to objectives and overall aim of the research

Table 3.1: The four phases of the research

Phase	Research Objective	Method	Type of knowledge
1	1	Secondary Research-Review of extant literature	Identification of possible CSFs related to the success delivery of supply chains, which will be utilised to form questions within a survey instrument.
1	1	Qualitative research-Round table discussions with supply chain decision maker (Members of the Chartered Institute of Purchasing Supply).	Identification of possible CSFs related to the successful deliver of supply chains, which will be utilised to form questions within a survey instrument.
2	2&3	Quantitative research – Data collection from questionnaire created from knowledge gained in phase 1	Data set collected and uploaded to SPSS for analysis in preparation of phase 3 of research.
3	2&3	Quantitative research-Exploratory Factor Analysis and descriptive statistics	Reduction in data offering loaded items against key components. Confirming CSFs associated to successful implementation of supply chain strategies
3	3	Quantitative research – Confirmatory Factor analysis	Confirmation of the plausibility of model-fit for the 7V conceptual framework and relationships between the themes.
4	4-5	Discuss the findings from the empirical research. Formulate a discussion from the evidence of the study in relation to theory and current practice	Discussion highlighting attainment of research objectives. and theoretical contribution of the study and contribution to practice

Table 3.1 gives an overview of how each of the research objectives are met within this thesis and during which phase of this study this occurred. It also briefly

describes the method for achieving the objective and the types of knowledge their attainment offers.

3.3.1 Phase 1 – Qualitative data collection

Aim – Attainment of research objective 1, which was to identify potential critical success factors, which could influence supply chains.

3.3.1.1 Approach

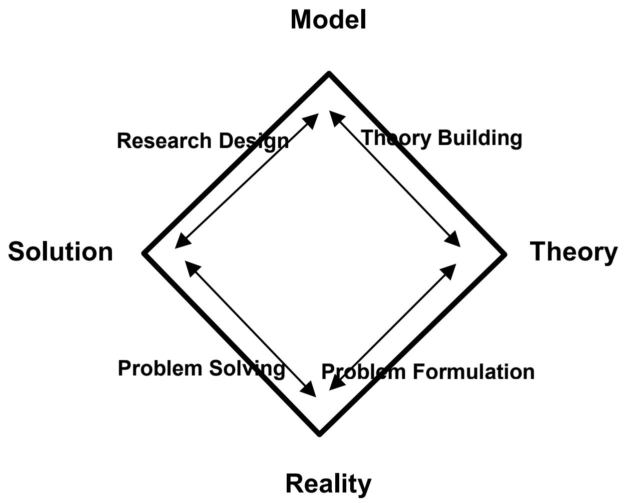
This research took a deductive approach and incorporated theory testing. Although the following section highlights that during the early phases of the research, knowledge was gained in a manner that sought to clarify themes suggested within the 7V Framework, it should not be misconstrued as theory building. According to Colquitt and Zapata-Phelan (2007) in order for theory testing to offer a high level of theoretical contribution, it is important that any conceptualisations that it is built upon needs to be validated. In the case of this study, this was achieved through phase 1 of the research.

Phase 1 of the study involved a review of supply chain literature to identify possible CSFs from the extant literature as shown in chapter 2. From this review 109 possible CSFs had been identified as was highlighted in section 2.6. Once a review of the literature was undertaken, initial contact was made with the Chartered Institute of Procurement & Supply. This organisation is considered to be “the premier global organisation serving the procurement and supply profession” (CIPS 2015).

The members of the CIPS are in the most part practitioners within the field of supply chain management. Informal round table discussion with members were set up. The focus of these discussions was based around their understanding of the themes associated to the 7Vs framework and CSFs associated to each theme previously identified within the literature. These round table discussions took place at the conclusions of local CIPS branch meetings. Van de Ven (2007) supports this process of engaging with key informants in relation to solving problems.

His Engaged Scholarship Diamond Model as shown in figure 3.1 emphasises that discussions with people with relevant experience is crucial, as it will embed the research in reality.

Figure 3.1: Engaged Scholarship Diamond Model



The model was very much embedded within the process during the attainment of phases 1 & 2 of this research. The engagement with people and knowledge experts which was highlighted by Van de Ven (2007) as being crucial, was prominent throughout these initial two phases of this research. For example, the approach in phase 1 focused around the prevalence of the themes and the CSFs within the literature and in turn through round table discussions with the CIPS members. The researcher would attend and seek out members of the CIPS at the conclusion of their regional branch meetings. This was facilitated during the social part of the evening where practitioners would come together to discuss issues or share information during the dinner part of the evenings. Having attended prior meetings in the effort to build relationships, this particular juncture of the meetings was identified as an excellent way to join conversations with practitioners. This allowed the researcher to seek assistance with understanding and development of CSFs identified within the literature. In the context of the Engaged Scholarship Model this process works towards theory building through initially addressing problem formulation. This meant utilising the knowledge of the people at the round table discussions to develop the operational understanding of the literature. In essence, this is what Van de Ven (2007) highlights as the 'problem formulation' and insists that grounding the problem or issue in reality is crucial in any research study. The round table discussions undertaken should not be mistaken for focus groups. The reason being is that these discussions were less structured and more informal than what may be expected from focus groups. In some instances, people at the table would seek out other members in attendance at the wider CIPS meeting who had more specialised knowledge, to join the discussions. In addition, unlike focus groups the process was not seeking to somehow collect data and analyse what the members were discussing. The members were embedded in the process of theory development; they were part of the research design, rather than part of the actual data collection during phase 1 of the research. In essence, this was purely part of a process that assisted in moving initial CSFs identified within the literature towards a practical understanding that could be interpreted by practitioners during phase 2 of the research.

3.3.1.2 Instrument design

The design of phase 1 of this study was structured to focus upon the attainment of research objective 1. Having identified the 109 possible CSFs from within the literature, it was then essential they were examined from an operational perspective before moving to phase 2 of the research. Through the round table meetings previously discussed, certain CSFs were adapted whilst new ones were identified. After two round table discussions with CIPS members, it was decided that 105 possible CSFs had been identified between the extant literature and the CIPS members. Table 3.2, highlights the changes made in relation to possible CSFs associated to each theme. These were all discussed in the context of the 7V conceptual Framework.

Table 3.2: CSFs post round table discussions

Themes	Number of CSFs identified from Literature search	Number of CSFs agreed upon post round table meetings
Value	9	26
Volume (Volatility)	13	9
Velocity	11	12
Variety	12	10
Variability	22	18
Visibility	29	20
Virtuality	12	11
Total	**109**	**105**

3.3.1.3 Outcome

In most instances, the CSFs stayed the same as those identified within the literature. However, within every theme changes were made that either saw CSFs increase or decrease for reasons such as:

Narrative - It became clear that language within the academic literature and practice could be confusing and more clarity was required. This was the case throughout most themes.

Overlap of CSFs - Similarities between CSFs were identified, this meant two or more were joined together to form one coherent CSFs. This was prominent in the CSFs associated with visibility as the amount associated to that theme was reduced by 9 CSFs.

Increase in understanding - There was an increase of 17 CSFs associated with the theme value. This happened during the first round table discussion. There was a consensus that the attainment of value highlighted more potential CSFs. Due to the input of the practitioners it was decided that it would be beneficial to validity of the study that additional CSFs identified through these discussion would be included in phase 2 of the research. The final 105 possible CSFs identified in phase 1 would be utilised in the design of the survey instrument for the primary data collection. On the conclusion of phase 1 and thus the attainment of research objective 1, the research study then moved onto phase 2 the quantitative data collection stage.

3.3.2 Phase 2 – Quantitative research – Data Collection

Aim – Design and dissemination of the survey instrument to lay grounding for attainment of research objectives 2&3

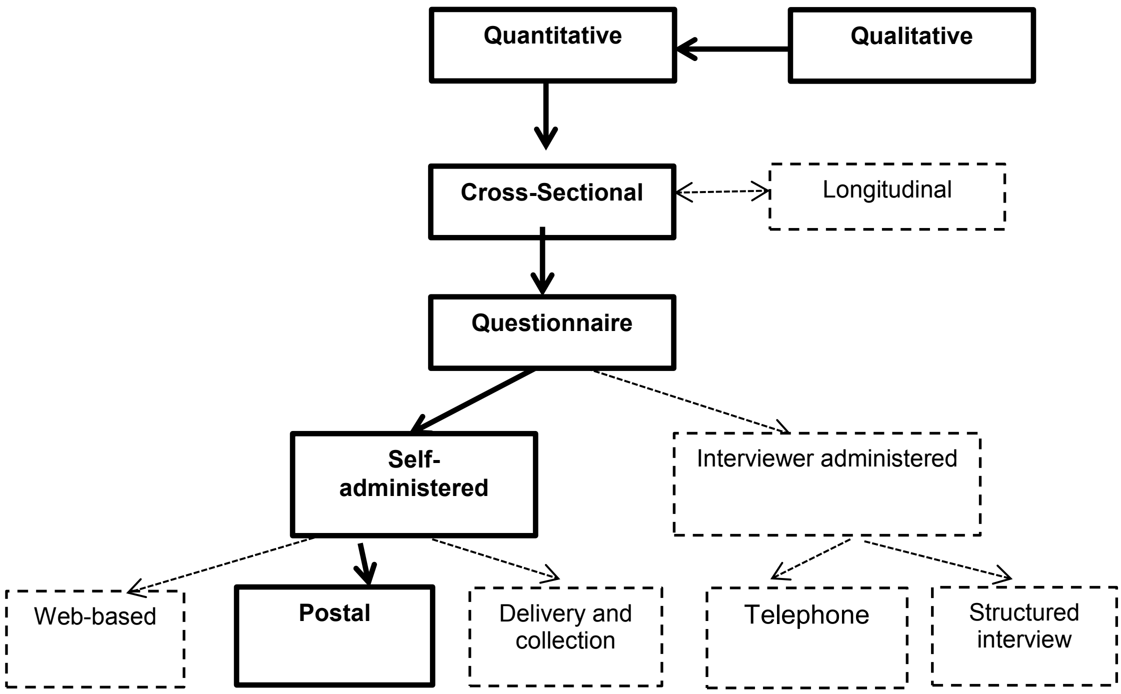
3.3.2.1 Approach

Phase 2 of the study involved the design of the survey instrument, which included three phases of piloting. The design of the questionnaire was structured around the 7V themes and the 105 CSFs identified through the completion of phase one of the study. Phase 2 primarily focused on the design of the survey instrument through to its dissemination to the designated sample. This phase was crucial for the attainment of research objectives 2 and 3 when the study moved onto phase 3. During phase 2 the population was identified from which the study sample was acquired. 3050 questionnaires were sent to supply chain decision makers within the United Kingdom. The aim was to gain a 10% sample from the chosen population in order to carry out the chosen analysis method in phase 3.

3.3.2.2 Instrument

The primary data collection undertaken incorporated a postal survey questionnaire. To ensure face validity of the questionnaire through the design and pilot stages, the opinions of key informants were utilised as previously mentioned. The following section will justify the decision of this chosen instrument and explain the process undertaken. Figure 3.3 gives a pictorial overview of the process; the bold arrows denote the path taken in this study in relation to the collection of primary data.

Figure 3.2: Research design decision route



(Saunders and Lewis 2012)

The choice of research methodology was addressed at the earliest opportunity and further investigation was carried out relating to the chosen method. With the philosophical underpinnings of the study grounded in pragmatism, the researcher was not seeking to debate the historic dualisms that would lead to the qualitative vs quantitative methods argument. It was felt that from the outset both methods would play their part in creation of a suitable instrument in which to gain the greatest opportunity to attain the overall aim of this study. Even though the research has a pragmatic approach it still fully accepts the importance of structure within the study

3.3.2.3 Justification of research tool

This study also gave due consideration to accepted methodological practices within the field of SCM, specifically around the research area pertaining to the themes of the 7V conceptual framework. Seminal papers that utilise a qualitative approach when focusing on the themes are Mentzer, DeWitt et al. (2001) Visibility; Coman and Ronen (2009) Variety & Value; Chen and Paulraj (2004) Velocity; Williamson, Harrison et al. (2004) Virtuality; Reichart and Holweg (2007) Volume and Siddiqui, Haleem et al. (2009) Variability.

However, quantitative methods are also an accepted practice within this research area. They are also located around the themes that are being researched by this study. Quantitative research within this field such as; Lancioni, Smith et al. (2000) Virtuality; Elmuti (2002) Volume & Velocity; Simpson (2007) and the more historic Forker, Mendez et al. (1997) Variability; Sengupta, Heiser et al. (2006) Value; Li, Ragu-Mathan et al. (2004) Visibility and (Simpson 2007) Variety lends additional support to the justification of such a method being utilised. From the SCM literature it was highlighted that in relation to CSF conceptual papers had earlier prominence. However, since the turn of the 20th century more quantitative papers have been published that highlight the use of survey instruments. These include Power, Sohal et al. (2001) Volume- Volatility; Elmuti (2002) Velocity & Variety; Samat, Ramayah et al. (2006) Variability; Patnayakuni, Ral et al. (2006) Visibility and Gunasekaran, Patel et al. (2001) Virtuality.

Further to that, research into CSFs within project management as discussed in section 2.1.1 highlights a clear precedence that has been set in using quantitative research methods in the gathering and understanding of this particular phenomena.

3.3.2.4 Question Design

It was crucial that the respondent's responses produced meaningful data in relation to the aim and objectives of the study. Using closed questions offered the opportunity to present questions quickly and clearly to participants, allowed for the comparison of responses and provided an opportunity to assess the representativeness of the findings to the wider population. (Appendix A). This is supported by Black (2009) who states closed questions are preferred for testing the generalizability of views to a larger population. Importantly, that is what this study achieves from the chosen population in relation to the 7V themes within the conceptual framework. Closed questions simplifies the collection of data into a quantifiable set for analysis, particularly when pre-coded which makes data management easier (Bryman and Bell 2003).

Although the variables addressed in closed questions were focused it assisted in giving them their operational definitions. In turn this assisted in confirming construct validity. In order to maximise the efficiency of the use of closed questions for this study the survey instrument utilised a 7-point Likert-Scale. There was an option of using a 5-point Likert-Scale instrument; however, a 7-point spread would give a clearer representation of views. The spread of the scale as is shown in figure 3.7 gave the respondent the choice of either 'strongly disagreeing, disagreeing, slightly disagreeing, having no opinion or slightly agreeing to agreeing or strongly agreeing. There is no doubt ambiguity and disagreement regarding the middle point (measurement) of any Likert Scale (Black 2009). Options were open to the researcher including words such as 'uncertain', or 'unsure'. In the case of this study the researcher wanted to reduce ambiguity from any response, these words highlighted could be interpreted of being unsure of the question being asked. It was felt that it was important that if a respondent had 'no opinion' regarding a statement/question then that should be recorded accordingly. These Likert-Scale type questions allowed the study to implement a fixed choice response, which is designed to measure the opinions of the respondents. In doing, so these most common of summative scales measured levels of agreement and disagreement related to the questions asked (Balnaves and Caputi 2012).

As evidenced below the seven-point Likert-scale response tool would minimize extreme responses. Likert-scale style questions have been utilized previously in established operational SCM research, in seminal papers such as Simpson (2007); Elmuti (2002) and Sengupta, Heiser et al. (2006) so the was a clear precedence identified. The next step was the identification of possible content and the design of the individual questions to. In order to do so, the study returned to the literature. A codebook was created from the 105 possible CSFs confirmed at the completion of phase 1.

Table 3.3: Extract from code book related to the theme Volume

Critical Success Factor	7Vs Theme	Source
Ability to alter predetermined delivery agreements	Volume	Reichhart and Holweg (2007)
Flexibility	Volume	Reichhart and Holweg (2007)
Changes in market conditions	Volume	Power et al, (2001)
Changes in demand	Volume	Narasimham and Das (2000)
Poor synchronisation	Volume	Christopher (2000)
Accurate forecasting	Volume	Hamment and Fisher (1997)
Decision making at the planning stage	Volume	Tyndal et al, (2000)
Data accuracy	Volume	Mullor (2000)

An extract from the codebook is shown in Table 3.2. This highlights the starting point for the development of the questions. Once the individual CSFs relating to each theme had been identified from the literature, the researcher then moved onto the next stage of question design. As Black (2009) suggests, at this stage of the question design, if the survey instrument was going to be reliable, it was crucial that its respondents would interpret the questions being asked in a similar manner.

Figure: 3.3: Extract from questionnaire – questions related to Volume

***Volume:** 'Ensuring that customers have the flexibility to increase and decrease volume as their demands dictate'*

To ensure that **volume** flexibility can be offered to customers, it is important that…	**Strongly disagree**	**Disagree**	**Slightly disagree**	**No opinion**	**Slightly agree**	**Agree**	**Strongly agree**
…the supply chain has the ability to alter pre-determined delivery dates	☐	☐	☐	☐	☐	☐	■
…the supplier understands the customers market conditions	☐	☐	☐	☐	☐	■	☐
…the suppliers are able to anticipate changes in demand	☐	☐	☐	☐	☐	☐	■
… forecasting is accurate	☐	☐	☐	☐	☐	☐	■
…the supply chain has reliable suppliers	☐	☐	☐	☐	☐	☐	■
…data being used throughout the chain is accurate	☐	☐	☐	☐	☐	■	☐
…decisions at the planning stage are correct	☐	☐	☐	☐	☐	☐	■
…the behaviour of everyone in the supply chain is integrated	☐	☐	☐	☐	☐	■	☐
…the supply chain is flexible enough to deal with sudden changes in demand	☐	☐	☐	☐	☐	■	☐

With that in mind the CSFs identified were developed to include a narrative that made operational sense, ensuring that respondents would understand what was being asked. In order to accomplish this before each question was asked, a short definition was given prior to the main questions confirming operational meaning of the theme being investigated, as can be seen in figure 3.7. Once the operational definition of the theme was articulated, the next stage was to lay out the question that encompassed a main question in conjunction with the Likert scale being utilised and the individual CSFs. As can be seen from figure 3.7 this was accomplished by an overall statement style question that was then followed by the related CSF identified, for example questions related to volume (figure 3.7) would be as follows;

"Statement"

To ensure that volume flexibility can be offered to customers, it is important that…

…the supply chain has the ability to alter pre-determined delivery dates (Question 1)

…the supplier understands the customers market conditions (Question 2)

After ensuring that the questions being asked, flowed from the statement to the CSFs, next the closed options replies from the previously highlighted Likert scale were added. This style of statement and questions is continued throughout.

3.3.2.5 Pilot testing

As highlighted by Bryman and Bell (2003) the importance of carrying out pilot testing prior to a self-completion questionnaire being administered is crucial. The pilot testing within this study carries many functions related not only to the actual questions of the questionnaire, but also to the confirmation that the overall process and its design are suitable (Balnaves and Caputi 2012). Importantly for this study, the process undertaken within the piloting stage ensured in assisting that face validity. The process that was undertaken can be broken down into three distinct phases as follows:

Pilot Testing Phase 1

The first phase constituted an initial draft of the questionnaire with questions drawn from the codebook. This draft was used to inform discussions with supply chain decision makers. These decision makers were members of the professional body the Chartered Institute of Purchasing Supply (CIPS). The draft was also discussed in depth with senior academic members of Manchester Metropolitan Business School. These academics have extensive knowledge of both the area of research and this particular method of collecting data. At this point, the focus of the initial pilot testing and meeting with CIPS members focused on construct validity and operational definitions of the 7V themes. It also concerned itself with the operational understanding of the questions, language being used and the relationship the questions had to the research objectives. Through this initial stage of piloting, specific changes were made to questions that the members of the CIPS felt were too academic in their wording. They felt that the interpretation of these questions could prove problematic. Therefore, wording and narrative were adjusted accordingly before phase 2 testing began.

Pilot Testing Phase 2

Following phase one, the changes were made to the questionnaire and the second phase of the pilot testing encompassed face to face round table meetings with 8 members from the CIPS. During this phase, focus was set around each individual question and the language used. At this point, questions requiring adapting and restructuring were amended during the meeting. This was a crucial part of the process as it allowed the researcher the opportunity to better understand, how potential participants within the larger sample would react to certain questions. In addition, a key change to the questionnaire at this point was to the structure; each of the themes was given their own subsection. Due to subsequent discussions that took place at the meeting, the researcher inserted a short definition of each theme prior to the subsequent question being asked as highlighted in figure 3.7.

Pilot Testing Phase 3

The third phase of the pilot testing involved the researcher utilising the supply chain network built up during the life cycle of the study. This particular network consisted of individuals met through meetings with CIPS members and subsequent introductions made by them through ‘LinkedIn’. The researcher considered all members of this sample group (30 members) to be decision makers who operated within operational supply chains. This phase of the pilot testing was facilitated by a previous agreement with the participants. This enabled a 100 per cent response rate by directly emailing each individual a copy of the questionnaire that had previously gone through two phases of piloting.

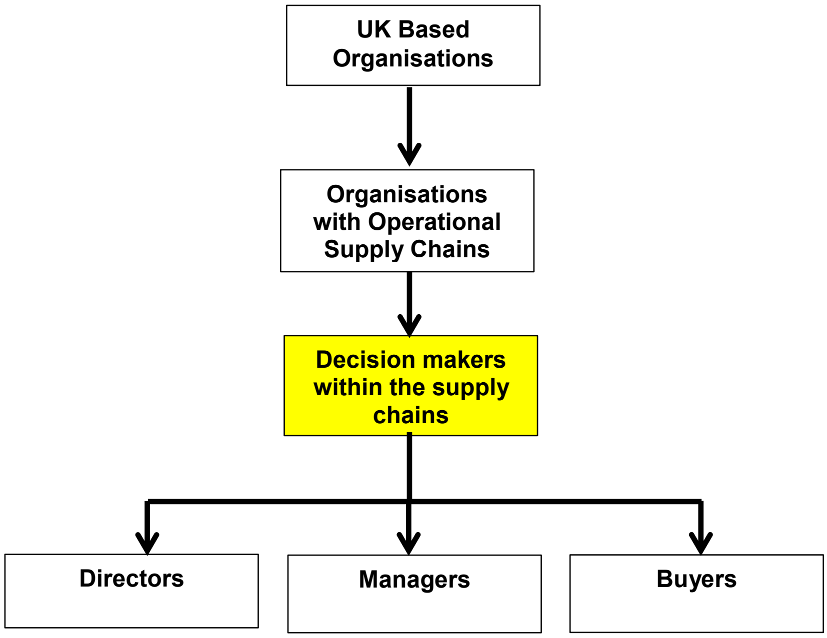
Respondents were requested to complete the questionnaire and comment upon its structure and language etc. This phase again proved valuable to the study as issues surrounding understanding the themes, enabled the researcher to re-address the short definition before each section.

From this final pilot test, minimal changes were made to the final questionnaire. In addition, from the returned questionnaires an initial database was created on SPSS and descriptive analysis was undertaken. This allowed for the identification of any issues that may have arisen from the transferring of data from the questionnaires to a digital format. On completion of the pilot test, all subsequent changes had been made and the questionnaire was considered ready for dissemination to the population as discussed in the following section.

3.3.2.6 Population and sampling strategy

Within social science research, Balnaves and Caputi (2012) explain that ‘sampling’ is seen as a technique for selecting a subset of units for the purpose of analysis from a given 'population', with the premise being that representativeness is possible from good sampling procedures. The importance of the correct population being chosen is highlighted Black (2009) who informs that it is the 'individual' that is the primary concern within social science research. It is these individuals, that offer their subjective thoughts to this study and which the researcher measures in an objective manner. The population of the current study was a group of individuals who shared the same set of traits and experience within the area being researched. This study utilised probability sampling, more specifically simple random sampling. The sampling frame for this study was derived from a database containing key decision makers within operational supply chains located within organisation based within the United Kingdom.

Figure 3.4: Sampling framework



To gain direct access to a sample of the population the study utilised the 'Data Partnership Ltd' to purchase a contact list of 3050 contacts of what the study considered to be decision makers within organisational supply chains within the United Kingdom. This is an acceptable practice in SCM research such as Li, Ragu-Nathan et al. (2004) and Kannan and Tan (2007) have used data bases they have not created. However, Bryman and Bell (2003) warned that a problem with using existing databases is that they are often, incomplete, inaccurate and out of date. This was the case with this study as 76 questionnaires were returned incomplete, acknowledging that the persons targeted within that organisation no longer worked there.

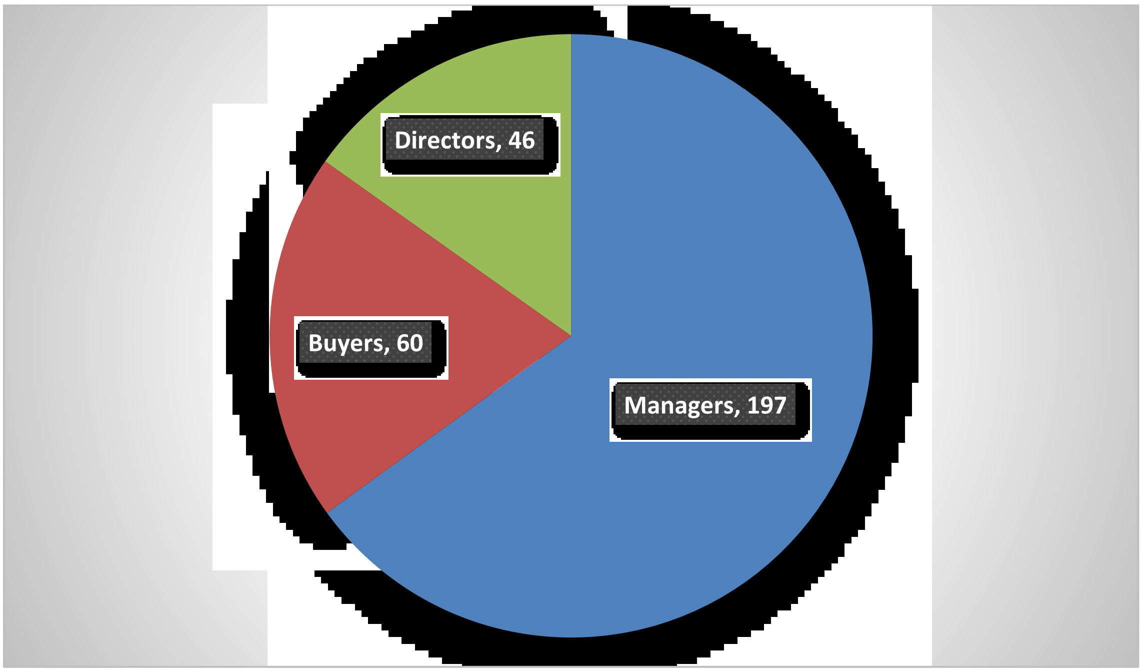
Figure 3.4 highlights the sampling framework for this study and concerns itself with decision makers within operational supply chains based in the United Kingdom. Within these organisations, experienced decision makers were targeted such as supply chain directors, managers and buyers. As highlighted in in table 3.4, these jobs titles varied; 34 different organisational job titles within the 3050 sample were utilised by this study. The group was analysed as a whole. There was no stratification sought according to job role. It is important for the researcher to highlight that for any future study these job titles had been deemed acceptable and fit within the population criteria of decision makers within operational supply chains. This was a decision that was taken following round the table discussions with supply chain experts. To give order to the 34 job titles highlighted in tables 3.4, the study bracketed the decision makers into these generic titles as shown in figure 3.8.

Table 3.4: Organisational title and breakdown of population targeted

Organisational Tile	Participants in Sample
Buying Director	17
Buying Manager	6
Chief Buyer	40
Chief Procurement/Purchasing Officer	7
Chief Supply Chain Officer	1
Director of Purchasing	3
Director of Supply Chain Services	2
Group Buyer	1
Group Procurement/Purchasing Director	6
Group Purchasing Manager	11
Head Buyer	10
Head of Group Procurement	1
Head of Procurement	21
Head of Purchasing	72
Head of Supplies	1
Head of Supply Chain Management	2
Procurement Director	10
Procurement Manager	95
Purchasing Controller	5
Purchasing Coordinator	57
Purchasing Director	110
Purchasing Manager	2414
Purchasing Supervisor	2
Senior Buyers	31
Senior Procurement Managers	2
Senior Purchaser	1
Senior Purchasing Managers	2
Supplier Manager	1
Supplies Coordinator	2
Supplies Manager	39
Supplies Officer	9
Supply Chain Coordinator	1
Supply Chain Director	8
Supply Chain Manager	64
TOTAL	**3050**

As an additional way to show rigor of the data collection, it was not presumed that the job titles supplied by the contact list were wholly accurate. In order to ascertain if the respondents could be categorised as supply chain decision makers, a survey question asked directly for each job title within a categorisation of Director, Manager and Buyer. The responses from the survey question related to job role, are shown in appendix F and figure 3.5. They highlight that from the sample of 303 participants, 197 classified themselves as managers, 60 as buyers and 46 as directors. It should be reiterated that no stratification was sought and the main reason for the question being asked was to confirm that the respondents could be classed as supply chain decision makers and fit within the sample framework.

Figure 3.5 Sample by Supply Chain decision maker type



3.3.2.7 Questionnaire Dissemination

Although, the researcher had email addresses for the targeted sample group within the organisation it was felt that the low response rates associated to on-line surveys as suggested by Bryman and Bell (2003) would leave the researcher nowhere to go if the uptake in requests was poor. According to Dillman and Groves (2011) self-administered postal surveys have higher response rates than online surveys, therefore it was deemed this approach would be more beneficial to this study. Another benefit to a postal questionnaire was that the targeted population was located throughout the United Kingdom. As there was a requirement for a large sample an interviewer administered questionnaire was impractical due to time and cost implications.

Table 3.5: Advantages and disadvantages of postal survey design

Advantages	Disadvantages
Results are easy to assimilate and communicate	Questionnaire can be confusing and need simple and easily understood questions
Results can be presented in different formats and can incorporate several issues in one survey	Postal surveys involves a lot of administrative work by the researcher
Large numbers of people can be contacted, either targeted or at random, at relatively low cost	Poor design can produce misleading results
Respondents less influenced by interviewer so assist in the reduction of biasing error	Researcher can't control who completes the questionnaire
Respondents complete questionnaire in own time, this may lead to more considered responses	Poor response rates starting to be associated to postal surveys (reminder's sometimes required)
The sample can be statistically accurate	
Accessibility	

(Bryman and Bell 2003, Creswell 2012, Saunders and Lewis 2012)

The advantages of postal surveys outweighed the disadvantages. It was possible to address some of the disadvantages through careful planning. Each of the postal questionnaires sent to participants highlighted in the sample shown in table 3.4 was accompanied by a printed letter (Appendix B). In addition, a return addressed envelope and a complements return slip was also inserted in to the envelope (Appendix C). The slip offered the respondent the opportunity to receive a copy of the findings from the study.

It was envisaged that this offer of reciprocal information sharing would motivate possible respondents, in a manner that would increase the return rate of the survey. The printed envelopes containing the questionnaire and accompanying documents were collated and sorted into batches of approximately five hundred. Due to restrictions set by the University postal room, these were then sent out in these batches over a six-day period. The return response rate will be discussed in sub-section 3.3.3.2.

3.3.3 Phase 3 - Data Collection and Analysis

Aim – Collection of quantitative data and analysis in attainment of research objective 2 & 3

3.3.3.1 Approach

Phase 3 of this study focused primarily upon the attainment of research objectives 2 & 3. An SPSS data file was created from the responses that took place from the survey instrument disseminated on conclusion of phase 2. During this phase, research objective 2 was first to be addressed. This took the form of an Exploratory Factor Analysis (Principal Component) that was carried out to facilitate the identification of heavily loaded items.

Next step in phase 3 to was to address objective 3. This focused upon the confirmation of the plausibility of model-fit for the 7V conceptual framework and the identification of relationships between the themes. By carrying out a Confirmatory Factor Analysis (CFA), objective 3 was achieved. On conclusion of phase 3, the study had at this point attained research objectives 1-3. This gave a grounding for the subsequent discussion to take place in phase 4 and where the attainment of the final 2 research objectives 4 & 5 would be the focus.

3.3.3.2 Postal response and data treatment

The response rate was 303 completed questionnaires from 3050 distributed. By extracting the 76 questionnaires that are known to not have reached their intended recipient's, it can be confirmed that the overall response rate from the postal survey was 10.3 per cent. Data treatment was of prime importance to assist in the reliability of the study (Black 2009). Within this study, the researcher was proactive in preparation of the returned questionnaires. Each returned questionnaire was numbered, dated and then filed into folders. This quality process was put in place in case of possible mistakes when inputting data, such as missed data input on the SPSS file. The researcher then had the ability to return to the numerically filed questionnaires, to track back to the exact question answered and find the missing data. The returned complements slips from the respondents requesting a copy of the initial research findings were logged for future reference. Before the information from the questionnaires could be analysed, it was uploaded to an SPSS file. The researcher created the SPSS file prior to the questionnaires being returned. This was necessary due to the pilot testing stages as discussed in section 3.4.5. and allowed the researcher to develop; design and test data file in conjunction with the questionnaire going through the piloting stages.

3.3.3.3 Data Analysis – Statistical Tool

This section focuses on the specific attainment of research objectives 2 & 3 whilst offering a foundation for discussion related to objectives 4 & 5. Stage 1 of the data analysis focused on the data collected from the survey being analysed using Exploratory Factor Analysis (EFA) to assist in the confirmation of CSFs which assisted the specific attainment of research objective 2. As there are differing options open to a researcher when undertaking EFA, this section also clarifies the process undertaken during this study. In the first instance, this was possible by justifying the study's use of EFA and the parameters that were set during the analysis.

Stage 2 of the analysis sought 'model fit' by undertaking a Confirmatory Factor Analysis (CFA). The findings from this analysis assisted the attainment of research objective 3 which was to reconceptualise effective supply chain strategies on the evidence from the study. In utilising these forms of analysis, the study agrees with Bagozzi (1983) suggestion that EFA and CFA approaches can be seen as specific ends on a continuum. EFA is a technique for reducing data thus offering a structure to the CSF's associated to each of the 7Vs themes within the conceptual framework, whilst the CFA will allow a form of testing the structured that has been created and offer a theoretical contribution from its findings.

3.3.3.4 Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) is a widely used statistical technique utilised within the social sciences (Floyd 1995, Costello and Osborne 2005). The literature discussed in chapter 2 highlights that it is also prominent in relation to the research associated to CSFs in SCM (Forker, Mendez et al. 1997, Power, Sohal et al. 2001, Elmuti 2002, Ueno 2008).

Other types of analysis techniques were considered for this study. From the literature, tables highlighted throughout chapter 2 that Regression Analysis and Descriptive statistics as well as EFA were the most common forms of analysis within academic studies into this research area. This study accepted that descriptive statistics would be able to highlight key issues in relation to the study, but would not be enough on their own to confirm CSFs, nor would it be suitable to see if the 7V Framework could be validated as a model. Regression Analysis, did offer a process for estimating relationships between variables and had the capacity of analysing several variables at once (Field, 2009). The drawback to the utilisation of regression was what it would actually be analysing. With regression, the focus is on a relationship between a dependent and one or more independent variables. Further to this, it also focuses on the strength of the relationship between variables. There is evidence of regression analysis being utilised in the area of CSFs in SCM studies such as Elmuti (2002). However, the focus of that particular study was to investigate integrated behaviour between customer and suppliers and the strength of such relationships. When identifying operational CSFs in supply chains the actual relationship or strength of relationship is not of prime importance. In the case of this study, it was the ability of EFA to reduce data that specifically links to the attainment of research objective 2; ‘analyse findings from the empirical study with a view to confirming or disconfirming CSFs’ which influenced the decision of it being chosen as a research method. As a multivariate statistical method, EFA seeks to clarify the structure of interrelationships found within a large set of variables (Hair, Black et al. 2006). The reason that this study utilizes EFA rather than regression is that as a data analysis technique, it seeks to identify variables (CSFs) that load heavily onto key factors/components (Themes). Further justification for the use of EFA comes from the research field of SCM and its CSFs. Power, Sohal et al. (2001) seminal paper on ‘critical success factors in agile supply chain management’, has informed key research throughout the field of SCM. Their data collection instrument of questionnaires sent to key decision makers within manufacturing industries in Australia draws clear comparisons with this study.

It is important to note that EFA has few absolute guidelines (Field 2009). EFA offers varying options, which leads to complexity. In the simplest cases, these varying options that lack definition that can be linked by basic terminology which can be identified between the differing software packages available to carry out such analysis, such as SPSS and SAS. There are varying options open to a researcher during the analysis (Field 2009). It is also crucial to ensure replicability and that the options taken within research are well documented and justified. In this study, the variables are the CSFs previously identified which informed the survey instrument. The study uses EFA to identify the separate dimensions (factors), which are individual Vs of the conceptual framework. In doing so, the factor analysis allowed the researcher to ascertain how each variable was attributed to the dimensions/components (Individual Vs). EFA assists the researcher in identifying the variables/items (CSFs) associated to each of the individual themes.

In undertaking the EFA, the study utilised 'principle component analysis' (PCA) rather than component analysis. The reasoning for this is that PCA unlike component analysis does not discriminate between shared and unique variance (Costello and Osborne 2005). In the strictest sense there are arguments that PCA is not factor analysis in the purest sense; however, as highlighted by Field (2009) the two approaches more often than not produce similar results. PCA is an analysis technique for identifying groups or clusters of variables and serves three main purposes. The first assists in the understanding of the structure within a set of variables (The CSFs in this research). Secondly, it measures the underlying variables within the questionnaire and finally it reduces the data set so that it is easier to manage (Field 2009). As this study sought to reduce the number of variables/items (CSFs) within the data file, the utilisation of PCA was suitable. When undertaking PCA, it is necessary to test the adequacy of the sample size being utilised in relation to the analysis undertaken.

A general rule of thumb has been 'the more participants the better' with subject-to-variable ratios of 5:1 being an accepted norm (Floyd 1995, Hair, Black et al. 2006). Others such as Gorsuch (1990) state that as well as the 5:1 ratio, there is also a requirement for a minimum of 200 within the sample size, which is, double the amount that is suggested by Streiner (1994). This study utilised Kaiser-Meyer-Oklin (KMO) and Bartlett's Test of Sphericity. KMO and Bartlett's tests play a crucial part in the confirmation of sampling adequacy of this study. KMO ranges between 0 to 1. Accepted levels for sampling adequacy are those above 0.5 (Field 2009). If the KMO for the factor analysis in this study had been valued at 0 then that would have indicated the amount of partial correlations was high when compared to the overall amount of actual correlations. This would in turn indicate diffusion and would highlight the inappropriateness of using factor analysis with the sample available (Field 2009).

Likewise if the test in this study yielded a value closer to 1, then that would suggest that correlations and patterns associated to them can be seen as compact and therefor the factor analysis will produce factors that are reliable and acceptable. It is also beneficial to highlight the varying levels of KMO values and consideration should be given to these acceptance levels; 0.5 - 0.7 is classed as mediocre, 0.7 – 0.8 good and 0.8 - 0.9 great whilst values above 0.9 are classed as superb (Hair, Black et al. 2006, Field 2009). In addition, Bartlett's Test of Sphericity relates directly to the overall significance and measures validity and suitability of the responses to the actual problem being addressed within the study. In measuring the suitability of Bartlett's, this study seeks a significance value of less than 0.05. Field (2009) suggests that in order for factor analysis to work there is a requirement for some relationships to be evident, meaning that by carrying out the significance test it will inform the researcher of the r-matrix that could be an identity matrix is in fact not, then there are the required relationships and therefore factor analysis is deemed appropriate. The next step addressed the extraction method undertaken; in essence which rotation the researcher should use. Field (2009) suggests that through rotation, the interpretability of certain factors is improved. In utilising rotation, it allowed the analysis to maximise the loading of the variables (CSFs) onto the individual factors (Themes) whilst at the same time attempting to minimise the variables loading over more than one factor. In selecting ‘Varimax rotation’, it is accepted that an orthogonal rotation instead of oblique rotations such as Promax was the preferred. In doing so, the study is accepting that at this point the factors are independent off each other.

As the current study did not seek correlations between factor scores it utilised the method proposed by Anderson-Rubin test instead of regression (Field 2009). Bartlett’s test produces unbiased scores that only correlate with their own factors. However, Field (2009) states that the Anderson-Rubin test although similar to Bartlett’s test generates factors scores that are standardised and uncorrelated. The study reduced a large set of data into smaller subsets. Field (2009) suggests this analysis ensures that the coefficient display format will sort the variables by size so that it is easier to interpret the factors. Stevens (2002) suggests that for a sample size over 300, supressing smaller loadings at less than 0.298 is acceptable but the variance in the variable is then considered low. However, the significance of this loading gives little in the way and that a factor loading of greater than 0.4, which accounts for 16% of variance within the variable. It is from that level that this study used as a starting point. Once the descriptive, extraction, rotation, scores and options were addressed then the analysis was run. The EFA and the subsequent outputs associated to it will be discussed further chapter 4.

3.3.3.5 Confirmatory Factor Analysis

Once the EFA was completed and identified which variables/items (CSF) loaded heavily against specific components, the next stage of the analysis undertaken was to carry out a Confirmatory Factor Analysis (CFA). The study has highlighted literature that has utilised CFA in relation to themes from the 7V Framework (Li, Ragu-Mathan et al. 2004) and CSFs associated to themes (Fotopoulos and Psomas 2009). As highlighted by Schreiber (2006) the confirmatory technique CFA is theory driven, meaning the planning of the analysis is driven by the theoretical relationships among the observed and unobserved variables (the themes and the CSFs). The CFA was undertaken using a specific model. Primarily CFA was undertaken to achieve research objective 3, which was to 'examine CSFs influencing supply chain strategies applying a 7V conceptual framework' and to assist in attaining research objectives 4-5.

Up to this point the researcher has limited control over which variable loads onto which factor (Hoyle 2000). As discussed by Hair, Black et al. (2006) CFA gives control back to the researcher in that they can seek to establish a goodness of fit (model fit), which was not possible with the previously discussed EFA when utilising principle component. CFA is also seen as a validation technique in relation to the measurement of specific constructs (Hair, Black et al. 2006). As highlighted by Diana (2014) by undertaking a CFA it was possible to validate the relationship between unobserved constructs and observed variables. In essence, the study uses CFA to see if the 7Vs conceptual framework is plausible. In doing so, it is important to note that in using CFA the study evaluates the plausibility of model-fit between themes within the 7V conceptual framework, it does not, seek the causal nature between factors and variables. The findings from the CFA like the previously discussed EFA assist the researcher in attaining research objective 4 for this study. As with EFA the study ensures that, the CFA outputs generated from the SPSS-Amos statistical tests were evaluated, in a manner that offered validity to the findings. Unlike most statistical data analysis techniques, CFA utilises multiple tests in an effort to determine the plausibility of model fit.

Schermelleh-Engel (2003) state that this means that a good model fit merely gives an indication that the model is plausible, it will not explain large proportion of covariance nor will it even confirm that the model is correct. It is noted that in relation to model fit indices many have developed, this can lead to confusion and conflicting conclusions as to the extent to which a model is plausible (Schermelleh-Engel 2003). In choosing specific model fit indices this study gives a polarised view by utilising indices that may be conflicting. This ensured it was reported in an unbiased manner. In order to achieve this the analysis initially focuses on Chi Square. To supplement Chi Square, Bollen (1989) suggests further Goodness of Fit Indices (GFI) should considered. With that in mind the findings also report on Baseline Comparison such as the commonly used Comparative Fit Index (CFI) as discussed by Bentler (1990), which suggests that a good model fit can be measured with an output close to .900. Whilst, Bollen (1989) offers Incremental Fit Index (IFI) as an alternative Baseline Comparison where values of close to .950 also offer the suggestion of good fit. Mulaik, James et al. (1989) state that a balanced approach to the analysis is necessary to ensure that compensation is made for the possibility of artificial fit from eliminating more parameters associated to baseline comparisons. They suggest by simply freeing parameters goodness-of-fit can be achieved, however, this would dilute the model. To overcome this issue, the parsimony of the model-fit is measured through PRATIO and the Parsimonious Normed-fit index (PNFI); the analysis sought scores of >0.900 and >0.600 respectively (Mulaik, James et al. 1989). The final index reported in an attempt to highlight the plausibility of model fit is the root mean square error of approximation (RMSEA). Brown and Cudeck (1992) discuss the subjective manner in which RMSEA should be interpreted, highlighting that 0.05 should be regarded as a close fit, but that this figure is not infallible. They further suggest that a score of 0.1 would indicate a reasonable error for approximation and would not recommended that as a close fit. Others such as Bentler and Hu (1999) suggest a score of 0.06 the plausibility of model fit.

3.4 Reliability and validity of the research design

There is little doubt that validity and reliability issues can be the main factors that can weaken the power of a research study (Black 2009). Maximising both construct and internal validity within this study reduces any bias in its conclusion; however, as highlighted as an issue by Balnaves and Caputi (2012), validity should not be achieved at the cost of reliability.

Reliability

The reliability of this study is linked to the extent in which other researchers would arrive at similar results, if studying the same case, data collected and following identical analytic procedures as the original researcher (Field 2009, Saunders, Lewis et al. 2012).

Achieving reliability was not a simple process. An example of a threat to reliability in this study was that of ‘participant error’; if a participant incorrectly completed a questionnaire i.e. rushing through due to how busy they are. Another threat was ‘participant bias’, in which a false response i.e. a participant given false positive answers to make themselves come across as having more importance than their role would suggest. The issue surrounding researcher error was another threat to reliability during this study. The researcher undertook over 63,000 individual data inputs from the questions answered related to the questionnaire returned onto a SPSS file. This task was managed in a manner that the researcher minimised errors through a quality check in place throughout the inputting process. Finally, there was the potential for an issue surrounding 'researcher bias', which Saunders, Lewis et al. (2012) suggests as being linked to the researcher using their own subjective opinion when recording or interpreting responses from participants.

As this study collected data from a structured questionnaire, this issue is minimised but not eradicated. The researcher ensured that all data inputs were correct and any ambiguity with responses i.e. two or more responses to the same Likert-scale question, then the response is was not recorded. The most appropriate way to deal with the threats highlighted in relation to reliability was ensuring this study is transparent which allows others to judge its reliability if they wish to replicate the study (Saunders and Lewis 2012).

However, the researcher notes Balnaves and Caputi (2012) warning that reliability cannot in itself be deemed sufficient enough to guarantee a high standard of research. For this to be possible the study also considered validity and its various forms. The study clearly addresses the issues surrounding construct, external and face validity which will now be discussed. However, it will not focus upon internal validity. The justification for this is that, internal validity is seen as to what extent the design of your research study will allow the researcher to justify conclusions related to potential relationships between variables (Black 2009, Balnaves and Caputi 2012, Saunders, Lewis et al. 2012). In essence, internal validity focuses on 'causality' related to potential relationships of variables. Although this study will attempt to identify and confirm relationships between the identified themes it will not seek causality so will therefore not seek to guarantee its presence within the process.

Construct validity

This study confirms construct validity by ensuring that the data collection instrument measured what it is supposed to. In doing this the researcher asked, can the constructs be operationalised? (Field 2009, Balnaves and Caputi 2012) This specific issue was addressed early within the study's life cycle. The importance in doing so is highlighted by Black (2009) who states that issues related to research outcomes are more likely to be traced back to the how the construct was defined rather than the instrument that has been put in place to measure it.

Within this study, themes are operational constructs that have been built upon existing theories and literature highlighted in chapter 2. It was accepted that these constructs could have been fundamentally flawed and if not checked the study would be attempting to analyse themes that should not be measured and offer no validity. To overcome this potential issue this study established that each of the seven themes constitute a valid operational definition of the constructs, as can be seen throughout section 2.3.

External Validity

The study addressed external validity which relates to the findings of this study being able to be generalised beyond the specific context of the research (Saunders and Lewis 2012). It is stated that the selection of the participants within the population is critical and should be noted as a key issue for quantitative researchers who seek to produce representative samples (Bryman and Bell

2003). The sample and the conditions of this study are “representative of the situations and time to which the results are to apply” (Black 2009). To ensure validity of this, studies results can be applied to the selected sample, the researcher ensured any issues around planning, design and execution were addressed at each stage of the process. Within this study external validity was addressed by the way in which the population was identified and the sample was gathered. This is clearly articulated in section 3.3.26.

Face Validity

Although similar to construct validity, face validity was considered and actioned upon. Face validity is seen as, the extent in which a test is viewed by its participants. In essence similar to construct validity in how closely it measures what it is meant to (Holden 2010). In the case of this research it asks the question ‘will the participants see the questionnaire and what is being asked as valid. In order to for Face validity to be achieved the researcher worked closely with professional members of the Chartered Institute of Purchasing Supply (CIPS) when designing the questionnaire. Initial group meetings focused around the meaning and understanding of the individual 7V themes. There was a clear attempt to ensure that the themes constructed within the literature would translate to an operational sense. Through the initial piloting stages the 7 themes were closely investigated to ensure face validity as were the questions being asked within the survey tool.

3.5 Summary

This chapter outlined the first three phases of the research. It highlighted the key elements of the instrument applied to this study, and these were explained and justified. The following chapter will now highlight the findings of the thesis as it moves into phase 3 of the study, which is post collection of quantitative data through the survey instrument and subsequent analysis of data.

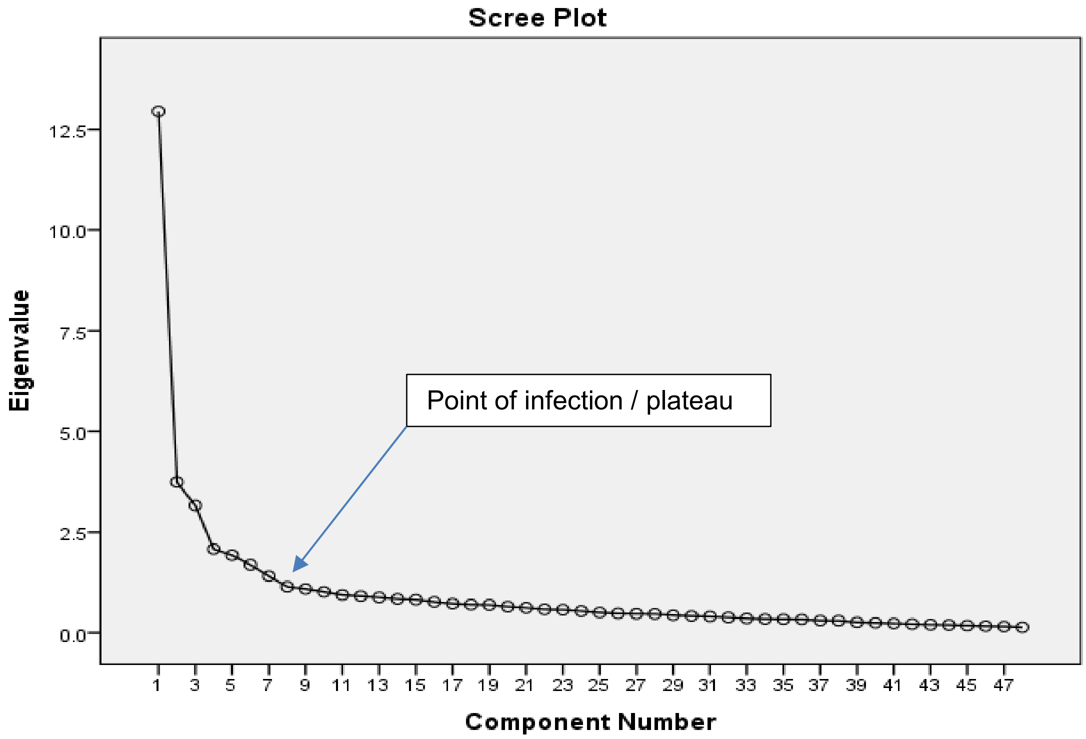
Chapter 4 Findings

This chapter reports the results of the findings from phase 3 of the study. The Descriptive statistics, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) findings are highlighted. All analysis was conducted using SPSS and AMOS software. As previously stated the purpose of the EFA was to achieve research objective 2, which was to analyse findings from the empirical study with a view to confirming or disconfirming CSFs. The EFA is complemented by the inclusion of descriptive statistics. The chapter then states the findings of the CFA and highlights the plausibility of model fit, which in turns initiates the process of validating the 7V Framework. The results of the CFA lay the foundations for seeking clarification on the issues surrounding research objective 3 which was to examine CSFs influencing supply chains applying a 7V conceptual framework.

4.1 Exploratory Factor Analysis

The EFA (principal component) utilising varimax rotation was carried out to validate the 106 possible CSFs highlighted during phase 1 of the research. In conjunction with the factor extraction, specific tests relating to sampling adequacy and overall significance such as Bartlett's Test of Sphericity were undertaken. Kaiser-Meyer-Olkin (KMO) measurement of sampling adequacy highlights a 0.898, which is classed as great and above the commonly recommended measurement of 0.6. Bartlett's Test of Sphericity revealed a level of 0.000 which suggested the strength of the relationships between the variables was strong. In addition to both KMO and Bartlett's it was also found that the commonalities were all above 0.3, this lends weight to the assumption that each item shares in part some common variance with other items. By focusing on these three initial indicators, it was decided that proceeding with EFA was justifiable. As discussed by Field (2009) the initial stage of factor extraction is to determine the linear components within the data set. The researcher accepts that every component will have a value, but not all components are valued equally.

Figure 4.1: Scree plot



(Compiled by the author)

Table 4.2 displays the initial Eigenvectors which demonstrates that that 27.1% of variance is explained by the first component. The second and third components explain 7.7% and 6.6% of variance respectively. The fourth, fifth and six components contribute to 4.2 %, 3.9% and 3.4% of the variance respectively, and the seventh constitutes to 2.8%. The first seven component factors account for to 56% total of the combined the variance, which is well above the recommended 50% (Field 2009). When utilising EFA to reduce the items and determine factors it is recommended that with a sample of more than 250 participants a scree plot assists in determining the number of factors extracted. In the case of this study figure 4.1 shows that after component seven the rest of the components start to plateau, suggesting seven factors.

Table 4.1: Factor Analysis - Rotated component matrix

Component	1	2	3	4	5	6	7
Visibility (α = 0.918)							
Culture of integration within SC	.822						
Suppliers are fully integrated within SC	.797						
Cooperation between managers within the SC	.677						
Processes within SC are integrated	.676						
Joint planning of SC between SC members	.673						
Cooperation & collaboration amongst SC members	.663						
SC members share information openly	.662						
Open relationship with suppliers	.647						
SC members have organisational compatibility	.614						
Virtuality (α = 0.890)							
Infrastructure mismatches addressed with suppliers		.799					
New SC members IT capabilities evaluated before insertion to SC		.756					
Differing processes between SC members identified		.726					
Standard IT platform agreed between SC members		.704					
Integration of SC members IT systems takes place		.696					
IT security risks evaluated & managed		.648					
SC members have compatible technologies		.604					
Variability (α = 0.864)							
Quality standards maintained			.783				
Products meet customer specification /quality requirements			.749				
Quality not unambiguous but specified			.748				
SC Managers understand quality standards			.691				
New SC members are vetted and understand quality procedures			.656				
Lower tier suppliers agree to quality standards			.600				
Procurement of defect free product			.590				
Initial design of good quality			.485				
Value (α = 0.793)							
Flexibility offered regarding clients requirements				.625			
Suppliers can add value and reduce costs				.575			
SC offers service that meets clients requirements				.571			
Assets fully utilised				.562			
Reducing costs/adding value through continuing learning				.560			
Value for all parties is achieved				.533			
Costs minimised				.522			
Product offers customer satisfaction				.496			
SC is profitable for each partner				.471			
Variety (α = 0.806)							
Changes to product not complex					.787		
Products not complex					.772		
Ability to customize locally					.702		
Over specification is reduced					.626		
Design of products adaptable for differing markets					.586		
SC can change or introduce new product without starting new SC					.543		
Velocity (α = 0.831)							
Delays identified quickly to reduce risks						.734	
Lead-times have careful planning						.724	
SC blockages need to be identified quickly						.718	
Realistic time frames agreed						.653	
Suppliers timely response						.635	
Volume (α = 0.694)							
Suppliers can anticipate changes in demand							.721
Forecasting is accurate							.606
SC has flexibility to address changes in demand							.585
Behaviour with SC is integrated							.576
Eigenvalues	13.23	3.80	3.31	2.09	1.94	1.69	1.40
% of Variance explained	27.01	7.76	6.75	4.26	3.96	3.42	2.87
Cumulative % of variance explained	27.01	34.78	41.53	45.80	49.76	53.23	56.10

Sample: n=303
Combined α= .933

Coefficients of less than 0.4 were suppressed. The rotated component matrix utilised Varimax rotation with Kaiser Normalization.

As can be seen in the rotated component analysis in Table 4.1 the decision to load the items onto seven principal components (themes) was justified and the rotation converged was set in 7 iterations. As part of the process of undertaking exploratory factor analysis, the reduction of items needed careful consideration. As shown in appendix E, the initial exploratory factor analysis (EFA) highlights all 106 items within the rotated competent matrix. This EFA shows items that were loaded onto multiple components and others that loaded with less than the 0.45 factor loading sought (highlighted in section 3.3.3.4). The first attempt at reduction, focused on extracting the items with a value of less than 0.45. The next run of the EFA reduced the items from 106 to 73 within the rotated component matrix.

The researcher then focused on items that loaded heavily onto more than one principal component. An item was considered to have a duel loading if it scored more than 0.45 on one component. This process then went back and forth reducing and then re-running the factor analysis until no items loaded onto multiple components and all had a factor loading of more than 0.45 until only 48 items met this criterion.

The final rotated component matrix is show in Table 4.1 and appendix E (full EFA data statistics). It highlights 48 items loading onto the 7 principal components each named after their relevant themes.

Cronbach's Alpha = **α** was also applied to each individual factor to determine the interrelatedness between items. Field (2009) suggests lower scores below 0.6 are considered heterogeneous with little correlation to other items. Options have been known to differ in relation to an ideal score, however, according to Tavakol (2011) a score between 0.70 and 0.95 is acceptable with a value closer to 1.0 highlighting a more reliable result. Although, it is accepted most results over 0.6 are also considered to be valid (Field, 2008). Table 4.1 also highlights α = 0.69 >< 0.91 for all factors, therefore the reliability was considered good. The EFA is not used to measure the importance of each item; however, the descriptive statistic can be used to how decision makers see them.

In conjunction with the descriptive statistics shown in appendix B, a more in-depth investigation of the rotated component matrix is broken down into individual component findings as follows.

Component 1 (visibility)

The first component which explains 27.1 percent of variance within the EFA is that of visibility. The Cronbach's Alpha score of α=0.918 highlighted clear interrelatedness between items and was close enough to 1.0 to confirm a reliable result. The EFA reduced the initial 20 items for the component visibility to 9, with those remaining shown in table 4.2. These 9 remaining items have a factor loading spread of 0.614 >< 0.822, the highest suggesting that a 'culture of integration within the supply chain' as being key to visibility. The significance of this item is supported by the descriptive statistics that show a mean of 6.19 and a standard deviation of only 0.829. This suggests that the respondents strongly agree with the importance of his item in relation to visibility.

Table 4.2: Component 1-analysis findings

Item	CSF	Factor Loading	Std Dev	Mean	N
1	Culture of integration within SC	.822	.829	6.19	303
2	Suppliers are fully integrated within SC	.797	1.007	5.84	303
3	Close cooperation between SC managers	.677	.950	5.96	303
4	Processes within SC are integrated	.676	1.183	5.63	303
5	Joint planning of SC between SC members	.673	1.147	5.90	303
6	Cooperation & collaboration between SC members	.663	.996	5.91	303
7	SC members share information openly	.662	1.235	5.61	303
8	Open relationship with suppliers	.647	.829	6.19	303
9	SC members have organisational compatibility	.614	1.233	5.46	303
Eigenvalues 13.23	**% of Variance explained** 27.01%	**α =** 0.918	**Cumulative % of variance** 27.01%		

The item 'suppliers are fully integrated within the supply chain' had the second heaviest loading against the component visibility. This item had a factor loading of 0.797. However, when looking at the descriptive statistics it can be seen as having a mean score of 5.84 and a standard deviation of 1.007. This suggests that the respondents do agree with its importance but do not strongly agree. It was also noted that their opinions were more spread.

The third item that is loaded against visibility is that of 'close cooperation between managers within the supply chain'. It has a strong loading of 0.677 and a mean of 5.96. This represents supply chain decision makers either agreeing or strongly agreeing with the levels of importance this item holds. Also, noting that the standard deviation is low at 0.950, suggesting that opinion is closely grouped together, thus implying a stronger agreement between supply chain decision makers. The fourth item; 'processes within supply chain are integrated' has a strong factor loading of 0.676, a mean of 5.63 and a standard deviation of 1.186. This suggests that decision makers agree with the importance of this item, however, their opinion is widespread. When considering the fifth item 'Joint planning of SC between yourself and SC members', the analysis confirms a factor loading of 0.673, with a mean of 0.590 which highlights agreement which verges on strong agreement with the items importance. However, with a standard deviation of 1.147 there is a spread of opinion regarding its importance.

The sixth item ‘cooperation and collaboration between supply chain members’ has a factor loading of 0.663. It has a standard deviation of 0.996 which is considered as a close grouping of opinion around a mean of 5.91, demonstrating the decision makers strongly agree regarding its importance. The seventh item ; ‘supply chain members share information openly’ attained a factor loading of 0.662. With a mean score of 5.61 the decision makers agree this is an importance item. However, a standard deviation of 1.235 demonstrates that these same decision makers’ opinions vary more on this item than of any others that were highlighted within the component visibility.

The eighth item within this component was that of ‘open relationship with suppliers’. With a factor loading of 0.647 it is also clearly loaded heavily against visibility. With a mean of 6.19 and a standard deviation of 0.829, it suggested that decision makers strongly agree regarding the importance of this item and their opinion is very much grouped together. The ninth and final item within component 1 is that of ‘supply chain members have organisational compatibility’. The decision makers agreed on this items importance, although with a standard deviation of 1.233 it was more spread.

Component 2 (Virtuality)

Component 2 Virtuality, which accounts for 7.76 percent of variance and combines with component 1 Visibility, to highlight a combined variance of 34.78 percent. The Cronbach’s Alpha score of α=0.890 highlights clear interrelatedness between items and close enough to 1.0 to confirm a reliable result. The EFA reduced items from an initial 11 to 7, with those remaining shown in table 4.3. These seven remaining items have a factor loading spread of .604><.799.

Table 4.3: Component 2-analysis findings

Item	CSF	Factor Loading	Std Dev	Mean	N
1	Infrastructure mismatches addressed between suppliers.	.799	1.196	5.50	303
2	SC members IT capabilities evaluated before joining SC	.756	1.545	5.01	303
3	Differing processes between SC members identified.	.726	1.152	5.56	303
4	Standard IT platform agreed between SC members.	.704	1.453	5.32	303
5	Integration of key SC members IT systems takes place.	.696	1.592	5.05	303
6	IT security risks are evaluated and Managed.	.648	1.046	5.95	303
7	SC members have compatible technologies	.604	1.356	5.47	303
Eigenvalues 3.80	**% of Variance explained** 7.76%	**α =** 0.890	**Cumulative % of variance** 34.78%		

The EFA highlighted the item 'infrastructure mismatches have to be addressed between suppliers' with a factor loading of .799 as having the most significance. This item has a mean of 5.50 suggesting that the decision makers agreed with its importance. With a standard deviation of 1.196, the spread of opinion from the Mean is within an acceptable level of agreement. The second item for component 2 is 'new supply chain members IT capabilities evaluated before insertion to supply chains'. This has a factor loading of .756. With a mean of 5.01 this item is verging between the makers agreeing or slightly agreeing. This is supported by a standard deviation of 1.545 highlighting a greater spread of agreement. On closer inspection of the descriptive statistics (appendix B), only 46.8 percent of decision makers highlighted that they agreed or strongly agreed that with its importance.

The third item with a factor loading of 7.26 is that of 'differing processes between supply chain members identified'. A mean of 5.56 suggests decision makers believe this to be important and in turn the standard deviation of 1.152 highlights that opinion is tightly grouped together. The fourth item of 'standard IT platform agreed between supply chain members' has a loading of .704. The mean of 5.32 suggest that decision makers agree with the importance of this item. Although it should be noted that although the standard deviation of 1.453 is within an acceptable range it does highlight a greater spread of disagreement in comparison to other items.

The 'integration of key supply chain members IT systems takes place' and has a factor loading of .696 is the fifth item of component 2. With a mean of 5.05 and given that 35.6 percent of decision makers, agree on its importance it should be seen as a strong item. However, it should be noted that with a standard deviation of 1.592 it highlights that the item has a wider range of opinion attributed to it. The sixth item is loaded at .648 and is that 'IT security risks are evaluated and managed'. The decision makers opinion was that they agreed with this and with a mean of 5.95 were bordering on strongly agreeing. Interestingly with a standard deviation of 1.046, this is the lowest of all the items within this component. It seems that opinion regarding this item was closely group around the level of agreement.

The seventh and final item within component 2 is 'supply chain members have compatible technologies' and has a factor loading of .604. A Mean of 5.47 highlights that the decision makers agree that on its level of importance. The standard deviation is 1.356 and on closer inspection of the descriptive statics, it that 82.9 percent either slightly agree, agree or strongly agree on its importance.

Component 3 (Variability)

The third component variability accounts for 6.75 percent of variance and combines with components 1 & 2 (visibility and virtuality) to highlight a combined variance of 41.53 percent. The Cronbach's Alpha score of α=0.864 is highlighting clear interrelatedness between items and close enough to 1.0 to confirm a reliable result. The EFA has seen the component virtuality items reduce from the initial

18 to 9, with those remaining shown in table 4.4. These 9 remaining items have a factor loading spread of .485><.783.

Table 4.4: Component 3 - analysis findings

Item	CSF	Factor Loading	Std Dev	Mean	N
1	Quality standards maintained	.783	.650	6.50	303
2	Products meets specification and quality requirements	.749	.704	6.52	303
3	Quality not unambiguous but specified	.748	.937	6.28	303
4	SC managers understand quality standards	.691	.695	6.39	303
5	New SC members are vetted & understand quality procedures	.656	.901	6.30	303
6	Lower tier suppliers works to agreed quality standards	.600	.809	6.17	303
7	Procurement of defect free product	.590	.917	6.17	303
8	Initial design of good quality	.485	.844	6.28	303
Eigenvalues 3.31	**% of Variance explained** 6.75%	**α =** 0.864	**Cumulative % of variance** 41.53%		

The EFA shows that the first item ‘quality standards are maintained’ has the highest factor loading of .783. With a mean of 6.50, it can be ascertained that decision makers strongly agree that on its importance and with a standard deviation of .650 this agreement is closely grouped. The second item of ‘products meet customer specification/quality requirements’ has a factor loading of .749 and a mean score of 6.52. Similarly, to item 2 it has a low standard deviation range of .704, suggesting that the majority of decision makers strongly agree that this is important to the attainment of variability. The third item with a factor loading of .748 is ‘quality not unambiguous but specified’. This item has the highest mean of any item within component 2 with 6.52 and by also having a standard deviation of .704 it is clear that the decision makers strongly agree upon its importance.

The fourth item is that ‘supply chain managers understand quality standards’. This has a strong factor loading of .691. The item also has a mean score of 6.39, which additionally highlights decisions makers strongly agree that it is important and with standard deviation being .695, the opinion amongst them is tightly grouped. The fifth item is ‘new supply chain members are vetted and understand quality procedures’ which has a factor loading of .656. The mean of 6.30 is similar to all component 3 items in that decision makers strongly agree with its importance in relation to variability. With the standard deviation being .901, it shows that opinion is tightly grouped. On further inspection of the descriptive statistics it confirms 88.4 percent of decision makers agree or strongly agree with its importance in relation to variability.

The sixth item is loaded at .600 and is ‘lower tier suppliers works to agreed quality standards’. This item has a mean of 6.17 and standard deviation of .809. Next, the seventh item suggests that ‘procurement of defect free product’ with a factor loading of 5.90 is linked to variability. This is the first item from the first three component that scores under .600. However, it is still considered acceptable and with a mean score of 6.17, decision makers strongly agree on its importance. Finally, the eighth item loaded onto component 3 is that of the ‘initial design of good quality’ ad score at .485. This is the first item within the EFA that scores between .400 and .500. With a high, mean score of 6.28 it shows that decision makers strongly agree with its importance towards variability. In addition, the standard deviation of .844 also suggests that their agreement is closely grouped together.

Component 4 (value)

The forth component of value accounts for 4.26 percent of variance and combines with components 1-3 (visibility, virtuality and variability) to highlight a combined variance of 45.80 percent. The Cronbach’s Alpha score of α=0.793 is highlighting clear interrelatedness between items and close enough to 1.0 to confirm a reliable result. The EFA significantly reduced the initial 26 items identified to 9, these are highlighted in table 4.5. The nine remaining items have a factor loading spread of .471><.625.

Table 4.5: Component 4 - analysis findings

Item	ITEM/CSF	Factor Loading	Std Dev	Mean	N
1	Flexibility offered regarding clients requirements	.625	.952	6.01	303
2	Suppliers can add value and reduce costs	.575	.927	6.08	303
3	SC offers service that meets clients requirements	.571	.665	6.38	303
4	Assets fully utilised	.562	1.258	5.62	303
5	Reducing costs/adding value through continuing learning	.560	.895	6.06	303
6	Value for all parties is achieved	.533	.797	6.01	303
7	Costs minimised	.522	.893	6.01	303
8	Product offers customer satisfaction	.496	.865	6.36	303
9	SC is profitable for each partner	.471	.898	6.16	303
Eigenvalues 2.09	**% of Variance explained** 4.26	**α =** 0.793	**Cumulative % of variance** 45.80%		

The EFA identifies item 1, the 'flexibility offered regarding clients requirements' has a factor loading of 0.625 as the highest loaded item in relation to value. With a mean of 6.1, the decision makers see this as being very important in the attainment achieving value. With a standard deviation of .952 it is also shown that opinion is closely grouped together. In comparison to the items from other components, the items attributed to value have a lower loading with only item above.600. However, all but one of the items has a mean lower that .600 highlighting their individual importance in attaining value. Item 2 has a factor loading of .575 as is that 'suppliers can add value and reduce costs', with a Mean of 6.08 and a standard deviation of .927 suggesting that decision makers strongly agree on its importance to the attainment value. Item 3 with a factor loading of .571 is that a 'supply chain offers service that meets clients requirements'. Within component 4 this item has the highest Mean of 6.38 with the lowest standard deviation of .665. This suggests that item 3, should be seen as being very important in attaining value by decision makers.

Item 4 with a factor loading of .562 suggests that 'assets are fully utilised' to enable value to be achieved. A mean score of 5.62 with a standard deviation of 1.258 suggesting a wider spread of opinion between decision markets as to its importance. However, closer inspection of the descriptive statistics it highlights only 6.3 percent that have no opinion or disagree on the importance of this CSF.

The fifth item of 'reducing costs/adding value through continuing learning' has a factor loading of 5.06 and a mean of 6.06 and standard deviation of .895. This suggests an acceptably loaded item in which decision makers strongly agree on its importance to component 4. Item 6, which is loaded at .533, is that 'value for all parties is achieved'. This item has a strong mean of 6.01 and a tight standard deviation of .797 that, highlights agreement between decision makers. The seventh item focuses on 'costs minimised' being important to attaining value is loaded at .5.22. This item also has a mean of 6.01 and a standard deviation .893, which suggests that opinion is grouped around strong agreement of its importance in attaining value. Item 8 is the first from component 4 that falls below a factor loading of .500. It is highlighted that 'product offers customer satisfaction' has a factor loading of .496. Interestingly this item has the second highest mean within the component with a score of 6.36. In addition, a standard deviation of .865 shows that decision makers generally see this as very important item in attaining value. The final item 'supply chain is profitable for each partner' has a factor loading of .471, with a mean of 6.16 and an acceptable standard deviation of .898.

Component 5 (Variety)

The fifth component value accounts for 3.96 percent of variance and combines with components 1-4 to highlight a combined variance of 49.76 percent. The Cronbach's Alpha score of α=0.806 is highlighting clear interrelatedness between items and close enough to 1.0 to confirm a reliable result. The EFA has seen the component variety items reduce from the initial 10 to 6, with those remaining shown in table 4.6. These six remaining items have a factor loading spread of .543><.787.

Table 4.6: Component 5 - analysis findings

Item	ITEM/CSF	Factor Loading	Std Dev	Mean	N
1	Changes to product not complex	.787	1.558	5.11	303
2	Products are not complex	.772	1.785	4.39	303
3	Ability to customize locally	.702	1.670	4.75	303
4	Over specification is reduced	.626	1.249	5.55	303
5	Design of products adaptable for differing markets	.586	1.313	5.56	303
6	SC can change or introduce new product without starting new SC	.543	1.254	5.46	303
Eigenvalues 1.94	**% of Variance explained** 3.96%	**α =** 0.806	**Cumulative % of variance** 49.76%		

The EFA highlights that the heaviest loaded factor on component 5 is 'changes to product not complex' with a loading of .787. In relation to the mean score of 5.11 it suggests that decision makers agree on its importance. However, the standard deviation of 1.558 suggests that opinion is spread. On closer inspection of the descriptive statistics, it can be seen that 70.3 percent of decision makers either slightly agree, agree or strongly agree. This suggests that although opinion is spread, it still leans heavily to an agreement that the item is important between decision makers. Item 2 has a factor loading of .772 and in relation to variety it seeks that 'products are not complex'. This item has the lowest mean score 4.39 for not only this component, but also the previous four. This suggests that decision makers only slightly agree of its importance in relation to variety. The standard deviation has a spread of 1.785 which this highest for this or any other component up to this point. On closer inspection of the descriptive statistics, it can be seen that 51.2 percent slightly agree, agree or strongly agree with its importance. In turn 32.4 percent slightly disagree, disagree or strongly disagree, with 15.5 percent having no opinion.

The third item is the 'ability to customize locally' and has a strong factor loading of .702. The mean of 5.11 shows that there is agreement that the item is important between decision makers, however, the standard deviation of 1.670 again suggests that it is spread. On closer inspection of the descriptive statistics, it can be seen that 64.0 percent of decision makers either slightly agree, agree or strongly agree about the items importance to variety. Item 4 has a factor loading of .626 and concerns itself with the point that ‘over specification is reduced’. This item has a mean score of 5.55 suggesting again that decision makers agree that it is important. With the lowest standard deviation for any item within this component at 1.249 and the descriptive statistics highlighting that 81.6 percent of decision makers stating they either slightly agree, agree or strongly agree that it is important highlights a strong item. Item 5 which is the importance of the ‘design of products adaptable for differing markets’ has a factor loading of .586. This item has the highest mean score within this component of 5.56 and a relatively acceptable standard deviation of 1.313 that suggests decision makers agree on its importance to attaining variety. The final item suggesting a ‘supply chain can change or introduce new product without starting a new supply chain’ has a factor loading of .543. It also has a solid mean score of 5.46 and a standard deviation of 1.254. Within that standard deviation spread 80.3 percent of decision makers stated that the either slightly agree, agreed or strongly agreed that this was an important item in relation to variety.

Component 6 (Velocity)

The sixth component velocity accounts for 3.42 percent of variance and combines with components 1-5 to highlight a combined variance of 53.23 percent. The Cronbach’s Alpha score of α=0.831 is highlighting clear interrelatedness between items and close enough to 1.0 to confirm a reliable result. The EFA has seen the component variety items reduce from the initial 12 to 5, with those remaining shown in table 4.7. These five remaining items have a factor loading spread of .635><.734.

Table 4.7: Component 6 - analysis findings

Item	CSF	Factor Loading	Std Dev	Mean	N
1	Delays need to be identified quick to reduce risks	.734	.641	6.42	303
2	Lead-times have careful planning	.724	.750	6.32	303
3	SC blockages need to be identified quickly	.718	.621	6.43	303
4	Realistic time frames agreed	.653	.782	6.35	303
5	Suppliers timely response	.635	.615	6.37	303
Eigenvalues 1.69	**% of Variance explained** 3.42%	**α = 0.831**	**Cumulative % of variance 53.23%**		

The first item that is loaded heaviest against the component velocity is that 'delays need to be identified quickly to reduce risks'. This item has a factor loading of .734. It also has a mean of 6.42, which highlights that the decision makers strongly agree that this is an important item when it comes to attaining velocity. Further to this the standard deviation score of .641, suggests that their opinion is closely grouped together. The second item with factor loading of .724 highlights the importance that decision makers feel that 'lead-times have careful planning'. This item has the lowest mean 6.32 from this component, however, it is accepted that this still suggesting that decision makers strongly agree with its importance and with a standard deviation of .750 their opinion is closely grouped together.

Item 3 suggests 'supply chain blockages need to be identified quickly' and has a factor loading of .718. Within this component, this item has the highest mean of 6.43 and the second highest from the 48 items within the EFA. With a standard deviation of .621, it clearly groups opinion around strongly agreeing with the importance of this item. The forth item attributed to velocity has a factor loading of .653 is 'realistic time frames agreed'.

As per the other items in the component it has a strong mean 6.35 again suggesting the decision makers feel that this is a very important item. Although it has the highest standard deviation .728 within the component, this is still considered a key item. The final item of 'suppliers timely response' has a loading of .635 which is the lowest within this component. However, it has a mean of 6.37

and a standard deviation spread of 6.15, which is the lowest within the 48 items being discussed. This means that within the decision makers responses, this item was agreed upon the closest.

Component 7 (Volume)

The seventh and final component is volume and accounts for 2.87 percent of variance and combines with components 1-6 to highlight a combined variance of 56.10 percent. The Cronbach's Alpha score of α=0.694 although lower than other components is still highlighting interrelatedness between items and close enough to 1.0 to confirm a reliable result.

The EFA has seen the component volume items reduce from the initial 9 to 4, with those remaining shown in table 4.8. These four remaining items have a factor loading spread of .576><.721.

Table 4.8: Component 7 - analysis findings

Item	CSF	Factor Loading	Std Dev	Mean	N
1	Suppliers can anticipate changes in demand	.721	1.194	5.65	303
2	Forecasting is accurate	.606	1.220	5.85	303
3	SC has flexibility to address changes in demand	.585	.931	6.01	303
4	Behaviour with SC is integrated	.576	.776	6.24	303
Eigenvalues 1.40	**% of Variance explained** 2.87	**α =** 0.694	**Cumulative % of variance** 56.10%		

The first item with the heaviest factor loading from component 7 is 'suppliers can anticipate changes in demand' and has a loading of .721. The mean for item 1 is 5.65 which on the scale utilised highlights that he decision makers agree that this is an important item, it is noted that this is the lowest mean within this component. The standard deviation of 1.194 suggests that this opinion is spread. On closer inspection of the descriptive statistics in appendix B, it highlights that the main disagreement is focused around slightly agreeing, agreeing or strongly agreeing on its level of importance as these three options contribute to 87.8 percent of the responses.

Item 2 focuses on the importance that 'forecasting is accurate'. This item has a strong loading of .606 and a mean of 5.85. Again, this shows that the decision makers have stated that they agree on its importance. However, the standard deviation of item 2 is 1.220 which is the highest of any within this component. The spread is similar to item 1 in that 80.4 percent of decision makers stated they slightly agree, agree or strongly agree that this is an important item in relation to volume. Item 3 has a lower factor loading of .585, which is adequate. Interestingly it has a higher mean than items 1 or 2 with a score of 6.01. Also with a standard deviation of .931 it suggests that this agreement is closely grouped. The final item related to volume is 'behaviour with SC is integrated' with a loading of .576. However with a highest mean of 6.24 and a tightest standard deviation of .776 of any item in component 7, it seems that decision makers see this as the most important item.

4.1.1 In Conclusion - EFA and Descriptive statistics

In reducing the data through the EFA the final rotated component matrix highlights 48 items from the initial 106. If compared to the CSFs (variables) identified in table 2.9, it can be seen that there is a reduction of 58 items as shown in table 4.9.

Table 4.9: Breakdown of CSFS pre and post exploratory factor analysis

Themes	CSFs – Pre EFA	Number of CSFs – Post EFA
Value	26	9 (-17)
Volume (Volatility)	9	4 (-5)
Velocity	12	5 (-7)
Variety	10	6 (-4)
Variability	18	8 (-10)
Visibility	20	9 (-11)
Virtuality	11	7 (-4)
Total	**106**	**48 (-58)**

Key points from the EFA and descriptive analyses are, firstly, the 48 items have acceptable levels of factor loadings. The highest loaded item was the 'culture of integration within a supply chain' (factor loading of 0.822) which was attributed to component 1 'visibility'. The lowest loading item could be found in component 4 'value' which was 'supply chains being profitable for each partner'. As the remaining 48 items loaded higher than 0.400, it justifies their final inclusion in the model..

Secondly, the descriptive statistics explaining the individual item mean and standard deviations, offer clear points for discussion. The heaviest loaded item did not necessarily have the highest mean. For example, the item 'products meet customer specification and quality requirements' which is attributed to component 3 'variability', was loaded at 0.749 but had the highest mean of any item at 6.52. Likewise, the item 'supplier's timely response highlighted the closest agreement of any item within the analysis with a standard deviation of 0.621. On closer inspection it is shown that although it had a high mean of 6.37, it was still loaded the lowest against its component with 0.635. In relation to individual component loadings the results show that value has amongst the lowest loaded items. However, consideration is given to the observation that it also has the highest means and some of the narrowest standard deviations. This demonstrated that, the individual level of importance of each item was considered to be high and agreement on that opinion was tightly grouped.

Research objective 1 was attained during phase 1 of the study; CSFs influencing supply chain strategy were identified. The study has now achieved research objective 2 by analysing findings from the empirical study and has confirmed.

4.2 Confirmatory Factor Analysis

The Confirmatory Factor Analysis (CFA) which sought model fit was carried out on the reduced data set of items from the previously discussed EFA. This analysis was carried out in direct relation to the attainment of research objective 3. The remaining 48 items from the EFA were inputted into SPSS Amos software with a graphical interface in an attempt to seek the plausibility of model fit.

As seen from table 4.10, the initial overall model fit measures for model 1 are not strong when consideration is given to all available measurements. An χ^2/Degrees of Freedom of 1.98 offered the suggesting of an adequate fit for model 1.

Table 4.10: Confirmatory factor analysis - 3 model fit results

Model	Themes	Items	Chi Square	Baseline Comparisons			Parsimony-Adj Measures		RMSEA
			χ^2/DF	IFI	TLI	CFI	PRATIO	PNFI	Default Model
1	7	48	1.98	.707	.849	.830	.901	.663	.057
2	7	41	2.09	.864	.852	.863	.928	.713	.060
3	6	37	2.10	.869	.858	.868	.926	.725	.063

However, all the baseline comparisons in model 1 were at least .050 below the recommended relative fit measures of 0.900 (Bentler 1990) for CFI and TLI, whilst almost 0.200 below for IFI (Bollen 1986) . The parsimony fit measures of PRATIO at 0.901 and PNFI = 0.663 (>0.6) both suggest a poor model fit. As did the index of RMSEA = 0.05 (<0.06) which indicates poor fit. However, the baseline comparisons caused concern and a second model was attempted.

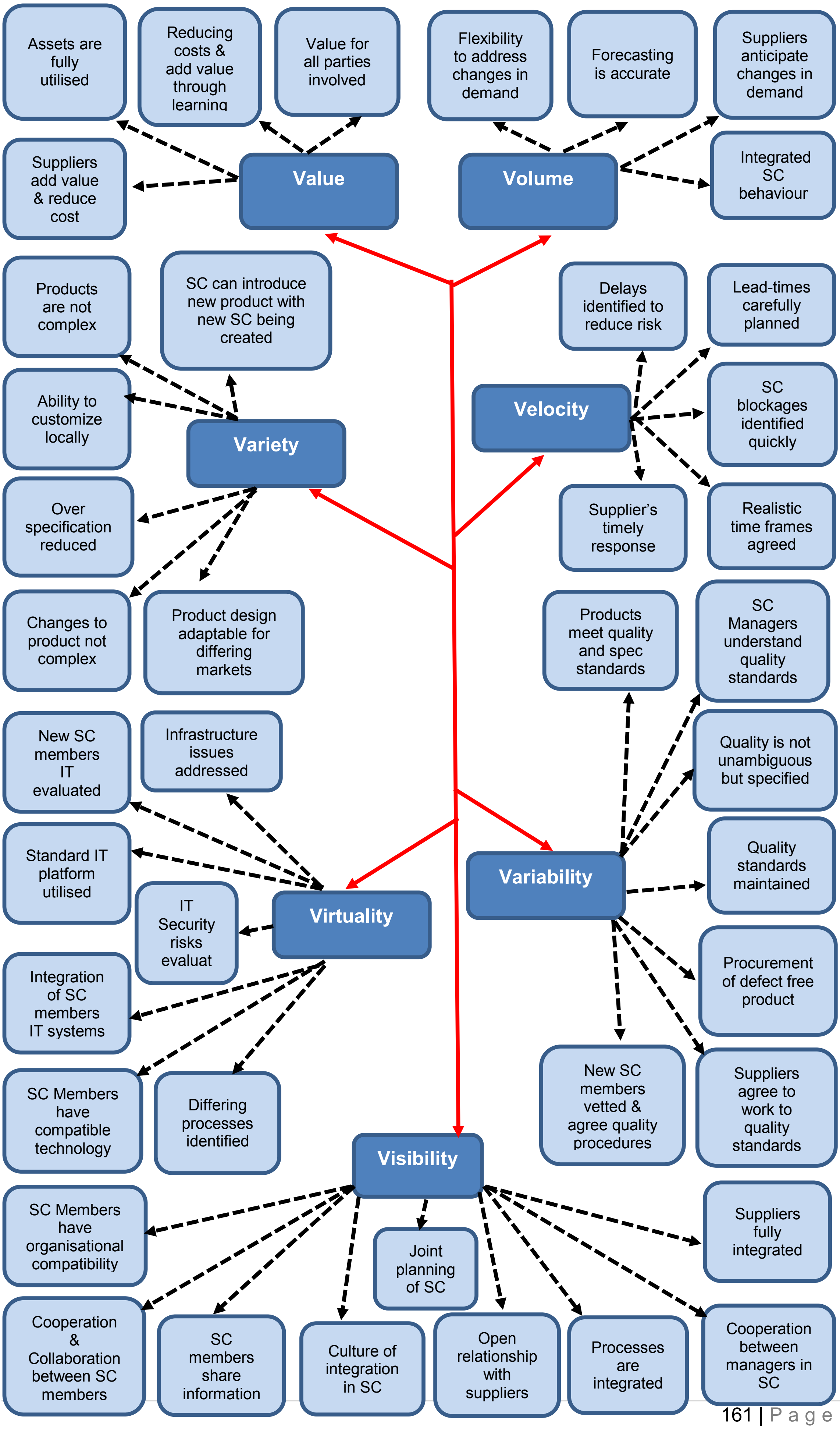
Model 2, similar to model 1, was created with 7 component themes as seen in figure 4.2. In order to attain a more acceptable Model Fit, model trimming was undertaken. All items loading with a value of less than 0.5 from the initial CFA results were removed from their respective component themes. This is acceptable practice as highlighted by Schreiber (2006). This action meant that the component theme value was reduced from 9 to 4 items. The removed items from the component value were:

- Flexibility offered regarding clients requirements
- Supply chain offers service that meets the clients requirements
- Costs minimised
- Product offers customer satisfaction
- Supply chain is profitable for each partner

The component variability had 1 item removed; ‘initial design is of good quality’. As can be seen in table 4.10, when re-running the CFA with the items removed, the plausibility of the model fit increased substantially on all indices. The baseline comparisons TFI 0.852 and CFI 0.863 were then lower than 0.050, whilst the IFI of 0.864 was only 0.080 from an ideal model fit. From these baseline comparison indices, the plausibility of model fit was now within an acceptable margin of error. In addition, the parsimony fit measures of PRATIO improved to 0.928 as had PNFI = 0.713 (>0.6) both suggesting that the removal of the items had not weakened the model. In addition the RMSEA was still within the acceptable margin at 0.60. as was χ^2/DF at 2.09.

A third model was also tested. As an improvement of the model fit indices was achieved in part by removing all 5 items from the theme value. It was envisaged that removing value as a themed component and rerunning the analysis might offer a more ideal model fit overall. Having done this, the results shown in table 4.10 demonstrate that the Baseline Line comparisons have all improved but no more than 0.006. The parsimony fit measure of PRATIO reduced slightly to 0.926, however, the PNFI improved slightly to 0.725. The RMSEA model fit index exceeded the minimum at score of 0.063. Overall, it could be argued that the analysis suggests a slight improvement to model 3 from model 2 however; it is argued this is only slight. Therefore, it was decided to utilise model 2 rather than fall into the trap of chasing model fit at the cost of the model quality itself.

Figure 4.2: Confirmatory factor analysis - model 2



4.2.1 In Conclusion - Confirmatory Factor Analysis

The purpose of the CFA was to ascertain the plausibility of model fit from the findings of the EFA in relation to both the confirmed CSFs and the individual component themes. This has been achieved and the 7V Framework has been validated. Through the process of CFA and subsequent validation of the 7V Framework the CSFs were reduced from 48 post EFA, and then further reduced to 42 post CFA. This reduction and subsequent model fit assisted in the overall attainment of research objective 3; discussed further in section 5.3.

4.3 Summary

Phase 3 of the study focused on the attainment of research objectives 2 and 3 as highlighted in table 3.1. EFA and CFA were undertaken in order to complete objectives 2 & 3. Phase 1 of the research identified variables (CSFs) that could contribute to the effectiveness of supply chains. Through the analysis of these variables, the findings of the EFA confirmed 48 specific CSFs were considered by the sample to contribute to supply chain effectiveness. From the findings of the descriptive statistics, the varying levels of importance of the 48 individual CSFs in relation to supply chain effectiveness has confirmed. The completion of the CFA has progressed the EFA a stage further by confirming Model Fit and in turn takes the 7V Framework from being conceptual model to a validated model. This process and eventual validation supports the strength of the relationship between the 7V Framework and supply chain effectiveness.

Chapter 5 - Discussion

Chapter 4 presented the results from the statistical analysis carried out in relation to the primary data collected for this study. Phases 1-3 primarily involved data collection and analysis. The study now moves onto phase 4 which formulates a discussion from the study evidence in relation to theory and current practice. To assist in clarity, the chapter discusses the results of the findings of the study and each objective individually.

5.1 Objective 1: Identification of CSFs influencing Supply Chains

In order to attain research objectives 2-5 it was crucial that research objective 1 was met and formed a solid grounding on which the subsequent objectives could be achieved. The importance of this is highlighted within the study as it was treated as an individual phase of the research (phase 1).

The initial starting point was the search within the literature that focused upon the 'identification of possible CSFs attributed to the delivery of supply chains'. To assist the study the parameters of the 7V Conceptual framework were utilised. This allowed for a more focused search and identification of initial CSFs. The review of CSFs within the SCM literature highlighted the eclectic nature of the research area. The identification of possible CSFs within certain themes was facilitated by the existence of seminal research in the area (REFs). However, within themes such as value, the identification was problematic and more interpretation of the literature was required. During the review of the literature, it was also confirmed that empirical research methods into CSFs had a solid grounding within quantitative methods and the use of EFA and CFA. Subsequently, this assisted decision-making regarding the subsequent research design. As highlighted in the literature, 109 possible CSFs were identified as shown in table 2.17. By focusing the literature search around the themes within the 7V conceptual framework, it was also possible to identify CSFs that specifically influenced decision makers when considering SCM. The need for face validity and the ability to operationalise these CSFs became apparent. Relying solely on the researcher interpretations of the literature may not be acceptable. This was addressed through informal round table discussions with members of the Chartered Institute Purchase and Supply. The discussions enabled the interpretation and operationalisation and subsequent early stages of the survey instrument to be created. These discussions were the final key to the attainment of research objective 1. The discussions examined the CSFs identified within the literature and reworked them from a decision maker with SCM perspective. In addition CSFs previously unknown to the researcher that were not identified within the literature were highlighted. This was a key element of the study; had the round table discussions not taken place, or had the experience of the CIPs members not been utilised, the validity of the study could have been open to criticism. Through this process the study has clearly shown validity in the attainment of research objective 1. In turn, this laid a solid grounding for the remaining research objectives to be attained.

To summarise, in achieving research objective 1 and phase 1 of the study, the following took place;

1. A review of the extant literature resulting in identification of 109 possible CSFs.
2. Round table discussions with members of the CIPS focusing on the initial 109 CSFs. Through these discussion CSFs were adapted and subsequently reduced to 105 possible CSFs.
3. Through this process the grounding was laid for the creation of a survey instrument and the start of phase 2 of the research.

5.2 Objective 2: Analyse findings confirming or disconfirming CSFs

The completion of phases 1 and 2 of the study allowed for the subsequent data analysis (EFA) to take place in phase 3. The 105 possible CSFs identified were reduced to 48 as highlighted in section 4.1. Utilising principal component the EFA allowed for 48 items to be loaded against specific 7 specific components (themes) within the 7V conceptual framework. Additionally, the descriptive statistics identified what levels of importance could be attributed to each CSF. The EFA refuted 57 items initially identified as being potential CSFs. The following subsections discuss the remaining 48 confirmed CSFs. This will allow for completion of research objective 2.

<u>Confirmed CSFs associated with Visibility</u>

This study initially identified 27 items that were considered as potential CSFs related to visibility. In order to achieve visibility members must 'ensure that the supply chain is transparent and all parties are able to see and avoid blockages and issues surrounding bottom heavy inventories'. On completion of the EFA the study was able to confirm the existence of 9 CSFs associated to the attainment of visibility, these are highlighted in table 5.1.

Table 5.1: Confirmed CSFs associated to visibility

Visibility	Concept / Deliverables	CSFs
Ensure that the supply chains transparent and all parties are able to see and avoid blockages and issues surrounding bottom heavy inventories	Transparency between members, Bullwhip reduced, IT systems communicate, Information sharing, Pipeline visible to members, reduction in transaction risk,	• Culture of integration • Suppliers are integrated • Cooperation between SC Manager • Processes are integrated • Joint planning between SC Members • SC members cooperation and collaboration • SC Members share information • Open relationships • SC have organisational compatibility

The highest loaded CSF is what Bowersox and Closs (1996) along with Mentzer, DeWitt et al. (2001) suggest is the need of a 'culture of integration within the supply chain'. Interestingly, the culture of integration and in turn relationships between supply chain members seems to be a theme arising within the attainment of visibility. This is seen with Haung and Mak (2000) and also again with Mentzer, DeWitt et al. (2001) who identified the CSF 'closer relationships with suppliers' as critical. In turn, Chen, Lin et al. (2006) suggested that the CSF of 'open relationships with suppliers' as being key to achieving visibility. The current study supports their premise as shown in the results of the EFA. The CSF of 'cooperation between managers within the supply chain' previously identified by Cooper, Lambert et al. (1997) is also accepted as a key CSF.

Elmuti (2002) took a more holistic view regarding cooperation stating that it should not just be confined to managers and that the 'cooperation and collaboration between supply chain members' is a highly regarded CSF. This studyhas adds confirmation to this. There is clear acknowledgment within the findings that working with others within the supply chain assists in attaining visibility. This is again evidenced by the confirmation of the CSF of 'joint planning of supply chains between members' which was first suggested by (Cooper, Lambert et al. 1997) then Tyndall, Gopal et al. (1998) and latterly Mentzer, DeWitt et al. (2001).

The notion of 'increased transparency' within supply chains was first discussed by Towill (1997) and although this study could not confirm that specifically as a CSF, it can confirm 'supply chain members share information openly' identified by Elmuti (2002) as being one. This openness between supply chain members offers a solid grounding within the CSFs theme of visibility.

According to Chen, Lin et al. (2006) it is important that 'suppliers are fully integrated with the supply chain', similarly Elmuti (2002) suggests that 'processes within the supply chain are integrated'. The study also confirmed that both of these items are CSFs. The final CSF identified relates to the integration of supply chains in that 'supply chain members have organisational compatibility' which was first highlighted by Mentzer, DeWitt et al. (2001). There is clear evidence from the findings of the analysis that the current study can offer nine specific CSFs attributed to the theme of visibility.

Confirmed CSFs associated with Virtuality

A total of 13 possible items were identified in relation to virtuality in section 2.3.7 prior to the EFA. In identifying these CSFs the research focused upon what is critical in the 'ability to manage and coordinate the supply chain using information technology'. On completion of the EFA the study was able to confirm the existence of 7 CSFs associated to the attainment of virtuality, these are highlighted in table 5.2.

Table 5.2: Confirmed CSFs associated with Virtuality

Virtuality	Concept / Deliverables	CSFs
The ability to manage and coordinate the supply chain Using information technology	Multi-dimensional systems, improved communication	• Infrastructure mismatches addressed • New SC members IT evaluated • Differing processes between SC members identified • Standardised IT platforms agreed between members • Integration of SC members IT systems • It security risks evaluated • SC members have compatible technologies

The heaviest loading CSF in relation to the attainment of virtuality was that 'infrastructure mismatches have been addressed between suppliers'. This was first suggested by Williamson, Harrison et al. (2004) who also proposed 'differing processes between supplied chain members are identified' as a CSF. This was also confirmed through the EFA undertaken in the current study. With these two

CSFs in mind the study also asked how important it was that 'standard IT platforms are agreed between supply chain members'. The findings suggest that this too can also be confirmed as a CSF.

Interestingly the first two CSF do not focus upon IT capabilities, but more on the procedures that take place. However, there is a clear need for IT capabilities to be considered as is shown in the remaining CSFs associated with virtuality. This is supported as the need for 'new supply chain members IT capabilities to be evaluated before insertion to supply chain' was previously suggested by Mills (2001) and confirmed in the findings of the EFA. In addition to technologies being evaluated, Christopher (2000) and Gunasekaran, Patel et al. (2001) suggest that 'integration of key supply chain members IT systems take place', This was also confirmed in the current study. The study also identified the importance of 'supply chain members having compatible technologies' as a CSF. It is clear that in relation to the CSFs associated with virtuality that integration, process and IT capabilities are seen as an underlying theme amongst the CSFs identified. In addition, Williamson, Harrison et al. (2004) suggestions on the issue of 'IT security risks being evaluated and managed' have been confirmed within the results of this study as also being a CSF associated with virtuality.

The CSFs associated with the theme virtuality, are grouped around processes and IT capabilities. With the physical distances that supply chains can now cover and the varying amount of members within a supply chain, it seems that CSFs associated with virtuality focus upon reducing the impact of both of these variables. The standardisation of IT capabilities reduces the amount of miss-information within the supply chain which in theory should improve efficiency.

Confirmed CSFs associated with Variability

During the initial identification of CSFs related to the theme variability, section 2.3.4 highlighted a possible 22 items that the study would investigate further. Through the subsequent EFA this number was reduced to 8 specific CSFs associated with the attainment of variability; these are highlighted in table 5.3.

Table 5.3: Confirmed CSFs associated with Variability

Variability	Concept / Deliverables	CSFs
The products/services have no varying levels of quality and that they are delivered in a manner that is of a level that is acceptable to the customers	Value adding process, Quality of product/service to end user, Total Quality Management	• Quality standards maintained • Products meet specification & quality requirements • Quality not unambiguous but specified • SC managers understand quality standards • Suppliers work to agreed standards • SC Members are vetted and understand quality procedures • Procurement of defect free products • Initial design of good quality

The issues surrounding the attainment of variability within the conceptual framework focuses on the point that the products/services have no varying levels of quality and that they are delivered in a manner that is of a level that is acceptable to the customers. In addition to identifying items from the literature, the actual process of creating a survey instrument assisted in identifying possible CSFs to be analysed.

In relation to variability, it was seen that this process was beneficial to the study as four of the remaining CSFs came directly from this process and not the literature. Within the discussion surrounding quality, there seemed a lack of focus on what quality actual was. As previously mentioned in section 2.3.4, this could be attributed to the understanding of what quality actually means.

The CSF which loaded most heavily onto the component variability was ‘quality standards are maintained’. Although this was not a direct CSF taken from one individual source, it was seen as an underlying theme within the literature and therefore included. The results in chapter 4 support this as the key CSF related to the attainment of variability. Similarly, the CSF of ‘products meet customer specification and quality requirements’ was confirmed having been initially created from opinions gained from sources such as Saraph, Benson et al. (1989) and Deming (1986).

When addressing quality and the subjective nature of what it actually is and means, the idea of ‘quality not being ambiguous but specified’ was confirmed as a CSF through the analysis carried out. A key to achieving quality standards and in turn attaining variability was the influence of management. The CSF of ‘supply chain managers understanding quality standards’ was widely seen as a crucial factor (Feigenbaum 1956, Crosby 1979, Fotopoulos and Psomas 2009, Fraisat and Sawalha 2013).

The findings have shown that supply chain decision makers agree of its importance as a CSF in delivering variability. The importance of suppliers within the supply chain was never in question, however, the study wanted to understand exactly where this would influence a CSF. Therefore, the items of ‘vetting of new suppliers and their understanding of quality procedures’ and ‘suppliers agreeing to work to agreed quality standards’ were analysed. In the attainment of variability, this study classes both of these items at a level of importance that they are considered as CSFs. The study has also been able to confirm the CSF ‘procurement of a defect free product’ is key as first highlighted by Forker, Mendez et al. (1997). In addition this study agrees and offers clear evidence that the ‘initial design of is of good quality’ as previously discussed by Fraisat and Sawalha (2013) is also a CSF.

Confirmed CSFs associated with Value

This study originally identified 26 possible CSFs related to the theme value. Through the EFA this number was reduced to 9 CSFs that loaded heavily enough to be considered as key items. In defining the theme value within the conceptual framework, the focus was set against 'the relationship between what the customers want and expects against what the supplier can offer'. These 9 CSFs confirmed as being associated to the attainment of value, are shown in table 5.4.

Table 5.4: Confirmed CSFs associated with Value

Value	Concept / Deliverables	CSFs
The products/services have no varying levels of quality and that they are delivered in a manner that is of a level that is acceptable to the customers	Value adding process, Quality of product/service to end user, Total Quality Management	• Flexibility offered to clients • Suppliers ass value and reduce costs • SC offers service that meets clients requirements • Assets fully utilised • Continual learning to add value and reduce costs • Value for all parties is achieved • Costs minimised • Products offer customer satisfaction • SC Is profitable for each partner

As Sengupta, Heiser et al. (2006) has stated, customers are demanding value and it is essential that organisations ensure it is delivered. The challenge for suppliers is how they can achieve this value for their customers and what the CSFs are that must be considered to attain this. Within the findings chapter it was shown that, supply chain decision makers strongly agreed that each of the CSFs identified were very important to the attainment of value. The highest loaded CSF; 'flexibility is offered regarding clients requirements' was originally suggested within the literature by Heikkila (2002) . The CSF of 'suppliers can add value and at the same time reduce costs' was also seen as a key item amongst decision makers in the attainment of value. Although, it is not confirmed how this value could be added, an argument exists that suggests that addressing other CSFs may help to achieve this.. For example, the CSF of the 'supply chain offers a service that meets the clients requirements' may go some way to assist the attainment of value. It is also suggested that the CSF of 'assets being fully utilised' meaning that where possible everything is being done to achieve value with the tools that the decision makers have at their disposal.

Although, not highlighted directly from

the literature but rather through an interpretation of it in conjunction with the piloting that took place, it seems costs attribute to the attainment of value. The second CSF to mention costs focuses on 'reducing costs and adding value through continuing learning' as being crucial in the attainment of value. Whilst the third CSF highlighting costs simply states 'costs must be minimised'. It is clear that decision makers see cost and cost savings as a way of appeasing customers and assisting in achieving value. Interestingly the final two CSFs identified take a holistic view and suggest benefits for all parties within the supply chain must be sought when seeking value. The first states that 'value is achieved for all parties' whilst the final CSF suggests that the 'supply chain is profitable for each partner'. Both these CSFs were identified during the round table discussions with members of the CIPS who this study has highlighted as being supply chain decision makers.

<u>Confirmed CSFs associated with Variety</u>

Hines (2004) states that in order to attain variety suppliers must have; 'the ability to customise or standardise a product as per consumer demands or even in anticipation of changes in demand'. This study initially identified 12 possible CSFs related to the theme variety, after piloting these formed 10 questions. The results of the EFA show that 6 CSFs were confirmed as being directly attributed to variety and are highlighted in table 5.5.

Table 5.5: Confirmed CSFs associated to Variety

Variety	Concept / Deliverables	CSFs
The ability to customise or standardise a product as per consumer demands or even in anticipation of changes in demand	Local Customisation, Product/Service variety increasing over varying sectors, Increased outsourcing, Shorter product life cycles, Reduced complexity of customisation	• Changes made to products are not complex • Products are not complex • Ability to customise locally • Over specification reduced • Design of products adaptable to different markets • SC can introduce new products without creating a new SC

The highest loaded CSF was that of ‘changes made to products are not complex’. This particular CSF was informed by decision makers as being of possible importance during the piloting stage of the data collection. Although this CSF is not directly attributed to a single academic source, Hines (2004) does highlight the need for the ability to switch to varied or new products when the market dictates. Christopher (2000) added to the conversation regarding over complexity by stating that ‘products are not complex’. This CSF resonated with the decision makers as the results have confirmed this as a CSF. Further to this, ensuring that ‘over specification is reduced’ which was highlighted in the literature by Coman and Ronen (2009) has also now been confirmed as a CSF within the results shown in chapter 4. The next CSF to be confirmed as being crucial for the attainment of variety was the ‘design of products adaptable for differing markets’, as was highlighted in the research of Elmuti (2002). The decision makers who contributed to this study took this a step further by suggesting that adapting products are important, however, they have also stated that the ‘ability to customize locally’ is also a CSF. Additionally, the item ‘supply chain can change or introduce a new product without starting a new supply chain’ was confirmed as a CSF.

Within the CSFs related to variety, there are two specific areas that need to be addressed. The first is that the product should not be complex. However, if it is, it should be possible to adjust it as required. Secondly, the ability to customize products as and when is required is also seen as being important in the attainment of variety.

Confirmed CSFs associated with Velocity

The theme velocity focuses on ‘enabling the customer to utilise speed as a competitive advantage, by ensuring prompt delivery’. It is clear that the speed of delivery is a competitive advantage suppliers will seek to offer customers, when and where possible. In order to ascertain how to achieve velocity this study initially identified 12 possible CSFs which was r reduced to 5 confirmed CSFs. These CSFs are highlighted in table 5.6, the first of which focuses on the issues that ‘delays need to be identified quickly to reduce risks’. This focuses on communication of information and links closely back to visibility in that the transparency of the supply chain can be an issue that needs to be addressed.

Table 5.6: Confirmed CSFs associated to Velocity

Velocity	Concept / Deliverables	CSFs
Enabling the customer to utilise speed as a competitive advantage, by ensuring prompt delivery	Speed of delivery, Proactive practices, Time-based competition, Adapting to changes in the market	• Delays identified quickly to reduce risks • Lead-time carefully planned • SC blockages identified quickly • Realistic time frames • Suppliers response times

In addition, it was seen as crucial that ‘supply chain blockages need to be identified quickly’. As shown in the results, decision makers agreed that this was the most important CSF in attaining velocity. Reichart and Holweg (2007) highlighted that ‘suppliers must offer a timely response’ if velocity is to be achieved. This study confirmed this was a CSF.. In addition, the importance of ‘realistic time frames being agreed’ between supply chain members was also seen as crucial. This was originally identified by Elmuti (2002). Similarly, decision makers offered the idea that ‘lead-times have careful planning’. This planning can reduce the impact of CSFs associated with velocity. This is supported by Tyndall, Gopal et al. (1998) who suggested that 'practical timeframe's are agreed between supply chain members'. This was also confirmed as a CSF through the findings of this study. The CSFs confirmed from the empirical research could be set into two simple subthemes of proactive and reactive strategies. Proactive focuses on putting in place realistic timeframes and planning careful lead times, whilst reactive strategies incorporate the identification of blockages and delays as well as suppliers being able to respond to them.

Confirmed CSFs associated with Volume

The theme volume has suppliers 'ensuring that customers have the flexibility to increase and decrease volume as their demands dictate'. Initially this study identified 13 possible items that could be considered as CSFs. However, through the piloting process these were reduced to 9. These CSFs were further reduced to 4 confirmed CSFs associated with the attainment of volume and are highlighted in table 5.7.

Table 5.7: Confirmed CSFs associated to Volume

Volume	Concept / Deliverables	CSFs
Ensuring that customers have the flexibility to increase decrease volume as their demands dictate	Flexibility to adjust demand, Bullwhips identified, Lead time gap addressed, Forecasting accuracy based on real time data, SC competence, dynamic systems	• Suppliers can anticipate demand • Forecasting is accurate • SC has flexibility to deal with changes in demand • Behaviour is integrated

The issue highlighted by Narasimham and Das (2000) in relation to 'suppliers being able to anticipate changes in demand' was found to be a CSF. I In addition to being able to anticipate changes, the 'supply chain also has the flexibly to address changes in demand' as discussed by Power, Sohal et al. (2001) and also Reichart and Holweg (2007) was also a CSF.

In order to achieve this knowledge Elmuti (2002) suggested that the 'behaviour within the supply change is integrated', the results of this study identified that this was also a CSF. The final CSF associated with volume was 'forecasting is accurate' (Fisher, Hammond et al. 1994). Two themes could be identified from the CSFs associated with volume, the first was supplier related. This takes into account suppliers throughout the supply chain being able to anticipate changes in demand. The second theme was the supply chains capabilities/capacity to deal with change.

In conclusion - Research Objective 2

The focus of research objective 2 was to confirm or refute CSFs. This chapter described and discussed the CSFs associated with each theme. Through the research process the study has confirmed the existence of 48 CSFs associated with the themes of the 7V conceptual framework. Each of the CSFs identified was loaded heavily enough against each theme to suggest that they are relevant. In addition, the importance of each CSF to that theme was highlighted through the descriptive statistics. These 48 loaded items produced by the EFA, were utilised when seeking to attain research objective 3. This objective is discussed in the following section.

5.3 Objective 3: Development of the 7V conceptual framework incorporating CSFs

This section considers both the development of the 7V conceptual framework and the incorporation of CSFs. This is achieved through the incorporation of the confirmed CSFs into the existing 7V framework. This starts to build a specific contribution to theory that will be fully developed in section 5.4. In addition, this section also discusses the validation of the 7V framework in order to ensure its relevance and usefulness in maximising the efficiency of supply chain processes. The first two research objectives focussed on the existence of CSFs and their relationship with individual themes within the 7V framework. Research objective 2 utilised the EFA that identified 48 CSFs related to themes within the framework. Research objective 3 utilised the findings of the CFA. Through the process of attaining the plausibility of model fit, certain CSFs were extracted from the ones produced by the EFA. The relevance of this is that through the process of attaining model fit and validation the plausibility of the model, the number of CSFs was reduced to 42. The subsequent analysis of the CSFs identified from the EFA by the undertaking of a CFA was highlighted in section 4.2.

Up until this point, the 7V Framework has been justifiably developed to include themes, concepts and business challenges as has been described in previous chapters. As seen in table 5.8 the 7V conceptual framework has now been developed to include the CSFs attributed to each theme. These were first highlighted in figure 4.2 and can also be seen in appendix C. The framework has matured to a point where, it can be utilised to assist supply chain decision makers. This will be discussed further in section 5.4 when research objective 4 will be addressed. Through the EFA and the CFA it has been possible to focus on 42 CSFs associated the validated model.

Up until this point this study has;

- Conceptualised the themes from the 7V framework as summarised in table 2.2.
- Confirmed the existence of CSFs, through the findings of the EFA in section 4.12.
- Confirmed the 7V themes within the framework are related through the findings of the CFA and the attainment of model fit as highlighted in section 4.2.

Table 5.8 7V Framework Source: Developed from Hines 2004

Theme	Concept/Deliverables	Business Challenges	Critical Success Factors
Value - The relationship between what the customers want and expects against what the supplier can offer	Reduce cost, meeting customer expectations, continuous improvement, Value chain, Value streams, Reduce risks, Economic value, Value for all parties	Offer value for money to customers based on what they want. Value not just at point of exchange by through time and use	• Suppliers add value at reduced costs • Assets are fully utilised • Reducing costs and adding value through learning • Value for all parties involved
Volume - Ensuring that customers have the flexibility to increase decrease volume as their demands dictate	Flexibility to adjust demand, Bullwhips identified, Lead time gap addressed, Forecasting accuracy based on real time data, SC competence, dynamic systems	Customers want to order as late as possible to ensure they have 'best forecast' of demand. Reduced likelihood of standard orders in many sectors. Requirement to facilitate changes in order quantities	• Flexibility to address changes in demand • Forecasting is accurate • Suppliers can anticipate changes in demand • Integrated SC behaviour
Velocity - Enabling the customer to utilise speed as a competitive advantage, by ensuring prompt delivery	Speed of delivery, Proactive practices, Time-based competition, Adapting to changes in the market	The speed of response in adapting to change in areas such as demand conditions, market structures, production technology and suppliers capabilities	• Delays identified to reduce risk • Lead-times carefully planned • SC blockages identified quickly • Realistic time frames agreed • Suppliers timely response
Variety - The ability to customise or standardise a product as per consumer demands or even in anticipation of changes in demand	Local Customisation, Product/Service variety increasing over varying sectors, Increased outsourcing, Shorter product life cycles, Reduced complexity of customisation	Being able to customize the product/service offered. This may mean moving from economies of scale to economies of scope or economies of value to customer	• SC introduces product without new SC being created • Products not complex • Ability to customise locally • Over specification reduced • Changes to products not complex • Product design adaptable for differing markets
Variability - The products/services have no varying levels of quality and that they are delivered in a manner that is of a level that is acceptable to the customers	Value adding process, Quality of product/service to end user, Total Quality Management	The business must be able to reduce variability and offer standard quality.	• Products meet quality and spec standards • SC Managers understand quality standards • Quality not unambiguous but specified • Quality standard maintained • Procurement of defect free product • Suppliers agree to work to quality standards • New SC members vetted and agree quality procedures
Visibility - Ensure that the supply chain is transparent and all parties are able to see and avoid blockages and issues surrounding bottom heavy inventories	Transparency between members, Bullwhip reduced, IT systems communicate, Information sharing, Pipeline visible to members, reduction in transaction risk	Enabling all parts of the supply chain to be transparent and avoid blockages, 'ice berg' inventories and hidden costs; keeping the customer informed.	• SC members have organisational compatibility • Cooperation and collaboration between SC members • SC members share information • Culture of integration in SC • Joint planning of supply chain • Open relationship with suppliers • Processes are integrated • Cooperation between managers in SC • Suppliers fully integrated
Virtuality - The ability to manage and coordinate the supply chain Using information technology	Multi-dimensional systems, improved communication	Coordinating of both intangible and tangible assets within SC. Facilitated by ICT give customer confidence and ensure dependability.	• Infrastructure issues addressed • New SC members IT evaluated • Standard IT platforms utilised • IT Security risks evaluated • Integration of SC members IT systems • SC members have compatible IT systems • Differing processes identified

The final model identifies specific CSFs that are related to each theme (shown in figure 4.2). These CSFs were inserted into the 7V Framework as highlighted in table 5.8. Through each of the stages undertaken and the utilisation of EFA and subsequent CFA, this research validated the 7V conceptual framework model. In doing so, this research offers a direct contribution in the field of supply chain management.

Previous SCM research has highlighted a clear link between the themes variety, variability and volume, specifically when discussing agile and lean supply chains (Christopher 2000). Evidence also suggested that virtuality could be added to the three themes (Coman and Ronen 2009). The literature also highlighted the possibility of other individual relationships between the themes within the framework (section 2.4). In addition, there was evidence for the plausibility that certain themes had an operational impact on each other. This was important discovery for the development of the study as it warranted the assumption that all themes could be brought together (Hines 2004).

The findings from the CFA, and the creation of figure 4.2 confirms that having utilised the CSFs highlighted from the EFA, the CFA offers a plausible model that suggests relationships exist. This is a clear contribution to knowledge as previously, no evidence confirmed a relationship between all of the seven themes within this conceptual framework.

In relation to the themes within the framework, value involves the expectations of the customer and the supplier's ability to manage them. The model has 4 CSFs associated to the theme value. The first is attributed to ensuring that all assets are fully utilised. The study suggests that this focus might come from supply chain decision makers' desire to attain value with what they had at their disposal.

However, fully utilising assets could also be interpreted as decision makers not wanting to waste assets that they do not fully utilise. The reason could simply be unnecessary fixed costs, raising overall costs that in turn could increase the customer’s expectations.

The attainment of value for all parties involved focuses on the expectations of both the supplier and the customer. The meeting of such expectations regarding the variable value within a practice setting should be seen as key to all parties within the supply chain. All members should be satisfied with the workings and outputs of the supply chain to ensure continued cooperation.

The reduction of costs could be seen as key within the variables associated with value. In the first instance, focus is placed on suppliers to ensure they add value and reduce costs. The second instance focuses on reducing costs whilst at the same time adding value. According to the CSFs identified this can be achieved through continual learning of the processes undertaken.

Volume-volatility ensures that customers have the flexibly to increase and decrease volume as their demands dictate. In essence, customers place specific demands on their downstream suppliers as a way to ease the demands on themselves (Hines 2013). Within the framework 4 key CSFs have been identified related to the theme. The CSF, ‘flexibility to address the changes in demand’ is key as previously highlighted (Christopher 2000, Narasimham and Das 2000, Power, Sohal et al. 2001). This flexibility needs to be examined from two perspectives. Firstly, the ability to be flexible for the customer so that they benefit is no doubt a competitive advantage that a supplier can offer. However, it is also crucial that the supplier reduces the risk to themselves of the Bullwhip effect as previously discussed in chapter 2 (Forrester 1961). The CSFs identified suggest that forecasting accuracy and suppliers ability to anticipate changes in demand will assist in the attainment of volume-volatility. However, it seems that for this to happen the supply chain and its members require to behave in an integrated manner as previously suggested by Elmuti (2002).

Velocity enables the customer to utilise speed as a competitive advantage by ensuring prompt delivery. Within the framework 5 CSFs were inserted against this theme. From these, two sub-themes of planning and proactive practices emerged. Firstly, the issues around planning are concerned with the variables (CSFs) of realistic time-frames being agreed and lead-times being carefully planned (Tyndall, Gopal et al. 1998). Interestingly these CSFs were originally suggested by practitioners during the round table discussions when creating the survey instrument. Enabling the customer to utilise speed as a competitive advantage, by ensuring prompt delivery is the very definition of velocity. CSFs related to velocity can be seen as having two sub-themes; proactive and reactive practises. Proactive practices are attributed to issues that decision makers should address during the planning stages of the supply chain process. The CSF of 'lead times being carefully planned', is also seen as a key operational issue for supply chains and can also be seen as an item that can be addressed during the planning stages of supply chain operations. Likewise, the CSF of 'realistic time-frames being agreed between supply chain partners' are negotiated either prior to the start of initial operations or before a supplier is integrated into a supply chain. The second sub-theme identified is that of reactive practices. This is seen as supply chain decision makers changing strategies in reaction to issues occurring within a supply chain. The first variable attributed to this is the identification of delays to reduce risk. Secondly, supply chain blockages are identified quickly and suppliers response is timely as previously discussed by Elmuti (2002) .

Variability focuses on the products/services having no varying levels of quality and being at a level that is acceptable to the customers. As shown in table 2.9, there were originally 22 possible CSFs identified from extant literature. Through the CFA this was reduced to 7 CSFs. As discussed in section 2.3.4, the importance of quality cannot be underestimated and will in part affect the length of relationships between supplier and customer. The loading of these CSFs onto the themes does not highlight their importance however, the descriptive statistics do show that each one is seen as being either ‘ important’ or ‘very important’ by decision makers. As highlighted in section 4.2, the CSFs of ‘quality standards are maintained’ and ‘products meet customer specifications/quality requirements’, can be ranked as the two most important. However, these are both closely followed by the other 7 CSFs associated to variability. The theme variability brings into play a subjective measurement in regards to an individuals’ understanding of value. It could be argued that there is a need for the CSF of quality not being ambiguous, will assist in managers/decision maker understanding these requirements.

As first highlighted by Forker, Mendez et al. (1997) the CSF of ‘the procurement of a defect free product’ is important to the attainment of variability. The last two CSFs focus upon the suppliers and what they must do before becoming part of a supply chain. Firstly, they must agree to work to quality standards and before they are even considered, new supply chain members must be vetted. The CSFs surrounding variability came under the most scrutiny when undertaking the round table discussions with the supply chain decision makers. Their opinions did not always align with the literature and this meant that new CSFs were created for insertion into the survey instrument. In addition, others were adapted to be more operationally defined.

As shown in in table 2.7, 30 possible CSFs were highlighted for consideration in relation to the theme visibility. Through the stages undertaken in the development of the survey instrument and subsequent EFA and CFA, this has been reduced to 9 CSFs. Interestingly, the EFA shows that the theme visibility is the component that makes up 27% of the variance, the most from any of the themes in the framework. All CSFs were seen as important from the decision-makers perspective. Unlike the previous theme of value, the CSFs associated with visibility linked closely to the extant literature. The CSF suggesting the culture of integration within the supply chain, which had a factor loading of 0.822 and open relationships with suppliers, were both seen as important by decision-makers in the attainment of visibility. This openness and integration between members is highlighted previously by Bowersox and Closs (1996) and Mentzer, DeWitt et al. (2001) . The next CSF within the framework associated with visibility goes further by suggesting suppliers should fully integrate within the supply chain and was taken from Chen, Lin et al. (2006). This importance of integration in relation to the attainment of visibility is key, even going to the extent of processes being fully integrated as shown in table 4.4. The remaining CSFs focus upon collaboration, cooperation and organisational capability which all have a clear grounding within the extant literature (Cooper, Lambert et al. 1997, Tyndall, Gopal et al. 1998, Mentzer, DeWitt et al. 2001). It is evidenced in section 2.4 that, throughout the growing body of SCM literature the theme of visibility is closely linked to that of final theme virtuality (Christopher 2011, Harrison and Hoek 2011, Williams 2014).

Virtuality is also linked to the themes variability, volume and variety as highlighted in figure 2.5. As IT systems are improving and becoming more accessible, the theme virtuality is becoming more prominent within supply chain operations. Further to the literature search and round table discussions, 11 potential CSFs were identified. After the EFA and subsequent CFA were undertaken this was reduced to 7 confirmed CSFs. As shown in table 4.4 all of the 7 CSFs loaded against virtuality were seen as important by SCM decision makers. All 7 CSFs loaded heavily against the component theme. The research has shown that the CSFs first highlighted by Williamson, Harrison et al. (2004);'infrastructure mismatches addressed between suppliers', 'differing processes between supply chain members' and 'IT security risks being evaluated and managed', are all key to the attainment of virtuality. In addition Mills (2001) ascertain that supply chain members IT platforms are compatible is essential.

In conclusion - Research objective 3

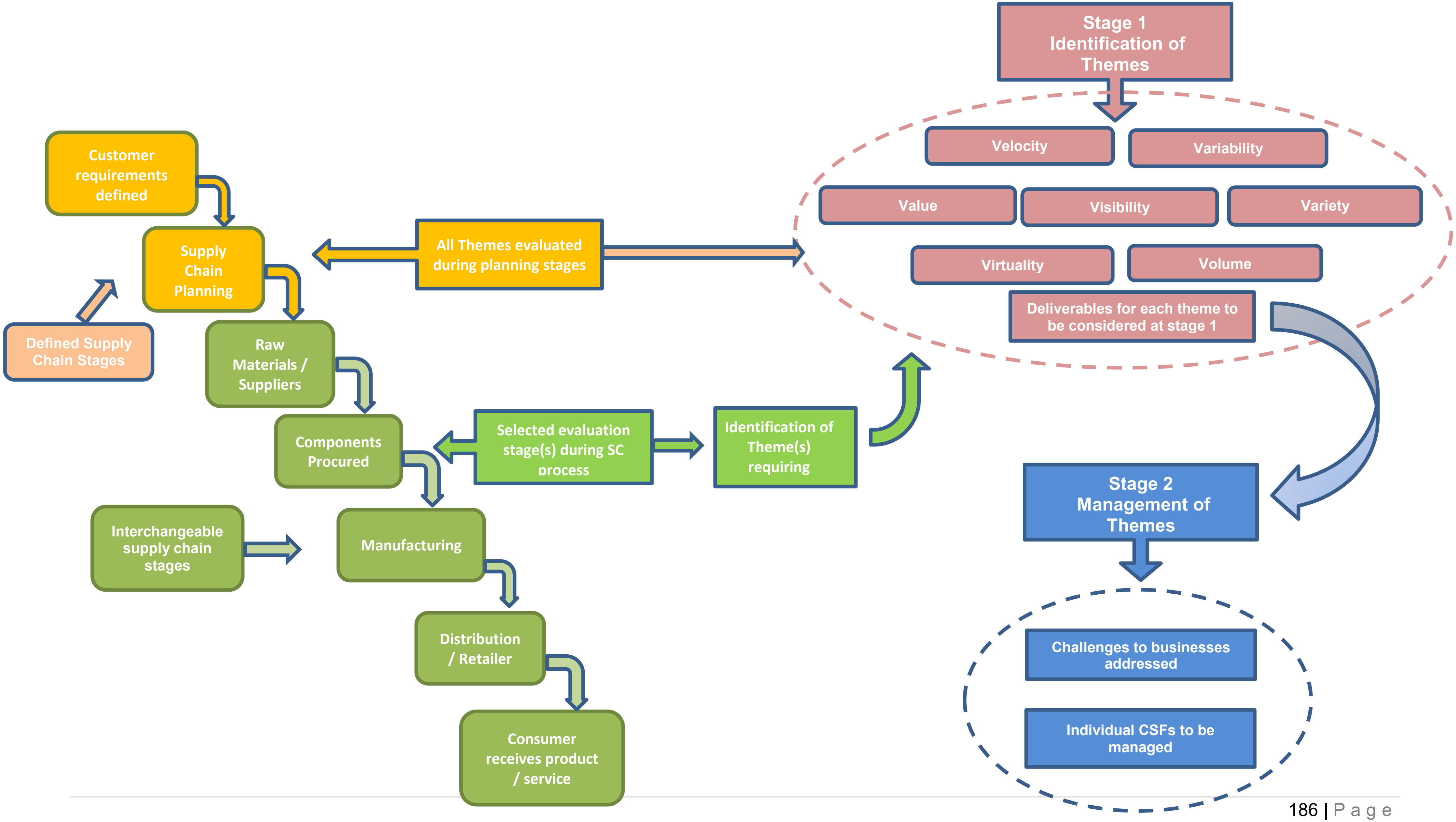
Through the processes undertaken that led to the inclusion of the CSFs into the 7V conceptual framework on the completion of the CFA, the framework can now be seen as validated. This staged process has shown that key CSFs can be attributed to individual themes and that through the attainment of Model Fit, the themes within the framework can be seen as related to each other. The attainment of research objective 3 is seen as a contribution to theory. The model that considers all themes within the framework has been validated.. It also considers the CSFs associated with each theme. The attainment of research objective 3 and the validation of the 7V Framework, allows research objective 4 to be addressed. This will be possible as the research looks to reconceptualise effective SCS on the evidence of from the study thus far. The research now moves onto phase 4 of the study.

5.4 Objective 4: Reconceptualise effective SCS on the evidence from the study

Having attained research objectives 1-3 during phases 1-3 of the study, focus turned to the development of the 7V Framework. This section utilised the now validated 7V Framework to reconceptualise effective supply chain strategies. To show the attainment of research objective 4, the study looked at how the 7V Framework highlighted in 5.8 can be interpreted within a supply chain process. Figure 5.1 will be used to explain how the 7V Framework can be used in practice. The section will also discuss the versatility and implementation of the Framework in different supply chains.

In addition, figure 5.1 highlights the 7V Framework giving specific consideration to issues at each stage of the supply chain process. At this point, it is again stated that no two supply chain processes are identical. However, this study would argue that most go through a linear development that starts with the planning stages, through to the eventual point where the customer receives the product or service. It is appreciated that supply chains are more complicated than that being suggested in figures 5.1 5.2 and 5.3, with many more tasks and sub-networks in operation. However, the processes outlined are realistic and give a clear pictorial view of the Framework.

Figure 5.1: Implementing the 7V Framework in a Supply Chain Process



It is accepted that when planning organisations will firstly decide upon the supply chain stages and process required. Figure 5.1 highlights an example of a generic supply chain process. Elements of this supply chain is interchangeable at differing stages. It begins with an organisation understanding the customer requirements, before then moving onto the planning stage and design stage of the supply chain. These two stages are described as defined stages within the context of figure 5.1 (highlighted yellow). It could be argued that these points are generic starting points for most supply chains.

Next, the process moves on to the interchangeable supply chain stages highlighted in the example supply chain process shown in figure 5.1. These stages are ‘raw materials being sourced’, ‘components produced’, ‘manufacturing takes place’ and ‘distribution hands the product or service on to the final customers’ (highlighted in green). The reason these stages are seen as interchangeable is that different products and services may need different stages and in turn strategies. An example would be the difference between clothing manufacturing and fresh food supply chains**.** The basic stages of a clothing supply chain may look similar to the one shown in figure 5.1; however, a fresh food supply chain may have fewer stages to consider. The reason for this is newer techniques which have suppliers picking and packaging vegetables in the fields then sending direct to the retailer, which results in produce being on the shelves within hours. It is reasonable to suggest that the first two stages would be similar (interchangeable stages). However, the type of product or service would have a direct influence on the stages later in the supply chain. This will be discussed in more depth in section 5.5, when the research objective 5 ‘evaluate implications for supply chain strategy practice’ is addressed.

Having highlighted the supply chain process, the next step was to integrate the two-stage implementation of the 7V framework onto the process.

Stage 1 – Implementing the 7V Framework

Stage 1 of the 7V Framework is the 'identification of key themes' associated with each point within the supply chain process. This stage progresses from the initial defined stages to the interchangeable stages. During the planning stage highlighted in figure 5.1, all themes within the 7V Framework need to be considered by supply chain decision makers. They should then be evaluated specifically in the context of the deliverables as highlighted in the 7V Framework (table 5.8). This will assist in giving supply chain decisions makers an opportunity to take a holistic view of deliverables and strategically plan in accordance with the information attained. The business challenges must be fully understood. In addition, all CSFs must be fully considered. Some CSFs may require that action is taken during the planning stage to ensure issues do not arise or flexibility is available to decision makers later in the supply chain process. For example, in relation to the theme variety it is essential that in order to achieve certain levels of customisation, both an 'ability to customise locally' and 'over specification is reduced' must be achieved. CSFs such as these may be better addressed during the planning stage of the supply chain process, where specific strategies can be put in place to deal with such matters.

Key themes requiring specific consideration during the interchangeable stages of the supply chain process would be identified during planning. Once the supply chain is in operation (interchangeable stages), the focus may centre on specific themes as they take prominence over other themes within the framework. All themes should be managed accordingly at each stage of the supply chain process. Some may just need simply monitoring, however, depending on the type of supply chain and stage within the process it could be that certain themes are more crucial than others. This would be for the supply chain decision makers to decide during the planning stage and when monitoring the process at a specific stage. For example in figure 5.1 during the manufacturing stage, the importance of visibility and volume volatility may be seen as more crucial, especially for organisations who want to see up the supply chain and adapt to the changes in demand, whether that be increasing or decreasing component parts. If an increase in component parts was necessary then velocity would be a crucial addition to be considered. If a decrease in requirements for component parts to reduce non required stock was necessary, then the volume volatility they offer their customers should be in an attempt to reduce possible ‘bullwhip’ in their supply chain. This should be carefully managed and not simply forced upon suppliers. In order for that to happen, it could be during this stage that visibility and virtuality could come into prominence. This would allow suppliers to see what customers are seeing and through IT technology adjust their own inventory levels. They key point at stage 1 and throughout the process is that each theme considered.

Stage 2 Managing the Framework

Stage 2 focuses on the management of the themes at each stage of the supply chain process. Having already confirmed that during the planning stage all themes should be considered, Stage 2 moves onto the business challenges and CSFs as highlighted on the 7V Framework (table 5.8). These challenges and CSFs should be addressed at the planning stage. As the supply chain stages develop, supply chain decision makers should focus on stage 2 issues as highlighted in table 5.9.

Table 5.9: Extract from 7V Framework

Theme	Concept / Deliverables	Business Challenges	Critical Success Factors (1st Tier)
Variety - The ability to customise or standardise a product as per consumer demands or even in anticipation of changes in demand	Local Customisation, Product/Service variety increasing over varying sectors, Increased outsourcing, Shorter product life cycles, Reduced complexity of customisation	Being able to customize the product/service offered. This may mean moving from economies of scale to economies of scope or economies of value to customer	• SC introduces product without new SC being created • Products not complex • Ability to customise locally • Over specification reduced • Changes to products not complex • Product design adaptable for differing markets

Stage 1 **Stage 2**

The prominent operational issues in the attainment of the theme are that the consideration of CSFs should be key in the deliberations of the decision makers. Table 5.9 extracts the theme variety from the 7V Framework. Key issues need addressing when focusing upon this theme during the retailer distribution of the supply chain process. As previously highlighted, the theme variety seeks to address the standardisation or customisation of a product. The business challenges at that particular point in the supply chain process are challenging. By addressing the CSFs associated with the theme at this stage of the process (and previously during the planning stage), it is suggested that this theme can be attained and a competitive advantage could be achieved.

In conclusion - Research Objective 4

Research objective 4 focused on the possibility of the supply chain strategies being reconceptualised by utilising the 7 V Framework. The Framework should not be used in isolation but rather as a management tool. The key point is that the 7V Framework will assist decision makers in planning and operating and will help to identify specific risks in supply chains.

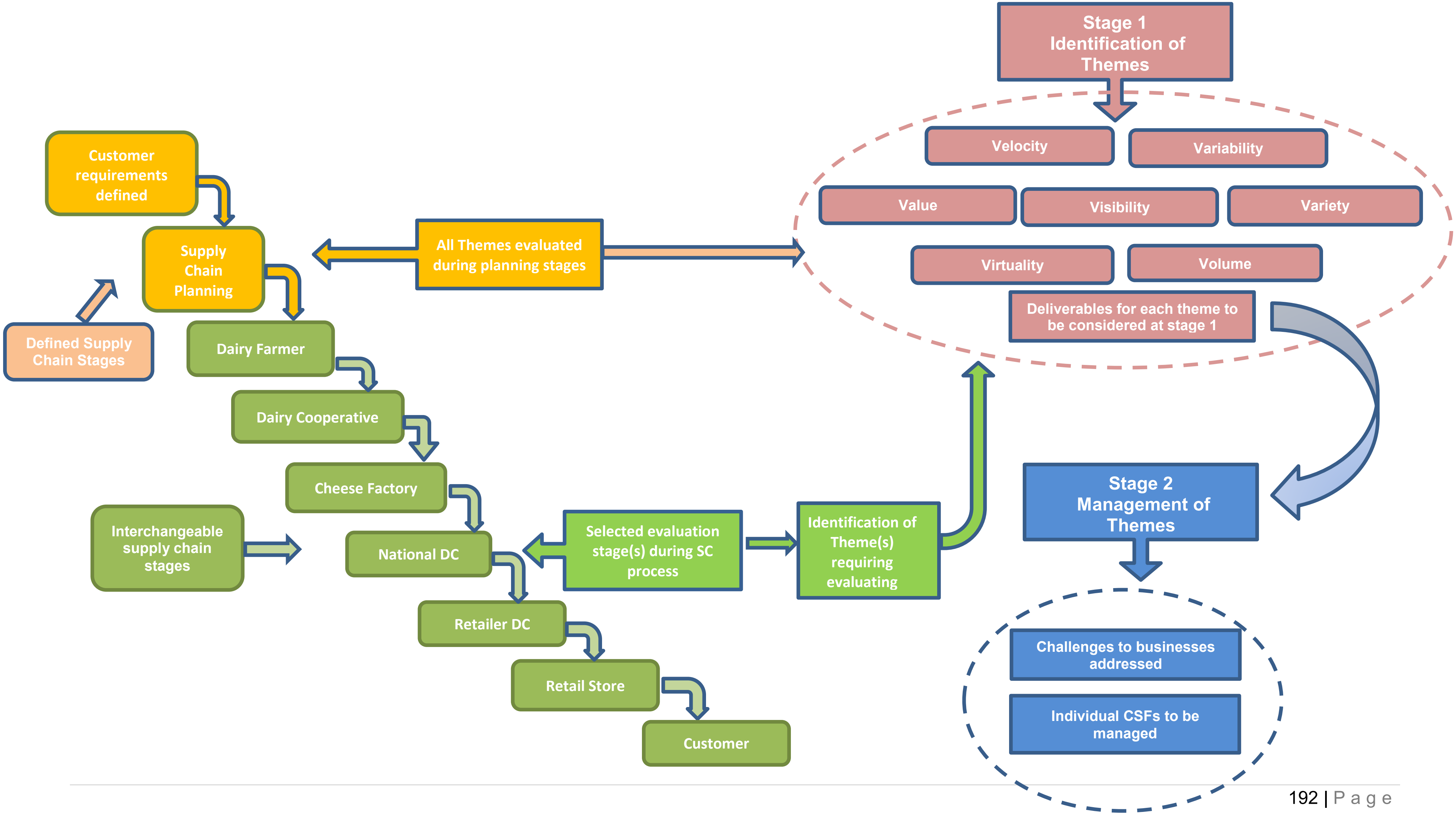
5.5 Objective 5: Evaluate implications for supply chain strategy practice

The fifth and final objective focuses on the contribution to practice from the research study. It is important to note that the 7V framework is not to be seen in isolation as the one stop shop. The 7V Framework should be seen as offering focus to key areas regarding the planning and managing of supply chains. If the 7V Framework was to be utilised during the stages highlighted it would offer decision makers guidance on what key areas should be examined.

There is no doubt that companies need to take a long term view when adopting SCM initiatives; the focus should be right across the supply chain from dirt to end user (Rao, Phillips et al. 2006). The literature states that competition in many industries will revolve around the development of supply chains (Narasimham and Das 2000). Therefore, the 7V Framework should be seen as an opportunity for organisations to make marginal gains in the improvement of their operations. It could assist in giving them focus around specific areas of operations as highlighted in section 5.4.

As can be seen in figure 5.2 the 7Vs Framework has been inserted onto a dairy supply chain. This type of supply chain deals with a product that has a specific time restraints placed upon it due to consumption date. Products must be with the retailer in enough time for them to sell it and for the customers to have enough time to store prior to consumption.

Figure 5.2: Implementing the 7V Framework onto a Dairy Supply Chain

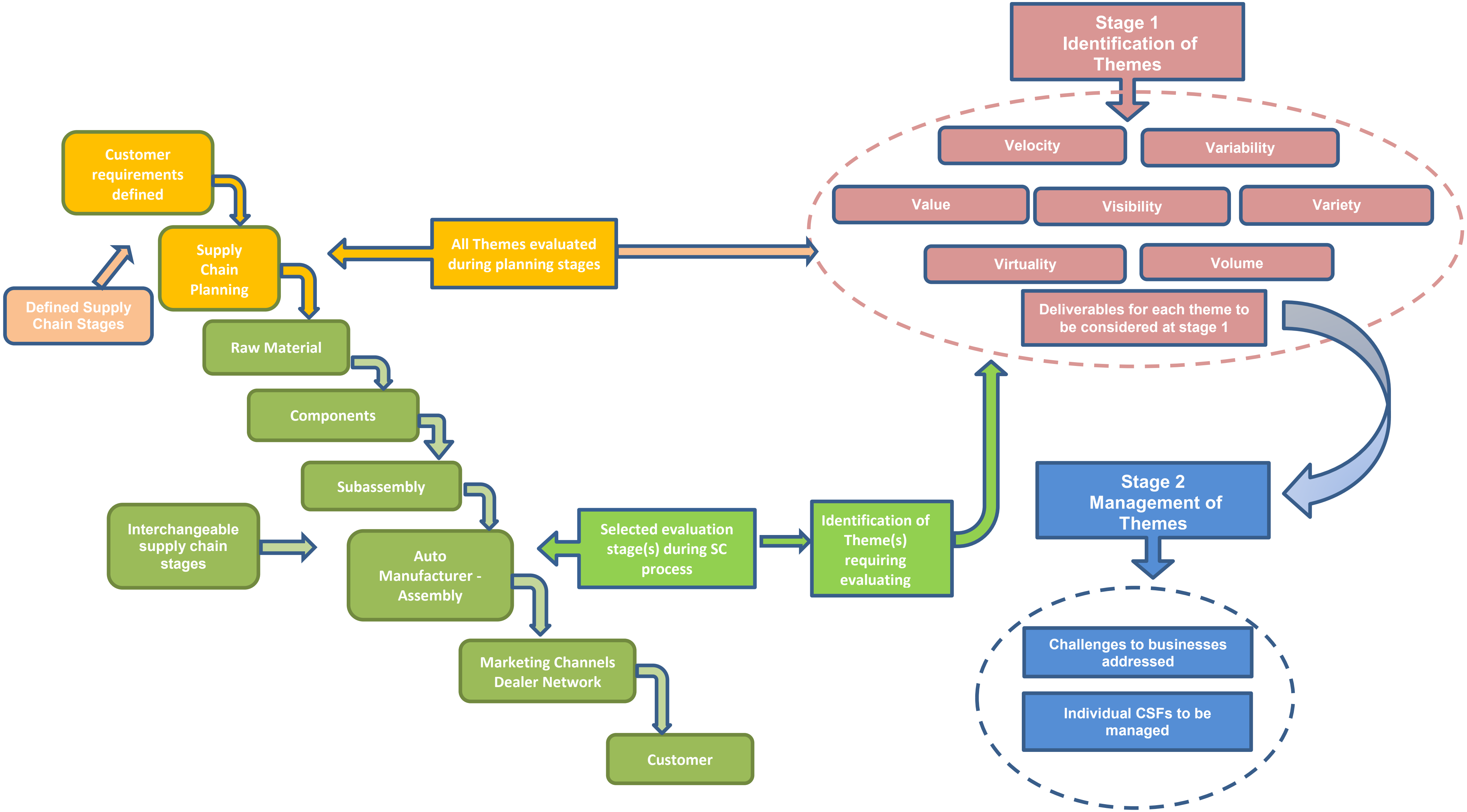


The sustainable issues surrounding waste and products not being fit for market are key with such supply chains. As per the previously highlighted stage 1, the organisation would have considered the framework in its entirety during planning. If consideration is given to CSFs within the framework during planning, then potential issues can be identified and addressed at the earliest stage. For example, during planning stages of the diary supply chain (figure 5.2), the theme volume could raise significant issues to be addressed.

The theme volume ensures customers have the flexibility to increase volume as their demands dictate. In relation to a dairy supply chain this would be a key issue in reducing waste, as suppliers could not simply place unwanted stock into storage. The CSFs identified highlight that forecasting would need to be accurate, suppliers would need to anticipate changes in demand, there would need to be flexibility to make changes due to demand and finally the supply chain would have to act in an integrated manner. The latter being key in that all members would be looking to work together to control the flow of products. If the focus then went on to the supply chain being in operation then other themes may become more prominent at certain stages. An example of this is shown again in figure 5.2. Within this supply chain, the point of the national distribution centre is key as it is at this point where all products come together. The visibility of the supply chain both back to the downstream suppliers and up to the retail store would be at its most crucial as to ensure that demand can be matched. This would enable the reduction of potential bullwhip effect. Within the framework key issues such as integration of and joint planning have already been addressed at the planning stage. However, at this point the national distribution centre, would be interested in ensuring that other

CSFs within the framework related to visibility are being addressed. These could be that supply chain members share information, all suppliers at that point are fully integrated, and there are continued open relationships between suppliers. The key business challenges here are that the supply chain is transparent and that blockages are avoided, all in an effort to keep the upstream customer informed. The 7V Framework is not designed to be rigid and should be seen as adaptable from supply chain to supply chain. In some instances at differing points on subsequent supply chains, themes and CSFs will be more prominent in relation to importance. This is acceptable and fully expected. It is the ability of the Framework to be adaptable that allows it to be used in such a holistic manner and in turn be used for different types of supply chains. For example, figure 5.3 highlights a car manufacturing supply chain. As previously stated all themes would be considered during planning. In this case, during operation the supply chain may be more focused on specific themes such as Virtuality and Variety. Within figure 5.3 the focus is at the auto manufacturer assembly stage. During this stage, all parts and components are brought together. All downstream suppliers are controlled through IT systems as is communication upstream. The business challenge here is to coordinate tangible and intangible assets within the supply chain facilitated by IT. In turn this should give customers confidence and ensure dependability (Hines 2004). The CSFs associated with virtuality at this time would have, in the most part, been addressed as the supply chain was designed or as new suppliers entered the process. However, the key thing in a supply chain like this is stability. Suppliers must be integrated through IT systems and standard IT platforms should continue to be used.

Figure 5.3: Implementing the 7V Framework onto a Car Manufacturing Supply Chain



Likewise, all IT security risks are evaluated and differing processes are identified. At this point in the supply chain IT systems would be crucial to the achievement of the theme variety. With customers wishing to customise products, in this case cars, the systems used by the marketing channels would need to feedback downstream through to the manufacturing assembly stage. Long gone are the days of Henry Ford's philosophy of you can have it in any colour as long as that colour is black.

This clearly shows the link again between virtuality and variety. The ability to customise or standardise a product as per customer demand is key within the marketing and dealer network of the car manufacturing industry. This type of supply chain would already ensure it had the ability to customise locally without starting a new supply chain as has been highlighted as two CSFs. Also, product design would be adaptable to differing markets, this could be differing engine sizes or simply seat fabrics.

It is this ability to deliver a standardised product that at the same time has been specified to the customers' requirements that is key here especially when addressing the CSF 'changes to product are not complex'. Most car models will come with a wide range of options from sound systems to alloy wheels. These are either fitted towards the end of the production line or locally once at the dealers. It is the ability to offer the customer variety, whilst at the same time addressing the CSFs identified that is key to this being a possibility.

In Conclusion

Research objective 5 focussed on the implications for supply chain practice through the implementation of the framework. It is important that with supply chains constantly changing, organisations find the external environment that they are operating in constantly changing through the face of economic and political uncertainty. It is therefore important that where possible they are utilising what information they have to their full advantage. Being able to identify key areas of operation and subsequent CSFs will be vital to organisations being best placed to achieve the competitive advantage they seek. The 7V Framework, offers organisations the opportunity to identify and manage CSFs associated with 7 key areas in delivering a successful supply chain.

Chapter 6 Conclusions

The overall aim of this research was to gain a greater understanding of key factors related to the effective delivery of supply chains.

This research identified specific CSFs believed to be associated with the successful delivery of supply chains. Additionally, the research offered evidence of the suitability of the 7Vs conceptual framework as an organisational tool for better understanding and managing these CSFs. The main findings of the research are:

- Firstly, the themes within the 7Vs conceptual framework have been conceptualised from the literature and validated through the empirical research
- Secondly, the identification of CSFs attributed to the successful delivery of supply chains has been achieved. Through the research process, 48 CSFs were identified as being related to specific themes within the conceptual framework that were directly attributed to the successful delivery of supply chains.
- Thirdly, the validation of the 7Vs conceptual framework through the achievement of model fit has contributed to theory.
- Finally, the research is able to draw implications for the practices of SCM.

To conclude this thesis, the following chapter will now reiterate both the contributions to theory and practice. The chapter will highlight the limitations of the research and discuss further areas of possible research suggested by this study. Finally, a personal reflection is offered by the researcher on the research process undertaken.

6.1 Contributions to Theory

Two clear contributions to theory can be taken from the findings of this study, the first being the confirmation of CSFs and secondly the validation of the 7Vs Framework. The attainment of these are discussed further in this chapter and can be seen as stand-alone contributions. Firstly, no other research can be found that confirms 48 CSFs related to the effective delivery of supply chains. Likewise no research been identified that has previously tested and in turn validated the 7V Framework.

As the aim and objectives of this study have been met, the contributions made should be discussed in relation to existing SCM models. Previously, the SCOR and Lamberts (1998) Models were highlighted as having been considered for the attainment of the aim and objectives of this study. Although, neither was deemed suitable for the identification of CSFs in SCM, it is believed that through its validation, the 7V Framework could now be utilised in conjunction with the SCOR model. It was previously highlighted, that it may be possible in what SCOR calls its management process of ‘Enable’. This is where SCOR ‘Manages Supply Chain Risk’. The 7 themed areas of the Framework along with the 48 CSFs offers specific guidance to supply chain decision makers that could assist in the area of risk identification. As this area is non prescriptive within the SCOR Model, the 7V Framework could be utilised by supply chain decision makers to assist organisations in what SCOR process highlights as designing and maintaining supply chains.

In relation to Lamberts (1998) Model, similar to the SCOR there are specific areas that do overlap and would add more depth of understanding. These would include what Lamberts (1998) model calls 'Demand Management' where forecasting and supply chain capabilities would be considered. However, unlike the SCOR model it does not offer a specific area in which the CSFs associated to the supply chain could be considered. Additionally, due to the Lambert (199) Models prescriptive structure it would be problematic for the 7V Framework to be added or run in conjunction with it.

6.1.1 Confirmation of CSFs

The identification of potential CSFs associated with the delivery was discussed in depth within section 2.5. It is noted, the extant literature associated to CSFs is growing as this research area develops. As supply chains are continually evolving they bring new factors that need consideration.

The premise set was that CSFs are in essence crucial to the outcome of an event or in this case the delivery of a theme. This allowed for a comfortable link to the 7V framework. The CSFs this research has confirmed as being associated with each theme has allowed for clarity in a research area that at present in still evolving.

To date, no other SCM research has been identified that gives such focus to CSFs in relation to the collective amount confirmed within this study. The confirmation of 48 CSFs from a possible 106 original analysed assisted in the attainment of research objective 2. The 48 CSFs confirmed following the EFA (table 4.2) reflected a direct contribution to theory. The research contributes to a deeper understanding of CSFs associated with supply chain management. Although the validation of the model post CFA reduces the number of CSFs associated with the framework in its entirety to 42 CSFs, if examining the themes individually then it would be prudent to focus on the findings of the EFA.

The extent in which the CSFs identified effect or impact supply chain management has not been measured and could be a possible avenue for future research; however, the implications of each CSF in relation to the individual themes within the framework has been discussed in depth within section 5.2. Each individual theme offers clear areas in which CSFs should be focused upon and considered by supply chain decision makers.

Visibility

The study has contributed to the identification and confirmation of 9 CSFs that need to be considered in ensuring that a supply chain is transparent, blockages can be identified and issues surrounding bottom heavy inventories can be addressed. These are:

- Culture of integration between supply within supply chain
- Suppliers are fully integrated within supply chain
- Cooperation between managers within supply chain
- Joint planning of supply chain between members
- Processes within supply chain are integrated
- Cooperation and collaboration between supply chain members
- Supply chain members share information openly
- Open relationships with suppliers
- Supply chain members has organisational compatibility

There are clear themes surrounding the CSFs related to Visibility of integration, cooperation and openness between suppliers. This suggests that where and when possible, physical and cultural barriers within supply chains and between participating members need to be addressed in order to achieve the challenges associated with the attainment of visibility.

Virtuality

This study contributed to the identification and confirmation of 7 CSFs that need be considered in ensuring that a supply chain is able to manage and coordinate itself using information technology. These are:

- Infrastructure mismatches are addressed with suppliers
- New supply chain members IT capabilities evaluated
- Differing processes between supply chain members identified
- Standard IT platforms agreed between members
- Integration of supply chain members
- IT security risks are evaluated and managed
- Supply chain members have compatible technologies

Section 2.6 identified 13 possible CSFs (see table 2.9) associated with the theme of virtuality. The development of the questionnaire reduced these to 11 prior to data collection. It first highlighted that there is a clear link between the themes virtuality and visibility (section 2.4). This suggests that the use of IT systems to manage and coordinate supply chains will assist in the transparency and ability of supply chains to identify potential blockages. It is clear that with advancements in technology supply chains will benefit, however, there is an argument that this technology must have compatibility with all supply chain members.

Variability

This study contributed to the identification and confirmation of 8 CSFs that need to be considered when ensuring that products/services quality has standard levels of delivery. In addition to that, delivery of products/services is at an acceptable level to the customer, in doing so the following CSFs were highlighted:

- Quality standards are maintained
- Products meet customer specification/quality requirements
- Quality not unambiguous but specified
- SC Managers understand quality standards
- New SC members vetted and understand quality procedures
- Lower tier suppliers agree to quality standards
- Procurement of defect free product
- Initial design of good quality.

The issue regarding attainment of quality is well noted within operational literature as discussed in section 2.3.4 and is a crucial value adding process (Sila, Ebrahhimpour et al. 2006). It is also suggested that it is the most visible aspect of supply chain performance (Gattorna 2010). The CSFs associated with the attainment of variability suggest a subtheme; that there needs to be an understanding of what quality actually means throughout the supply chain. This suggests that quality levels are given precedence throughout the supply chain. This is highlighted from the initial design, to the procurement of defect free products and right through to the final product meeting customer requirements.

<u>Value</u>

The study contributed to the identification and confirmation of 9 CSFs in relation to the attainment of what a customers expect against what the supplier can offer. The expectations related to the theme value are discussed within section 2.3.1. The attainment of value is problematic as highlighted within the literature for varying reasons. This is emphasized by the fact that initially the study had identified 26 potential CSFs from the literature and discussions with supply chain decision makers.

Issues such as value changing over time and more specifically the ability to fully understand expectations has been well articulated (Tracy and Tan 2001). From the process undertaken the study has been able to focus the attainment of value to the following:

- Flexibility offered regarding clients requirements
- Suppliers ability to add value and reduce costs
- Supply chain offers a service that meets clients requirements
- Assets fully utilised
- Reducing costs and adding value through continual learning
- Value for all parties is achieved
- Costs minimised
- Product offers customer satisfaction
- Supply chain is profitable for each partner

The ability for organisations to be able to anticipate what is acceptable to customers in today's markets is no doubt challenging (Sengupta, Heiser et al. 2006). The focus on value is difficult particularly due to the inability to directly measure it.

Although reduction of costs is seen as a key way to attain value as highlighted in the CSFs, it is seen more in a reduction of costs and value for all within the supply chain. Within this theme the CSFs remaining after the initial EFA was carried out were the ones created through the discussions with the supply chain decision makers and not the literature.

This supports the previous suggestion made in section 2.5.1 that the literature surrounding value is widely used and fragmented. The main contribution here was that the majority of CSFs identified in association with value were new and created from a purely operational perspective.

Variety

This study contributed to the identification and confirmation of 6 CSFs in relation to the ability to customise or standardise a product either through demand or due to anticipation of changes to demand. With products and services ever changing and adapting, the ability for supply chains to offer such flexibility is clear. To assist in this the following were highlighted as being key:

- Changes to products not complex
- Product not complex
- Ability to customise locally
- Over specification is reduced
- Design of products adaptable to differing markets
- SC can change or introduce new product without starting new SC

This is a clear indication that in order for organisations to offer variety, changes must be possible within the supply chain. New supply chains should not need to be started in order to implement changes to products or services. Decision makers must ensure products are not over complex, are adaptable to changes within the supply chain and have ability to customise locally.

Velocity

The speed in which an organisation can get products to market is widely accepted as an area where competitive advantage can be achieved as discussed in section

2.3.3. Enabling a customer to utilise this competitive advantage through the speed and prompt delivery forms the foundations of the theme velocity. This study has contributed to the research area through the identification and confirmation of 5 CSFs associated to the attainment of this theme, they are:

- Delays identified quickly to reduce risks
- Lead times have careful planning
- SC blockages need identified quickly
- Realistic time frames agreed
- Suppliers timely response to issues

As stated previously, the importance of velocity and improved responsiveness is a fundamental reason why organisations are investing in new approaches to enhance performance (Harrison and Hoek 2011). These CSFs identified can assist in the design of these new approaches.

Volume-Volatility

The ability for customers to have the flexibility to adjust demands on downstream suppliers in relation to demand from their own customers is the basis of volume-volatility. Literature highlighted that historically, this would be addressed by down-stream suppliers keeping high levels of inventory (Christopher 2011). Clearly, this would be impractical and costly. The focus should be to ensure the reduction in the 'bull whip' effect that is created through demand uncertainty. To that end, the study contributed to knowledge by confirming 4 CSFs attributed to attaining volume-volatility:

- Suppliers can anticipate changes in demand
- Forecasting is accurate
- Supply chain has flexibility to address changes in demand
- Behaviour within the supply chain is integrated

It could be argued that the management of volume-volatility needs to be addressed early in the planning stages and once the supply chain is operational as the CSFs would suggest.

6.1.2 Validation of 7V Conceptual Framework

Through the research undertaken it has been possible to validate the 7V conceptual framework. The framework is a step forward in the understanding of how decision makers see factors affecting supply chains. The framework has highlighted key issues that need managing in relation to CSFs associated with each theme. It has also contributed to knowledge in that it offers the premise that all themes within the framework are related. This is an important point as it confirms previous research, as highlighted in section 2.4. Earlier research focused on relationships between only three or four themes. Specifically around the discussions of lean and/or agile supply chain literature such as variety, variability and volume (Christopher 2011). However, this research is able to offer the plausibility that as a model the four additional themes of virtuality, value, visibility and virtuality can be included as confirmed in section 4.2.

This allows the researcher to suggest that the framework in its entirety may be utilised to give a clearer understanding to the factors affecting the successful delivery of supply chains.

6.2 Contribution to Practice

The practice of successful planning and managing of supply chains is becoming more crucial in a world where political economic and geographical borders are constantly shifting. This study makes a direct contribution to practice in the validation and development of the 7V Framework. The study has highlighted the importance organisations place on their supply chains. In certain cases, organisations are competing directly through their supply chains as they seek competitive advantages where possible.

This study offers a framework, which practitioners can use to identify and address CSFs at key points throughout the supply chain life cycle. Unlike previous research into CFSs, this framework is not focused on individual industries or organisations. This framework offers the ability to take a more holistic view of any supply chain, therefore its findings can be applied to different industries and organisations as highlighted in section 5.5. Practitioners can adapt the framework and in turn create checklists more aligned with their own organisations.

6.3 Limitations

The scope of the study highlights certain limitations. In relation to the findings, the scope of the 7V Framework focused on specific areas related to supply chain effectiveness. However, it is acknowledged throughout the study that these areas take a holistic view of all supply chains. Therefore, in its attempt to be non-prescriptive the model cannot cover all issues related to all supply chains. For example, if a supply chain has a focus on sustainability, then the model would need to be adapted to include a theme that could identify CSFs in that area. Furthermore, due to the snap shot in time, that this type of research study offers, certain CSFs may arise that had not been included and others may become less relevant.

Additionally, the scope of this study made the possibility of acquiring a representative sample of supply chain decision makers difficult, given the amount of people operating in supply chains. However, the sample size of 303 attained during the data collection offered a diverse range of opinion from key informants. Phase 1 of the study contributed to the identification of 105 possible CSFs. This was taken from both the extant literature and from discussions with supply chain decision makers. Efforts were made to have a diverse range of decision makers (from different supply chain backgrounds) at each round table discussion through the identification of CSFs and piloting of the survey instrument. However, this was not always possible due to the restrictions of only having access to one branch of the Chartered Institute of Procurement and Supply. One of the difficulties in carrying out research in this area is the job titles that are given to decision makers within supply chains. The population sought was that of supply chain decision makers. This is clearly a wide scope of roles and positions within organisations as shown in table 3.4. All recipients were required to highlight their job roles. No guarantee can be made that through the postal survey respondents accurately reflected these roles.

The survey instrument utilised a 7-point Likert scale so that a clearer representation of views would be achieved. Although the Likert scale provided a spread from 1 (Strongly disagree) to 7 (Strongly agree) most respondents answered either slightly agreeing, agreeing or strongly agreeing. This was highlighted in the mean scores and standard deviation. During piloting, no concerns were raised about the use of the 7-point Likert scale and it is noted that on responses to some questions, a wider spread of answers was achieved. This gives the researcher confidence that the layout of the questionnaires in part allowed for more thought being put into responses.

6.4 Further Research

Continued globalisation and the inherent need for organisational supply chains to become more competitive, has in part led to an increase in research within the area of CSFs. At the time of writing this thesis, supply chain research in the area of CSFs, is more organisation or industry focused and any holistic views of supply chains are limited. This lends weight to the argument that existing research is not transferrable between organisations and in turn industries.

The findings of the current study offer a framework that can be utilised to assist in the management of supply chains. This should be seen as a starting point as the framework can and will be developed further post completion of the PhD. It is envisaged that the next stage of this research is to take the 7V framework out into industry and assess its practical implementation within supply chains.

The current study has given clarity to the phenomena surrounding CSFs within supply chain management. The 7V Framework will assist decision makers during both planning and operations of supply chain management as stated. At present this is restricted to the 7V themed areas of the Framework as it stands. However, due to the non-prescriptive nature of the Framework it also offers flexibility to add in other themes through future research. For example, this could be in the growing research area of sustainability. By creating new themes and identifying potential deliverables, business challenges and CSFs the Framework could expand to include many areas related to the delivery of supply chains. As no causality between the themes or CSFs was sought during this study, future research could focus on the strengths of relationships between the themes.

Additionally, with current political and economic issues surrounding Briexit having organisations with supply chains scrambling for answers new avenues for research into CSFs arise. At the point of writing, ‘Article 50’ has not yet been invoked. Even when this happens, it will be at least two year of ambiguity through political negotiations, with some saying that it could take as long as 10 years for processes to truly completed. This offers the supply chain research community opportunities to focus on issues related to CSFs post Brexit supply chains for both British and European organisation. Organisations will be looking to understand what opportunities and challenges exist. With the potential risk of lower economic growth and possible tariffs, barriers to entry and restrictions on migration of labour, new areas of research have arisen.

6.5 In Conclusion

Supply chain management practice, research and literature continue to develop. It is time to reassess the issues that affect its successful outcome. Failures to address key issues in the delivery of supply chains could be catastrophic for organisations. As highlighted, organisations are competing more and more through supply chain efficiency. Knowledge gained through the better understanding and management of these supply chains could go a long way to attaining the competitive advantage organisations. Marginal gains can be achieved through better planning and focus on key areas during operations. The research around CSFs within supply chain management is nowhere nearing maturity, in part due to the changing face of the business environment. However, this offers an opportunity to further develop research in this field.

6.6 Personal Reflection

To conclude this thesis, the following section will reflect upon the journey I have taken over the past 6 years, from a Construction Project Manager trying to better understand his working environment to submitting the PhD. This will be structured by focusing on the reflection of the trigger and the research process.

6.6.1 Reflecting on the trigger

This study has no doubt taken me on a journey in relation to the processes it undertook and the research method it utilised. I have gone from a practicing construction project manager who undertook a part-time master's degree through a process that has developed me into an early career researcher. Previously my early research focused on the area of CSFs within the construction industry. As a project manager I had experience of what could go wrong and what needed to be managed. This focus was very much needs based. I wanted to understand how and what can go wrong and improve processes within the industry I worked.

I had very little knowledge regarding supply chain management other than it was crucial in the delivery of successful projects. Being a project manager I was considered the end user for many supply chains that feed into the construction projects. My initial research focused on project failure and specifically the identification of CSFs related to project management. From an operational perspective, the relationship between suppliers and a project had a profound effect on a project being delivered successfully. Delays were common and directly related to a supply chains inability to adapt or change to the programme requirements due to time restrictions and changes in the environment.

In practice, decisions relating to the choice suppliers make are often in direct response to the specification demanded from the client or external influences. Supply chains had pre-determined parameters in relation to distance and time. In essence, if these parameters do not reflect the needs of the overall project outcomes, experience suggests that it leads to issues surrounding project failure.

Although my initial research findings identified numerous CSFs within project management (PM) literature as being key to project success, one that linked to suppliers was that of SCM. Within PM literature, the individual CSF of SCM was limited and gave no depth as to why it was critical or what the variables were that influenced this process (Bellasi and Tukel 1996, Fortune and White 2006). Project management literature identified SCM as an individual CSF related to its own successful delivery. It did not give any depth to this CSF, giving little in the way of explanation as to what causes such a factor to arise. Further investigation highlighted that SCM had in turn the potential of having many CSFs that could lead it its own failure. It became apparent that this could be a gap and an opportunity to enhance the knowledge gained through my previous research into CSFs, by focusing solely on the CSFs related directly to SCM.

6.6.2 Reflections of the research process

My early research outputs focused on qualitative research for both my MSc and MRes dissertations. Whilst undertaking both my MSc and MRes both the research studies utilised qualitative research methods. I also co-authored a conference paper on how to undertake Thematic Analysis in business research. However, my PhD research took me out of my comfort zone of qualitative research methods. This was due to the necessity in achieving the aims and objectives of the research study. Due to the requirement to make generalisations from my findings, it set me on a path of gaining a deeper understanding of quantitative research methods. Having not undertaken any quantitative research methods previously, I found this a very difficult proposition. However, through the guidance of my supervision team and courses available at the university I was able to navigate my way through the quantitative research methods undertaken. I believe that this will be greatly beneficial to me both in my future academic teaching and research.

The creation of the survey instrument and the subsequent piloting was an enjoyable process and I took confidence from this. Through the development and piloting the instrument matured and became more focused and professional looking. The management of the data collection through the sending out of over 3000 postal questionnaires was a difficult task. The easier method would have been to undertake an online survey. However, response rates were a concern and the decision makers from the CIPs who helped me develop the questionnaires advised against such methods as their personal preference would be to receive a letter rather than something that could be treated as a spam email. The most difficult and arduous task was the inputting of the data from the returned questionnaires. This process took over 25 days of inputting data into an SPSS spreadsheet. However, it was also a rewarding task as I learnt about the use of the software and I could start to practice and run analysis as the data set was growing. Overall, I am satisfied with the quantitative research methods that I undertook. I believe that having undertaken this process I have become a more rounded early career researcher. I feel that I have a skill set which allows me to not be restricted in the type of research I am willing to carry out. In relation to the overall methodology I spent time struggling with the understanding of the philosophy and paradigms behind the approaches available to me. My thoughts had me looking at the study and assuming that through seeking generalisations that a positivist standpoint was required. This in turn gave me conflicting thoughts as I also saw the themes that I was looking to utilise within the framework, as being a social constructs. At that point, I looked at what I was trying to achieve, what I wanted to be able to say about the findings, I looked at myself, my back ground and the way that supply chain decision makers operate. In doing so it was clear that the philosophical approach of pragmatism fitted well. Research into Supply Chain Management and specifically CSFs is growing views from operational decision makers will be key to its continued development. I believe that the work I have undertaken has seen me grown from an at best novice student of research who didn't quite realise what he did not know and how far this journey would mature his outlook. I now see myself as a practitioner who now knows what he still has to learn and has the ability to develop the skills required for future studies.

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Appendix

Appendix A: Example cover letter and questionnaire

Manchester Metropolitan University

26th July 2012

Dear

<u>Reference: RIBM Research Questionnaire</u>

I am a research student at Manchester Metropolitan University Business School. My research is in the area of Supply Chain Management and I have identified you as someone who operates in this particular environment. My research investigates what the critical factors are that make supply chains work. By contacting people like yourself, with expertise in this area, I hope to contribute to our understanding of Supply Chain Management.

For this to be possible, I kindly request that you complete the enclosed questionnaire and return it in the addressed envelope, or if more suitable you can simply scan and email a copy back to me at s.bambrick@mmu.ac.uk. I fully understand how busy you must be and appreciate any assistance you can give in this matter. As a small token of appreciation for assisting me in my research, if requested I will send you a copy of the paper this research produces and would also like to invite you to attend a public dissemination of the research. All that is required is that you complete the request slip and return it in the same envelope as the completed questionnaire.

If I can be of any further assistance in this matter, please do not hesitate to contact me.

Yours Sincerely

Scott Bambrick
Doctoral Researcher

RIBM Small Grant Project

Supply chain success factors

Your views and experience

Please
will you help
us understand
effective supply chain
management, by spending
30 minutes completing the survey?
***Your* replies are completely confidential**

Your answers to the following questions will help us understand success factors in managing supply chains. We have identified and defined themes which appear before each question associated to them. Please answer the following questions with **your own organisation/department** in mind. To answer the questions, please mark ‘x’ in the most appropriate box that represents ***your own opinion*.**

About You

We are asking you for these details so that we can compare different groups of respondents. We will not use them to reveal your individual responses.

What is your job title ……………….…………………...........(Director, Manager, Buyer, Technician, etc)

What industry/sector is your organisation located ....(Manufacturing, Electronics etc)

How long have you worked within supply chains organisations ..……………….(Years)

Your organisation

With specific relation to the current organisation, you work within, approximately…	0-20	21-40	41-60	61-80	81-100	100+
…up to how many individual suppliers do they use	[ ]	[ ]	[ ]	[ ]	[ ]	[x]
…up to how many staff do they have	[ ]	[ ]	[ ]	[ ]	[ ]	[x]
…up to how many subcontractors do they use	[ ]	[ ]	[ ]	[ ]	[x]	[ ]
…up to how many different clients/projects do they manage	[ ]	[ ]	[ ]	[ ]	[x]	[ ]
…up to how many different individual components can be used in the final product	[ ]	[ ]	[ ]	[ ]	[ ]	[x]

With specific relation to your current organisation, where do you believe them to be located within their clients overall supply chain (if multiple clients then more than one answer is acceptable)…	Yes	No
…at the raw material stage (i.e. supplier for small component manufacturer)	[ ]	[x]
…at component pre-assembly stage (supplier for larger manufacturer)	[ ]	[x]
…at final manufacturing stage (prior to delivery to client/final user)	[x]	[ ]
…as a installation/service provider	[x]	[ ]
…other	[ ]	

***Value:** 'The relationship between what the customer wants and expects against what the supplier can offer'.*

To ensure '**Value**' can be achieved for the customer through the supply chain it is important…	Strongly disagree	Disagree	Slightly disagree	No opinion	Slightly agree	*Agree*	Strongly agree
… delays do not occur in product development that will slow time to market	☐	☐	☐	☐	☐	☒	☐
…the product/service delivered has no unnecessary features	☐	☐	☐	☐	☒	☐	☐
…a reliable and defect free product/service is produced	☐	☐	☐	☐	☐	☐	☒
…the product/ service supplied has stand-alone uniqueness	☐	☐	☐	☐	☒	☐	☐
…the product/service offers customer satisfaction	☐	☐	☐	☐	☐	☐	☒
…the supplier is able to offer flexibility regarding client requirements	☐	☐	☐	☐	☐	☒	☐
…it offers customer service that meets their expectations	☐	☐	☐	☐	☐	☐	☒
…non-value added activities must be removed from the supply chain to be efficient	☐	☐	☐	☐	☐	☒	☐
…flexible prices are applied to ensure that service costs add value	☐	☐	☐	☐	☐	☒	☐
…supplier has the necessary skills and equipment to add value and reduce cost	☐	☐	☐	☐	☐	☐	☒
…it represents value for money to all parties including the final customer	☐	☐	☐	☐	☐	☐	☒
…costs are minimized	☐	☐	☐	☐	☐	☐	☒
…the supply chain is profitable for each partner in the chain	☐	☐	☐	☐	☐	☒	☐
…there are no hidden costs	☐	☐	☐	☐	☐	☒	☐
…inventories in the supply chain must be kept low	☐	☐	☐	☐	☒	☐	☐
…practices such as JiT and Big JiT are applied as necessary to reduce SC total cost	☐	☐	☐	☐	☐	☒	☐
…cooperating /sharing information with all parties in the supply chain adds value	☐	☐	☐	☐	☐	☒	☐
…assets are fully utilised	☐	☐	☐	☐	☒	☐	☐
…continuous learning takes place to reduce cost and add value	☐	☐	☐	☐	☐	☐	☒
…there is effective sourcing of materials and suppliers	☐	☐	☐	☐	☐	☐	☒
…there are effective purchasing strategies in place	☐	☐	☐	☐	☐	☐	☒
…there are efficient purchasing practices employed	☐	☐	☐	☐	☐	☐	☒
…buyers are able to secure lowest prices when placing orders	☐	☐	☐	☐	☐	☐	☒
…goods at best price but not necessarily lowest price supplier	☐	☐	☐	☐	☐	☒	☐
…buyers ensure that there are no hidden costs in their purchasing decisions	☐	☐	☐	☐	☐	☐	☒
…buyers are able to achieve the required intake margin to allow for price flexibility	☐	☐	☐	☐	☐	☒	☐

Volume: 'Ensuring that customers have the flexibility to increase and decrease volume as their demands dictate'

To ensure that **volume** flexibility can be offered to customers, it is important that…	Strongly disagree	Disagree	Slightly disagree	No opinion	Slightly agree	Agree	Strongly agree
…the supply chain has the ability to alter pre-determined delivery dates	☐	☐	☐	☐	☒	☐	☐
…the supplier understands the customers market conditions	☐	☐	☐	☐	☐	☒	☐
…the suppliers are able to anticipate changes in demand	☐	☐	☐	☐	☐	☐	☒
… forecasting is accurate	☐	☐	☐	☐	☐	☐	☒
…the supply chain has reliable suppliers	☐	☐	☐	☐	☐	☐	☒
…data being used throughout the chain is accurate	☐	☐	☐	☐	☐	☒	☐
…decisions at the planning stage are correct	☐	☐	☐	☐	☐	☐	☒
…the behaviour of everyone in the supply chain is integrated	☐	☐	☐	☐	☐	☐	☒
…the supply chain is flexible enough to deal with sudden changes in demand	☐	☐	☐	☐	☐	☒	☐

Velocity: 'Enabling the customer to utilise speed as a competitive advantage, by ensuring prompt delivery'

To ensure that customers can utilise speed for competitive advantage it is important that…	Strongly disagree	Disagree	Slightly disagree	No opinion	Slightly agree	Agree	Strongly agree
…realistic timeframes are agreed	☐	☐	☐	☐	☐	☐	☒
…suppliers respond in a timely manner	☐	☐	☐	☐	☐	☐	☒
…suppliers have the ability to operate in a manner that assists in speed of delivery	☐	☐	☐	☐	☐	☒	☐
…levels of inventory are at a practical level for such operations	☐	☐	☐	☐	☐	☒	☐
…international tariffs and legislation are taken into account and managed	☐	☐	☐	☐	☐	☒	☐
…distance to delivery point is factored into timeframe	☐	☐	☐	☐	☐	☒	☐
…there are no complication in cost for the increased speed of delivery	☐	☐	☐	☐	☐	☒	☐
…intermediaries work with the same urgency as supply chain	☐	☐	☐	☐	☐	☒	☐
…lead times must be planned for carefully	☐	☐	☐	☐	☐	☐	☒
…blockages need to be identified quickly and removed	☐	☐	☐	☐	☐	☐	☒
…potential delays must be identified early to minimise risk	☐	☐	☐	☐	☐	☐	☒
…organizations learn from mistakes and factor this into future planning	☐	☐	☐	☐	☐	☐	☒

Variety: *'The ability to customise or standardise a product as per consumer demands or even in anticipation of changes in demand'.*

In order to customise or standardise products or services as to meet customer expectations it is important that…	Strongly disagree	Disagree	Slightly disagree	No opinion	Slightly agree	Agree	Strongly agree
…products are not complex	☐	☐	☒	☐	☐	☐	☐
…there is an ability to customise locally close to the point of final delivery	☐	☐	☐	☐	☒	☐	☐
…over specification is reduced	☐	☐	☐	☐	☒	☐	☐
…it has the ability to change to new or varied product, without starting a new chain	☐	☐	☐	☐	☐	☒	☐
…the quality of the product is not compromised	☐	☐	☐	☐	☐	☐	☒
…inventories are kept as low as possible	☐	☐	☐	☐	☒	☐	☐
…products are designed in a way that they are easily adaptable to different markets	☐	☐	☐	☐	☐	☒	☐
…all suppliers in the chain have the ability to support changes accordingly	☐	☐	☐	☐	☐	☒	☐
…communication across the supply chain is good	☐	☐	☐	☐	☐	☐	☒
…changes to product are not to complex	☐	☐	☒	☐	☐	☐	☐

Virtuality: ***'****The ability to manage and coordinate the supply chain using information technology'.*

To ensure supply chains can be managed and co-ordinated using information technology, it is important that…	Strongly disagree	Disagree	Slightly disagree	No opinion	Slightly agree	Agree	Strongly agree
…supply chain members have compatible information technology capabilities	☐	☐	☐	☐	☐	☒	☐
…relationships between supply chain members are constantly managed	☐	☐	☐	☐	☐	☒	☐
…there is a transparency of information	☐	☐	☐	☐	☐	☐	☒
…there is a joint strategy and determination between suppliers to ensure information systems and equipment are fit for purpose	☐	☐	☐	☐	☐	☒	☐
…security risks associated to using IT are evaluated and managed	☐	☐	☐	☐	☒	☐	☐
…the risk of infrastructure mismatch between suppliers and yourself has been assessed	☐	☐	☐	☐	☒	☐	☐
…differing processes between members are highlighted and managed	☐	☐	☐	☐	☐	☒	☐
…a comprehensive evaluation of a new supply chain members IT capabilities is carried out before they join the supply chain	☐	☐	☐	☐	☐	☒	☐
…integration of systems between key members of the supply chain has taken place	☐	☐	☐	☐	☐	☐	☒
…data produced on which key decisions are made is accurate	☐	☐	☐	☐	☐	☒	☐
…standard IT platforms are agreed to exchange data and information efficiently	☐	☐	☐	☐	☐	☒	☐

Variability:* *'The products/services have no varying levels of quality and that they are delivered in a manner that is of a level that is acceptable to the customer'.

In order to ensure that the supply chain produces consistent levels of quality, it is important that…	Strongly disagree	*Disagree*	Slightly disagree	No opinion	Slightly agree	Agree	Strongly agree
…there is a focus on planning and design of the supply chain	☐	☐	☐	☐	☐	☐	☒
…management practices are of a high standard across the supply chain	☐	☐	☐	☐	☐	☐	☒
…there is a culture of preventing problems by all members of the supply chain	☐	☐	☐	☐	☐	☒	☐
…there is procurement of a defect free product	☐	☐	☐	☐	☐	☒	☐
…there are good relationships between customer and suppliers	☐	☐	☐	☐	☐	☐	☒
…the initial design of the product is of good quality	☐	☐	☐	☐	☒	☐	☐
…there is good communication between all members of the supply chain	☐	☐	☐	☐	☐	☒	☐
…products meet customer specifications and achieve consistent quality	☐	☐	☐	☐	☐	☐	☒
…all managers within the supply chain understand the importance quality standards	☐	☐	☐	☐	☐	☒	☐
…quality standards are unambiguous and specified in processes	☐	☐	☐	☐	☐	☒	☐
…quality standards are maintained	☐	☐	☐	☐	☐	☐	☒
…continuous improvement is embedded in the supply chain processes	☐	☐	☐	☐	☐	☒	☐
…SC partners have appropriate accreditations to international standards (e.g. ISO 9000, 9001, 9002)	☐	☐	☐	☐	☐	☒	☐
…component suppliers and lower tier suppliers all work to agreed quality standards	☐	☐	☐	☐	☐	☒	☐
…new suppliers are subject to vetting procedures and understand quality standards	☐	☐	☐	☐	☐	☐	☒
…appropriate training is offered to improve/ maintain quality standards	☐	☐	☐	☐	☐	☒	☐
…regular compliance checks are made across the supply chain	☐	☐	☐	☐	☐	☒	☐
…regular compliance checks with outsourced or offshore supplies	☐	☐	☐	☐	☐	☒	☐

<u>Visibility:</u> *<u>'Ensure that the supply chain is transparent and all parties are able to see and avoid any blockages and issues surrounding bottom heavy inventories'.</u>*

To ensure transparency in the supply chain, it is important that…	Strongly disagree	Disagree	Slightly disagree	No opinion	Slightly agree	Agree	Strongly agree
…you are open with your supplier and have a close working relationship	☐	☐	☐	☐	☐	☒	☐
…suppliers are fully integrated with the supply chain	☐	☐	☐	☐	☐	☒	☐
…there is a culture of integration within the supply chain	☐	☐	☐	☐	☐	☒	☐
…there is close cooperation between managers throughout the supply chain	☐	☐	☐	☐	☐	☒	☐
…there is joint planning of the initial supply chain between suppliers and yourself	☐	☐	☐	☐	☐	☒	☐
…there is the availability of real time information	☐	☐	☐	☐	☐	☐	☒
…the processes within the supply chain are integrated	☐	☐	☐	☐	☐	☐	☒
…there is flexibility regarding business practices rather than them being entrenched	☐	☐	☐	☐	☐	☒	☐
…there are conflict resolution procedures	☐	☐	☐	☐	☐	☒	☐
…all supply chain members have access to similar information technology	☐	☐	☐	☐	☒	☐	☐
…members of supply chains have agreed goals	☐	☐	☐	☐	☐	☒	☐
…members openly share information	☐	☐	☐	☐	☐	☒	☐
…there is organisation compatibility /working practices between members	☐	☐	☐	☐	☐	☒	☐
…all members of the supply chain are committed to the process	☐	☐	☐	☐	☐	☒	☐
…management support is in place what does this mean?	☐	☐	☐	☐	☒	☐	☐
…there is shared risk and reward between yourself and supplier	☐	☐	☐	☐	☐	☒	☐
…there is co-operation and collaboration between all members of the supply chain	☐	☐	☐	☐	☐	☐	☒
…to measure inventories regularly	☐	☐	☐	☐	☐	☒	☐
…staff have skills and technology to identify potential delays as soon as possible	☐	☐	☐	☐	☐	☒	☐
…standardised practices are implemented where feasible	☐	☐	☐	☐	☐	☒	☐

<u>Any additional comments</u>

Thank you very much for taking the time to assist in this research, please return this completed questionnaire in the addressed envelope provided or email a scanned copy to s.bambrick@mmu.ac.uk.

Scott Bambrick,
Business School, All Saints Campus, Manchester Metropolitan University, Oxford Road, Manchester, M15

Appendix B: Descriptive statistics

Value 'The relationship between what the customer wants and expects against what the supplier can offer'										
To ensure value can be achieved for the customer through the supply chain it is important…	**Strongly Disagree** **1**	**2**	**3**	**%** **4**	**5**	**6**	**Strongly Agree** **7**	**N**	**Sd Dev**	**Mean**
Products off customer Satisfaction	**0.3**	**1.3**	**0**	**2.0**	**6.9**	**36.6**	**52.8**	**303**	**.865**	**6.36**
Flexibility offered regarding client requirements	0.3	1.0	1.7	1.7	15.2	50.5	29.7	303	.952	6.01
Supply chain offers service that meets clients requirements	**0**	**0**	**0.3**	**1.0**	**5.3**	**46.9**	**46.5**	**303**	**.665**	**6.38**
Supplier can add value and reduce costs	0	0.7	2.0	3.0	11.9	48.5	34.0	303	.927	6.08
Value for all parties are achieved	**0**	**0.3**	**1.0**	**1.0**	**9.6**	**45.2**	**42.9**	**303**	**.797**	**6.01**
Costs minimized	0	1.7	2.3	1.3	14.5	48.2	32.0	303	.893	6.01
Supply Chain is profitable for each partner	**0**	**0.3**	**1.7**	**3.0**	**10.9**	**44.9**	**39.3**	**303**	**.898**	**6.16**
Assets Fully utilised	0.3	3.0	4.6	8.3	18.2	41.9	23.8	303	1.258	5.62
Reducing costs/adding value through continuing learning	**0**	**0.3**	**0.7**	**5.3**	**14.2**	**45.9**	**33.7**	**303**	**.895**	**6.06**

Volume 'Ensuring that customers have the flexibility to increase and decrease volume as their demands dictate'										
To ensure that volume flexibility can be offered to customers, it is important that…	**Strongly Disagree** **1**	**2**	**3**	**%** **4**	**5**	**6**	**Strongly Agree** **7**	**N**	**Sd Dev**	**Mean**
Suppliers can anticipate changes in demand	**0**	**2.3**	**5.9**	**4.0**	**23.8**	**39.9**	**24.1**	**303**	**1.194**	**5.65**
Forecasting is accurate	1.0	2.0	3.6	3.0	17.2	40.9	32.3	303	1.220	5.85
Behaviour within supply chain is integrated	**0**	**0.3**	**1.3**	**4.0**	**19.5**	**40.9**	**34.0**	**303**	**.931**	**6.01**
Supply chain has flexibility to address changes in demand	0	0.3	1.3	0.3	8.6	50.5	38.9	303	.776	6.24

Velocity 'Enabling the customer to utilise speed as a competitive advantage, by ensuring prompt delivery'										
To ensure that customers can utilise speed for competitive advantage it is important that…	**Strongly Disagree** **1**	**2**	**3**	**%** **4**	**5**	**6**	**Strongly Agree** **7**	**N**	**Sd Dev**	**Mean**
Realistic time frames agreed	**0**	**0.3**	**0.7**	**1.7**	**6.9**	**42.2**	**48.2**	**303**	**.782**	**6.35**
Suppliers timely response	0	0	0	0.3	6.3	49.8	43.6	303	.615	6.37
Lead times have careful planning	**0**	**0.3**	**0.7**	**1.0**	**6.9**	**46.9**	**44.2**	**303**	**.750**	**6.32**
Supply chain blockages need to be identified quickly	0	0	0	0.7	5.0	44.9	49.5	303	.621	6.43
Delays need to be identified quick to reduce risk	**0**	**0**	**0**	**1.0**	**5.3**	**44.2**	**49.5**	**303**	**.641**	**6.42**

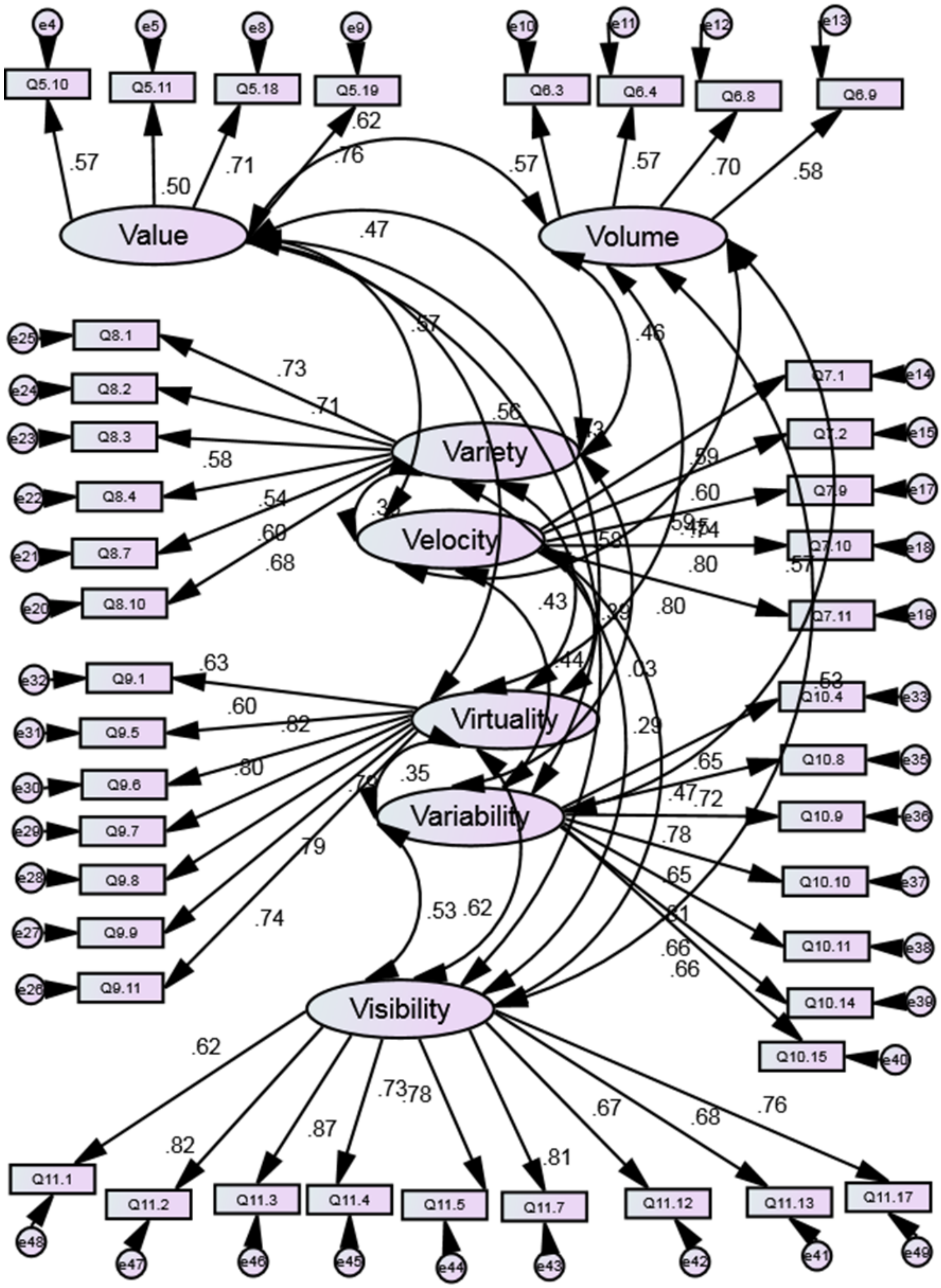
Variety 'The ability to customise or standardise a product as per consumer demands or even in anticipation of changes in demand'										
In order to customise or standardise products or services as to meet customer expectations it is important that…	**Strongly Disagree 1**	**2**	**3**	**% 4**	**5**	**6**	**Strongly Agree 7**	**N**	**Sd Dev**	**Mean**
Products are not complex	**4.0**	**18.8**	**9.6**	**15.5**	**16.8**	**24.4**	**10.9**	**303**	**1.785**	**4.39**
Ability to customise locally	2.6	12.2	9.6	13.5	21.1	27.7	13.2	303	1.670	4.75
Over specification is reduced	**0.3**	**2.6**	**4.6**	**10.9**	**18.5**	**41.6**	**21.5**	**303**	**1.249**	**5.55**
SC can change or introduce new product without starting new SC	0.3	2.6	5.3	11.6	22.8	38.0	19.5	303	1.254	5.46
Design of products adaptable for differing markets	**0.7**	**3.3**	**4.3**	**10.6**	**17.5**	**39.9**	**23.8**	**303**	**1.313**	**5.56**
Changes to product not complex	1.3	8.3	8.6	11.6	16.8	37.3	16.2	303	1.558	5.11

Virtuality 'The ability to manage and coordinate the supply chain using information technology'										
To ensure supply chains can be managed and co-ordinated using information technology, it is important that…	**Strongly Disagree 1**	**2**	**3**	**% 4**	**5**	**6**	**Strongly Agree 7**	**N**	**Sd Dev**	**Mean**
SC members have compatible technologies	**0**	**5.6**	**5.9**	**5.6**	**23.8**	**37.0**	**22.1**	**303**	**1.356**	**5.47**
IT security risks are evaluated and managed	0	0.7	3.0	6.6	12.9	44.2	32.7	303	1.046	5.95
Infrastructure mismatch have been addressed between suppliers	**0**	**1.7**	**4.6**	**15.8**	**17.5**	**41.3**	**19.1**	**303**	**1.196**	**5.50**
Differing processes between SC members identified	0	2.3	3.6	11.6	18.5	46.5	17.5	303	1.152	5.56
New SC member IT capabilities evaluated before insertion on SC	**0.3**	**8.3**	**12.2**	**11.6**	**22.1**	**28.1**	**17.5**	**303**	**1.545**	**5.01**
Integration of key SC Members IT systems takes place	1.0	9.2	10.2	11.2	16.2	35.6	16.5	303	1.592	5.05
Standard IT Platform agreed between SC members	**0.3**	**5.3**	**7.9**	**13.5**	**16.8**	**34.0**	**22.1**	**303**	**1.453**	**5.32**

Variability ' The products/services have no varying levels of quality and that they are delivered in a manner that is of a level that is acceptable to the customer'										
In order to ensure that the supply chain produces consistent levels of quality, it is important that…	**Strongly Disagree 1**	**2**	**3**	**% 4**	**5**	**6**	**Strongly Agree 7**	**N**	**Sd Dev**	**Mean**
Procurement of a defect free product	**0**	**0.3**	**2.6**	**2.0**	**9.9**	**45.5**	**39.6**	**303**	**.917**	**6.17**
Initial design of good quality	0.3	0.3	0.3	2.6	7.3	44.6	44.6	303	.844	6.28
Products meet customer specification and quality requirements	**0**	**0.3**	**0.3**	**1.0**	**4.0**	**33.7**	**60.7**	**303**	**.704**	**6.52**
SC managers understand quality standards	0	0	0.3	0.7	6.9	43.9	48.2	303	.695	6.39
Quality is not unambiguous but specified	**0.3**	**1.3**	**0.7**	**1.3**	**7.6**	**41.6**	**47.2**	**303**	**.937**	**6.28**
Quality standards are maintained	0	0	0.3	0.3	4.3	39.3	55.8	303	.650	6.50
Lower tier suppliers work to agreed quality standards	**0**	**0**	**0.3**	**4.0**	**11.9**	**46.5**	**37.3**	**303**	**.809**	**6.17**
New SC members are vetted and understand quality procedures	0.3	0.3	1.0	3.0	6.9	39.9	48.5	303	.901	6.30

Visibility 'Ensure that the supply chain is transparent and all parties are able to see and avoid any blockages and issues surrounding bottom heavy inventories'										
To ensure transparency in the supply chain, it is important that…	**Strongly Disagree 1**	**2**	**3**	**% 4**	**5**	**6**	**Strongly Agree 7**	**N**	**Sd Dev**	**Mean**
Open relationship with suppliers	**0**	**0.3**	**1.7**	**1.0**	**10.2**	**48.8**	**38.0**	**303**	**.829**	**6.19**
Suppliers are fully integrated into the SC	0	0.3	4.0	4.0	20.8	44.9	26.1	303	1.007	5.84
Culture of integration within SC	**0.3**	**0.7**	**5.0**	**4.3**	**18.8**	**46.2**	**24.8**	**303**	**1.094**	**5.78**
Close cooperation between managers within SC	0	0.3	3.0	2.6	17.8	46.5	29.7	303	.950	5.96
Joint Planning of SC between yourself and SC members	**0.7**	**2.3**	**2.3**	**2.6**	**16.2**	**44.9**	**31.0**	**303**	**1.147**	**5.9**
Process with SC are integrated	0.3	2.0	4.6	7.3	20.8	43.2	21.8	303	1.183	5.63
SC members share information	**0.3**	**2.3**	**5.3**	**8.6**	**18.8**	**43.2**	**22.4**	**303**	**1.235**	**5.61**
SC members have organisational compatibility	0.3	3.0	4.3	12.2	20.5	42.6	17.2	303	1.233	5.46
Corporation and collaboration between SC members	**0.3**	**0.7**	**1.3**	**5.9**	**16.8**	**46.5**	**28.4**	**303**	**.996**	**5.91**

Appendix C: Model 2 Confirmatory Factor Analysis AMOS


Value
Volume
Variety
Velocity
Virtuality
Variability
Visibility
Q5.10
Q5.11
Q5.18
Q5.19
Q6.3
Q6.4
Q6.8
Q6.9
Q7.1
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Q10.8
Q10.9
Q10.10
Q10.11
Q10.14
Q10.15
Q11.1
Q11.2
Q11.3
Q11.4
Q11.5
Q11.7
Q11.12
Q11.13
Q11.17

Model Fit – Model 2 Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	146	1674.690	799	.000	2.096
Saturated model	945	.000	0		
Independence model	84	7232.332	861	.000	8.400

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.768	.750	.864	.852	.863
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.928	.713	.800
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	875.690	762.045	997.064
Saturated model	.000	.000	.000
Independence model	6371.332	6103.302	6645.906

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	5.545	2.900	2.523	3.302
Saturated model	.000	.000	.000	.000
Independence model	23.948	21.097	20.210	22.006

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.060	.056	.064	.000
Independence model	.157	.153	.160	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	1966.690	2015.169		
Saturated model	1890.000	2203.784		
Independence model	7400.332	7428.224		

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	6.512	6.136	6.914	6.673
Saturated model	6.258	6.258	6.258	7.297
Independence model	24.504	23.617	25.414	24.597

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	157	162
Independence model	39	41

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Q5.10	<---	Value	.587	.068	8.599	***	
Q5.11	<---	Value	.446	.058	7.665	***	
Q7.1	<---	Velocity	1.000				
Q7.2	<---	Velocity	.804	.096	8.389	***	
Q7.9	<---	Velocity	1.201	.125	9.645	***	
Q7.10	<---	Velocity	1.074	.106	10.095	***	
Q7.11	<---	Velocity	1.113	.110	10.119	***	
Q8.10	<---	Variety	1.000				
Q8.7	<---	Variety	.739	.083	8.942	***	
Q8.4	<---	Variety	.641	.078	8.211	***	
Q8.3	<---	Variety	.684	.078	8.739	***	
Q8.2	<---	Variety	1.110	.108	10.291	***	
Q8.1	<---	Variety	1.230	.116	10.573	***	
Q9.11	<---	Virtuality	1.000				
Q9.9	<---	Virtuality	1.160	.085	13.609	***	
Q9.8	<---	Virtuality	1.131	.083	13.679	***	
Q9.7	<---	Virtuality	.853	.062	13.845	***	
Q9.6	<---	Virtuality	.909	.064	14.237	***	
Q9.5	<---	Virtuality	.581	.057	10.189	***	
Q9.1	<---	Virtuality	.792	.074	10.753	***	
Q10.8	<---	Variability	.837	.066	12.681	***	
Q10.9	<---	Variability	.901	.064	13.996	***	
Q10.10	<---	Variability	1.000				
Q10.11	<---	Variability	.874	.060	14.590	***	
Q10.14	<---	Variability	.892	.077	11.629	***	
Q10.15	<---	Variability	.983	.086	11.493	***	
Q11.17	<---	Visibility	.901	.074	12.115	***	
Q6.3	<---	Volume	1.000				
Q10.4	<---	Variability	1.000				
Q11.13	<---	Visibility	1.000				
Q11.2	<---	Visibility	.988	.076	13.016	***	
Q11.3	<---	Visibility	1.132	.083	13.633	***	
Q11.7	<---	Visibility	1.143	.089	12.846	***	
Q11.12	<---	Visibility	.990	.091	10.852	***	
Q11.1	<---	Visibility	.617	.061	10.130	***	
Q11.4	<---	Visibility	.823	.071	11.651	***	

			Estimate	S.E.	C.R.	P	Label
Q11.5	<---	Visibility	1.064	.086	12.394	***	
Q5.18	<---	Value	1.000				
Q5.19	<---	Value	.755	.070	10.843	***	
Q6.9	<---	Volume	.661	.090	7.310	***	
Q6.8	<---	Volume	.969	.118	8.203	***	
Q6.4	<---	Volume	1.034	.142	7.284	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q5.10	<---	Value	.569
Q5.11	<---	Value	.503
Q7.1	<---	Velocity	.590
Q7.2	<---	Velocity	.603
Q7.9	<---	Velocity	.739
Q7.10	<---	Velocity	.799
Q7.11	<---	Velocity	.802
Q8.10	<---	Variety	.681
Q8.7	<---	Variety	.597
Q8.4	<---	Variety	.543
Q8.3	<---	Variety	.582
Q8.2	<---	Variety	.706
Q8.1	<---	Variety	.731
Q9.11	<---	Virtuality	.742
Q9.9	<---	Virtuality	.785
Q9.8	<---	Virtuality	.789
Q9.7	<---	Virtuality	.798
Q9.6	<---	Virtuality	.819
Q9.5	<---	Virtuality	.598
Q9.1	<---	Virtuality	.630
Q10.8	<---	Variability	.717
Q10.9	<---	Variability	.782
Q10.10	<---	Variability	.651
Q10.11	<---	Variability	.811
Q10.14	<---	Variability	.665
Q10.15	<---	Variability	.658
Q11.17	<---	Visibility	.758
Q6.3	<---	Volume	.566
Q10.4	<---	Variability	.651
Q11.13	<---	Visibility	.680
Q11.2	<---	Visibility	.822
Q11.3	<---	Visibility	.867
Q11.7	<---	Visibility	.810

			Estimate
Q11.12	<---	Visibility	.672
Q11.1	<---	Visibility	.624
Q11.4	<---	Visibility	.726
Q11.5	<---	Visibility	.778
Q5.18	<---	Value	.715
Q5.19	<---	Value	.758
Q6.9	<---	Volume	.576
Q6.8	<---	Volume	.704
Q6.4	<---	Volume	.573

Intercepts: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q5.10	6.076	.053	114.149	***	
Q5.11	6.271	.046	136.963	***	
Q5.18	5.617	.072	77.752	***	
Q5.19	6.056	.051	117.752	***	
Q6.3	5.653	.069	82.413	***	
Q6.4	5.855	.070	83.525	***	
Q6.8	6.013	.054	112.389	***	
Q6.9	6.244	.045	140.041	***	
Q7.1	6.347	.045	141.296	***	
Q7.2	6.366	.035	180.103	***	
Q7.9	6.320	.043	146.654	***	
Q7.10	6.432	.036	180.379	***	
Q7.11	6.422	.037	174.518	***	
Q8.10	5.109	.090	57.066	***	
Q8.7	5.558	.075	73.674	***	
Q8.4	5.455	.072	75.708	***	
Q8.3	5.551	.072	77.378	***	
Q8.2	4.743	.096	49.443	***	
Q8.1	4.393	.103	42.836	***	
Q9.11	5.317	.083	63.696	***	
Q9.9	5.053	.091	55.256	***	
Q9.8	5.010	.089	56.441	***	
Q9.7	5.558	.066	83.983	***	
Q9.6	5.495	.069	79.999	***	
Q9.5	5.950	.060	99.049	***	
Q9.1	5.469	.078	70.191	***	
Q10.4	6.165	.053	115.784	***	
Q10.8	6.525	.040	161.389	***	
Q10.9	6.386	.040	159.975	***	
Q10.10	6.281	.053	117.944	***	

	Estimate	S.E.	C.R.	P	Label
Q10.11	6.495	.037	173.836	***	
Q10.14	6.165	.046	132.618	***	
Q10.15	6.297	.052	121.630	***	
Q11.13	5.459	.071	77.055	***	
Q11.12	5.607	.071	79.063	***	
Q11.7	5.630	.068	82.851	***	
Q11.5	5.901	.066	89.586	***	
Q11.4	5.964	.055	109.264	***	
Q11.3	5.782	.063	91.979	***	
Q11.2	5.842	.058	100.952	***	
Q11.1	6.195	.048	130.084	***	
Q11.17	5.914	.057	103.330	***	

Covariance's: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Value	<-->	Variety	.444	.083	5.358	***	
Variability	<-->	Volume	.230	.040	5.802	***	
Velocity	<-->	Variety	.163	.039	4.213	***	
Visibility	<-->	Velocity	.179	.033	5.491	***	
Virtuality	<-->	Variability	.228	.046	4.914	***	
Variety	<-->	Volume	.332	.068	4.896	***	
Value	<-->	Volume	.378	.065	5.775	***	
Visibility	<-->	Variability	.266	.041	6.489	***	
Value	<-->	Virtuality	.539	.084	6.389	***	
Value	<-->	Velocity	.236	.040	5.901	***	
Visibility	<-->	Virtuality	.555	.079	7.028	***	
Visibility	<-->	Variety	.261	.065	4.036	***	
Variety	<-->	Variability	.022	.043	.511	.609	
Virtuality	<-->	Volume	.326	.065	5.039	***	
Variety	<-->	Virtuality	.485	.090	5.364	***	
Velocity	<-->	Volume	.183	.034	5.457	***	
Velocity	<-->	Variability	.123	.023	5.384	***	
Value	<-->	Variability	.235	.044	5.381	***	
Visibility	<-->	Value	.437	.068	6.439	***	
Velocity	<-->	Virtuality	.192	.039	4.926	***	
Visibility	<-->	Volume	.302	.055	5.538	***	

Correlations: (Group number 1 - Default model)

			Estimate
Value	<-->	Variety	.467
Variability	<-->	Volume	.567

			Estimate
Velocity	<-->	Variety	.335
Visibility	<-->	Velocity	.465
Virtuality	<-->	Variability	.353
Variety	<-->	Volume	.464
Value	<-->	Volume	.624
Visibility	<-->	Variability	.528
Value	<-->	Virtuality	.558
Value	<-->	Velocity	.571
Visibility	<-->	Virtuality	.616
Visibility	<-->	Variety	.295
Variety	<-->	Variability	.035
Virtuality	<-->	Volume	.449
Variety	<-->	Virtuality	.425
Velocity	<-->	Volume	.589
Velocity	<-->	Variability	.443
Value	<-->	Variability	.435
Visibility	<-->	Value	.582
Velocity	<-->	Virtuality	.388
Visibility	<-->	Volume	.534

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Value	.805	.125	6.441	***	
Velocity	.212	.040	5.286	***	
Variety	1.124	.182	6.188	***	
Virtuality	1.158	.159	7.306	***	
Variability	.363	.047	7.703	***	
Volume	.456	.096	4.749	***	
Visibility	.700	.107	6.562	***	
e8	.771	.084	9.190	***	
e9	.340	.041	8.266	***	
e14	.397	.035	11.265	***	
e15	.240	.021	11.195	***	
e17	.255	.026	9.947	***	
e18	.139	.016	8.834	***	
e19	.146	.017	8.749	***	
e20	1.297	.128	10.109	***	
e21	1.105	.101	10.902	***	
e22	1.106	.098	11.248	***	
e23	1.028	.093	11.010	***	
e24	1.393	.142	9.784	***	
e25	1.477	.157	9.389	***	

	Estimate	S.E.	C.R.	P	Label
e26	.946	.088	10.808	***	
e27	.968	.094	10.337	***	
e28	.898	.087	10.287	***	
e29	.480	.047	10.160	***	
e30	.469	.048	9.808	***	
e31	.700	.060	11.618	***	
e32	1.106	.096	11.498	***	
e33	.494	.044	11.250	***	
e35	.240	.022	10.690	***	
e36	.187	.019	9.910	***	
e37	.494	.044	11.251	***	
e38	.145	.015	9.386	***	
e39	.364	.033	11.098	***	
e40	.459	.041	11.142	***	
e41	.815	.071	11.549	***	
e43	.480	.045	10.639	***	
e44	.517	.047	10.965	***	
e45	.425	.038	11.326	***	
e46	.296	.031	9.662	***	
e47	.328	.031	10.484	***	
e48	.418	.036	11.740	***	
e49	.420	.038	11.120	***	
e11	.997	.094	10.613	***	
e12	.437	.049	8.840	***	
e13	.401	.038	10.585	***	
e42	.833	.072	11.579	***	
e4	.579	.053	10.902	***	
e5	.473	.042	11.316	***	
e10	.965	.090	10.670	***	

Total: 2.159

Appendix D Sample from Population Statistics

Frequencies Sample Job Titles

Notes

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	Cases Used	Statistics are based on all cases with valid data.
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Statistics

Job Title

N	Valid	303
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Job Title

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Manager	197	65.0	65.0	65.0
	Buyer	60	19.8	19.8	84.8
	Director	46	15.2	15.2	100.0
	Total	303	100.0	100.0	

Appendix E Exploratory Factor Analysis 1st Iteration

Factor Analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.896
Bartlett's Test of Sphericity	Approx. Chi-Square	19488.826
	df	5565
	Sig.	.000

Communalities

	Initial	Extraction
Delays don't occur in product development	1.000	.326
Product has no unnecessary features	1.000	.374
Reliable/defect product is produced	1.000	.404
Product has standalone uniqueness	1.000	.237
Product offers customer satisfaction	1.000	.280
Flexibility offered regarding client requirements	1.000	.382
SC offers service that meets clients requirements	1.000	.320
Non-value activities removed from SC	1.000	.331
Flexible prices applied	1.000	.459
Supplier can add value and reduce costs	1.000	.512
Value for all parties are achieved	1.000	.409
Costs minimized	1.000	.386
SC is profitable for each partner	1.000	.251
No hidden costs	1.000	.428
SC inventories kept low	1.000	.467
JIT and Big Jit applied to reduce SC cost	1.000	.447
Sharing information within SC adds value	1.000	.377
Assets fully utilised	1.000	.535
Reducing costs/adding value through continuing learning	1.000	.524
Effective sourcing of materials and suppliers	1.000	.497
Effective purchasing strategies	1.000	.723
Efficient purchasing practices employed	1.000	.620
Buyers able to get lowest prices	1.000	.369
Goods at best price not necessarily lowest	1.000	.346
Buyers identify hidden costs	1.000	.583

Buyers achieve intake margins allowing flexibility	1.000	.423
SC can alter delivery dates	1.000	.276
Suppliers understands customer market conditions	1.000	.372
Suppliers can anticipate changes in demand	1.000	.294
Forecasting accurate	1.000	.375
SC has reliable suppliers	1.000	.495
Data within SC is accurate	1.000	.604
Planning stage decisions correct	1.000	.535
Behaviour with SC is integrated	1.000	.564
SC has flexibility to address changes in demand	1.000	.455
Realistic time frames agreed	1.000	.453
Suppliers timely response	1.000	.557
Suppliers operate in manner that facilitates speedy delivery	1.000	.537
Inventory at practical level for operations	1.000	.437
International tariffs/legislation considered	1.000	.410
Delivery distances factored	1.000	.439
Increased delivery speed doesn't complicate costs	1.000	.282
SC intermediaries work with same urgency as SC	1.000	.506
Lead times have carful planning	1.000	.549
SC blockages need to be identified quickly	1.000	.503
Delays needs to be identified quick to reduce risk	1.000	.500
Organisation learn from mistakes and factor into future planning	1.000	.448
Products not complex	1.000	.478
Ability to customise locally	1.000	.451
Over specification is reduced	1.000	.372
SC can change or introduce new product without starting new SC	1.000	.456
Quality is not compromised	1.000	.390
Inventories are kept as low as possible	1.000	.411
Design of products adaptable for differing markets	1.000	.441
Suppliers can support change	1.000	.532
Communication across SC is good	1.000	.467
Changes to product not complex	1.000	.396
SC members have compatible technologies	1.000	.476
Relationships between SC members are managed	1.000	.414

Transparency of information	1.000	.434
Strategy to ensure IT systems are adequate within SC	1.000	.583
IT security risks are evaluated and managed	1.000	.529
Infrastructure mismatch have been addressed between suppliers	1.000	.706
Differing processes between SC members identified	1.000	.681
New SC member IT capabilities evaluated before insertion to SC	1.000	.631
Integration of key SC members IT systems takes place	1.000	.613
Data produced is accurate	1.000	.436
Standard IT platform agreed between SC members	1.000	.586
Focus on planning and design	1.000	.347
Management practices are high with SC	1.000	.459
Culture of preventing problems with SC	1.000	.566
Procurement of defect free product	1.000	.536
Good relationships between customer and suppliers	1.000	.351
Initial design of good quality	1.000	.417
Good communication between SC members	1.000	.390
Products meet customer specification/quality requirements	1.000	.585
SC managers understand quality standards	1.000	.557
Quality is not unambiguous but specified	1.000	.477
Quality standards maintained	1.000	.644
Continuous improvement is embedded through SC	1.000	.457
SC partners have quality accreditations	1.000	.346
Lower tier suppliers works to agreed quality standards	1.000	.450
New SC members are vetted and understand quality procedures	1.000	.586
Training is offered to improve/maintain quality	1.000	.574
Regular compliance checks throughout SC	1.000	.638
Regular compliance checks outsourced	1.000	.501
Open relationship with suppliers	1.000	.508
Suppliers are fully integrated to SC	1.000	.603
Culture of integration within SC	1.000	.748

Close cooperation between managers with SC	1.000	.566
Joint planning of SC between yourself and SC members	1.000	.607
Availability of real time info	1.000	.504
Process with SC are integrated	1.000	.678
Flexibility regarding business practices	1.000	.269
Conflict resolution procedures are available	1.000	.449
SC members have access to similar IT	1.000	.642
SM members have agreed goals	1.000	.543
SM members share information openly	1.000	.584
SC members have organisational compatibility	1.000	.634
SC members are committed to process	1.000	.521
Management support in place	1.000	.559
Shared risk and reward between SC members	1.000	.465
Cooperation and collaboration between SC members	1.000	.693
Inventories measure regular	1.000	.438
Staff and It and skills to identify delays	1.000	.625
Standardised practices implemented where feasible	1.000	.514

Extraction Method: Principal Component Analysis.

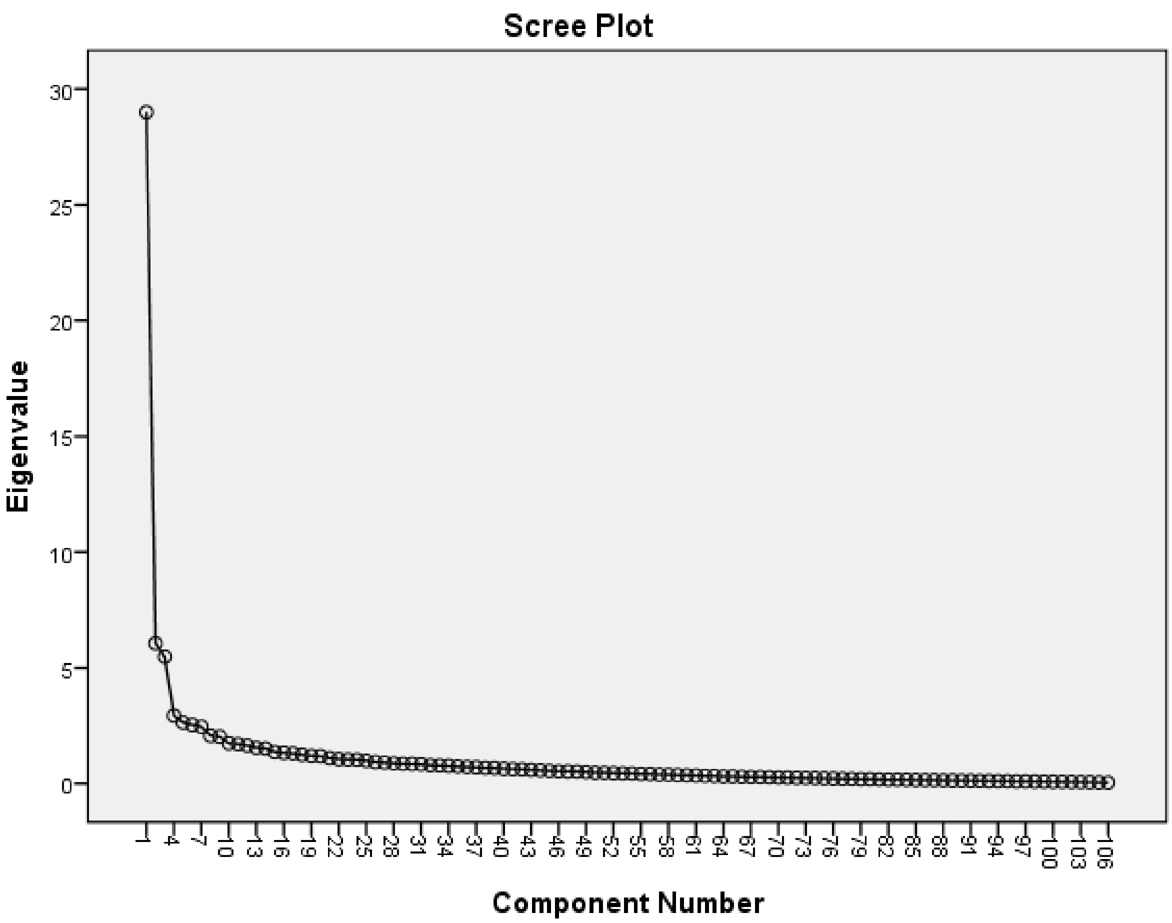
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	29.003	27.361	27.361	29.003	27.361	27.361	12.811	12.086	12.086
2	6.053	5.711	33.072	6.053	5.711	33.072	7.934	7.485	19.571
3	5.479	5.169	38.241	5.479	5.169	38.241	7.192	6.785	26.356
4	2.936	2.769	41.010	2.936	2.769	41.010	6.309	5.952	32.308
5	2.639	2.490	43.500	2.639	2.490	43.500	6.183	5.833	38.140
6	2.542	2.399	45.899	2.542	2.399	45.899	5.631	5.312	43.453
7	2.458	2.319	48.218	2.458	2.319	48.218	5.051	4.765	48.218
8	2.073	1.956	50.174						
9	2.033	1.918	52.092						
10	1.743	1.644	53.736						
11	1.705	1.609	55.345						
12	1.645	1.552	56.897						
13	1.550	1.462	58.359						
14	1.523	1.437	59.796						
15	1.366	1.288	61.084						
16	1.330	1.254	62.339						
17	1.300	1.226	63.565						
18	1.244	1.174	64.739						
19	1.201	1.133	65.872						
20	1.185	1.118	66.990						
21	1.103	1.040	68.030						
22	1.057	.997	69.027						
23	1.042	.983	70.010						
24	1.032	.974	70.984						
25	.993	.937	71.921						
26	.933	.880	72.802						
27	.905	.854	73.656						
28	.878	.828	74.484						
29	.856	.808	75.292						
30	.850	.802	76.094						
31	.838	.791	76.884						
32	.795	.750	77.635						
33	.785	.741	78.375						
34	.768	.725	79.100						
35	.739	.697	79.798						
36	.722	.682	80.479						
37	.706	.666	81.145						
38	.679	.641	81.786						
39	.675	.637	82.423						
40	.644	.608	83.031						
41	.630	.595	83.625						
42	.620	.585	84.211						
43	.594	.560	84.771						
44	.577	.544	85.315						
45	.556	.525	85.840						

46	.538	.508	86.348						
47	.528	.499	86.846						
48	.522	.493	87.339						
49	.501	.472	87.812						
50	.479	.452	88.263						
51	.473	.446	88.709						
52	.457	.431	89.140						
53	.448	.422	89.563						
54	.440	.415	89.978						
55	.420	.396	90.374						
56	.414	.391	90.765						
57	.394	.372	91.137						
58	.388	.366	91.503						
59	.375	.354	91.857						
60	.365	.344	92.201						
61	.352	.332	92.533						
62	.340	.321	92.854						
63	.333	.314	93.168						
64	.313	.296	93.464						
65	.311	.293	93.757						
66	.298	.281	94.038						
67	.289	.273	94.310						
68	.284	.268	94.578						
69	.276	.261	94.839						
70	.263	.248	95.087						
71	.259	.245	95.331						
72	.251	.236	95.568						
73	.243	.230	95.797						
74	.238	.224	96.022						
75	.229	.216	96.237						
76	.220	.208	96.445						
77	.207	.196	96.640						
78	.204	.192	96.833						
79	.195	.184	97.017						
80	.190	.179	97.196						
81	.182	.171	97.367						
82	.172	.163	97.530						
83	.169	.160	97.690						
84	.165	.156	97.846						
85	.155	.147	97.992						
86	.151	.143	98.135						
87	.149	.141	98.276						
88	.141	.133	98.408						
89	.135	.127	98.536						
90	.131	.124	98.660						
91	.127	.119	98.779						
92	.117	.110	98.889						
93	.116	.110	98.999						

94	.110	.104	99.103						
95	.108	.101	99.205						
96	.100	.094	99.299						
97	.096	.091	99.389						
98	.093	.087	99.477						
99	.087	.082	99.559						
100	.083	.079	99.638						
101	.079	.075	99.712						
102	.072	.068	99.780						
103	.068	.064	99.844						
104	.063	.059	99.903						
105	.053	.050	99.953						
106	.050	.047	100.000						

Extraction Method: Principal Component Analysis.



Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
Delays don't occur in product development	.407	.188	.234	.106	.018	-.081	.229
Product has no unnecessary features	.357	.246	.323	.231	.050	.125	.102
Reliable/defect product is produced	.454	-.170	.170	-.021	.303	.179	.122
Product has standalone uniqueness	.243	.314	.205	.122	.033	.105	.097
Product offers customer satisfaction	.388	-.070	.142	-.090	.259	.025	-.168
Flexibility offered regarding client requirements	.378	.020	.320	.132	.325	-.045	-.104
SC offers service that meets clients requirements	.396	-.162	.216	-.057	.239	.073	-.157
Non-value activities removed from SC	.244	.052	.359	.179	.207	.088	.240
Flexible prices applied	.478	.254	.311	.183	.161	.025	.097
Supplier can add value and reduce costs	.563	-.029	.278	.109	.295	.110	-.072
Value for all parties are achieved	.478	.021	.119	-.059	.283	.211	-.196
Costs minimized	.397	.062	.264	.354	.167	.023	.030
SC is profitable for each partner	.378	.016	.173	.135	.192	-.067	-.137
No hidden costs	.481	-.082	.245	.287	.003	-.027	-.216
SC inventories kept low	.313	.274	.188	.455	-.016	.051	.220
JIT and Big Jit applied to reduce SC cost	.483	.301	.073	.281	-.038	-.046	.187
Sharing information within SC adds value	.427	.337	.116	.062	.118	-.175	-.139
Assets fully utilised	.562	.276	.191	.096	.191	-.021	-.245
Reducing costs/adding value through continuing learning	.607	.188	.212	.012	.165	-.112	-.188
Effective sourcing of materials and suppliers	.556	-.186	.201	.066	.180	.120	-.248
Effective purchasing strategies	.673	-.336	.129	.217	-.053	.033	-.298
Efficient purchasing practices employed	.606	-.321	.159	.263	-.081	.035	-.218
Buyers able to get lowest prices	.295	.136	.223	.370	.152	.218	.082
Goods at best price not necessarily lowest	.391	-.149	.308	.062	-.243	.053	-.106
Buyers identify hidden costs	.562	-.386	.241	.152	-.107	.036	-.156
Buyers achieve intake margins allowing flexibility	.522	.126	.218	.171	-.081	-.038	-.223
SC can alter delivery dates	.379	.067	.317	.085	-.123	-.021	-.061
Suppliers understands customer market conditions	.499	.092	.173	-.020	-.075	.013	-.281
Suppliers can anticipate changes in demand	.448	.091	.056	-.023	-.273	.076	.030
Forecasting accurate	.489	-.113	.161	-.011	-.281	.131	-.035
SC has reliable suppliers	.443	-.495	.101	-.159	-.001	.129	-.048
Data within SC is accurate	.606	-.392	.152	-.083	-.151	.146	-.099

Planning stage decisions correct	.533	-.271	.162	.049	-.346	.162	.059
Behaviour with SC is integrated	.642	-.088	.190	-.038	-.296	-.106	-.088
SC has flexibility to address changes in demand	.501	-.273	.182	.054	-.251	-.070	-.160
Realistic time frames agreed	.427	-.091	.323	-.296	.061	-.259	-.021
Suppliers timely response	.461	-.124	.323	-.339	.226	-.242	-.010
Suppliers operate in manner that facilitates speedy delivery	.557	-.160	.327	-.216	.050	-.211	-.031
Inventory at practical level for operations	.482	-.099	.260	-.143	-.291	-.044	-.146
International tariffs/legislation considered	.519	-.054	.237	-.211	-.187	.019	.041
Delivery distances factored	.564	-.058	-.044	-.302	-.038	.024	.150
Increased delivery speed doesn't complicate costs	.415	.120	.207	-.019	-.128	.108	.155
SC intermediaries work with same urgency as SC	.648	-.028	.069	-.091	-.083	-.194	.164
Lead times have carful planning	.500	-.061	.203	-.342	.041	-.252	.268
SC blockages need to be identified quickly	.559	-.107	.121	-.315	.100	-.127	.198
Delays needs to be identified quick to reduce risk	.552	-.013	.208	-.288	.047	-.187	.179
Organisation learn from mistakes and factor into future planning	.466	-.316	.209	-.132	-.215	-.113	-.103
Products not complex	.277	.459	.163	.012	-.371	.072	.147
Ability to customise locally	.313	.411	.310	.047	-.256	-.055	.132
Over specification is reduced	.308	.226	.392	-.067	-.116	-.053	.228
SC can change or introduce new product without starting new SC	.400	.189	.287	-.009	-.188	-.231	.298
Quality is not compromised	.385	-.196	.223	-.094	.324	-.059	.190
Inventories are kept as low as possible	.305	.264	.279	.260	.072	.055	.306
Design of products adaptable for differing markets	.379	.286	.384	-.025	-.143	.046	.214
Suppliers can support change	.603	.116	.315	-.199	.031	-.124	-.007
Communication across SC is good	.515	-.012	.174	-.251	.276	-.150	.102
Changes to product not complex	.235	.375	.253	.004	-.289	.205	.100
SC members have compatible technologies	.449	.380	-.043	-.260	.014	.215	-.118
Relationships between SC members are managed	.549	.230	-.027	-.206	.041	-.055	-.111
Transparency of information	.479	.372	-.001	-.160	-.078	-.015	-.187
Strategy to ensure IT systems are adequate within SC	.547	.356	-.072	-.272	-.055	.144	-.234
IT security risks are evaluated and managed	.449	.139	-.091	-.325	.064	.392	-.190

Infrastructure mismatch have been addressed between suppliers	.633	.283	-.119	-.254	-.024	.380	-.038
Differing processes between SC members identified	.628	.306	-.219	-.232	-.021	.299	.009
New SC member IT capabilities evaluated before insertion to SC	.551	.348	-.230	-.070	.098	.364	-.083
Integration of key SC members IT systems takes place	.566	.376	-.274	-.078	-.051	.251	-.061
Data produced is accurate	.495	-.066	-.223	-.298	.025	.184	.116
Standard IT platform agreed between SC members	.518	.385	-.125	-.154	.042	.326	-.147
Focus on planning and design	.566	-.138	.043	.032	-.062	.033	-.009
Management practices are high with SC	.612	-.269	.010	.075	-.081	.002	-.022
Culture of preventing problems with SC	.634	-.298	-.229	.053	-.107	-.076	.048
Procurement of defect free product	.577	-.389	-.024	.086	.075	.186	.051
Good relationships between customer and suppliers	.376	-.196	-.107	-.091	.156	-.024	.355
Initial design of good quality	.379	-.223	.185	-.119	.159	.339	.187
Good communication between SC members	.556	-.020	-.161	-.132	.126	-.099	.109
Products meet customer specification/quality requirements	.427	-.578	-.096	.098	.169	.135	-.051
SC managers understand quality standards	.617	-.384	-.108	.077	.031	.099	.030
Quality is not unambiguous but specified	.476	-.424	-.085	.167	.010	.165	.091
Quality standards maintained	.528	-.537	-.122	.135	-.016	.133	.163
Continuous improvement is embedded through SC	.595	-.050	-.176	-.018	.098	-.016	.243
SC partners have quality accreditations	.381	.143	-.193	.158	.095	.178	.277
Lower tier suppliers works to agreed quality standards	.596	-.209	-.121	.048	.087	.124	.106
New SC members are vetted and understand quality procedures	.516	-.341	-.269	.067	-.007	.198	.296
Training is offered to improve/maintain quality	.658	-.121	-.330	.112	-.035	-.022	.062
Regular compliance checks throughout SC	.656	-.203	-.358	.135	-.071	.022	.122
Regular compliance checks outsourced	.536	-.181	-.399	.036	.033	.061	.124
Open relationship with suppliers	.518	.115	-.251	-.042	.236	-.284	.158
Suppliers are fully integrated to SC	.599	.193	-.323	.116	.090	-.266	-.103
Culture of integration within SC	.663	.180	-.406	.141	.094	-.285	-.030
Close cooperation between managers with SC	.642	.009	-.226	.057	.058	-.260	-.170
Joint planning of SC between yourself and SC members	.663	.096	-.342	.170	.000	-.111	.005

Availability of real time info	.635	.028	-.283	-.006	-.099	-.097	-.011
Process with SC are integrated	.699	.209	-.353	.095	-.014	-.088	-.055
Flexibility regarding business practices	.454	-.076	-.084	.074	-.130	-.162	-.042
Conflict resolution procedures are available	.590	.089	-.193	.198	-.024	-.129	.005
SC members have access to similar IT	.630	.370	-.264	.081	.131	.092	-.076
SM members have agreed goals	.685	.165	-.188	.035	.037	-.062	.069
SM members share information openly	.572	.307	-.314	.037	.176	-.166	-.063
SC members have organisational compatibility	.661	.274	-.331	.080	-.030	-.074	.012
SC members are committed to process	.657	.028	-.206	-.082	.086	-.167	-.063
Management support in place	.652	-.164	-.269	-.047	-.081	-.028	.161
Shared risk and reward between SC members	.572	.110	-.117	.204	-.122	-.173	-.161
Cooperation and collaboration between SC members	.742	-.007	-.162	.063	-.038	-.262	-.207
Inventories measure regular	.558	.081	-.246	.068	-.213	-.006	.098
Staff and It and skills to identify delays	.659	-.195	-.259	-.087	-.267	-.062	.061
Standardised practices implemented where feasible	.656	-.003	-.225	.027	-.177	-.029	-.001

Extraction Method: Principal Component Analysis.
a. 7 components extracted.

Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
Delays don't occur in product development	.183	.084	.066	.466	.024	.227	.108
Product has no unnecessary features	.056	.101	.048	.533	.113	.026	.247
Reliable/defect product is produced	.035	.061	.419	.160	.128	.241	.351
Product has standalone uniqueness	.058	-.003	-.034	.431	.168	.024	.131
Product offers customer satisfaction	.101	.126	.119	-.005	.164	.222	.404
Flexibility offered regarding client requirements	.084	.090	.055	.230	.005	.183	.526
SC offers service that meets clients requirements	.028	.198	.189	.014	.126	.210	.429
Non-value activities removed from SC	-.076	-.018	.188	.443	-.050	.142	.266
Flexible prices applied	.167	.073	.055	.519	.118	.156	.339
Supplier can add value and reduce costs	.133	.175	.238	.265	.149	.181	.531
Value for all parties are achieved	.112	.115	.180	.073	.342	.127	.461
Costs minimized	.153	.122	.135	.413	-.057	-.003	.393
SC is profitable for each partner	.186	.142	.039	.156	.022	.108	.398
No hidden costs	.205	.404	.080	.223	-.026	-.012	.407
SC inventories kept low	.196	.033	.074	.620	-.050	-.128	.136
JIT and Big Jit applied to reduce SC cost	.375	.077	.061	.531	.070	.032	.094
Sharing information within SC adds value	.346	.071	-.195	.270	.162	.163	.297
Assets fully utilised	.311	.167	-.090	.285	.267	.123	.484
Reducing costs/adding value through continuing learning	.325	.218	-.052	.249	.213	.261	.438
Effective sourcing of materials and suppliers	.138	.345	.242	.060	.161	.114	.508
Effective purchasing strategies	.298	.603	.297	.039	.034	.014	.423
Efficient purchasing practices employed	.249	.570	.296	.103	-.025	-.011	.367
Buyers able to get lowest prices	.048	.027	.177	.458	.049	-.139	.321
Goods at best price not necessarily lowest	.010	.522	.100	.194	.048	.085	.128
Buyers identify hidden costs	.131	.592	.318	.085	-.039	.094	.310
Buyers achieve intake margins allowing flexibility	.267	.388	-.058	.284	.140	.041	.310
SC can alter delivery dates	.076	.347	-.024	.312	.068	.124	.178
Suppliers understands customer market conditions	.210	.385	-.057	.137	.262	.111	.276
Suppliers can anticipate changes in demand	.208	.336	.090	.248	.237	.088	-.068
Forecasting accurate	.109	.494	.200	.188	.186	.095	.025
SC has reliable suppliers	.005	.413	.453	-.148	.077	.243	.179
Data within SC is accurate	.105	.580	.402	.001	.157	.198	.176
Planning stage decisions correct	.097	.580	.361	.203	.100	.083	-.027
Behaviour with SC is integrated	.287	.590	.094	.195	.124	.256	.075

SC has flexibility to address changes in demand	.181	.599	.155	.060	-.011	.132	.138
Realistic time frames agreed	.082	.281	-.008	.061	.040	.566	.205
Suppliers timely response	.076	.193	.062	.024	.061	.637	.316
Suppliers operate in manner that facilitates speedy delivery	.139	.375	.101	.101	.044	.533	.267
Inventory at practical level for operations	.100	.565	.021	.113	.160	.255	.063
International tariffs/legislation considered	.091	.414	.141	.193	.221	.352	.027
Delivery distances factored	.256	.196	.290	.067	.294	.399	-.031
Increased delivery speed doesn't complicate costs	.082	.219	.130	.374	.199	.173	.015
SC intermediaries work with same urgency as SC	.388	.293	.195	.235	.078	.410	.038
Lead times have carful planning	.176	.160	.156	.165	.056	.661	.014
SC blockages need to be identified quickly	.205	.161	.259	.104	.145	.572	.092
Delays needs to be identified quick to reduce risk	.201	.196	.139	.192	.127	.583	.091
Organisation learn from mistakes and factor into future planning	.107	.558	.158	-.017	.006	.303	.087
Products not complex	.124	.184	-.173	.518	.284	.035	-.220
Ability to customise locally	.110	.200	-.204	.554	.157	.148	-.064
Over specification is reduced	-.014	.163	-.051	.481	.092	.320	-.004
SC can change or introduce new product without starting new SC	.185	.204	-.031	.485	-.030	.367	-.090
Quality is not compromised	.042	.021	.318	.126	-.040	.420	.304
Inventories are kept as low as possible	.083	-.033	.099	.608	.005	.073	.135
Design of products adaptable for differing markets	.012	.190	-.022	.553	.186	.253	.012
Suppliers can support change	.194	.290	.005	.278	.223	.475	.240
Communication across SC is good	.194	.050	.157	.120	.136	.541	.277
Changes to product not complex	-.031	.192	-.103	.487	.313	.004	-.112
SC members have compatible technologies	.217	.053	-.039	.158	.609	.143	.095
Relationships between SC members are managed	.366	.141	-.028	.109	.378	.283	.157
Transparency of information	.336	.176	-.178	.174	.437	.163	.105
Strategy to ensure IT systems are adequate within SC	.322	.183	-.085	.098	.625	.157	.117
IT security risks are evaluated and managed	.107	.117	.166	-.034	.664	.098	.155
Infrastructure mismatch have been addressed between suppliers	.275	.132	.207	.190	.717	.123	.069
Differing processes between SC members identified	.376	.070	.200	.175	.670	.123	.013

New SC member IT capabilities evaluated before insertion to SC	.358	-.020	.173	.183	.642	-.051	.157
Integration of key SC members IT systems takes place	.448	.052	.101	.193	.601	-.029	.023
Data produced is accurate	.255	.080	.376	-.047	.397	.247	-.044
Standard IT platform agreed between SC members	.284	.047	.052	.179	.667	.013	.151
Focus on planning and design	.270	.346	.276	.132	.124	.150	.154
Management practices are high with SC	.315	.421	.357	.074	.049	.141	.167
Culture of preventing problems with SC	.493	.351	.422	-.029	.028	.139	.030
Procurement of defect free product	.206	.308	.572	.030	.075	.091	.236
Good relationships between customer and suppliers	.214	-.048	.448	.071	-.006	.311	-.009
Initial design of good quality	-.124	.119	.491	.146	.213	.212	.187
Good communication between SC members	.425	.056	.257	.043	.172	.316	.097
Products meet customer specification/quality requirements	.154	.270	.593	-.205	-.062	.039	.298
SC managers understand quality standards	.319	.332	.542	-.015	.060	.106	.191
Quality is not unambiguous but specified	.204	.289	.575	.012	-.024	-.002	.144
Quality standards maintained	.236	.329	.680	-.026	-.072	.063	.090
Continuous improvement is embedded through SC	.434	.048	.399	.158	.136	.247	.052
SC partners have quality accreditations	.312	-.125	.333	.298	.180	-.037	.008
Lower tier suppliers works to agreed quality standards	.329	.186	.487	.082	.143	.126	.164
New SC members are vetted and understand quality procedures	.307	.141	.677	.043	.075	.056	-.052
Training is offered to improve/maintain quality	.591	.210	.395	.046	.128	.056	.050
Regular compliance checks throughout SC	.574	.231	.494	.040	.098	.029	-.001
Regular compliance checks outsourced	.493	.087	.475	-.051	.143	.046	-.004
Open relationship with suppliers	.584	-.126	.147	.084	.060	.325	.115
Suppliers are fully integrated to SC	.733	.055	.017	.069	.130	.097	.176
Culture of integration within SC	.829	.029	.094	.084	.116	.106	.137
Close cooperation between managers with SC	.649	.219	.083	-.017	.098	.166	.229
Joint planning of SC between yourself and SC members	.701	.129	.214	.133	.156	.027	.098
Availability of real time info	.591	.227	.197	.053	.211	.130	.008
Process with SC are integrated	.729	.127	.134	.140	.286	.045	.097
Flexibility regarding business practices	.392	.294	.112	.058	.005	.105	.046

Conflict resolution procedures are available	.582	.169	.151	.193	.082	.037	.119
SC members have access to similar IT	.584	-.021	.092	.231	.439	-.010	.213
SM members have agreed goals	.579	.110	.195	.225	.251	.175	.114
SM members share information openly	.671	-.071	.011	.111	.259	.121	.186
SC members have organisational compatibility	.693	.079	.110	.202	.299	.056	.043
SC members are committed to process	.572	.160	.158	.009	.207	.266	.174
Management support in place	.503	.230	.427	.041	.150	.208	-.049
Shared risk and reward between SC members	.560	.307	.001	.163	.087	-.001	.152
Cooperation and collaboration between SC members	.671	.365	.080	.030	.120	.184	.233
Inventories measure regular	.506	.222	.210	.183	.201	.034	-.114
Staff and It and skills to identify delays	.508	.407	.347	-.015	.166	.190	-.134
Standardised practices implemented where feasible	.539	.314	.237	.107	.220	.092	-.011

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 14 iterations.

Appendix F Exploratory Factor Analysis – Final Iteration

Exploratory Factor Analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olin Measure of Sampling Adequacy.		.898
Bartlett's Test of Sphericity	Approx. Chi-Square	7251.823
	df	1128
	Sig.	.000

Communalities

	Initial	Extraction
Product offers customer satisfaction	1.000	.317
Flexibility offered regarding client requirements	1.000	.425
SC offers service that meets clients requirements	1.000	.415
Supplier can add value and reduce costs	1.000	.467
Value for all parties are achieved	1.000	.440
Costs minimized	1.000	.327
SC is profitable for each partner	1.000	.285
Assets fully utilised	1.000	.533
Reducing costs/adding value through continuing learning	1.000	.539
Suppliers can anticipate changes in demand	1.000	.622
Forecasting accurate	1.000	.523
Behaviour with SC is integrated	1.000	.551
SC has flexibility to address changes in demand	1.000	.517
Realistic time frames agreed	1.000	.524
Suppliers timely response	1.000	.577
Lead times have careful planning	1.000	.623
SC blockages need to be identified quickly	1.000	.665
Delays needs to be identified quick to reduce risk	1.000	.661
Products not complex	1.000	.656
Ability to customise locally	1.000	.562
Over specification is reduced	1.000	.505
SC can change or introduce new product without starting new SC	1.000	.468
Design of products adaptable for differing markets	1.000	.473

Changes to product not complex	1.000	.676
SC members have compatible technologies	1.000	.485
IT security risks are evaluated and managed	1.000	.515
Infrastructure mismatch have been addressed between suppliers	1.000	.746
Differing processes between SC members identified	1.000	.683
New SC member IT capabilities evaluated before insertion to SC	1.000	.685
Integration of key SC members IT systems takes place	1.000	.677
Standard IT platform agreed between SC members	1.000	.618
Procurement of defect free product	1.000	.491
Initial design of good quality	1.000	.369
Products meet customer specification/quality requirements	1.000	.639
SC managers understand quality standards	1.000	.633
Quality is not unambiguous but specified	1.000	.597
Quality standards maintained	1.000	.691
Lower tier suppliers works to agreed quality standards	1.000	.513
New SC members are vetted and understand quality procedures	1.000	.518
Open relationship with suppliers	1.000	.563
Suppliers are fully integrated to SC	1.000	.710
Culture of integration within SC	1.000	.773
Close cooperation between managers with SC	1.000	.591
Joint planning of SC between yourself and SC members	1.000	.621
Process with SC are integrated	1.000	.673
SM members share information openly	1.000	.560
SC members have organisational compatibility	1.000	.581
Cooperation and collaboration between SC members	1.000	.674

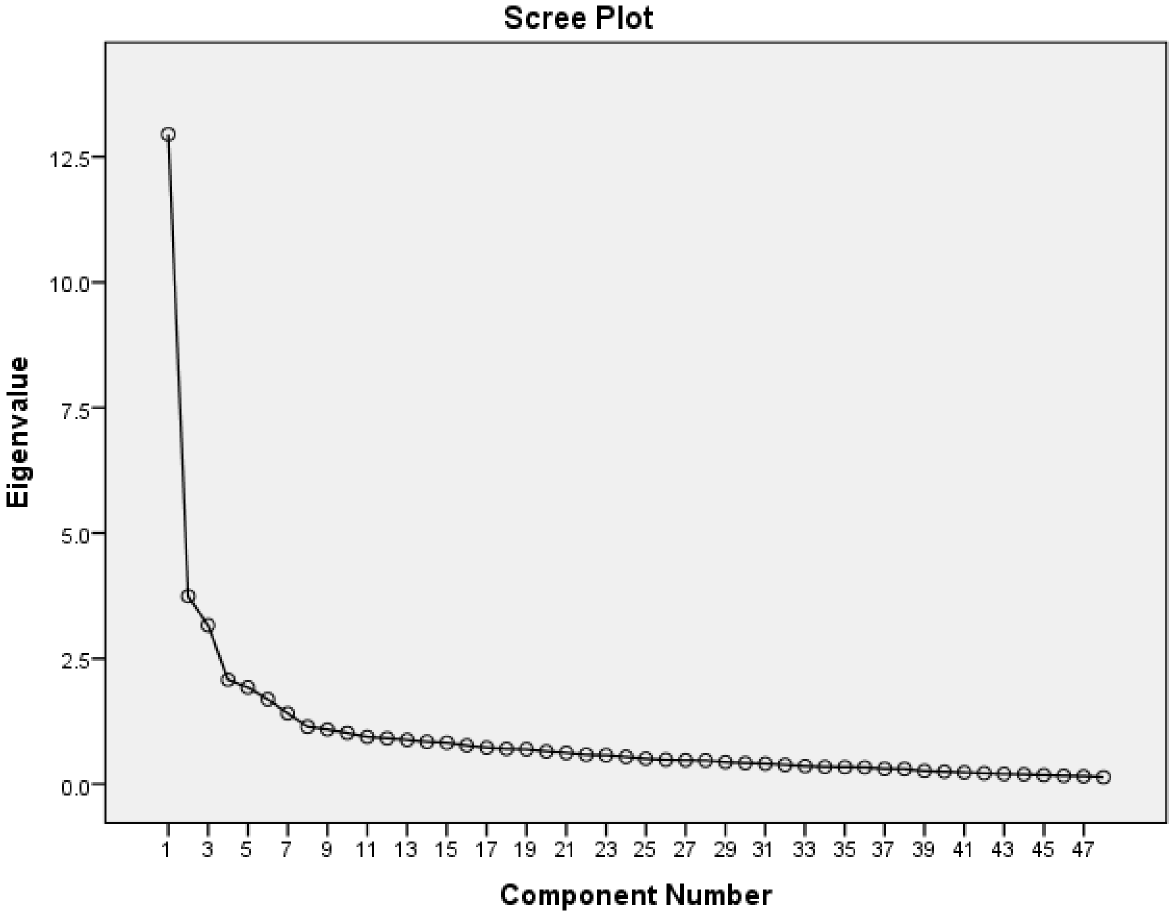
Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.231	27.009	27.009	13.231	27.009	27.009	5.550	11.562	11.562
2	3.802	7.758	34.778	3.802	7.758	34.778	4.509	9.394	20.956
3	3.301	6.740	41.528	3.301	6.740	41.528	4.421	9.211	30.167
4	2.091	4.240	45.804	2.091	4.240	45.804	3.722	7.754	37.921
5	1.935	4.261	49.764	1.935	4.261	49.764	3.261	6.794	44.715
6	1.689	3.957	53.284	1.689	3.957	53.284	3.163	6.589	51.304
7	1.404	2.864	56.157	1.404	2.864	56.157	2.330	4.854	56.157
8	1.144	2.383	58.540						
9	1.090	2.271	60.811						
10	1.018	2.120	62.931						
11	.940	1.958	64.889						
12	.912	1.900	66.789						
13	.881	1.835	68.624						
14	.842	1.754	70.378						
15	.824	1.716	72.094						
16	.767	1.598	73.692						
17	.724	1.508	75.201						
18	.700	1.459	76.660						
19	.694	1.447	78.107						
20	.650	1.355	79.461						
21	.622	1.296	80.757						
22	.584	1.216	81.973						
23	.573	1.195	83.168						
24	.541	1.127	84.295						
25	.504	1.050	85.345						
26	.483	1.006	86.351						
27	.473	.986	87.337						
28	.469	.978	88.315						
29	.436	.909	89.224						
30	.420	.875	90.098						
31	.406	.846	90.945						
32	.383	.798	91.743						
33	.358	.746	92.489						
34	.342	.713	93.201						
35	.337	.702	93.903						
36	.333	.694	94.597						
37	.305	.636	95.233						
38	.302	.629	95.862						
39	.260	.542	96.404						
40	.246	.513	96.918						
41	.232	.483	97.401						
42	.215	.449	97.849						
43	.202	.420	98.269						
44	.194	.404	98.674						
45	.178	.371	99.045						
46	.166	.346	99.391						

47	.155	.322	99.713						
48	.138	.287	100.000						

Extraction Method: Principal Component Analysis.



Rotated Component Matrix[a]

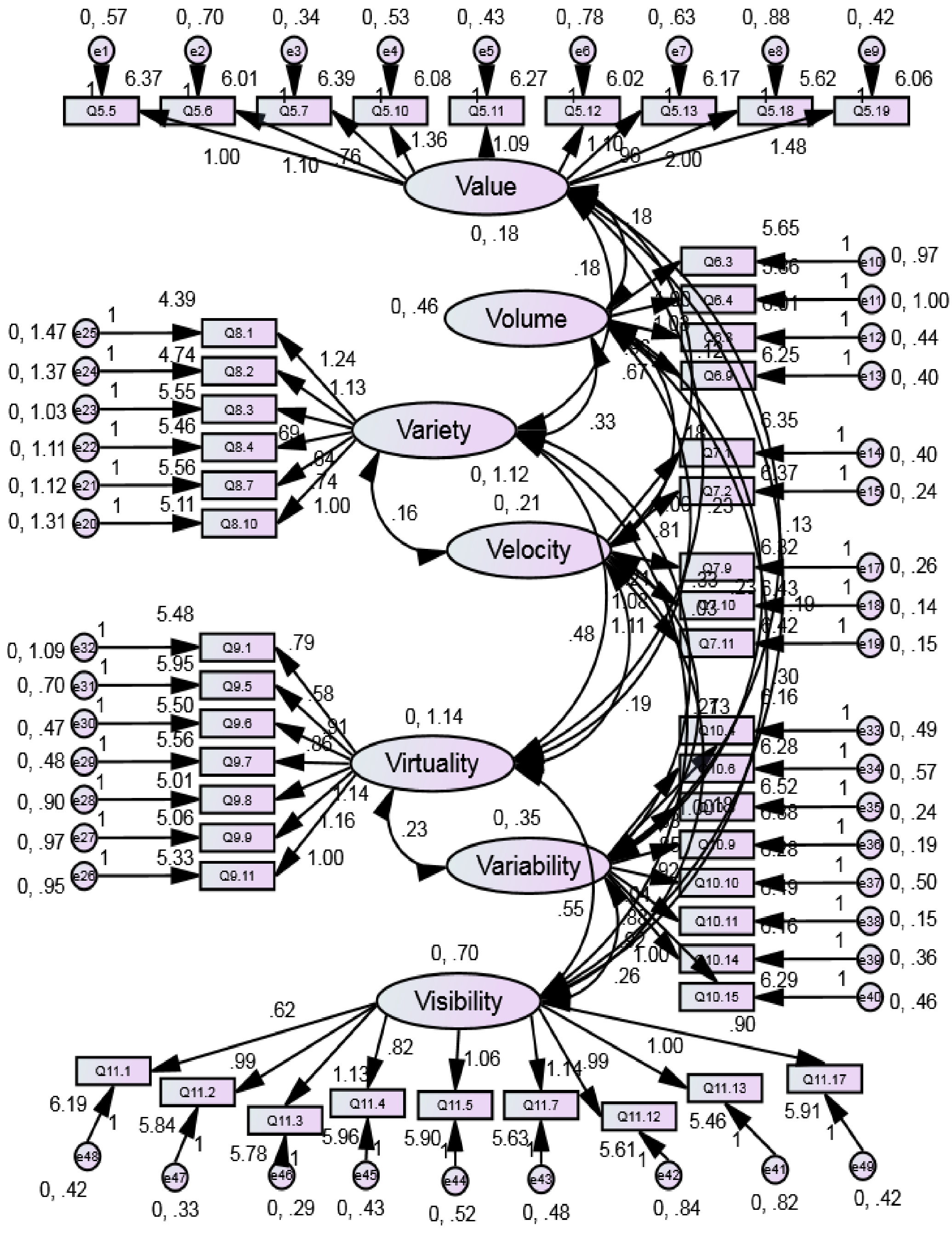
	Component						
	1	2	3	4	5	6	7
Product offers customer satisfaction				.496			
Flexibility offered regarding client requirements				.625			
SC offers service that meets clients requirements				.571			
Supplier can add value and reduce costs				.597			
Value for all parties are achieved				.533			
Costs minimized				.522			
SC is profitable for each partner				.471			
Assets fully utilised				.562			
Reducing costs/adding value through continuing learning				.560			
Suppliers can anticipate changes in demand							.721
Forecasting accurate							.606
Behaviour with SC is integrated							.576
SC has flexibility to address changes in demand							.585
Realistic time frames agreed						.653	
Suppliers timely response						.635	
Lead times have careful planning						.724	
SC blockages need to be identified quickly						.718	
Delays needs to be identified quick to reduce risk						.734	
Products not complex					.772		
Ability to customise locally					.702		
Over specification is reduced					.626		
SC can change or introduce new product without starting new SC					.543		
Design of products adaptable for differing markets					.586		
Changes to product not complex					.787		
SC members have compatible technologies		.604					
IT security risks are evaluated and managed		.648					
Infrastructure mismatch have been addressed between suppliers		.779					
Differing processes between SC members identified		.726					
New SC member IT capabilities evaluated before insertion to SC		.756					

Integration of key SC members IT systems takes place		.696					
Standard IT platform agreed between SC members		.704					
Procurement of defect free product			.590				
Initial design of good quality			.485				
Products meet customer specification/quality requirements			.749				
SC managers understand quality standards			.691				
Quality is not unambiguous but specified			.748				
Quality standards maintained			.783				
Lower tier suppliers works to agreed quality standards			.600				
New SC members are vetted and understand quality procedures			.656				
Open relationship with suppliers	.647						
Suppliers are fully integrated to SC	.797						
Culture of integration within SC	.822						
Close cooperation between managers with SC	.677						
Joint planning of SC between yourself and SC members	.673						
Process with SC are integrated	.676						
SM members share information openly	.662						
SC members have organisational compatibility	.614						
Cooperation and collaboration between SC members	.663						

Extraction Method: Principal Component Analysis.
Rotation Method: Varma with Kaiser Normalization.
a. Rotation converged in 7 iterations.

Appendix G Model 1 Confirmatory Factor Analysis Amos

Confirmatory Factor Analysis Model 1



Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	165	2104.302	1059	.000	1.987
Saturated model	1224	.000	0		
Independence model	48	7985.574	1176	.000	6.790

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.736	.707	.849	.830	.846
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.901	.663	.762
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	1045.302	918.590	1179.760
Saturated model	.000	.000	.000
Independence model	6809.574	6529.944	7095.814

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	6.968	3.461	3.042	3.906
Saturated model	.000	.000	.000	.000
Independence model	26.442	22.548	21.622	23.496

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.057	.054	.061	.001
Independence model	.138	.136	.141	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	2434.302	2498.215		
Saturated model	2448.000	2922.119		
Independence model	8081.574	8100.167		

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	8.061	7.641	8.506	8.272
Saturated model	8.106	8.106	8.106	9.676
Independence model	26.760	25.834	27.708	26.822

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	164	168
Independence model	48	49

Scalar Estimates (Group number 1 - Default model)
Maximum Likelihood Estimates
Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Q5.6	<---	Value	1.103	.179	6.179	***	
Q5.7	<---	Value	.757	.124	6.113	***	
Q5.10	<---	Value	1.360	.192	7.089	***	
Q5.11	<---	Value	1.093	.160	6.833	***	
Q5.12	<---	Value	1.101	.184	5.997	***	
Q5.13	<---	Value	.962	.163	5.903	***	
Q5.18	<---	Value	1.996	.271	7.370	***	
Q5.19	<---	Value	1.485	.198	7.511	***	
Q6.3	<---	Volume	1.000				
Q6.4	<---	Volume	1.032	.142	7.265	***	
Q6.8	<---	Volume	.964	.118	8.173	***	
Q6.9	<---	Volume	.666	.091	7.331	***	
Q7.1	<---	Velocity	1.000				
Q7.2	<---	Velocity	.809	.096	8.403	***	
Q7.9	<---	Velocity	1.211	.126	9.626	***	
Q7.10	<---	Velocity	1.084	.107	10.115	***	
Q7.11	<---	Velocity	1.110	.110	10.070	***	
Q8.10	<---	Variety	1.000				
Q8.7	<---	Variety	.741	.084	8.838	***	
Q8.4	<---	Variety	.643	.079	8.158	***	
Q8.3	<---	Variety	.687	.079	8.675	***	
Q8.2	<---	Variety	1.127	.110	10.275	***	
Q8.1	<---	Variety	1.238	.118	10.494	***	
Q9.11	<---	Virtuality	1.000				
Q9.9	<---	Virtuality	1.163	.086	13.477	***	
Q9.8	<---	Virtuality	1.138	.084	13.567	***	
Q9.7	<---	Virtuality	.863	.063	13.805	***	
Q9.6	<---	Virtuality	.914	.065	14.138	***	
Q9.5	<---	Virtuality	.585	.058	10.134	***	
Q9.1	<---	Virtuality	.791	.074	10.695	***	
Q10.4	<---	Variability	1.000				
Q10.6	<---	Variability	.634	.091	6.987	***	
Q10.8	<---	Variability	.850	.080	10.571	***	
Q10.9	<---	Variability	.915	.081	11.326	***	
Q10.10	<---	Variability	1.039	.105	9.858	***	
Q10.11	<---	Variability	.883	.076	11.576	***	

			Estimate	S.E.	C.R.	P	Label
Q10.14	<---	Variability	.917	.091	10.026	***	
Q10.15	<---	Variability	1.000	.101	9.861	***	
Q11.13	<---	Visibility	1.000				
Q11.12	<---	Visibility	.988	.091	10.827	***	
Q11.7	<---	Visibility	1.143	.089	12.839	***	
Q11.5	<---	Visibility	1.065	.086	12.391	***	
Q11.4	<---	Visibility	.823	.071	11.641	***	
Q11.3	<---	Visibility	1.133	.083	13.633	***	
Q11.2	<---	Visibility	.989	.076	13.014	***	
Q11.1	<---	Visibility	.618	.061	10.129	***	
Q11.17	<---	Visibility	.901	.074	12.102	***	
Q5.5	<---	Value	1.000				

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q5.6	<---	Value	.486
Q5.7	<---	Value	.478
Q5.10	<---	Value	.616
Q5.11	<---	Value	.576
Q5.12	<---	Value	.464
Q5.13	<---	Value	.453
Q5.18	<---	Value	.666
Q5.19	<---	Value	.695
Q6.3	<---	Volume	.567
Q6.4	<---	Volume	.573
Q6.8	<---	Volume	.702
Q6.9	<---	Volume	.581
Q7.1	<---	Velocity	.589
Q7.2	<---	Velocity	.606
Q7.9	<---	Velocity	.741
Q7.10	<---	Velocity	.805
Q7.11	<---	Velocity	.798
Q8.10	<---	Variety	.678
Q8.7	<---	Variety	.595
Q8.4	<---	Variety	.543
Q8.3	<---	Variety	.581
Q8.2	<---	Variety	.713
Q8.1	<---	Variety	.733
Q9.11	<---	Virtuality	.740
Q9.9	<---	Virtuality	.783
Q9.8	<---	Virtuality	.788
Q9.7	<---	Virtuality	.801
Q9.6	<---	Virtuality	.820
Q9.5	<---	Virtuality	.598
Q9.1	<---	Virtuality	.630
Q10.4	<---	Variability	.647
Q10.6	<---	Variability	.445
Q10.8	<---	Variability	.716
Q10.9	<---	Variability	.782
Q10.10	<---	Variability	.657

			Estimate
Q10.11	<---	Variability	.805
Q10.14	<---	Variability	.672
Q10.15	<---	Variability	.658
Q11.13	<---	Visibility	.680
Q11.12	<---	Visibility	.671
Q11.7	<---	Visibility	.810
Q11.5	<---	Visibility	.778
Q11.4	<---	Visibility	.726
Q11.3	<---	Visibility	.868
Q11.2	<---	Visibility	.822
Q11.1	<---	Visibility	.624
Q11.17	<---	Visibility	.758
Q5.5	<---	Value	.485

Intercepts: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q5.5	6.367	.050	127.381	***	
Q5.6	6.008	.055	109.125	***	
Q5.7	6.387	.038	166.297	***	
Q5.10	6.079	.054	113.524	***	
Q5.11	6.272	.046	136.074	***	
Q5.12	6.018	.058	104.645	***	
Q5.13	6.168	.052	119.756	***	
Q5.18	5.621	.073	77.397	***	
Q5.19	6.058	.052	116.870	***	
Q6.3	5.654	.069	82.170	***	
Q6.4	5.856	.070	83.279	***	
Q6.8	6.012	.054	112.217	***	
Q6.9	6.246	.045	139.662	***	
Q7.1	6.349	.045	140.937	***	
Q7.2	6.368	.035	179.691	***	
Q7.9	6.320	.043	145.438	***	
Q7.10	6.431	.036	180.047	***	
Q7.11	6.425	.037	174.169	***	
Q8.10	5.108	.090	56.758	***	
Q8.7	5.560	.076	73.104	***	
Q8.4	5.458	.072	75.515	***	
Q8.3	5.551	.072	77.141	***	
Q8.2	4.739	.097	49.085	***	
Q8.1	4.389	.103	42.565	***	
Q9.11	5.325	.083	63.809	***	
Q9.9	5.059	.092	55.224	***	
Q9.8	5.013	.089	56.253	***	
Q9.7	5.555	.066	83.554	***	
Q9.6	5.499	.069	79.863	***	
Q9.5	5.951	.060	98.621	***	
Q9.1	5.479	.077	70.705	***	
Q10.4	6.161	.053	116.511	***	
Q10.6	6.276	.049	128.616	***	
Q10.8	6.520	.041	160.651	***	

	Estimate	S.E.	C.R.	P	Label
Q10.9	6.381	.040	159.425	***	
Q10.10	6.278	.054	116.095	***	
Q10.11	6.494	.037	173.252	***	
Q10.14	6.162	.047	131.791	***	
Q10.15	6.294	.052	121.039	***	
Q11.13	5.459	.071	77.055	***	
Q11.12	5.607	.071	79.063	***	
Q11.7	5.630	.068	82.851	***	
Q11.5	5.901	.066	89.586	***	
Q11.4	5.964	.055	109.264	***	
Q11.3	5.782	.063	91.979	***	
Q11.2	5.842	.058	100.952	***	
Q11.1	6.195	.048	130.084	***	
Q11.17	5.914	.057	103.330	***	

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Value	<-->	Volume	.177	.035	5.112	***	
Value	<-->	Velocity	.116	.022	5.293	***	
Value	<-->	Variety	.183	.041	4.512	***	
Value	<-->	Virtuality	.232	.044	5.323	***	
Value	<-->	Variability	.128	.025	5.130	***	
Visibility	<-->	Value	.192	.036	5.413	***	
Volume	<-->	Velocity	.184	.034	5.450	***	
Volume	<-->	Variety	.335	.068	4.907	***	
Volume	<-->	Virtuality	.325	.065	5.024	***	
Volume	<-->	Variability	.228	.041	5.559	***	
Visibility	<-->	Volume	.302	.055	5.525	***	
Velocity	<-->	Variety	.163	.039	4.200	***	
Velocity	<-->	Virtuality	.191	.039	4.905	***	
Velocity	<-->	Variability	.127	.024	5.337	***	
Visibility	<-->	Velocity	.180	.033	5.494	***	
Variety	<-->	Virtuality	.481	.090	5.333	***	
Variety	<-->	Variability	.035	.043	.814	.416	
Visibility	<-->	Variety	.267	.065	4.109	***	
Virtuality	<-->	Variability	.230	.047	4.853	***	
Visibility	<-->	Virtuality	.549	.079	6.998	***	
Visibility	<-->	Variability	.262	.043	6.148	***	

Correlations: (Group number 1 - Default model)

			Estimate
Value	<-->	Volume	.623
Value	<-->	Velocity	.598
Value	<-->	Variety	.413
Value	<-->	Virtuality	.517
Value	<-->	Variability	.513
Visibility	<-->	Value	.548
Volume	<-->	Velocity	.590
Volume	<-->	Variety	.468
Volume	<-->	Virtuality	.449

			Estimate
Volume	<-->	Variability	.569
Visibility	<-->	Volume	.533
Velocity	<-->	Variety	.335
Velocity	<-->	Virtuality	.387
Velocity	<-->	Variability	.466
Visibility	<-->	Velocity	.467
Variety	<-->	Virtuality	.425
Variety	<-->	Variability	.055
Visibility	<-->	Variety	.302
Virtuality	<-->	Variability	.362
Visibility	<-->	Virtuality	.614
Visibility	<-->	Variability	.529

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Value	.176	.043	4.120	***	
Volume	.458	.097	4.742	***	
Velocity	.212	.040	5.270	***	
Variety	1.118	.182	6.125	***	
Virtuality	1.145	.158	7.252	***	
Variability	.351	.058	6.009	***	
Visibility	.700	.107	6.559	***	
e1	.574	.050	11.539	***	
e2	.695	.060	11.536	***	
e3	.342	.030	11.567	***	
e4	.535	.049	10.835	***	
e5	.425	.038	11.085	***	
e6	.779	.067	11.616	***	
e7	.633	.054	11.654	***	
e8	.881	.085	10.397	***	
e9	.417	.041	10.065	***	
e10	.968	.091	10.639	***	
e11	1.001	.095	10.588	***	
e12	.439	.050	8.845	***	
e13	.399	.038	10.516	***	
e14	.399	.035	11.268	***	
e15	.239	.021	11.175	***	
e17	.256	.026	9.915	***	
e18	.135	.016	8.724	***	
e19	.149	.017	8.883	***	
e20	1.315	.130	10.111	***	
e21	1.120	.103	10.864	***	
e22	1.110	.099	11.222	***	
e23	1.032	.094	10.985	***	
e24	1.374	.143	9.629	***	
e25	1.474	.158	9.308	***	
e26	.948	.088	10.789	***	
e27	.974	.094	10.323	***	
e28	.903	.088	10.258	***	
e29	.475	.047	10.072	***	

	Estimate	S.E.	C.R.	P	Label
e30	.468	.048	9.764	***	
e31	.702	.061	11.578	***	
e32	1.088	.095	11.457	***	
e33	.488	.044	11.206	***	
e34	.571	.048	11.871	***	
e35	.241	.023	10.719	***	
e36	.187	.019	9.951	***	
e37	.499	.045	11.144	***	
e38	.148	.016	9.557	***	
e39	.360	.033	11.038	***	
e40	.461	.041	11.143	***	
e41	.816	.071	11.548	***	
e42	.835	.072	11.583	***	
e43	.480	.045	10.635	***	
e44	.517	.047	10.959	***	
e45	.425	.038	11.325	***	
e46	.295	.031	9.638	***	
e47	.327	.031	10.474	***	
e48	.418	.036	11.738	***	
e49	.421	.038	11.120	***	