SUPPLY CHAIN DYNAMISM, INFORMATION SHARING AND INTER-ORGANISATIONAL RELATIONSHIPS AND THEIR EFFECT ON SUPPLY CHAIN PERFORMANCE

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DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree

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ABSTRACT

One of the most significant changes in the paradigm of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather as supply chains. In this emerging competitive environment, the ultimate success of the business will depend on management's ability to integrate the company's intricate network of business relationships. Effective supply chain management (SCM) has become a potentially valuable way of securing competitive advantage and improving organisational performance since competition is no longer between organisations, but among supply chains, which can be obtained through the sharing of appropriate information between supply chain partners and forming healthy inter-organisational relationships.

The purpose of this study is to investigate the influence of supply chain dynamism, information sharing and inter-organisational relationships on supply chain performance in manufacturing, service and mining in the Gauteng Province of South Africa. Data for the study were collected from 350 prominent organisations and the relationships proposed in the framework were tested using different statistical techniques. The results indicate that supply chain dynamism have a positive influence on both information sharing and inter-organisational relationships. They also indicate that higher levels of information sharing can lead to enhanced competitive advantage and improved supply chain performance, which further indicate that the more organisations have healthy inter-organisational relationships, the better the supply chain performance becomes. These results have value to both the academic and business worlds as they provide verification of the widely held belief of the value of effective supply chain management and performance.

Key words: supply chain dynamism, information sharing, inter-organisational relationships, supply chain performance.

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LIST OF ABBREVIATIONS

ABBREVIATION	FULL TITLE
AGFI	Augmented Goodness of Fit Index
AMOS	Analysis of Moment Structures
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative fit index
CIPS	Certified Institute of Purchasing and Supply
CR	Composite Reliability
DC	Dynamic Capabilities
DCV	Dynamic Capability View
DQ	Data Quality
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
GDP	Gross Domestic Profit
GFI	Goodness of Fit Index
GSCF	Global Supply Chain Finance
IFI	Incremental fit index
IOR	Inter-organisational Relationships
IP	Intellectual Property
IQ	Information Quality
IS	Information Sharing
IS	Information Systems

IT	Information Technology
JIT	Just In Time
NFI	Normed Fit Index
PGM	Platinum-Group Metals
POS	Point of Sale
QR	Quick Response
R&D	Research and Development
RMSEA	Random Measure of Standard Error Approximation
RSCM	Responsible Supply Chain Management
SA	South Africa
SC	Supply Chain
SCD	Supply Chain Dynamism
SCM	Supply Chain Management
SCP	Supply Chain Performance
SPSS	Statistical Package for Social Sciences
SSCM	Sustainable supply chain management
TLI	Tucker Lewis index
US	United States
VMI	Vendor-Managed Inventory
VUT	Vaal University of Technology

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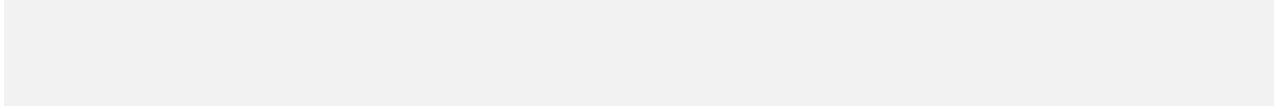
CHAPTER 1

INTRODUCTION AND RESEARCH BACKGROUND

1.1 INTRODUCTION

Effective supply chain management (SCM) has possibily become a valuable way of safeguarding competitive advantage and improving organisational performance since competition is no longer between organisations, but among supply chains (Li, Ragu-Nathan, Ragu-Nathan & Rao, 2006:107). Supply chain management has been defined to explicitly recognise the strategic nature of coordination between trading partners and to explain the dual purpose of supply chain management, which is to improve the performance of the whole supply chain (Li *et al.,* 2006:107). Supply chain dynamism, on the other hand, is defined as the volatile variations in products, technologies and demand for products in the market (Miller & Friesen, 1983:221; Dess & Davis, 1984:467).

To achieve an efficient and effective supply chain, information needs to be shared (Du, Lai, Cheung & Cui, 2012:89). By taking the data available and sharing it with other parties within the supply chain an organisation can speed up the information flow in the supply chain, improve the efficiency and effectiveness of it and respond quicker to changing needs of the customer (Li & Lin, 2006:1641). While information sharing is important, the importance of its impact on the performance of a supply chain rests on what information is shared, when and how it is shared and with whom (Holmberg, 2000:847). Inter-organisational relationship refers to the degree of trust, commitment, and shared vision between supplier partners (Li & Lin, 2006:1642). This study considers inter-organisational relationship as including one sub-dimension: trust in trading partners, which is defined as the willingness to rely on a trading partner in whom one has confidence (Monczka, Petersen, Handfield & Ragatz, 1998:5554).

In today's hyper-competitive global environment, organisations have begun to recognise that delivering the best customer value at the lowest cost is not only related to the activities' functions and processes within the organisation itself, but to the entire supply chain (Koçoglu, Imamoglu, Ince & Keskin, 2011:1630). The decreased inconsistency in information shared of all types of supply chain activities relieve firms from corrective (rush orders and over time) and preventive

(safety stocks and extra capacity) actions, which serve to reimburse poor information exchange between the partners (Koçoglu *et al*., 2011:1631).

This study has five objectives. First, the specific interest of this study is to examine the influence of supply chain dynamism on information sharing. Second, it seeks to present an empirical investigation of the influence of supply chain dynamism on inter-organisational relationship. Third, it aims to investigate the direct influence of information sharing on inter-organisational relationship. Fourth, it aims to examine the impact of information sharing on supply chain performance. Finally, an attempt is made to investigate the influence of inter-organisational relationship on supply chain performance.

1.2 PROBLEM STATEMENT

According to Moberg, Cutler, Gross and Speh (2002:757), information sharing is a key element for any supply chain management structure. Information sharing impacts the supply chain performance in terms of both total cost and service level (Zhao, Xie & Zhang, 2002:27). The higher level of information sharing is allied with the lower total cost, the higher order contentment rate and shorter cycle time (Lin, Huang & Lin, 2002:258). Zhou and Benton (2007:1348) also stated that supply chain dynamism has a significant, positive influence on effective information sharing.

In the perspective of a dynamic supply chain, constantly improving performance has become a serious issue for most suppliers, manufacturers, and the related retailers to gain and sustain attractiveness. Monitoring and improvement of performance of a supply chain has become an increasingly difficult task (Cai, Liu, Xiao & Liu, 2009:512), hence the need to conduct the current study in order to address the difficulties manufacturers and suppliers encounter, and also to assist in terms of how to deal with those difficulties.

Although a great deal is known about the impact of information sharing, less attention has been paid to its influence on inter-organisational relationship and supply chain performance. Although previous studies have addressed the importance of information sharing in SCM, few studies have considered simultaneously the impact of inter-organisational factors and information sharing on the supply chain performance. Previous research (Green, Whitten & Inman, 2012:109) mainly focused on supply chain management, marketing strategy alignment, supply chain performance, and organisational performance. Li *et al.* (2006:127) focused on SCM practices, organisational

performance and competitive advantage. Research that investigates the influence of supply chain dynamism, information sharing and inter-organisational relationship on supply chain performance remain scant, hence the need to conduct the current study.

1.3 PURPOSE OF THE STUDY

The purpose of this study is to investigate the effect of supply chain dynamism, information sharing and inter-organisational relationships on supply chain performance in manufacturing, service and mining organisations in Gauteng Province.

1.4 STUDY OBJECTIVES

1.4.1 Theoretical Objectives

The following theoretical objectives were formulated for the study:

- to review literature on dynamic capability theory;
- to review literature on supply chain dynamism;
- to review literature on information sharing;
- to review literature on inter-organisational relationships; and
- to review literature on supply chain performance.

1.4.2 Empirical Objectives

The following empirical objectives were formulated for the study:

- to investigate the influence of supply chain dynamism on information sharing in manufacturing, service and mining organisations in Gauteng Province;
- to determine the influence of supply chain dynamism on inter-organisational relationships in manufacturing, service and mining organisations in Gauteng Province;
- to ascertain the influence of information sharing on inter-organisational relationships in manufacturing, service and mining organisations in Gauteng Province;
- to determine the influence of information sharing on supply chain performance in manufacturing, service and mining organisations in Gauteng Province; and

- to investigate the influence of inter-organisational relationships on supply chain performance in manufacturing, service and mining organisations in Gauteng Province.

1.5 CONCEPTUAL MODEL

Based on the literature reviewed, the following conceptual model was developed. Hypothesised relationships between research variables were developed thereafter. In the conceptualised research model, supply chain dynamism is the predictor variable, information sharing and inter-organisational relationship are mediating variables and supply chain performance is the outcome variable.
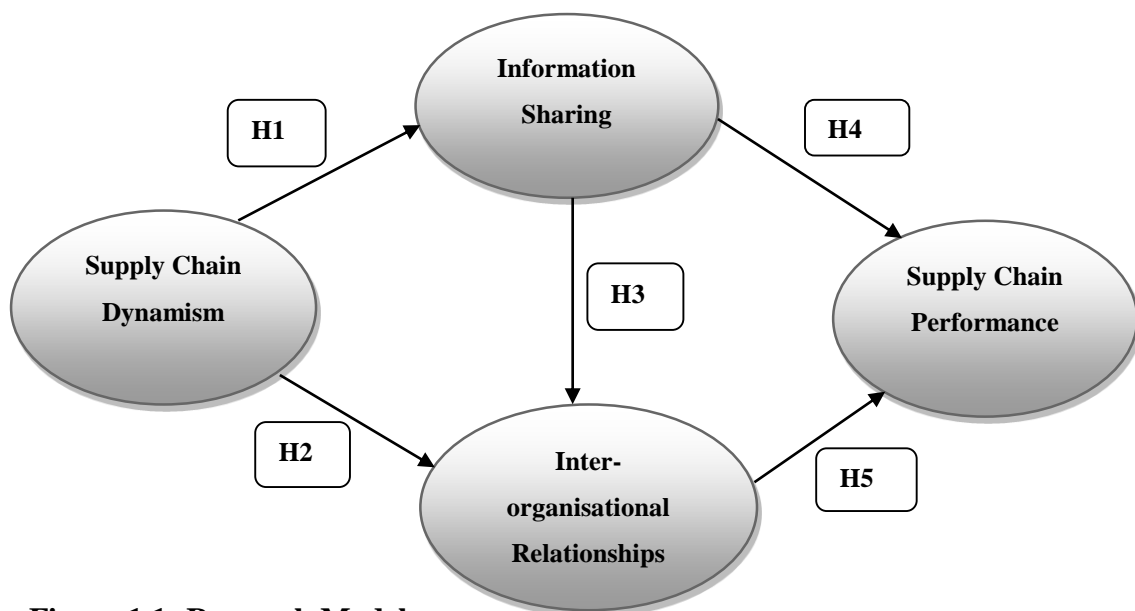
Figure 1.1: Research Model

1.6 HYPOTHESIS STATEMENTS

Based on the conceptual model above, the following hypothesis statements were proposed.

- **H1.** There is a positive relationship between supply chain dynamism and information sharing in the manufacturing, service and mining sectors in Gauteng Province.
- **H2.** There is a positive relationship between supply chain dynamism and inter-organisational relationships in the manufacturing, service and mining sectors in Gauteng Province.

- **H3.** There is a positive relationship between information sharing and inter-organisational relationships in the manufacturing, service and mining sectors in Gauteng Province.

- **H4.** There is a positive relationship between information sharing and supply chain performance in the manufacturing, service and mining sectors in Gauteng Province.

- **H5.** There is a positive relationship between inter-organisational relationships and supply chain performance in the manufacturing, service and mining sectors in Gauteng Province.

1.7 LITERATURE REVIEW

1.7.1 Theoretical Framework

1.7.1.1 Dynamic capability theory

The theoretical background informing this study draws from a dynamic capability view (DCV), which is in essence an extension of the Resource-Based View of the firm, which highlights how some firms develop and sustain competitive advantages and superior profitability (Cavusgil, Seggie & Talay, 2007:159). As an extension, the dynamic capabilities view stresses the key role of management to appropriately adjust, integrate and reshape organisational skills and resources as well as internal and external functional competences (Borch & Madsen, 2007:109).

Capabilities are said to be dynamic when they provide organisations with the ability to implement different strategies to adapt to varying market conditions (Teece, Pisano & Shuen, 1997:509). A firm's dynamic capabilities are characterised by its capacities to sense and shape opportunities and threats, grab opportunities, and maintain competitiveness through enhancing, combining, protecting and when necessary, reconfiguring the intangible and tangible assets of the business enterprise (Teece, 2007:175).

By and large, DCV contends that in a business environment where the competitive landscape is continuously shifting, a firm's dynamic capabilities become the source of sustained competitive advantage (Eisenhardt & Martin, 2000:1105; Wu, 2010:27). Relating the dynamic capability view to the current study, this study submits that in a business environment where the competitive landscape is constantly shifting, supply chain managers need to utilise the capabilities offered by use of information sharing and inter-organisational relationships in order to sustain their competitive advantage and hence, improve the supply chain or firm's performance.

1.7.2 Empirical Review

1.7.2.1 Supply chain dynamism

The business environmental dynamism is defined as the random changes in products, technologies, and demand for products in the market (Zhou & Benton, 2007:1351). According to Castrogiovanni (2002:130), business firms in unsettled environments need to continuously renew products/services so as to respond to environmental changes. These businesses are better able to satisfy customers' constantly changing preferences and make timely and effective responses to competitors' tactics.

1.7.2.2 Information sharing

Information sharing refers to the degree to which critical and proprietary information is communicated to one's supply chain partner (Monczka, Petersen, Handfield & Ragatz, 1998:554). Numerous researchers have emphasised the importance of information sharing in supply chain management practice. Hong, Youn and Nahm (2008:438) consider sharing of information as one of five building blocks that characterise a solid supply chain relationship.

According to Stein and Sweat (1998:37), supply chain partners who interchange information are frequently able to work as a single unit. Together they can understand the needs of the end customer better and hence can react to market change quicker. The intensity of communication establishes high levels of cooperative behaviour among supply chain partners, which leads to a high degree and regularity of strategic-information flows between them (Klein, Rai & Straub, 2007:615).

1.7.2.3 Inter-organisational relationships

Inter-organisational relationship refers to the degree of trust, commitment and shared vision between supplier partners. Without a foundation of effective inter-organisational relationship, any effort to manage the flow of the information or materials across the supply chain is likely to be unsuccessful (Seuring & Müller, 2008a:1699). Trust and commitment are necessary to build long-term cooperative relationships between supply chain partners (Spekman, Kamauff & Myhr, 1998:57).

The aim/purpose of this study is to consider an inter-organisational relationship, including one sub-dimension, trust in trading partners, which is defined as the willingness to rely on a trading partner in whom one has confidence (Monczka *et al.,* 1998:5557). Trust is conveyed through faith, reliance, belief or confidence in the supply chain partner, viewed as a willingness to forego opportunistic behaviour (Seuring & Müller, 2008a:1700). Trust has been considered to be the essential factor in most productive partner relationships (Wilson & Vlosky, 1998:215).

As environmental uncertainty increases, several types of inter-functional expertise are required, as more diverse skills and knowledge are needed to develop solutions and remain competitive (Fredericks, 2005:556). Subsequently, inter-organisational relationships can be used to create complementary and distinctive resources that can enhance the competitive advantage of organisations in the relationship. Distinctive resources are developed during the lifetime of the alliance or relationship (Lambe, Spekman & Hunt, 2002:214).

1.7.2.4 Supply chain performance

Previous researchers (Green, Inman, Brown & Willis, 2005:276) have defined supply chain performance as the ability of the supply chain to deliver quality products and services in precise quantities and at precise times and to minimise total cost of the products and services to the ultimate customers of the supply chain. Although organisational managers are held responsible for organisational performance, organisational success depends upon the performance of the supply chains in which the organisation functions as a partner (Rosenzweig, Roth & Dean, 2003:437). Supply chain performance is dependent on the supply chain partner's ability to adapt to a dynamic environment (Fawcett, Osterhaus, Magnan, Brau & McCarter, 2007:359).

1.8 RESEARCH DESIGN AND METHODOLOGY

Bakerm (2000:373) defines research design as a blueprint for conducting a study with maximum control over the factors that may interfere with the validity of the findings. This study adopts a survey as its research design. Surveys involve the assessment of thoughts, feelings and opinions through the administration of questionnaire instruments. Questionnaires are usually administered to a representative sample selected from a wider population although census surveys can also be undertaken to collect information from everyone (Terwee, Bot, de Boer, van der Windt, Knol, Dekker & de Vet, 2007:34).

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1.8.1 Sampling Design

Sampling design is a basic notion in sampling theory. It describes random selection of a sample from a finite population (Traat, Bondesson & Meister, 2004:397). Therefore, this study is a quantitative study, because quantitative research tends to be based on larger sample sizes in order to produce results which can be generalised to a wider population.

1.8.1.1 Target population

Atkinson and Flint (2001:2) describe target population as all elements that meet the criteria for inclusion in a study. This study aims to investigate the influence of supply chain dynamism, information sharing and inter-organisational relationships on supply chain performance in manufacturing organisations in Gauteng. Its target populations therefore are manufacturing, service and mining organisations in the Gauteng province of South Africa.

1.8.1.2 Sampling frame

Sampling frame defines a set of elements from which a researcher can select a sample of the target population (Kemper, Stringfield & Teddlie, 2003:274). Due to the fact that a researcher rarely has direct access to the entire population of interest in social science research, a researcher must rely upon a sampling frame to represent all of the elements of the population of interest. In this study the focus is mainly on the supply chain. A list of registered mining, service and manufacturing organisations around Gauteng province was obtained from the Certified Institute of Purchasing and Supply (CIPS) of South Africa.

1.8.1.3 Sampling size

A sample size refers to the number of elements to be included in the study (Sandelowski, 1995:179). Important factors that are considered in determining the sample size include: the importance of the decision, the nature of the research, the number of variables, and the nature of the analysis, sample sizes used in similar studies, completion rates and resource constraints (Collins, Onwuegbuzie & Jiao, 2007:267). For this study's purpose 350 questionnaires were distributed across manufacturing, mining and service orginisations. Different organisations were selected randomly. This sample size is deemed relatively acceptable to perform structural equation modeling using Analysis of Moment Structures (AMOS) 22.

1.8.1.4 Sampling method

The sampling method is the scientific procedure of selecting those sampling units, which would provide the required estimates with associated margins of uncertainty that arise from examining only a part and not the whole (Christensen, Johnson & Turner, 2011:17). There are two sampling methods, namely, probability sampling method, and non-probability sampling method. However, this study makes use of probability sampling since it is appropriate for a quantitative study.

Probability sampling methods include different types, namely, pure/simple random probability sampling, systematic probability sampling, stratified probability sampling and cluster probability sampling.

This study uses pure/simple random probability sampling, which is the most basic among the probability sampling techniques. This sampling technique involves assembling a sample in such a way that each independent, same-size subset within a population is given an equal chance of becoming a subject (Csikszentmihalyi & Larson, 1987:527). Freedom from human bias and classification error remains one of the biggest advantages that simple random sampling offers as it gives each element of a population a fair chance of being selected.

1.8.2 Measurement Instruments

The measurement items were measured on a 5-point Likert type scale anchored by 1-strongly disagree to 5-strongly agree to express the degree of agreement. The scale is based upon the assumption that each statement/item on the scale has equal attitudinal value, importance or weight in terms of reflecting attitudes towards the issued questions (Kimberlin & Winterstein, 2008:2277).

This study consists of four variables, namely: supply chain dynamism; information sharing; inter-organisational relationships; and supply chain performance. Each variable has its questions: "Supply chain dynamism", was measured using three (3) questions adapted from Zhou and Benton (2007:1360). 'Information sharing" was measured using six (6) questions adapted from Li *et al, (*2006:120), while "inter-organisational relationships" used three (3) questions adapted from Li and Lin. (2006:1650). Finally "supply chain performance" was measured using six (6) questions adapted from Green *et al.* (2012:1015).

1.8.3 Data Collection Method

Data collection is an important aspect of any type of research study. Inaccurate data collection can impact the results of a study and ultimately lead to invalid results. Data collection methods for impact evaluation vary along a continuum (Bar-Ilan, 2001:8). This study, therefore, made use of questionnaires in order to collect data from respondents. Questionnaires can be handed out physically or sent by e-mail. This method can be adopted for the entire population or sampled sectors.

For this study's purpose questionnaires were self-administered, which required a high level of literacy. In order to maximise return rates, questionnaires were designed to be as simple and clear as possible, with targeted sections and questions. Most importantly, questionnaires were also as short as possible. Study questionnaires were distributed to different manufacturing, mining and service organisations physically and some were emailed.

1.9 DATA ANALYSIS APPROACH

1.9.1 Data analysis Procedure, Statistical Approach and Testing the Hypothesis

In the proposed study the data analysis procedure consists of five stages. First, the collected data was coded in an excel spreadsheet and then proceeded to data cleansing. Second, coded data was transformed and descriptive statistics (profile data frequency table) extracted using Statistical Package for the Social Sciences (SPSS) 22.0 statistical software. Third, the research model fit was also assessed using Analysis of Moment Structures (AMOS) 22.0 statistical software, while the fourth stage focused on performing Confirmatory Factor Analysis (CFA), again using AMOS 22.0 statistical software. The final stage was the path modeling and also using AMOS 22.0 statistical software.

1.9.2 Measurement Instruments Reliability and Validity

1.9.2.1 Reliability test

The reliability of a research instrument concerns the extent to which the instrument yields the same results on repeated trials (Billinton, Kumar, Chowdhury, Chu, Debnath, Goel & Oteng-Adjei,

1989:1238). In order to test the reliability of the measurement instruments for this study, the Cronbach Alpha and composite reliability value were used.

1.9.2.2 Validity test

Validity refers to the degree in which a test or other measuring device is truly measuring what it is intended to measure (Golafshani, 2003:597). In this study three types of validity, namely, content validity, predictive validity and construct validity were tested.

1.9.2.3 Convergent validity

Convergent validity is the degree to which an operation is theoretically similar to other operations (Cunningham, Preacher & Banaji, 2001:164). In the case of this study, convergent validity was checked using item total correlation values, item loading values and Average Variance Extracted (AVE) values.

1.9.2.4 Discriminant validity

Discriminant validity refers to a scale that adequately differentiates itself or does not differentiate between groups that should differ or not differ, based on theoretical reasons or previous research (Bagozzi, Yi & Phillips, 1991:422). This study assessed discriminant validity using average variance extracted compared to shared variance and inter-construct correlation matrix as indicators.

1.9.3 Research Model Fit Assessment (CFA and Path Modeling)

A confirmatory factor analysis and path modeling using AMOS 22.0 was performed to establish the model fit. Model fit indicates if the data fit to the conceptualised research model. Model fit indicators such as Chi-square/degrees of freedom, Goodness of Fit Index (GFI), Augmented Goodness of Fit Index (AGFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), Composite Fit Index (CFI) and Random Measure of Standard Error Approximation (RMSEA) were used to assess the model fit.

1.10 ETHICAL CONSIDERATIONS

This study adhered to the ethical regulations of VUT. It is structured in such a way that there are no disturbances to any other human being; it actually holds high status in terms of how it is written

and interpreted, and sources of information used were obtained ethically with full, clear referencing. The questionnaires were completed anonymously and on a voluntary basis. The gathered data was regarded as confidential. The following ethical principles were also adhered to:

- Participation in the study was voluntary.

- Personal data of individuals was processed fairly and lawfully and used only for the purpose of this study.

- The respondents' privacy was respected.

- Personal information from the individuals was be ascribed to any individual.

- The questionnaire did not contain the names of the respondents.

- Professional competence in the data collection was maintained.

- Independent objectivity in the interpretation of the questionnaire findings was upheld.

1.11 OUTLINE OF THE STUDY

Chapter 1: Introduction and Research Background

In this chapter introduction, problem statement, purpose of the study, research objectives, justification, significance of the study and definition of key terms were outlined.

Chapter 2: Literature Review: Supply Chain Management

In this chapter the importance of supply chain and how it is linked to different sectors/industries (manufacturing, mining and service) was highlited.

Chapter 3: Literature Review: Empirical Variables of the Study

In this chapter theoretical grounding (theory), empirical review (research variables), conceptual model, hypothesis development and statements were discussed.

Chapter 4: Research Methodology and Research Design

In this chapter the target population, sampling frame, sampling size and measurement instruments as well as ethical considerations of the study were highlighted.

Chapter 5: Data analysis and Results

In this chapter analysis, interpretation and discussion of data, data analysis procedure, statistical software to be used, checking measurement instruments reliability and validity, checking model fit and testing hypothesis were discussed.

Chapter 6: Conclusion and Recommendations

In this chapter conclusion, recommendations, limitations of the study, with implications for future/further research and managerial implications were outlined.

1.12 CONCLUSION

This chapter covered introduction followed by the problem statement. The problem statement addresses the gap of this dissertation. The next section outlines the purpose of this thesis. The following section then discussed the study's objectives, which are theoretical and empirical objectives. Conceptual framework and hypotheses statements were also discussed, followed by the dissertation's literature review. Furthermore, the methodology used to collect data was also outlined, followed by the data analysis approach used for this study's purpose and its ethical considerations. Finally, the last section provided an outline of the chapters in the entire dissertation.

CHAPTER 2

SUPPLY CHAIN MANAGEMENT

2.1 INTRODUCTION

The previous chapter introduced the entire study, highlighted the objectives, articulated the problem statement, and outlined the research methodology. This chapter discusses supply chain in various sectors or industries such as mining, manufacturing as well as service industry in order to identify links between these industries and the supply chain as a whole. Firstly, this chapter clearly gives out different definitions of supply chain, so that we can have a clear understanding of the concept at hand. Furthermore, the development of supply chain management is discussed, as to how this concept evolved over the years. A supply chain management framework is illustrated to show clearly how the supply chain functions/operates. This chapter further discusses supply chain in various sectors (manufacturing, mining and service), supply chain risks management and sustainable supply chain management. It is imperative to focus on these topics so that a better understanding on their importance to the supply chain as a whole can be achieved.

2.2 SUPPLY CHAIN DEFINITIONS

Generally speaking, supply chain is also considered as a system of organisations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer. Supply chain activities transform natural resources, raw materials and components into a finished product that is delivered to the end customer (Agrell & Hatami-Marbini, 2013:567). Supply chain management takes an integrated system's view on the design, monitoring and control of the chain. This approach serves to arbitrate the potential conflicts of individual agents in the chain in order to coordinate the flow of products and services to best serve the ultimate customer (Christopher, 2000:38). Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and logistics management (Mentzer, Stank & Esper, 2008:32). Effective supply chain management maximises value to the ultimate customers of the supply chain in terms of both satisfaction with the product and/or services and a relatively low total cost of the product and/or service. Supply chain managers are responsible for reconciling supply and demand issues within value chains

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(Rainbird, 2004:230). The growing interest in SCM has led to the development of numerous definitions as shown in Table 2.1

Table 2.1: Supply Chain Definitions

Supply chain definition	Source
The integration of key business processes from end-user through original suppliers that provide products, services, and information that add value for customers and other stakeholders.	Lambert, Cooper and Pagh, 1998:1
The coordination of activities, within and between vertically linked firms, for the purpose of serving end customers at a profit.	Larson and Rogers, 1998:2
The management of the interface relationships among key stakeholders and enterprise functions that occur in the maximisation of value creation which is driven by customer needs satisfaction and facilitated by efficient logistics management.	Walters and Lancaster, 2000:160
The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.	Mentzer, DeWitt, Keebler, Min, Nix, Smith and Zacharia, 2001:18
All the activities involved in delivering a product from raw material through to the customer, including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities.	Lummus, Krumwiede and Vokurka, 2001:428
Encompassing the planning and management of all activities involved in sourcing and procurement, conversion, demand creation and fulfillment, and all logistic management activities.	Gibson, Mentzer and Cook, 2005:22
Managing the inputs of goods or services including a range of activities not only within a single department in an organisation but also from different departments and outside the organisation, for final users from procurement of raw materials through to the end of the products' useful life.	Eng, 2005:4
The management of a network of relationships within a firm and between interdependent organisations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximising profitability through efficiencies, and achieving customer satisfaction.	Stock and Boyer, 2009:706

Source: Own compilation

The above definitions have been collected through a review of literature and should be viewed as illustrative rather than comprehensive. Based on an analysis of the SCM definitions summarised above, the key characteristics of SCM may thus be expressed as: (1) flow focus, (2) coordination focus, (3) stakeholder focus, (4) relationship focus, (5) value focus, (6) efficiency focus, and (7) performance focus. SCM is viewed more than ever as a source of strategic advantage for organisations (Mol, 2003:44). This has transformed the position of the SCM function within the organisational structure (Kim, 2007:324), the way of organising the SCM function(s) (Elmuti, 2002:50), and the placement of SCM authorities in the organisational hierarchy (Monczka, Handfield, Giunipero & Patterson, 2008:6).

There are certain objectives to achieve in a supply chain management. Improving customer satisfaction and service and increasing competitiveness are a number of these objectives (Cooper, Lambert & Pagh, 1997:4; Cao & Zhang, 2011:164). A supply chain management also aims to lower the costs and resources involved in the creation of products as well as improve efficiency and effectiveness (Giunipero & Brand, 1996:30; Weber, Hiete, Lauer & Rentz, 2010:4). SCM also focuses on reducing inventory levels and respective costs (Cooper & Ellram, 1993:14; Ding, Guo & Liu, 2011:72), increasing profits (Droge, Jayaram & Vickery, 2004:558; Christopher & Jüttner, 2000:117) and improving cooperation (Flynn, Huo & Zhao, 2010:59; Droge, Vickery & Jacobs, 2012:251). In this regard it is safe to say that supply chain management has noticeably grown since its development in the early 1980s.

Many things have been transformed in the growth of this process, and many supply chain management definitions have been developed. Supply chain management is very broad concept, which has gained recognition in various sectors in the global society, which is discussed in this study. This section reflects on the most common definitions in the field of supply chain and its management in general. The next section discusses the development of supply chain management and also considers the supply chain management framework, which includes the supply chain business processes.

2.3 THE DEVELOPMENT OF SUPPLY CHAIN MANAGEMENT

Supply chain management (SCM) was introduced as a common scientific and managerial term in 1982 to describe a hierarchical control system for material, information and financial flows in a

potentially multidirectional network of autonomous decision making entities (Christopher & Holweg, 2011:64). In the late 1980s, the term supply chain management (SCM) was introduced and came into widespread use in the 1990s. SCM has been increasingly developed in theory and practice (Houlihan, 1985:23). From a process-oriented or cross-functional perspective, SCM comprises planning, sourcing, production, and distribution logistics but is not exclusively focused on one of these areas (Mentzer *et al.,* 2008:33).

Since the introduction of the concept in the early 1980s, SCM has been used to describe the planning and control of materials, information flows, and the logistic activities internally within a company and also externally between companies (Cooper, Lambert & Pagh, 1997:2). Over time, research on SCM has continued to broaden in focus (Burgess, Singh & Koroglu, 2006:704). Initially, SCM focused primarily on material flows. More recent research explores additional aspects of SCM, such as risk (Colicchia & Strozzi, 2012:403), performance (Hassini, Surti & Searcy, 2012:72) and integration (Fabbe-Costes & Jahre, 2007:837). There is also a growing emphasis on information flows, internal and external networks of relationships (Stock, Boyer & Harmon, 2009:32), and governance of supply networks (Pilbeam, Alvarez & Wilson, 2012:358).

Today, firms face the disruptive impacts of global competition, rapidly changing customer demands, and an accelerated pace of technological change that require the ability to respond to market changes in order to develop their own critical core competencies (Ganguly, Nilchiani & Farr, 2009:410; Overby, Bharadwaj & Sambamurthy, 2006:121; Sambamurthy, Bharadwaj & Grover, 2003:237). These competencies are even more important to firms that must identify and communicate market changes and orchestrate coordinated responses to these changes throughout an integrated supplier chain (Christopher, 2000:38).

2.4 SUPPLY CHAIN MANAGEMENT FRAMEWORK

Below is the supply chain framework which is aimed at giving a detailed structure of the entire supply chain processes. Figure 2.1 illustrates a significant conceptual framework of SCM proposed by Cooper *et al.,* (1997:4) and discussed by Lambert *et al.* (1998:3). Supply chain business processes are integrated with functional entities and management components that are common elements across all supply chains (SCs) and determine how they are managed and structured. Not only back-end and its traditional stand-alone modeling is addressed, but the front-end beyond the

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factory door is also addressed through information sharing among suppliers, supplier's suppliers, customers, and customers' customers.
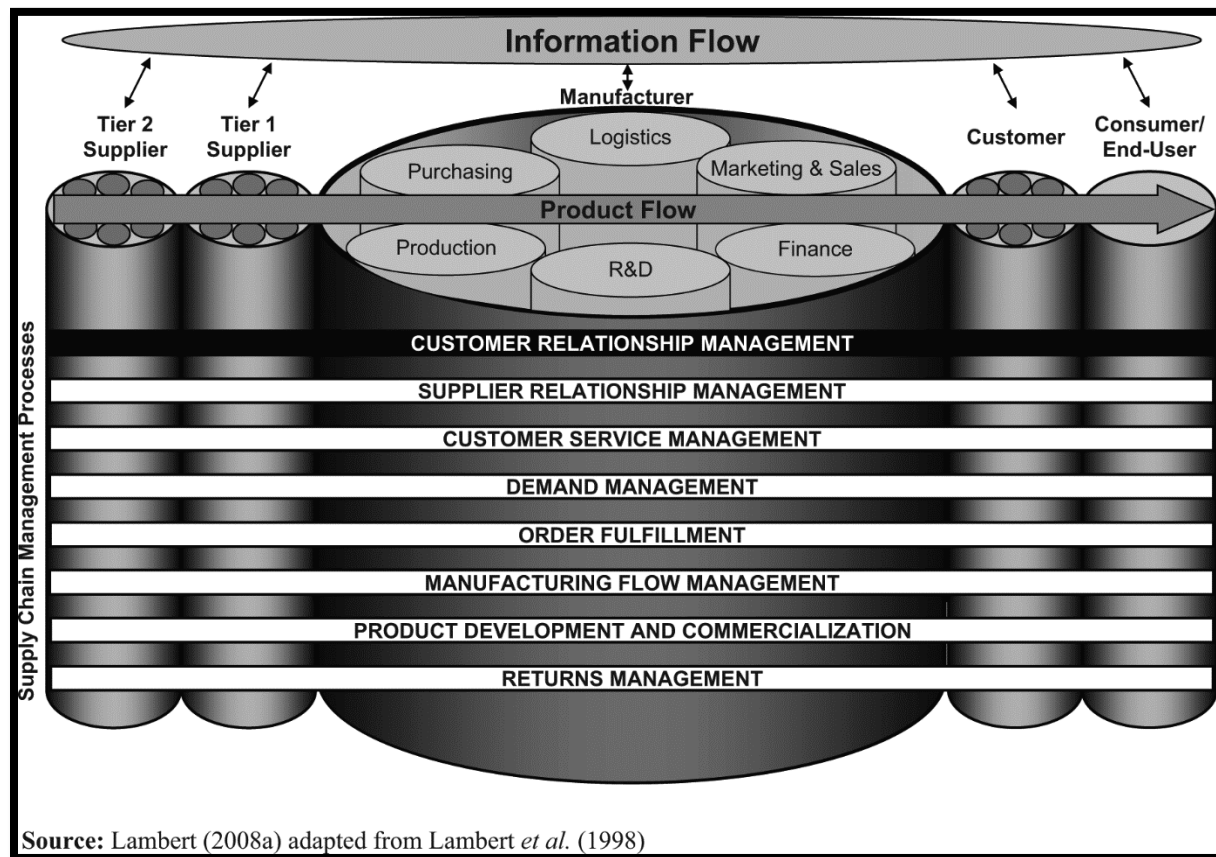
Figure 2.1 Supply Chain Business Processes

Successful SCM requires a change from managing individual functions to integrating activities into key supply chain processes. Traditionally, both upstream and downstream portions of the supply chain have interacted as disconnected entities receiving sporadic flows of information over time (Christopher, 2000:39). The purchasing department placed orders as requirements became necessary and marketing, responding to customer demand, interfaced with various distributors and retailers and attempted to satisfy this demand. Orders were periodically given to suppliers and their suppliers had no visibility at the point of sale or use. Satisfying the customer often translated into demands for expedited operations throughout the supply chain as member firms reacted to unexpected changes in demand.

Operating an integrated supply chain requires continuous information flows, which in turn help to create the best product flows (Agrell & Hatami-Marbini, 2013:568). The customer remains the primary focus of the process. Achieving a good customer-focused system requires processing information both accurately and in a timely manner for quick response systems that require frequent changes in response to fluctuations in customer demand. Controlling uncertainty in customer demand, manufacturing processes, and supplier performance are critical to effective SCM (Huang, Lau & Mak, 2003:1483). The key supply chain processes identified by members of The Global Supply Chain Finance (GSCF) are described below.

2.4.1 Customer Relationship Management

The first step toward integrated SCM is to identify key customers or customer groups, which the organisation targets as critical to its business mission. Product and service agreements specifying the levels of performance are established with these key customer groups. Customer service teams work with customers to further identify and eliminate sources of demand variability. Performance evaluations are undertaken to analyse the levels of service provided to customers as well as customer profitability (Chen & Popovich, 2003:673).

2.4.2 Customer Service Management

Customer service provides the single source of customer information. It becomes the key point of contact for administering the product/service agreement (Cheung, Lee, Wang, Chu & To, 2003:457). Customer service provides the customer with real time information on promised shipping dates and product availability through interfaces with the organisation's production and distribution operations. Finally, the customer service group must be able to assist the customer with product applications.

2.4.3 Demand Management

Hewlett-Packard's experience with SCM indicates that inventory is either essential or variability-driven. Essential inventory includes work-in-process in factories and products in the pipeline moving from location to location. Variability stock is present due to variance in process, supply and demand. Customer demand is by far the largest source of variability and it stems from irregular order patterns (Lee, So & Tang, 2000:627). Given this variability in customer ordering, demand

management is a key to effective SCM. The demand management process must balance the customer's requirements with the firm's supply capabilities (Raghunathan, 2001:606). Part of managing demand involves attempting to determine what and when customers will purchase. A good demand management system uses point-of-sale and "key" customer data to reduce uncertainty and provide efficient flows throughout the supply chain. Marketing requirements and production plans should be coordinated on an enterprise-wide basis. Thus, multiple sourcing and routing options are considered at the time of order receipt, which allows market requirements and production plans to be coordinated on an organisation wide basis (Aviv, 2002:55). In very advanced applications, customer demand and production rates are synchronised to manage inventories globally.

2.4.4 Customer Order Fulfillment

The key to effective SCM is meeting customer need dates. It is important to achieve high order-fill rates either on a line item or order basis. Performing the order fulfillment process effectively requires integration of the firm's manufacturing, distribution, and transportation plans (Hariharan & Zipkin, 1995:1599). Alliances should be developed with key supply chain members and carriers to meet customer requirements and reduce total delivered cost to the customer (Gallego & Ozer, 2001:1344). The objective is to develop a seamless process from the supplier to the organisation and then on to its various customer segments.

2.4.5 Manufacturing Flow Management

The manufacturing process in make-to-stock firms traditionally produced and supplied products to the distribution channel based on historical forecasts. Products were pushed through the plant to meet a schedule. Often the wrong mix of products was produced resulting in unneeded inventories, excessive inventory carrying costs, mark downs and trans-shipments of product. With SCM, product is pulled through the plant based on customer needs. Manufacturing processes must be flexible to respond to market changes (Lambert & Pohlen, 2001:2). This requires the flexibility to perform rapid changeover to accommodate mass customisation. Orders are processed on a just-in-time (JIT) basis in minimum lot sizes. Production priorities are driven by required delivery dates. At 3M, manufacturing planners work with customer planners to develop strategies for each

customer segment. Changes in the manufacturing flow process lead to shorter cycle times, meaning improved responsiveness to customers (Goldsby & García-Dastugue, 2003:34).

2.4.6 Procurement

Strategic plans are developed with suppliers to support the manufacturing flow management process and development of new products. Suppliers are categorised based on several dimensions, such as their contribution critical to the organisation. In companies where operations extend worldwide, sourcing should be managed on a global basis (Lewis & Roehrich, 2009:126). Long-term strategic alliances are developed with a small core group of suppliers. The desired outcome is a win-win relationship, where both parties benefit. This is a change from the traditional bid-and-buy system to involving a key supplier early in the design cycle, which can lead to dramatic reduction in product development cycle times (Caldwell, Roehrich & Davies, 2009:178). Having early supplier input reduces time by getting the required coordination between engineering, purchasing, and the supplier prior to design finalisation. The purchasing function develops rapid communication mechanisms such as electronic data interchange (EDI) and Internet linkages to quickly transfer requirements. These rapid communication tools provide a means to reduce time and cost spent on the transaction portion of the purchase (Weele & Raaij, 2014:57). Purchasers can focus their efforts on managing suppliers as opposed to placing orders and expediting. This also has implications for the role of the sales force when orders are not placed through the sales person.

2.4.7 Product Development and Commercialisation

If new products are the lifeblood of a corporation, then product development is the lifeblood of a company's new products. Customers and suppliers must be integrated into the product development process in order to reduce time to market (Rogers, Lambert & Knemeyer, 2004:44). As product life cycles shorten, the right products must be developed and successfully launched in ever shorter timeframes in order to remain competitive. Managers of the product development and commercialisation process must:

- coordinate with customer relationship management to identify customer articulated and unarticulated needs;
- select materials and suppliers in conjunction with procurement; and

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- develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow for the product/market combination.

2.4.8 Returns Process

Managing returns as a business process offers the same opportunity to achieve a sustainable competitive advantage as does managing the supply chain from an outbound perspective (Mollenkopf, Russo & Frankel, 2007:568). In many countries this may be an environmental issue, but not always. Effective process management of returns enables identification of productivity improvement opportunities and breakthrough projects (Srivastava, 2008:312). At Xerox, returns are managed in four categories: equipment, parts, supplies, and competitive trade-ins. "Return to available" is a velocity measure of the cycle time required to return an asset to a useful status. This metric is particularly important for those products where customers are given an immediate replacement in the case of product failure (Vogt, Pienaar & de Wit, 2002:263). Also, equipment destined for scrap and waste from manufacturing plants is measured in terms of the time until cash is received.

This section describes the development of supply chain management, the supply chain management framework and the supply chain business processes needed for successful supply chain management. The key components which were defined are: customer relationship management, supplier relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, product development and commercialisation and returns management. The next part of this chapter discusses supply chain in different sectors as to how it links to its various sectors.

2.5 SUPPLY CHAINS IN VARIOUS SECTORS

Supply chain concept is very broad and exists in almost every sector. However, this study focuses on supply chain in the mining sector, manufacturing sector and service sector. Relationships that exist within these industries/sectors are thoroughly discussed.

2.5.1 Mining Industry

The South African gold mining industry commenced around 1886 when the mineral was first found on the Witwatersrand. From this point onwards, and central to its expansion into what

remains South Africa's most important industry and one of its largest employers was the entrenchment of a labour recruiting system around the migration of black workers back and forth between the Witwatersrand mines and rural reserves in South Africa and neighboring states. The South African government is centrally concerned with identifying strategies and programmes that maximise and broaden the economic linkages that naturally arise from the need to extract, process and refine the country's mineral resources (Lydall, 2009:113).

The mining industry in South Africa and gold mining in particular, has traditionally been one of the major contributors to the country's gross domestic product (GDP) as well a primary earner of foreign exchange (Butchart, 1996:185). Gold, the mines and in fact the entire mining industry are, however, experiencing increasing cost pressures. Even though the gold mining industry has always been extremely conservative in adopting technological innovations, economic, social, and political realities have brought a new focus on the impact of technology on productivity. While doing so, innovation in the supply of equipment and services to mining and mineral processing industries is not considered to be 'moving up the value chain' in the conventional sense; evidence from around the world attests to the fact that this activity does indeed generate significant value through the manner in which it is applied to the mining industry, simply because innovation also plays a major role in the industry because customers want differentiated products.

One of the key drivers for productivity growth is technological progress enabled by innovation. Derived from the Latin word "innovāre" that means change, renew or alter, innovation in the business context is the search for and the adoption of new products, processes, and organisational setups. Platinum-group metals (PGMs) include platinum, palladium, rhodium, ruthenium, osmium, and iridium. PGMs are used in a wide variety of applications, including vehicle catalysts for controlling vehicle pollution, chemical catalysts and coatings, dental alloys, electronic components and computer hard discs, fuel cells for power generation, glassmaking equipment, investment coinage, jewelry, medicines and petroleum catalysts for gasoline refining (Wilburn & Bleiwas, 2004:2005). Most production of PGMs originates from only two countries, Russia and South Africa. The worldwide physical supply of PGMs is influenced by cost of production, environmental consequences, government policies, industry decisions, market price, sociocultural trends, substitution issues, and technological factors (Muduli, Govindan, Barve & Geng, 2013:337).

At the top of the PGM supply chain are the producer companies providing the primary source of demand for goods and services in South Africa. Anglo American Platinum, Impala Platinum, Lonmin Platinum, Aquarius Platinum and Northam Platinum are the main PGM producers in the country operating an array of mines, concentrators, smelters and refineries. Anglo Platinum, Impala Platinum and Lonmin account for 95% of South Africa's platinum production and export revenue (Lydall, 2009:114). A host of smaller junior exploration mining companies, mostly Canadian and Australian, complement the activities of these larger firms.

The supply chain supporting the PGM industry is vast. A 20 000 ton per month platinum mine can involve up to 100 000 part assemblies and the number of active suppliers in any one PGM operation can range from 2000 to 5000 firms. Demand for inputs tends to follow the six stages of activity involved in planning a PGM project, commencing operations and producing a final product i.e. exploration and mine development; project implementation/construction; surface mining; underground mining; mineral processing; and smelting and refining (base metal and precious metal). Each of these stages is designed to increase the grade of the economic components of the ore while reducing the bulk of the products.

2.5.2 Manufacturing Industry

Manufacturing industry refers to those industries which are involved in the manufacturing and processing of items and indulge in either creation of new commodities or in value addition. It accounts for a significant share of the industrial sector in developed countries. The final products can either serve as a finished good for sale to customers or as intermediate goods used in the production process (Chen, Olhager & Tang, 2014:154).

Manufacturing industries are important for an economy as they employ a huge share of the labour force and produce materials required by sectors of strategic importance such as national infrastructure and defense (Dou & Sarkis, 2010:567). However, not all manufacturing industries are beneficial to the nation as some of them generate negative externalities with huge social costs. The cost of letting such industries flourish may even exceed the benefits generated by them (Roh, Hong & Min, 2014:198). Although agriculture and later mining have historically dominated South Africa's economy, manufacturing became the most productive sector in the early twentieth century.

Until then manufacturing industries such as wine making, tanning and tallow production were entirely derived from agriculture and were intended primarily for the domestic market.

Then as the mining sector expanded new industries arose to meet growing urban demands for processed foods, clothing, and footwear. Until the 1920s, the country still depended heavily on imports, ranging from mining equipment to textiles and clothing. The government encouraged local manufacturing through the establishment of state corporations to produce electricity (in 1922) and steel (in 1928) for manufacturers' use and through tariffs designed to protect local industry. In an era of worldwide economic downturn, a global supply chain is fraught with greater demand uncertainty, higher risk, and increasing competitive intensity. As such, the success of global manufacturing activities often hinges on a manufacturing firm's flexibility in terms of its ability to adapt its supply chain to dynamic changes in customer needs and preferences (Ganguly, Nilchiani & Farr, 2009:410).

In order to survive and compete in today's global economy, manufacturing sector strongly needs to create, share and disseminate up-to-date and appropriate knowledge and information (Nunes, Annansingh, Eaglestone & Wakefield, 2006:104). For competitive advantages, many companies have now focused more on their supply chains and hence have thought of ways to improve their supply chain management (Lotfi, Mukhtar, Sahran & Zadeh, 2013:299). A supply chain stays connected by flows of information, finance and material by the suppliers, producers, retailers, distributors and customers (Fiala, 2005:419).

Since such flexibility can be enhanced by increased access to real-time customer information throughout the supply chain, many leading-edge manufacturing firms have attempted to enrich their customer information sources and share real-time customer information with their supply chain partners. Thus the main principle of supply chain management (SCM) is that firms must become more customer-centric, information-intensive and flexible. A firm may pursue efficient supply chains when a market is mature and competitive advantage is achieved primarily through low cost and high productivity. Firms employ an efficient supply chain strategy to manufacture quality products efficiently and to provide customers with reliable services (Roh, Hong & Min, 2014:200).

2.5.3 Service Industry

Service industry is an industry made up of companies that primarily earn revenue through providing intangible products and services. Service industry companies are involved in retail, transport, distribution, food services, as well as other service-dominated businesses, also called service sector, and the tertiary sector of industry. Service industries include everything else: banking, communications, wholesale and retail trade, all professional services such as engineering and medicine, all consumer services and all government services (Chou & Shao, 2014:107).

Over the past several decades, developed countries have transformed themselves from a manufacturing-based economy to a service-based economy. The service sector has become an engine of economic growth and is one of the factors used to measure an economy's progress, its development, its quality and its perspectives (Karmarkar & Apte, 2007:440). Service industries represent 63.2% of the gross domestic product in the world, occupy 41.9% of the labour force, consume 12% of energy and account for 9% of CO_2 emissions. Between 1974 and 2009, due to the structural changes accompanying the migration from manufacturing to service industries, energy consumption has increased 69%, and electricity as a main energy source has increased from 15% to 23% (Owen, Inderwildi & King, 2010:4744; Miller, 2011:1570).

Increasing competition in the financial service industry has meant that the retention of existing customers has significantly become more important, especially due to the potential impact on revenues. Customer retention has also been increasingly of interest to academic researchers especially in areas of risk assessment and customer behaviour, including customer attrition and attraction (Ganesh, Arnold & Reynolds, 2000:67). Financial service firms that lose existing customers and have to seek new customers incur more expense than those that retain their customers, not to mention the associated risk involved in taking on new customers (Verbeke, Dejaeger, Martens, Hur & Baesens, 2012:211).

The end goal of any company is a satisfied customer. The process of locating, obtaining and transporting the inputs needed to do this is the core function of supply chain management. Supply chain design in the manufacturing industry requires a great deal of focus on physical product and a broader supplier base, while service firms typically have little need for physical inputs other than office supplies, and often work with a much smaller group of suppliers. This will also lead us to

the discussion of supply chain risks and risk management as they form part of the supply chain management.

This section discussed supply chain business processes, which are integrated with functional entities and management components that are common elements across all supply chains (SCs) and determine how they are managed and structured. Back-end and its traditional stand-alone modeling was addressed as well as the front-end beyond the factory door through information sharing among suppliers, supplier's suppliers, customers, and customers' customers. The following section discusses supply chain risks management and sustainable supply chain management.

2.6 SUPPLY CHAIN RISK MANAGEMENT

As the supply chain expands globally there is a growing need for managing supply chain disruptions from across-national perspective. Failure to manage the supply chain in a socially and environmentally responsible manner can have significant implications for a firm's corporate reputation. Supply chain disruptions and related issues are considered the most pressing concerns facing firms competing in today's global marketplace (Craighead, Blackhurst, Rungtsunatham & Handfield, 2007:131). The figure below illustrates supply chain risks management process.
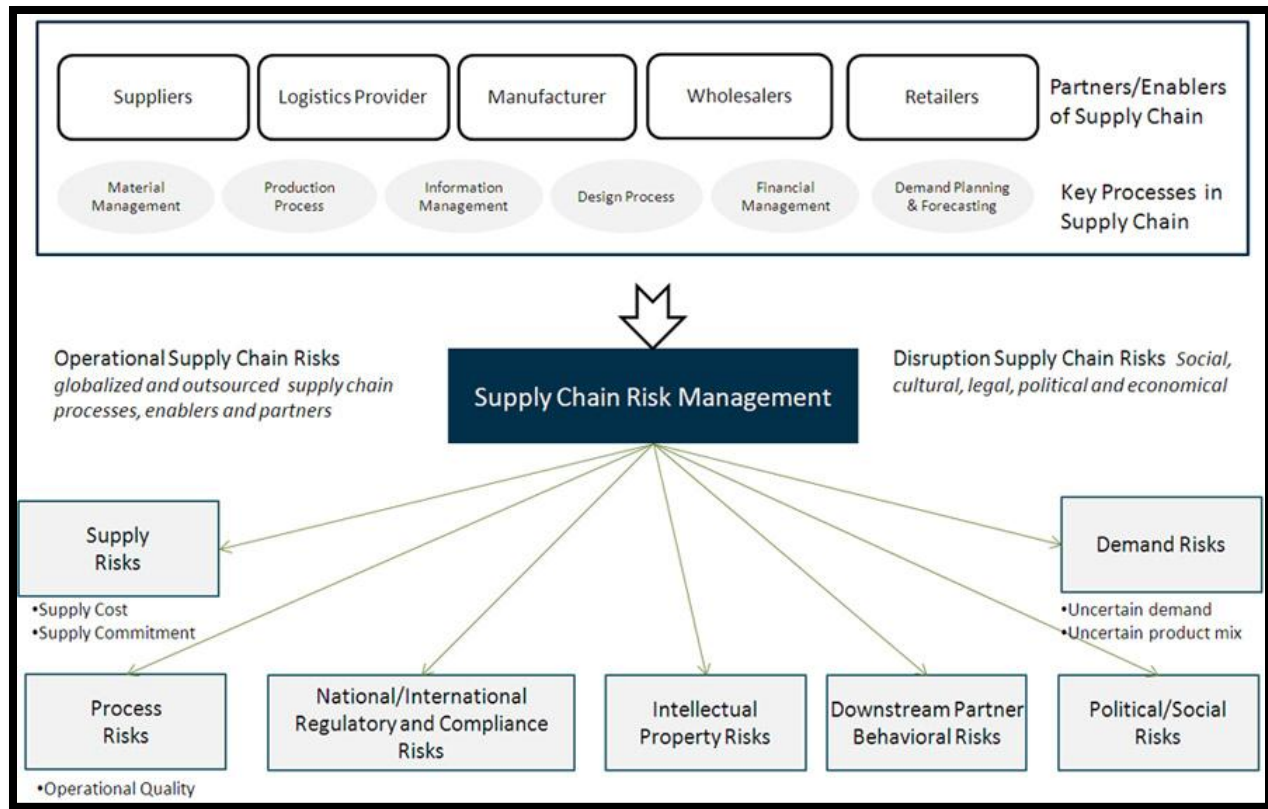
Source: adapted from Manuj and Mentzer (2008:194)

Figure 2.2: Supply Chain Risk Management

2.6.1 Supply Risks

All purchasing organisations encounter supply risk, whether it is explicitly understood and assessed, or reactively managed. Supply risk can be defined as anything that obstructs the introduction of a new product, or any event that could disrupt production (Zsidisin, 2003:220). This definition of supply risk focuses on the introduction of new products. By the time a product is considered mature.

Supply risk can also be defined as the probability of an incident associated with inbound supply from individual supplier failures or the supply market occurring, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety. Supply risk is a multi-faceted concept, since its scope includes risk sources and outcomes.

In addition, the scope for understanding supply risk differs according to industry (Hallikas, Virolainen & Tuominen, 2002:46).

Sources of supply risk tend to arise from individual supplier failures and from market factors. The individual supplier failures that define the scope of supply risk were the inability to handle demand fluctuations, quality problems at supplier plants, and the inability to stay in pace with technological changes. In addition, supply risk was understood in terms of supplier market characteristics. Market characteristics include sole sources (such as suppliers having a clear) and market capacity constraints (Harland, Brenchley & Walker, 2003:52).

2.6.2 Process Risks

Processes are the sequences of value-adding and managerial activities undertaken by the company. Process risk relates to disruptions to these processes. A process risk can be defined as risk of loss resulting from inadequate or failed internal processes, people and systems or from external events (Kleindorfer & Saad, 2005:54). Process risk is risk associated with the variability of a company's operational processes. A breakdown in the company's processes can be experienced in some or all of the following ways:

- variation in manufacturing yields, equipment and hence utilisation;
- quality and rework issues associated with internal manufacturing and technical processes;
- warehouse operations leading to fulfillment issues;
- business and supply chain systems' failures; and
- transport failures where the operation is under the control of the focal company.

2.6.3 National/International Regulatory and Compliance Risks

Anticipating and reacting to compliance and regulatory requirements in order to support performance objectives, sustain value and protect the organisational brand. The complexity of the business and regulatory landscape is increasing dramatically. Companies are navigating a proliferation of new regulatory requirements and stakeholder expectations, and are challenged to do so in a way that supports performance objectives, sustains value and protects the brand. Critical compliance and regulatory issues include:

- protecting brand reputation and value;

- meeting the demands and expectations of investors, legislators, regulators, customers, employees, analysts, consumers and other key stakeholders;

- driving value and managing performance expectations for governance, ethics, risk management and compliance; and

- managing crisis and remediation while defending the organisation and its executives/board members against legal enforcement and the rising impact of fines, penalties and business disruption.

2.6.4 Intellectual Property Risks

Intellectual property may be the single most important asset a company possesses. Whether it is physical or digital, customer data or operational information, trade secrets or business strategies, intellectual property (IP) is often the main driver of revenue for any organisation (Tang & Musa, 2011:26). It is what distinguishes one company from another and is the main reason customers buy the products and services that they do. But, of course, this also means that any vulnerability in the security of these assets are primed for exploitation by parties looking to gain an edge, and given the sheer amount of data available, achieving total protection has never been more difficult or has required such a broad scope of attention.

2.6.5 Downstream Partner Behavioural Risks

As the number of partners increases in a global supply chain, the level of visibility and control can be reduced significantly. For instance, according to a study conducted by AMR research in 2006, if supply chain visibility is relatively low: few companies have demand/inventory information from downstream partners and over 56% of the companies take more than 2 weeks to sense changes in actual demand. The low visibility level and the low control level reduce the confidence of each supply chain partner regarding the following information: the replenishment lead time/order status quoted by upstream partners, and demand forecasts provided by downstream partners. Christopher and Lee (2004:389) argue that the entire supply chain enters a "risk spiral" that can be described as follows. Each supply chain partner either "inflates" their order or "disguises" their on-hand inventory, and because of the lack of confidence in the replenishment lead time, demand forecasts, etc. the confidence level deteriorates further as every partner starts gaming the system, and hence the "risk spiral" continues (Zsidisin & Ritchie, 2009:4). To break

this vicious cycle, supply chain visibility, timely communication and coordinated corrective actions are needed to restore the confidence level of each supply chain partner.

2.6.6 Political/Social Risks

The question of potential social unrest within organisations remains one of the largest single risks, not only regarding the delivery reliability of certain suppliers, but also regarding peace and stability around the world (Sodhi, Son & Tang, 2012:2). It would not only affect public perception of one country and by association potentially damage the company's reputation, but also have a strong influence on the delivery reliability of the supplier. Several factors contribute to social tension, and each of them has to be closely monitored in order to be aware of the current situation and risk exposure. Income inequality might be one trigger for social instability and unrest. The Gini coefficient is a measure that describes the inequality of the distribution of income. The higher the Gini coefficient, the higher is the income inequality (Sodhi *et al.,* 2012:3).

2.6.7 Demand Risks

Demand distortion is a name given to the phenomenon whereby purchase orders to suppliers have a larger variance than sales' orders received from customers within a single node or decision point in the supply chain. Variance amplification occurs when this demand distortion "propagates upstream in an amplified form" (Lee, Padmanabhan & Whang, 1997:94). Collectively known as the "Bullwhip Effect" (since the oscillating demand magnification upstream is reminiscent of a cracking whip) it was first discussed in these terms in 1961 (Forrester, 1968:601) and is also known as Forrester or the whiplash effect. The expressions demand amplification; bullwhip effect, and dynamics are effectively used interchangeably in practice. A classic interpretation of demand amplification, by observing that the feedback loops inherent in supply chains create a flywheel effect, was coined by Houlihan (1985:24) and termed the 'Forrester Flywheel'.

Upswings in demand create a perceived shortage somewhere along the chain. This may simply be inventory falling below a target level. Lacking an overview of the entire supply chain, the company concerned then over-orders to protect itself against further fluctuations. This increase in orders triggers further localised protection since it is misinterpreted as real extra orders.

2.6.8 Some of Supply Chain Risks Include:

- Supplier Risks;
- Undesirable events (storm, flood, earthquake, etc.);
- Contract, legal and regulatory non-conformance;
- Information system failure and compromises; and
- Supplier country political stability.

It has been increasingly recognised that an individual business no longer competes as a stand-alone entity, but rather as member of a supply chain (Christopher, 2000:38). A considerable number of studies on supply chain management in the past have focused attention on different ways of improving supply chain performance. However, within unpredictable and turbulent business environment, supply chains are vulnerable to business disruptions such as the occurrence of undesirable events, natural disasters, loss of partnership relationships, and new customisation demands from customers (Wieczorek, 2012:142).

Supply chain disruption risks have been described as the occurrence of these unpredictable and undesirable events (Braunscheidel & Suresh, 2009:120; Tang & Tomlin, 2008:13). Supply chain disruptions are risks related to the collaboration and uncertainty of supply chain and the impact of natural disasters, terrorism and labour strikes (Kleindorfer & Saad, 2005:54).

Research on responsible supply chain management has gained considerable attention in the last decade, with contributions from a variety of fields, including marketing (Closs, Speier & Meacham, 2011:101; Piercy & Lane, 2009:335; Polonsky & Jevons, 2009:328), supply chain (Awaysheh & Klassen, 2010:1248; Simpson, Power & Samson, 2007:29), corporate responsibility (Preuss, 2009:213; Seuring & Muller, 2008a:1699) and industrial marketing (Ewing, Windisch & Newton, 2010:729; Helm & Salminen, 2010:738; Liu, Kasturiratne & Moizer, 2012:581).

Firms that fail to implement responsible supply chain practices run the risk of damaging their reputation if discovered. For example, firms such as Nike, Primark (Jones, Temperley & Anderson, 2009:928), and Adidas (Winstanley, Clark & Leeson, 2002:211) all suffered negative reputational media exposure and loss of income as a result of their irresponsible supply chain practices such as the utilisation of child labour. Another example, auto parts makers that won accolades for efficient manufacturing have suffered from hyper-competition and have gone bankrupt due to their failure

to make their operations more flexible (Roh, Hong & Min, 2014:199) Similarly, Motorola's market share in the U.S cell phone industry plummeted from 60% in 1994 to 31% in 1998 and then to 16% in 2002 due to its lack of responsiveness to the growing customer demand for digital technology (Roh *et al.,* 2014:199). To make it worse, Motorola in 2008 laid off 150 research and development (R&D) staff in its attempt to reduce product development costs and was criticised by its customers for uninspired hand-set lineups that contributed to further losses in its revenue and market share in the cellphone industry (Schoenherr, Tummala & Harrison, 2008:101). It is, however, not only business-to-consumer firms that can experience reputational damage as a result of their irresponsible supply chain activities. For instance, Haliburton, Total SA, and Baxter are just some of the firms in the business-to-business market which have seen the value of their firms decrease and their reputation tarnished due to poor supply chain practices (Hoejmose, Roehrich & Grosvold, 2014:78).

The existing literature on supply chain risks shows that there are two fairly distinct categories of risks affecting supply chain design and management (Kleindorfer & Saad, 2005:54; Norrman & Jansson, 2004:434; Oke & Gopalakrishan, 2009:168): risks arising from the problems of coordinating supply and demand and risks arising from disruptions to normal activities. This part of the chapter below clearly indicates how risks can be managed within supply chains.

2.7 RISK MANAGEMENT

Failure to manage the supply chain in a socially and environmentally responsible manner can have significant implications for a firm's corporate reputation. Responsible supply chain management (RSCM), which encapsulates socially (e.g. child labour, working conditions, human rights) and/or environmentally (e.g. ISO 14001,3 waste management, recycling, use of natural resources) responsible supply chain issues (Carter & Rogers 2008:361; Seuring & Muller, 2008a:1700), can help protect a company's reputation by shielding the firm from negative media attention and consumer boycotts.

Corporate reputation protection occurs when firms faced with negative press can prove to its stakeholders that they took reasonable steps to prevent an incident from happening, through for instance, appropriate RSCM practices. RSCM can also enhance corporate reputation, which in turn allows firms to secure business contracts and better target specific customer groups (Phillips &

Caldwell, 2005:346). A firm's corporate reputation is enhanced through the positive actions firms take, the programmes they implement and the other tangible things that firms do, rather than by increasing advertising or more effective corporate communication management (Greyser, 1999:178).

While showing interest in improving supply chain performance, scholars are increasingly focusing on supply chain agility. Christopher (2000:38), for example, stated that agility is the effective and flexible accommodation of unique customer demands. Business practitioners and scholars have embraced notion of agility in the supply chain. An agile supply chain enables exchange partners in the supply chain to sense, respond quickly to, and exploit anticipated or unexpected changes in market demand and in the business environment (Sharifi & Zhang, 2001:773). Improving supply chain agility is a potential strategy for mitigating supply chain disruption risks discussed above (Tang & Tomlin, 2008:13).

Organisations are experiencing rapid supply chain expansion with decentralised supplier base. Although expanded suppliers based in a supply chain have helped organisations gain major cost advantage and market share it has resulted in a more unstable supply chain. Supply chains are vulnerable to various types of disruptions caused by uncertain economic cycles, consumer demands, and natural and man-made disasters. Consequence of an unstable supply chain has increased risks in conducting business operations and raises concerns on continuity of manufacturing or service delivery operations. Supply chain risk management needs to be adopted as best practice for supply chain governance to minimise impact on financial strategy and profitability. Therefore, maintaining a sustainable supply chain is very important. Sustainability can be maximised throughout the supply chain, beginning with concept and development then continuing through all phases of production and final customer distribution. Sustainability is thoroughly defined and discussed below.

2.8 SUSTAINABLE SUPPLY CHAIN MANAGEMENT

The most well-adopted and most often quoted definition of sustainability is that of the Brundtland Commission (Oltean-Dumbrava, Watts & Miah, 2013:20) development that meets the needs of the present without compromising the ability of future generations to meet their needs. According to the definition, given by Seuring and Müller (2008b:455), sustainable supply chain management

(SSCM) can be defined as "the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements."

Sustainable supply chain management (SSCM) can also be defined as "the strategic, transparent integration and achievement of an organisation's social, environmental, and economic goals in the systematic coordination of key inter-organisational business processes for improving the long term economic performance of the individual company and its supply chains" (Carter & Rogers, 2008:361). Carter and Rogers (2008:363) posit that a deliberate long-term strategy combining environmental and social aspects of sustainability, which extends beyond a firm's boundary with economic objectives, helps firms mobilise those supply chain activities that directly support sustainability.

These can in turn, create a pervasive and less imitable set of processes and a basis for competitive advantage for these firms and associated chain members (Carter & Dresner, 2001:13). As Flint and Golicic (2009:842) observe, not surprisingly, sustainability has received increasing attention in the literature as a potential differentiating competency for supply chains, and has become an inescapable priority for firms worldwide (Porter & Kramer, 2006:78). Performance measurement systems that include sustainability considerations can be a driver for sustainability performance improvement without sacrificing other aspects of operating performance (Angell & Klassen, 1999:576).

2.9 CONCLUSION

Supply chains consist of the series of links and shared processes existing between suppliers and customers, which involve all the activities from the acquisition of raw materials to the delivery of the finished goods to the end consumers. In this chapter the significance of supply chain in various sectors has been elaborated. Supply chain management has also been defined from almost all angles, so has the supply chain management framework and sustainable supply chain management. Hence it is becoming increasingly apparent that competitive advantage derives from the combined capabilities of the network of linked organisations that today we call "the supply chain". This is a fundamental shift in the traditionally held view of a business model based upon a single firm. It's

also obvious that markets today are increasingly volatile and hence less predictable and so the need for a more agile response has grown.

The next chapter is based on literature review that looks at the study's four variables, namely, supply chain dynamism, information sharing, inter-organisational relationships and supply chain performance. The conceptual model/research model and hypothesis development is also included.

CHAPTER 3

THEORETICAL GROUNDING AND EMPIRICAL VARIABLES

3.1 INTRODUCTION

This chapter discusses the theoretical framework, reviews literature on supply chain dynamism, information sharing, inter-organisational relationships and supply chain performance. It proposes a conceptual model and hypotheses with a view to show the relationship that exists between the study's variables. In order to achieve the study's purpose, theoretical grounding is first discussed as to which theoretical framework the study has adopted and how it is developed. Empirical variables of the study are also fully discussed, that is supply chain dynamism, information sharing, inter-orgainisational relationships and supply chain performance. Furthermore, the conceptual framework is also be highlighted and hypotheses developed, based on the study's variables.

3.2 THEORETICAL GROUNDING

3.2.1 Dynamic Capability Theory

The theoretical background informing this study draws from a dynamic capability view (DCV) which in essence is an extension of the resource-based view (RBV) of the firm which highlights how some firms develop and sustain competitive advantages and superior profitability (Cavusgil, Seggie & Talay, 2007:159). As an extension, DCV stresses the key role of management to appropriately adjust, integrate and reshape organisational skills and resources as well as internal and external functional competences (Borch & Madsen, 2007:109). Capabilities are said to be dynamic when they provide organisations with the ability to implement different strategies to adapt to varying market conditions (Teece *et al.,* 1997:509). A firm's dynamic capabilities are characterised by its capacity to sense and shape opportunities and threats, grab opportunities, and maintain competitiveness through enhancing, combining, protecting and when necessary, reconfiguring the business enterprise's intangible and tangible assets (Teece, 2007:1320).

By and large, DCV contends that in a business environment where the competitive landscape is continuously shifting, a firm's dynamic capabilities become the source of sustained competitive advantage (Eisenhardt & Martin, 2000:1105; Vogel & Güttel, 2013:427). Relating the dynamic

capability view to the current study, this study submits that, in a business environment where the competitive landscape is constantly shifting, supply chain managers need to utilise the capabilities offered by use of information sharing and inter-organisational relationships in order to sustain their competitive advantage and hence improve the supply chain or firm's performance.

3.2.2 Development of DCV

The DCV was first put forward by Teece *et al*., (1997:1321) to explain competitive advantage and performance on high velocity and dynamically changing markets (Eisenhardt & Martin, 2000:1106). Helfat, Finkelstein, Mitchell, Peteraf, Singh, Teece and Winter (2007:8) define dynamic capabilities as "the capacity of an organisation to purposefully create, extend, or modify its resource base" and as such to reach a higher economic value than their competitors. The economic value is linked to the benefits for the customer (Peteraf & Barney, 2003:309) and thus is not limited to economic performance but can be gained in other performance areas as well, in the case of SCM within the other two dimensions of sustainability.

Eisenhardt and Martin (2000:1106) state that dynamic capabilities (DCs) are the firm's processes that use resources specifically to integrate, reconfigure, gain and release resources to match and even create market change. Dynamic capabilities thus are the organisational and strategic routines by which firms achieve new resource configurations. As such, DCs can be understood as bundles of capabilities and not only single processes. Following the definitions of Helfat *et al*., (2007:9) for a dynamic capability, the proposed practices of the SCM form the basis for the dynamic capabilities as ones to reconfigure the resource base, which are the bundles of practices that make up specific DCs. Often DCs are discussed as firm centred capabilities to enhance the performance of one single company (Ambrosini & Bowman, 2009:29; Easterby-Smith, Lyles & Peteraf, 2009:1). So far, only few researchers have linked the dynamic capabilities' approach with SCM. Defee and Fugate (2010:181) present a framework for Dynamic Supply Chain Capabilities, which should be implemented in supply chains. Foerstl, Reuter, Hartmann and Blome (2010:118) focus on the managing of suppliers within dynamically changing environments to reach corporate social responsibility goals. Zhu, Cordeiro and Sarkis (2013:232) concentrate on the path dependent development of environmental capabilities and the effect of learning and experience.

3.3 EMPIRICAL VARIABLES

In this section empirical variables are thoroughly outlined, which are supply chain dynamism, information sharing, inter-organisational relationships and supply chain performance, with more literature provided based on these variables.

3.3.1 Supply Chain Dynamism

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers (Bolumole, 2000:2). Supply chains exist in both service and manufacturing organisations, although the complexity of the chain may vary greatly from industry to industry and firm to firm. Realistic supply chains have multiple end products with shared components, facilities and capacities (Yildiz & Yercan, 2011:327). In this context, supply chain dynamics have been defined as the variation of orders or inventory level (Hall, 2000:456). This effect is obviously undesirable as it increases the supply chain costs (e.g. stock holding, backlog, late delivery, under/over resource utilisation etc.). The source of such fluctuation and amplification of orders and inventory is mainly due to the lack of timely sharing of production information, including delays and feedback in the decision rules between enterprises in the supply chain (Lee, Padmanabhan & Whang, 2004:1875).

The business environmental dynamism is defined as the random changes in products, technologies, and demand for products in the market (Zhou & Benton, 2007:1351). Business firms in unsettled environments need to continuously renew products/services so as to respond to environmental changes. These businesses are better able to satisfy customers' constantly changing preferences and make timely and effective responses to competitors' tactics (Castrogiovanni, 2002:130). As environmental uncertainty increases, various types of inter-functional expertise are required, as more diverse skills and knowledge are needed to develop solutions and to remain competitive (Duncan, 1972:314). Uncertainty refers to the unanticipated changes in circumstances surrounding a transaction. This uncertainty could preclude both the formulation of a contract ex ante and/or the ability to verify compliance ex post (Grover & Malhotra, 2003:460). The former (environmental uncertainty) can be reflected in constructs such as unpredictability of the environment, technology,

and demand volume and variety. The latter (behavioural uncertainty) includes performance evaluation and information asymmetry problems.

Uncertainty can also be defined as the difference in the amount of information required and already possessed to perform a task (Erdem & Keane, 1996:4). It exists when the possessed information is not adequate for task accomplishment, because it is either insufficient or excessive, causing information overload (Ben-Arieh & Pollatscheck, 2002:3561). In today's hyper-competitive global environment organisations began to realise that delivering the value at the lowest cost is not only related to the activities' functions and processes within the organisation itself, but to the whole of the supply chain (Barratt & Barratt, 2011:514). As customers become more aware of their demands and conscious about their improved choices, faster response time, shorter product cycle time and customised products/services are placed at the very core of dynamic and responsive value chains, aiming to offer added value for the customers (Barlow & Lee, 2005:100). Due to the complex nature of supply chains; having various activities encompassing multiple functions and organisations (Arshinder & Deshmukh, 2008:316), supply chain members, while acting in a decentralised manner, need to move towards the efficiency associated with a unified system and centralised control (Zhu, Gavirneni & Kapuscinski, 2009:173).

Dynamic models of supply chains try to reflect changes in real or simulated time and take into account that the network model components are constantly evolving. The supply chain dynamics lead to the increase in the cost of the units and the whole chain. The overall business environment is becoming increasingly dynamic. Demand and supply for custom products can be very dynamic (Fiala, 2005:420).

3.3.1.1 Environmental uncertainty

Uncertainty refers to the unpredictability of environmental or organisational variables that have an impact on corporate performance (Elbanna & Child, 2007:562). Aldrich (2007:4) observes that firms do not operate in isolation from their environments, and that environmental complexity influences internal uncertainty. The greater the instability of the general environment, the greater the uncertainty facing decision makers (Lubatkin, Simsek, Ling & Veiga, 2006:647). When the environment is stable, firms can pre-plan and reduce much of the information that is required during task execution. When the environment is unstable it will result in more exceptions during

task execution. There are many potential sources of environmental uncertainty. However, our centre of attention is on environmental dynamism. Dynamism reflects the extent to which task-relevant characteristics of the environment are changing. Where the environment is changing, cause-and-effect relationships between the environment and the firm become unclear (He & Baruch, 2010:44). Environmental market conditions shape the nature and intensity of competition and influence the dynamics of local industries.

3.3.1.2 Supply-chain uncertainty

The order-fulfillment process involves the coordination of diverse supply-chain activities, such as sales commitment, manufacturing, and relationships with suppliers for purchasing or shipping, that normally take place in several different business units. The real problem of this confusing network is the uncertainty that plagues it (Simangunsong, Hendry & Stevenson, 2012:4494). Uncertainty cannot be avoided for a finished product, because the processes involve the many different organisations that comprise the supply-chain network. The mechanism by which the order-fulfillment process is managed to mitigate the negative effects of uncertainty is the key to the successful operation of a supply chain. In light of the complexity of the interactions among companies in the order-fulfillment process, it was concluded that demand, manufacturing, and supply uncertainty were the main problems that plague the management of order fulfillment (Chan, Chung & Choy, 2006:307). Each of these uncertainties must be thoroughly measured and analysed if its impact on the order-fulfillment process is to be fully understood and performance improved.

3.3.1.3 Uncertainty in demand

Variations in customer demand are one source of supply-chain uncertainty. Demand uncertainty involves unknowns associated with product characteristics or environmental factors, which makes it difficult to predict and control the demand for a final product (Boonyathan & Power, 2007:392). The nature of the demand for the products a company supplies is the critical element in an analysis of demand uncertainty. There are many facts on the demand side that must be considered in determining demand uncertainties, such as rate of new product introduction, product life cycle, product variety, lead-time from design to production, variation of marketing product mix, number of sales channels, accuracy of demand forecasts, and predictability of product demand (Song, Zhang, Hou, & Wang, 2010:68; Kwon, Im & Lee, 2007:691; Taylor, 2000:516).

3.3.1.4 Demand uncertainty

Lee tries to find demand patterns for different product categories. He splits the products of a company into two categories: functional products and innovative products. Functional products have a stable demand, usually due to a long product life cycle. Usually the product variety is low and the volume per SKU high. The author correctly concludes: "Clearly, different supply chain strategies are required for functional versus innovative products."

Table 3.1: Demand uncertainty

	Demand Uncertainty	
	Low (Functional Products)	High (Innovative Products)
Low (Stable Process)	Grocery, basic apparel, food, oil and gas	Fashion apparel, computers, pop music
High (Evolving Process)	Hydro-electric power, some food produce	Telecom, high-end computers, semiconductor

Source: Lee 2002:107

3.3.1.5 Uncertainty in supply

Failure to deliver as required by the customer is another source of supply chain uncertainty. It may be caused by a malfunctioning production process at the supplier, late delivery due to unexpected weather conditions, or unacceptable quality of the delivered products (Deo & Corbett, 2010:1). Davis proposed that supply uncertainty is related to unpredictable and uncontrollable factors in the supply of materials (Wilding, Kricka, Cheng, Hvichia, Shoffner & Fortina, 1998:96). Many facts in the supply process must be considered when determining supply uncertainties, such as frequency of changing suppliers of critical materials, complexity of critical materials, complexity of procurement technology for critical materials, time specificity of materials procurement, delivery frequency of critical materials, delayed delivery of critical materials, and fluctuations in the selling price of critical materials (Datta & Christopher, 2011:766).

3.3.1.6 Supply uncertainty

As well as the demand side, the supply side risks are classified as well. Supply processes can be stable and evolving. Stable supply means: reliable suppliers, less process change and less quality problems. Evolving supply processes are those with still unreliable suppliers, also limited supply sources.

Table 3.2: Supply uncertainty

Source: Lee 2002:108

3.3.1.7 Uncertainty in manufacturing

Manufacturing uncertainty is related to unpredictable and uncontrollable factors in the manufacturing process. Variations in manufacturing lead-time are the major source of manufacturing uncertainty (Wazed, Ahmed & Nukman, 2009:343). Other factors are variations in product quality, changes in production technology, and the complexity of manufacturing. Generalising from earlier studies, the many aspects of the manufacturing process that must be considered in a discussion of manufacturing uncertainties include degree of process interaction, degree of process decomposition, degree of interaction among components, degree of product decomposition, process yield stability, manufacturing lead-time, employee turnover rate, engineering redesign, and frequency of changes in production technology (Merschmann & Thonemann, 2011:44).

3.3.2 Information Sharing

Fiala (2005:419) defined information sharing as "the extent to which one party in the chain communicates critical and proprietary information to another party in the chain", and when all members have access to the same information the supply chain can become smoother and more responsive (Huang & Gangopadhyay, 2004:21). According to Chen and Lee (2009:782), there are three levels of information sharing: the first level is called "decentralised control", which refers to a situation where no information is shared in the supply chain and each segment makes all strategic decisions independently to reach individual optimisation. The impacts the decisions will have on suppliers and customers are not considered, which in the worst case can lead to situations where the company becomes more exposed to the danger of the bullwhip effect.

The second level is called "coordinated control" and refers to when two inventories are coordinated based on sharing of customers´ order information. In such a situation the manufacturer receives information about customers´ demand along with retailer´s ordering information and based on these data the manufacturer makes decisions about the proper inventory level. The third and last level is called "centralised control", where one single organisation or a small group of executives are the decision-makers for the entire supply chain, and processes all relevant information to execute decisions that, optimally, should assure better system efficiency and system wide optimisation.

Information sharing refers to the degree to which critical and proprietary information is communicated to one's supply chain partner (Fawcett, Osterhaus, Magnan, Brau & McCarter, 2007:358). Information sharing is viewed as one of the key elements for successful supply chain management and coordination.

Numerous researchers have emphasised the importance of information sharing in supply chain management practice. Li and Lin (2006:1642) considers sharing of information as one of five building blocks that characterise a solid supply chain relationship. Information sharing is considered an important approach to increasing organisational efficiency and performance.

According to Zhou and Benton (2007:1349), supply chain partners who interchange information frequently are able to work as a single unit. Together they can understand the needs of the end customer better and hence can react to market change quicker. The intensity of communication

establishes high levels of cooperative behaviour among supply chain partners, which leads to a high degree and regularity of strategic-information flows between them (Klein, Rai & Straub, 2007:615).

Information sharing enables suppliers to respond to consumer demand more quickly by appropriately scheduling the replenishment of the inventory. Information sharing often improves the accuracy of demand forecasts, which enables a better price structure, improved production scheduling, and better management of consumer demand (Ganesh, Raghunathan & Rajendran, 2014:79). Information sharing improves coordination between supply chain processes to enable the material flow, which reduces inventory costs. Information sharing leads to high levels of supply chain integration by enabling organisations to make dependable delivery and introduce products to the market quickly (Sezen, 2008:234).

The pressure from customers to move away from the traditional ''make-to-stock'' production model to ''build to demand'' customer service model, creates the need to leverage product information throughout the supply chain and have greater visibility among the supply chain to ensure customisation and rapid delivery of innovative products (Blackhurst, Wu & O'Grady, 2005:344). In this customer oriented competitive market, lack of information is a killer criteria as information plays the vital role of a driving force behind the operation of the supply chain (Bullinger, Kuehner & Van Hoof, 2002:3544). Information sharing can include end-customer demand, sales forecasts, order status, inventory levels, capacity availability, lead times and quality (Stevenson & Spring, 2007:685).

To utilise information, information technology systems such as enterprise research planning (ERP) and electronic data interchange (EDI) should be implemented in every participating company in order to easily share and store information and data so that anyone in the supply chain can access it at any time. The chances of the bullwhip effect and forecasting mistakes can then potentially be reduced, which could lead to a reduction in system wide costs and increase the chances of total supply chain optimisation (Lee, Padmanabhan & Whang, 2004:1876). Benefits from information sharing have been analysed by other researches as well. Kelle and Akbulut (2005:42) found that when information sharing is introduced, the cost of holding inventory and backorders can be reduced with 13.8%, while Lee and Whang's (2000:80) research found that if information is shared the overall cost has potential to decrease with 12-23%.

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3.3.2.1 Crucial aspects of information sharing and coordination in supply chains
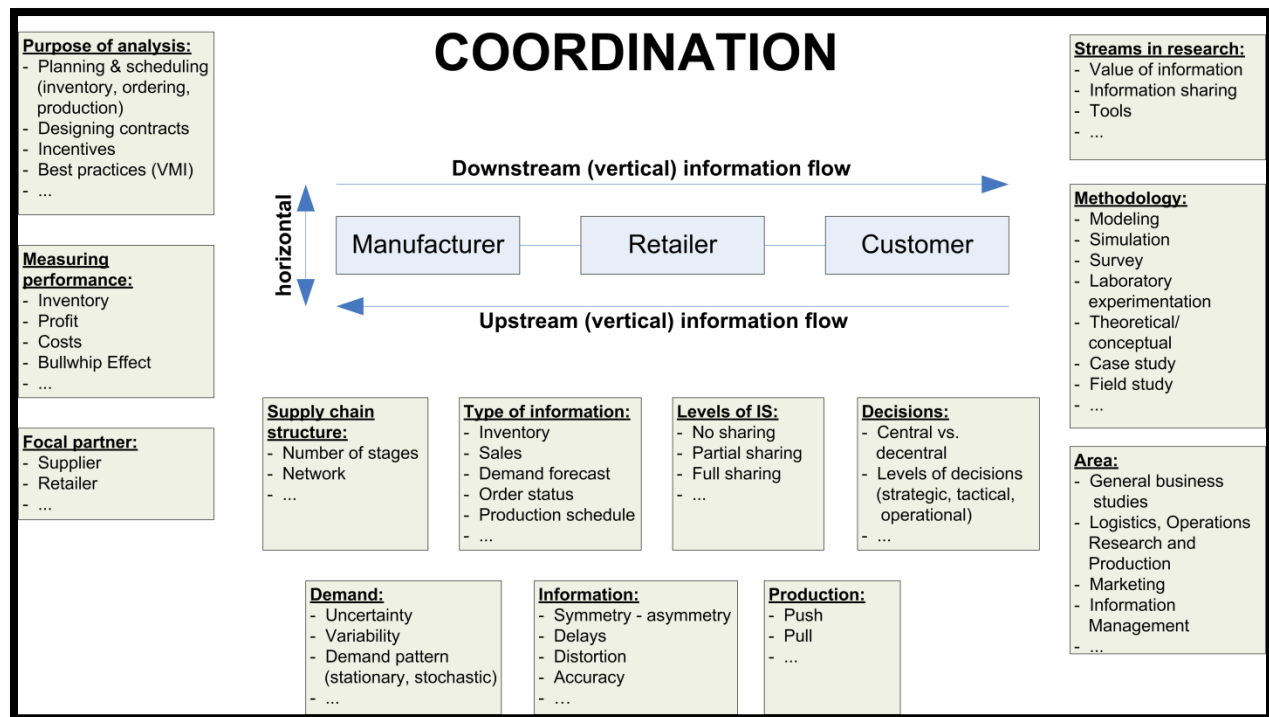
Source: Poiger (2010:31)

Figure 3.1: Supply chains and information sharing coordination

Usually, SCM deals with three types of flows: moving upstream and downstream the supply chain: products, and funds and information (Chopra & Meindl, 2007:266). For many concepts and best practices in SCM, the flow (exchange) of information is crucial. In a very general statement Simchi-Levi and Kaminsky (2008:67) notes that abundant information reduces variability, facilitates forecasting, enables coordination, enables retailers to react and adapt to supply problems more rapidly, and enables lead time reduction. As information plays such an important role within supply chain management, information flows and the concept of information sharing are investigated in plenty of studies.

Useful frameworks to organise this knowledge are provided by Huang, Lau and Mak (2003:1483) and Sahin and Robinson (2002:507). Huang *et al*., (2003:1485) review the literature on sharing production information using a framework consisting of the following dimensions:

> (1) supply chain structure (serial, divergent, dyadic, convergent or network);
>
> (2) level of decision (strategic, tactical or operational);

(3) production information (product, process, resource, inventory, order and planning);

(4) sharing modes (full/no);

(5) dynamics performance index model (metrics to measure the dynamic performance of a supply chain like total cycle time or fill rate); and

(6) supply chain dynamics model (mapping between (3) and (5).

Sahin and Robinson (2002:508) suggest the following classification schemes to organise the research on information sharing:

(1) Channel structure (breadth and depth of the supply chain);

(2) Channel focus (the scope of the integration effort including either the supply side or the distribution side of the manufacturer, or both);

(3) Research methodology (analytical models, simulation, case study, mathematical programming, empirical analysis);

(4) Performance metrics (total system costs or profit, individual members' costs, demand variance, and capacity requirements);

(5) Number of products;

(6) Demand pattern (stationary, stochastic, and identically distributed among retailers);

(7) Degree of information sharing (the timing and specific data ranged from only sharing immediate replenishment order to sharing all POS, inventory, and cost data);

(8) Degree of decision-making coordination (from independent decision-making to fully centralised); and

(9) Planning horizon (infinite and short sales season planning horizon).

This figure is inspired by the frameworks above shows the main aspects necessary for the discussion of information sharing. Just as in SCM, the literature on information sharing is very heterogeneous as many different fields and areas have contributed. Relevant studies can be found in the areas of general business studies, logistics, operations research and production, marketing, and information management. In terms of research methodology all of the main approaches can be found: modeling, simulation, survey, laboratory experimentation, theoretical/conceptual modeling, case study, and field study classification (Alfalla-Luque & Medina-Lopez, 2009:202).

Furthermore, it is very important for any supply chain analysis to clarify the relevant performance dimensions and the associated performance metrics. These dimensions should be defined through a strategy development process starting from the customer expectations. Probably the most important aspect within information sharing is the identification of the different types of information, exchanged among supply chain partners.

3.3.2.2 Timing of information sharing

An important question in information sharing is when to share information. To simplify the analysis, we focus on the single ordering period model and assume that the retailer can share information with the manufacturer only once during the ordering period. Intuitively, the higher the production capacity per unit time is, the later the time information may be shared. Of course, the later time information is shared, the more accurate the information on demand during the ordering period but the smaller the remaining production capacity, i.e. the product per unit time production capacity and the remaining time until the end of the ordering period (Sahin & Robinson, 2005:580). For instance, if production capacity per unit of time is very high, information should be transferred and used almost at the end of the ordering period. As production capacity per unit of time decreases, it is expected that it is optimal to share information earlier.

3.3.2.3 Information sharing support technology

As organisations continue to search for a competitive advantage in increasingly tight markets, emerging technology is often considered to be an enabling factor for gaining such an advantage (Wu, Yeniyurt, Kim & Cavusgil, 2006:494). Information technology (IT), if used effectively, provides an organisation with the opportunity to engage its customers in interactive communication and has led to the emergence of the one-to-one marketing paradigm (Ray, Muhanna & Barney, 2005:625). This paradigm suggests that organisations will be more successful if they concentrate on obtaining and maintaining a share of each customer rather than a share of the entire market, with IT as the enabling factor.

With respect to IT, there have been those who have focused on how data integration and customer support activities can be a foundation for improving an organisation's ability to serve customers effectively (Mitchell, 2006:919). Effective customer service typically leads to a higher volume of sales. Piccoli and Ives (2005:747) identified IT as the catalyst toward reversing the trend of

standardising services. They point out that IT can improve customer service strategies in three ways: personalising service, augmenting service, and transforming products. Organisations are taking advantage of IT to enhance their marketing efforts. Information technology is an important enabler of efficient supply chain strategies, information technology has changed the way companies interact with suppliers and customers. Strategic partnering, which relies heavily on information sharing, is becoming ubiquitous in many industries. As observed by Li, Rao, Ragu-Nathan and Ragu-Nathan (2005:618), sharing demand related information vertically among supply chain members has achieved huge impact in practice.

According to Li *et al.,* (2005:619) by exchanging information, such as point of sales (POS), forecasting data, inventory level and sales trends, these companies are reducing their cycle times, fulfilling orders more quickly, cutting out millions of dollars in excess inventory, and improving customer service. By using technology and sharing information on webserver all supply chain partners amazingly decrease inefficiency in supply chain, which leads to a well-designed production process resulting in lower inventories on time deliveries, improving availability of product and low service gaps. However, it is not easy to apply and without the use of information technology it is almost impossible, therefore information technology plays a very important role in collaborative supply chain for a company's achievement (Choi, Lee & Yoo, 2010:856).

All the tools like quick response (QR), vendor-managed inventory (VMI) and efficient consumer response (ECR) mainly depend on technology. Information technology is therefore very important in collaborative planning, forecasting and replenishment (CPFR), which is a new tool in collaborative supply chain.

3.3.2.4 Manufacturer information

To understand the impact of information sharing, traditional supply chain strategies are considered. Supply chains are highly complex systems with multiple production and storage facilities. A typical supply chain consists of raw material suppliers, assembly manufacturers, distributors and retailers. It is often managed in a decentralised manner, each stage managed based on information received from its immediate suppliers and customers (decentralised information) and the objective of the stage is to maximise profit with no, or very little regard to its impact on other stages in the supply chain (decentralised control). Thus, each stage makes locally optimal decisions based on

the orders placed by its customers, and the replenishment lead time provided by its suppliers. Such a decentralised information and control system faces significant challenges. For example, ordering information flow may be distorted in the sense that the variation of orders tends to increase as one moves up the supply chain, a phenomenon known as the bullwhip effect. This was first observed in practice by companies such as Procter & Gamble and Hewlett-Packard, and later quantified by Lee *et al.,* (2004:1877), and Chen, Drezner, Ryan and Simchi-Levi (2000:436). Lee *et al*., (1997:94) identified the sources of the bullwhip effect to be: promotional activities, inflated orders, order batching and price variation. Chen *et al.,* (2000:437) show that traditional forecasting methods such as moving average and exponential smoothing also contribute to the increase in variability, which also play an important role in the bullwhip effect.

The writers above also show that transferring demand information across supply chain partners can significantly reduce the bullwhip effect but it will never eliminate it. The impact of the bullwhip effect can be very significant. Indeed, the increase in order variability implies that the firm needs to increase safety stock levels, or otherwise service levels decrease. In addition, it is difficult to manage resources, e.g., labour, equipment and transportation effectively. More importantly, companies are slow to respond to market changes because of the distortion in market signals (Chen *et al.,* 2000:438). The question of course, is how to match demand and supply with minimal inventory. In particular, the challenge is to do that in supply chains with long production and transportation lead-times, and short product lifetime. To address these challenges, a number of trends have emerged in supply chain strategies, all of which take advantage of the abundance of information available in today's supply chains.

In this strategy, retailers share with the suppliers point-of-sales (POS), inventory levels and forecast data, as well as information on promotional events. With the visibility of current demand and inventory levels, suppliers can better forecast and schedule their production-inventory activities and provide better service to their customers. Indeed, information sharing can reduce the demand uncertainty to such an extent that suppliers can build inventory well in advance of receiving a promotional order (Min & Yu, 2008:5). The ability of suppliers to prepare in advance of an incoming order implies that they can reduce lead-times to the retailers. This together with an improved fill rate, allow retailers to reduce inventory levels and the bullwhip effect (Chen *et al.,* 2000:438). For example, Milliken and Company, a U.S based textile and chemicals manufacturer,

asked its retail partners not only to provide the manufacturer, Milliken and Company, with demand information, but also to provide the same information to its suppliers, so that it can synchronise its production schedule with its suppliers.

This allowed Milliken and Company to reduce replenishment lead-time to its retailers from 18 weeks to 3 weeks (Chen, Drezner, Ryan & Simchi-Levi, 1999:419). Many companies not only share information with their supply chain partners, but also jointly make decisions to improve supply chain performance. Specifically, in collaborative planning forecasting and replenishment, companies share information and also collaborate on forecasts, promotional activities and production strategies.

3.3.2.5 Customer information

Information is one of the most vital assets any organisation possesses (Meagher, 2003:51), while Dearstyne (2005:38), makes reference to the strategic centrality of information. Organisations should therefore try to manage information just as they would any other vital organisational asset (Megher, 2003:51). Of critical importance within these information assets is data about the organisation's customers (Crie & Micheax, 2006:282). In fact Chettayar (2002:42) calls customers "a company's only strategic asset", and customer information is a "competitive advantage in a marketplace". However, according to Brohman, Watson, Piccoli and Parasuraman (2003:48), "organisations are still struggling to analyse the data they have", and to make best use of it to increase profit, improve customer service and build long-lasting relationships with customers.

Successful companies build systems that enable corporations to use the customer's information wisely and deliver what the customer wants on their level (Xu, Yen, Lin & Chou, 2002:442). It is important to know who the customers are but also how they behave and if there are any common patterns they follow. This information is sourced either directly from the customer, from the organisation's internal systems or from external information providers, such as public databases, partners or information service providers (data brokers). Of course, sourcing, storing and acting on this information is governed by the legal system (international treaties, national statutes and case law and local regulations), industry codes of practice, internal organisational policies and customer expectations. Information should be attained on defecting customers to see why they leave and if there are any common reasons for it. Information on why customers are leaving could,

for example, be used to create a list of problems facing the company or products. Information should also be collected on what makes customers loyal to competitors and why customers are defecting from the organisation.

3.3.2.6 Information quality

Information quality (IQ) is commonly described as a multidimensional concept (Aladwani & Palvia, 2002:467). Data quality (DQ) is another term which is often used synonymously with IQ and is described as data that is fit-for-use (Li & Lin, 2006:1642). Stvilia, Twidale, Smith and Gasser (2008:984) also reasoned that since IQ is relative, information considered useful for one person may not be fit for another person's use. The fit-for-use model is widely adopted in quality literature and emphasises the importance of taking a consumer's viewpoint of quality because ultimately it is the consumer who will make a judgment about the product's "fitness-for-use" (Kahn, Strong & Wang, 2002:184).

Information quality (IQ) is an information systems (IS) research area that seeks to apply modern quality management theories and practices to organisational data and systems. This involves building and applying conceptual frameworks and operational measures for understanding the causes and effects of IQ problems. Additionally, some research seeks to evaluate the impact of initiatives to improve IQ. IQ is fundamental to the study and use of Information Systems. Yet it is not the principle focus of research or practice. Perhaps the most widely understood model of how IQ fits into IS more generally is the Delone and Mclean Model of IS Success (DeLone & McLean, 1992:61; DeLone & McLean, 2003:10; Seddon, 1997:241).

3.3.3 Inter-organisational Relationships

Inter-organisational relationship refers to the degree of trust, commitment and shared vision between supplier partners. Without a foundation of effective inter-organisational relationship, any effort to manage the flow of the information or materials across the supply chain is likely to be unsuccessful (Handfield & Nichols, 2004:30). Trust and commitment are necessary to build long-term cooperative relationships between supply chain partners (Matanda & Freeman, 2009:89).

The aim/purpose of this study is to consider inter-organisational relationships including one sub-dimension, trust in trading partners, which is defined as the willingness to rely on a trading partner

in whom one has confidence (Monczka, Petersen, Handfield & Ragatz, 1998:554). Trust is conveyed through faith, reliance, belief or confidence in the supply chain partner, viewed as a willingness to forego opportunistic behaviour (Handfield & Nichols, 2004:31). Trust has been considered to be the essential factor in most productive partner relationships (Chen, Yen, Rajkumar & Tomochko, 2011:262). As environmental uncertainty increases, several types of inter-functional expertise are required, as more diverse skills and knowledge are needed to develop solutions and remain competitive (Wong, Boon-Itt & Wong, 2011:604). Subsequently, inter-organisational relationships can be used to bring in complementary and create distinctive resources that can enhance the competitive advantage of organisations in the relationship. Distinctive resources are developed during the lifetime of the alliance or relationship (Lambe, Spekman & Hunt, 2002:142).

3.3.3.1 Inter-organisational trust

Trust has been described as elusive both in theory and practice (McKnight & Chervany, 2006:29; Gambetta, 2000:213; Atkinson & Butcher, 2003:282). This has contributed to different definitions, confusions about its antecedents and outcomes and even a lack of clarity in the relationship between trust and other related constructs such as risk and control (Das & Teng, 2001:251; Manu, Ankrah, Chinyio & Proverbs, 2015:1495). To develop an integrated perspective of trust in inter-organisational relationships (IORs), there is the need to understand the widely divergent theoretical persuasions that have often emerged in trust literature. Sabel (1993:1134) defined trust as "the mutual confidence that no party to an exchange would exploit the other's vulnerabilities". Trust has also been defined as "commitment to an exchange even when there is uncertainty that the opposite party would reciprocate" (Fynes, De Burca & Marshall, 2004:180). Gambetta (2000:215) defined trust as "the level of subjective probability with which an agent assesses that another agent or group would perform a particular action to their favour irrespective of their ability to monitor or control such actions".

The definition that features most prominently in literature is that trust is "a psychological state that enables a party to accept vulnerability based on positive expectations in the intentions or behaviours of other parties" (Rousseau, Sitkin, Burt & Camerer, 1998:393; Das & Teng, 2001:252; Dekker, 2004:27; Costa & Bijlsma-Frankema, 2007:392; Mayer, Davis & Schroorman, 2007:84). Although most of these definitions assert the subjective and psychological nature of trust, there exist similarities and differences which have implications for understanding trust in relation to

other related constructs. These different definitions reveal the acceptance of vulnerability in situations of uncertainty as a recurrent theme.

Most of the definitions also suggest that trust is just the psychological state of having positive expectations rather than an action although the definition by Fynes, Voss and de Búrca (2005:340) seems to suggest that trust is a commitment. It is, however, agreed that trust is that psychological expectation which triggers vulnerability acceptance rather than a direct action *per se*. Thus in the absence of risk and uncertainty and without a party's acceptance of vulnerability, the relevance of trust would be lost.

Inter-organisational trust is defined by Zaheer, McEvily and Perrone (1998:142) as "the extent of trust placed in the partner organisation by the members of a focal organisation". They define trust itself as the expectation that an actor (1) can be relied on to fulfill obligations, (2) will behave in a predictable manner, and (3) will act and negotiate fairly when the possibility for opportunism is present. From a transaction perspective, trust reflects a calculated decision by a party to the transaction about the risks of opportunism. From an institutional perspective, institutional arrangements (e.g., regulations, professions, laws, rules) produce the trust that supports complex economic systems.

Distrust leaves a party vulnerable, requiring more information to mitigate uncertainty about the behaviour of their partners. The exchange of reliable and accurate information is one facet of trusting relationships, in which partners share rather than withhold information (Mishra, 1996:261). Malone and Rockart (1993:38) assert that IOS can mitigate the uncertainty created in low trust situations by:

- making remote decision makers more effective;

- controlling and monitoring remote decision makers; and

- socialising remote decision makers and building loyalty.

3.3.3.2 Interpersonal and inter-organisational trust

Roehrich and Lewis (2010:1155) pointed out the importance of distinguishing between interpersonal and inter-organisational trust. Interpersonal trust involves trust between individuals

of contracting organisations that develops based on close interactions and personal ties (Kale, Singh & Perlmutter, 2000:217). Zaheer, McEvily and Perrone (1998:143) further explained that interpersonal trust concerns the extent to which a boundary-spanning agent trusts in their counterpart from another organisation. Inter-organisational trust on the contrary, is that which the member of a focal organisation places in a partner organisation (Zaheer *et al.*, 1998:144). Agency trust, according to Human and Naudé (2009:3), is that which each firm has in their own representatives. The intra-entity trust (interpersonal trust) is that which derives from interpersonal interactions during a contractual relationship and inter-organisational trust is that which develops between the collaborating firms.

From Janowicz and Noorderhaven's explanation, trust can either be an interpersonal phenomenon between two individuals, an individual trusting an organisation or between two organisations. Yet even the trust between two organisations is arguably a reflection of trust in their individual representatives at either strategic or operational levels. This is particularly relevant in temporary project organisations such as in construction where highly transient project teams represent their organisations at the project level. Laan, Noorderhaven, Voordijk and Dewulf (2011:98) and Lau and Rowlinson (2009:539) thus emphasised the importance of interactions between interpersonal and inter-organisational trust in construction contracting. Individual actions at the project level, for instance, have been claimed to be starting mechanisms for inter-organisational trust development (Lau & Rowlinson, 2009:540), especially when such individuals possess high levels of authority and responsibility within their organisations (McDermott, Khalifan & Swan, 2004:140).

3.3.3.3 Attributes of trust

Trust has been associated with numerous attributes such as confidence, reliability, dependability, credibility, fairness, goodwill, honesty, competence, integrity, benevolence and predictability (Dyer & Chu, 2000:259; Mayer, Davis & Schroorman, 2007:82). However, three broad parsimonious trust attributes have often emerged in the literature (Mayer *et al.*, 2007:83) as: 1) competence or ability, 2) integrity and 3) benevolence. These are also similar to Jarvenpaa and Shaw's (1998:36) model of trust, which identifies three attributes: 1) achieving results, 2) acting with integrity and 3) demonstrating concern.

3.3.3.4 Integrity

Integrity describes that aspect of trust, which is based on the belief that a party feels moral obligation and responsibility to act in the interest of a relationship above their own individual interest even when there is an incentive for opportunism (Das & Teng, 2001:254). It has also been described as a trustor's perception that a trustee would act in accordance with principles that are acceptable to the trustor (Mayer *et al.*, 2007:84), suggesting that the trustee would have to be aware of principles that are considered acceptable by the trustor in any exchange relationship. Integrity trust can also be likened to intentional trust (Palanski, Kahai & Yammarino, 2011:203), which concerns the extent to which a trustee intends to use their ability to conform to the trustor's expectations without behaving opportunistically. Wong, Then and Skitmore (2000:797) also related integrity to honesty, consistency, keeping promises, fairness, predictability, openness, honouring commitments, reliability, dependability, responsibility and benevolence although some of these are classified as stand-alone attributes in other studies. Das and Teng (2001:255) have linked integrity trust to relational risks in exchange relationships since this attribute is concerned with a party's good faith and good intentions irrespective of their high competence.

3.3.3.5 Shared goals and values

The development of mutually shared goals and values provide the basis for trust building in project teams (Arnold, Barling & Kelloway, 2001:316). These can be realised through the establishment of strategic management relationships that explicitly demonstrate mutually shared goals and objectives (McDermott, Khalfan & Swan, 2004:140). The use of charters and agreements which explicitly prescribe mutually shared goals and values also create a conducive environment for trust development (McDermott *et al.*, 2004:141). Eriksson and Laan (2007:227) emphasised profit sharing, accompanied by joint objectives as requirements for trust development in IORs. Laan *et al.*, (2011:99) revealed from their case study how common interest was achieved through an alliance fund that was created during contract negotiation. This alliance fund was agreed based on the openness of principal and contractor organisations about their risks, design and management budgets. The use of this alliance fund during the project later promoted cooperative relationships that were more conducive to trust as alliance benefits far outweighed opportunities to deviate from agreed upon goals.

Similarly, Kwon and Suh (2004:4) revealed from their survey of supply chain practitioners that a firm's trust in its supply chain partners is positively associated with both sides' specific asset investments in the relationship. Thus, people freely negotiate and accept compromises in a bid to ensure sustained, healthy and trust-based relationships when there is a feeling that risks and incentives are jointly shared. Such realisation of mutually shared goals and values through institutional mechanisms (joint risk and reward sharing, charters and agreements and joint objectives) therefore contribute towards the emergence of system-based trust.

3.3.4 Supply Chain Performance

Previous researchers (Green, Inman, Brown & Willis, 2005:276) has defined supply chain performance as the ability of the supply chain to 1) deliver quality products and services in precise quantities and at precise times; and 2) to minimise total cost of the products and services to the ultimate customers of the supply chain. Although organisational managers are held responsible for organisational performance, organisational success depends upon the performance of the supply chains in which the organisation functions as a partner (Rosenzweig, Roth & Dean, 2003:437). Supply chain performance is dependent on the supply chain partner's ability to adapt to a dynamic environment (Cao & Zhang, 2011:164).

Market globalisation has made supply chain management an interesting topic to be discussed. An efficient supply chain can lead to a range of benefits including reduced cost, increased market share and sales, and sustainable customer relationships. It has also been cited that evaluation of supply chain performance can improve the overall performance of the organisation (Chen & Paulraj, 2004:120). Efficiency of the supply chain is the result of integration of the performance of all members. As such, managing the overall supply chain efficiency is a challenging task. Improving supply chain performance has become one of the critical issues in sustaining competitive advantages for companies (Cai, Liu, Xiao & Liu, 2009:513; Estampe, Lamouri, Paris & Djelloul, 2013:247).

However, the performance of firms can be improved significantly by understanding the information provided by the supply chain. One of the most significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous

entities, but rather as supply chains (Lambert & Cooper, 2000:65). Companies compete and win based on the capabilities they can assemble across their supply networks (Rice & Hoppe, 2001:47).

With supply chain now comprising a key element in corporate competitiveness, some firms have come to view this function as the cornerstone of their differentiation strategy. Supply chain performance can be measured both in terms of customers' level of satisfaction since they remain the ultimate judges of how much value is actually being created at a logistics level and the costs incurred. By eliminating excess inventory and improving the quality of parts, the supply chain is able to reduce set-up time, adjust capacity, enhance product quality and respond quickly to the customer. As a result, supply chain performance is enhanced (Wang, Huang & Dismukes, 2004:2; Vonderembse, Uppal, Huang & Dismukes, 2006:223).

Accordingly, many studies have suggested both financial and non-financial indicators to measure an organisation's supply chain performance. Other studies argued similarly that dependability, flexibility, quality and efficiency are the key indicators for measuring supply chain performance (Vickery, Jayaram, Droge & Calantone, 2003:523; Angerhofer & Angelides, 2006:283). Dependability is the ability to meet delivery dates at promised prices. Flexibility refers to the ability to react to market changes, new product developments, and customer requirements. Quality determines how well products/services meet customer needs.

Efficiency relates to the improvement of processes, such as lowering inventory levels, reducing manufacturing costs, and increasing production volumes. Increased global development and competition have pushed many industries to operate on a much more global level. Together with increased outsourcing, the number of companies involved in a typical supply chain has greatly increased (Seuring & Muller, 2008a:1704).

Suppliers play a more direct role in an organisation's quality performance than is often recognised (Lascelles & Dale, 1989:10). Poor quality of incoming parts adds significantly to buyer's cost in terms of inspection, rework and returns, purchasing and overproduction. Therefore, quality-oriented organisations maintain a few reliable, competent, and cooperative suppliers on a long-term basis (Garvin, 1987:101; Giunipero & Brewer, 1993:35). This performance in turn affects the final product quality. Thus, supplier quality, flexibility, delivery and cost performance are intermediate outcomes of the implementation of an appropriate supply chain strategy.

3.4 CONCEPTUAL FRAMEWORK

Based on the literature reviewed, the following conceptual framework has been developed. Hypothesised relationships between research variables is developed thereafter. In the conceptualised research model, supply chain dynamism is the predictor variable, information sharing and inter-organisational relationships are mediating variables and supply chain performance is the outcome variable.
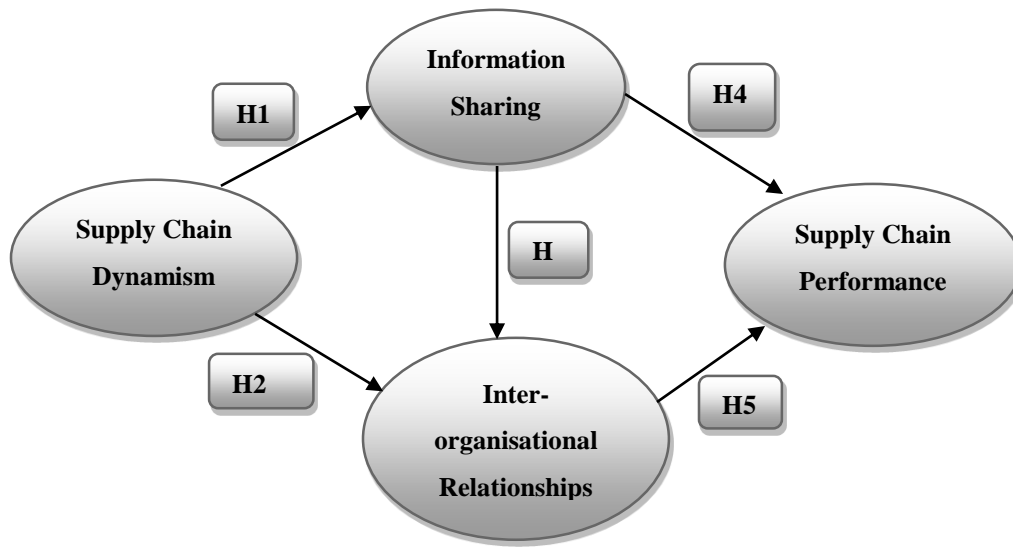
Figure 3.2: Research Model

3.5 HYPOTHESIS DEVELOPMENT

3.5.1 Supply Chain Dynamism and Information Sharing

Perceived environmental uncertainty results from the inability of individual managers to predict changes in the environment (resulting from changes in technology, markets, and income volatility), due to a lack of information or knowledge necessary to distinguish data needed for decision-making (Du, Lai, Cheung & Cui, 2012:89). In this customer-oriented competitive market, lack of information is a "killer" criterion as information plays the vital role of a driving-force behind the operation of the supply chain (Bullinger, Kuhner & Van Hoof, 2002:3533). Increasing unpredictability of the customer's demands leads an organisation to share more information with its supply chain partners in order to respond to customers' changing needs (Swafford, Ghosh & Murthy, 2008:289).

Information processing theory supports the influence of supply chain dynamism on information sharing (Turner & Makhija, 2006:198; Malhotra, Gosain & Sawy, 2005:146). As supply chain dynamism increases, information processing capacity needs to increase in order to achieve superior firm performance. In supply chains, sharing information among supply chain members is one way to increase information processing capacity. There is no doubt that effective information sharing

allows a supply chain to operate more efficiently, and hence generate a higher overall supply chain profit. However, information sharing often involves cost. If the cost of information sharing is solely born by the informed party and if, in addition, there is no pre-defined mechanism to distribute some of the additional profit that is generated through the information sharing to the informed party, then it is debatable whether the informed party has any incentive to share information with the uninformed party (Chu & Lee, 2006:1568).

It can be recognised that the benefit of information sharing lies in the supplier's capability to react to the retailer's needs via the knowledge of the retailer's inventory levels to help reduce uncertainties in the demand process faced by the manufacturer, and in turn reduce the supply chain operating costs (Ding, Guo & Liu, 2011:71). It has been reported that the benefit of information sharing is significant, especially in reducing the bullwhip effect and supply chain costs (Lee *et al*., 1997:94; Cachon & Fisher, 2000:1033). By using the shared information, each supply chain entity can make better decisions on ordering, capacity allocation and production/material planning so that the supply chain dynamics can be optimised. Therefore, it can be postulated that:

H1: There is a positive relationship between supply chain dynamism and information sharing.

3.5.2 Supply chain dynamism and inter-organisational relationships

As environmental uncertainty increases, various types of inter-functional expertise are required, as more diverse skills and knowledge are required to develop solutions and remain competitive (Skipper & Hanna, 2009:404). Consequently, inter-organisational relationships can be used to bring in complementary and create idiosyncratic resources that can enhance the competitive advantage of organisational in the relationship. Idiosyncratic resources are developed during the lifetime of the alliance or relationship (Lambe, Spekman & Hunt, 2002:141). Complementary resources are an outcome of combining the resources of partnering firms, and when inter-organisational resources turn to capabilities they can be used in the marketplace to create a competitive advantage (Lambe *et al*., 2002:142). In fast changing and turbulent environments, it is not feasible for an organisation to acquire all the information and resources needed to effectively serve its customers on their own (Stevenson & Spring, 2007:687).

The relationship between organisations involved in the performance of an inter-organisational task is a source of uncertainty and information processing requirements. As organisations become more

interdependent, inter firm relations increase in their significance as a source of uncertainty. As Fawcett, Magnan and McCarter (2008:37) argue the closer the coupling or interdependency, the greater the intentional or accidental harm one unit can inflict upon the other. It is argued that the greater the interdependency between firms, the greater the potential for issues of power, trust and conflict between partners to create uncertainty about the execution of an inter-organisational task. Lai, Chen, Chiu and Pai (2011:66) argue that one party's power resides implicitly in the other's dependency. The power of one party to control or influence another resides in the control the first has over things that the second values.

Emerson asserts that where one party has greater power than the other, the situation is unstable and sets in motion processes that attempt to reduce the costs of meeting the more powerful party's demands and balancing operations. A powerful firm may lead to anti-information sharing behaviours towards the less powerful firm, such as reducing visibility into its operations or denying information to the less powerful firm. Such behaviours can create uncertainty for both parties during task execution. Access to or control over information flows and power are two sides of the same coin (Lai *et al*., 2011:67). Therefore, it can be postulated that:

H2: There is a positive relationship between supply chain dynamism and inter-organisational relationships.

3.5.3 Information Sharing and Inter-organisational Relationships

Information sharing is considered an important approach to increasing organisational efficiency and performance. With advances in information and communication technology, sharing information across organisations has become more feasible. Effective information sharing between supply chain partners enhances most supply chain initiatives, including vendor managed inventory, continuous replenishment programme, collaborative forecasting and replenishment, and efficient customer response (Soosay, Hyland & Ferrer, 2008:161). Improving information exchange between companies gives partners greater visibility and time to respond to change (Stevenson & Spring, 2009:946).

Information sharing is an important element in the integration of supply chain partners. Typical information shared includes inventory levels, production plans, demand forecasts and supply capacity, the benefits that can be gained by both downstream operators and upstream suppliers

(Ding, Guo & Liu, 2011:70). Mutual trust, organisational compatibility and top management support are important antecedents in forming strategic supply chain partnerships. Partnering firms share critical and proprietary information to sustain and support their partnership relationships. Such information includes multi-level information that is characterised by strategic and operational data (Bachmann & Inkpen, 2011:282; Mentzer, DeWitt, Keebler, Min, Nix, Smith & Zacharia, 2000:2).

Strategic information enables shop-floor employees to work on operational details. For instance, top management criteria for selecting new product lines (strategic information) enable cross-functional teams to clarify sets of new product development project targets (operational details) (Youn, Yang, Hong & Park, 2013:122). Information sharing is a scope that vital and proprietary information runs among supply chain members (Mansoori, Jamshidinavid & Hashemi, 2014:230). Information sharing between supply chain partners has been detected as the central component of effective supply chain management. Organisations should create external relations to coordinate the flow of information and materials across a set of business activities which enable supply chain partners to obtain information supply chain regarding the activities and high and low levels performances (Fiala, 2005:419).

Daugherty, Richey, Roath, Min, Chen, Arndt and Genchev (2006:61) found that firms engaged in collaborative relationships achieved improved visibility, higher service level, increased flexibility, greater end-customer satisfaction and reduced cycle times. Vijayasarathy (2010:489) considered the quality of the partnership as the result of trust, reliability and commitment of partners and finally showed that the quality of the partnership of supply chain partners has a positive and direct effect on supply chain performance. Any attempt to manage the flow of information or material across the supply chain is most likely met with no success without organisational effective relationships (Rajaguru & Matanda, 2009:457). Thus, it can be said that proper and timely information sharing among supply chain members causes partner to be able to manage their relationships with each other much better. Moreover, a good inter organisational relationship based on trust, commitment and shared vision is necessary to encourage information sharing and to overcome the fear of information disclosure and the loss of power over competitors (Chandra, Grabis & Tumanyan, 2007:2508). Therefore, it can be postulated that:

H3: There is a positive relationship between information sharing and inter-organisational relationships.

3.5.4 Information sharing and supply chain performance

Information sharing and coordination between the buyer and vendor in the supply chain have been considered as useful strategies to remedy the so-called bullwhip effect and to improve supply chain performance. The debate is not about whether or not production information should be shared in the supply chain, but about how to share the right information at the right time in the right format by the right people under the right environment to maximise the mutual benefits of the supply chain as a whole, as well as the individual business players. Information sharing can reduce the risk brought by asymmetric and incomplete information, cut down lead time, mitigate bullwhip effect, and reduce total cost and increase total supply chain profit (Flynn, Huo & Zhao, 2010:59).

Customer value can be increased and the expenses of the supply chain reduced by means of information sharing. This in turn will provide competitive advantages to the firms. The chain members who provide products with high quality can sell them at higher prices and improve their trade. There are many examples to show the positive influence of information sharing on supply chain performance. Simatupang and Sridharan (2002:18) pointed out that sales and stocking data have been shared by Wal-Mart, a retailing firm, with its main dealers. This online sharing of information was found to improve its supply chain performance (Nyaga, Whipple & Lynch, 2010:102).

Information sharing impacts the supply chain performance in terms of both total cost and service level (Zhao, Xie & Zhang, 2002:25). According to Lin, Huang & Lin (2002:258), the higher level of information sharing is associated with the lower total cost, the higher the order fulfillment rate and the shorter order cycle time. Drawing from previous studies, information sharing amongst supply chain partners has a significant consequential impact on the effectiveness of business performance (Madlberger, 2010:101). Information sharing also allows firms to make better decisions on ordering, capacity allocations, production and material planning through increased visibility of demand, supply and inventory (Lin *et al.,* 2002:259; Iyer, Germain & Claycomb, 2009:314).

Furthermore, many studies have indicated information sharing to be a key ingredient in achieving: increased coordination; reduced uncertainty; faster material flow; higher order fulfillment and shorter order cycle times; reduced inventory costs; increased customer satisfaction with fast and reliable delivery; (Soosay *et al.,* 2008:162). Some studies suggest that information sharing leads to improved business performance through its role as the driver of competitiveness and supply chain effectiveness (Forslund & Jonsson, 2007:91). Accordingly, in the context of this study, it is submitted that information sharing has a positive impact on supply chain performance (Iyer *et al.,* 2009:316). Eventually, this in turn creates superior customer value for the organisations' long-term survival and success within the supply chain context (Lai, Wong & Cheng, 2010:274). It can therefore be postulated that the higher the level of information sharing, the higher the expected level of supply chain performance. Prior empirical evidence from large firms has found a positive relationship between information sharing and supply chain performance (Forslund & Jonsson, 2007:92). Hence this study seeks to determine such a relationship in this case. Therefore:

H4: It can be postulated that there is a positive relationship between information sharing and supply chain performance.

3.5.5 Inter-organisational Relationships and Supply Chain Performance

The performance of the chain received much attention on the consumption side. (Morash, 2001:37) The firms try to deliver products to the destination to build the ground rules on having the product ready for the consumption. The performance on the supply side must meet the requirements to assure the dependability and reliability to demand management. Cost and overall efficiency of organisations are rooted from the need to survive and to grow. The efficiency is a reaction from the proactive market necessity. The inter-organisational relationships involve many aspects which are crucial to the firm's success. Working cooperatively with each other, as suggested in Whipple and Russell (2007:175), will boost the success level of the chain. The level of relationships will determine the level of data shared, which in turn facilitates the operations, involves planning and simplify the flow (Barrat, 2004:31).

Relationships among organisations on the management of various supply chain activities is a current trend believed by some company executives to lead to a competitive advantage over other supply chains (La Londe & Masters, 1994:37; Mentzer, Foggin & Golicic, 2000:53). Inter-

organisational relationships have been described in the literature in many ways as a business tool that build sales as an interaction among peers sharing a common set of goals and measures, as a process for parties to jointly search for solutions and as a relationship in which trading parties develop a long-term cooperative effort (Sriam, Krapfel & Spekman, 1992:304; McCarthy & Golicic, 2002:431). Common to many of these descriptions is a long-term relationship between supply chain parties that work together.

Mentzer *et al.* (2001:4) explain that a managed supply chain environment begins with forming collaborative relationships initially with immediate trading partners, then eventually with additional tiers in the supply chain. Intuitively, focusing collaborative efforts on strategic sources of disruption between trading partners can result in improved performance for the supply chain. Ireland and Bruce (2000:81) suggest that healthy relationships are vital business function that, when not strategically, systematically coordinated between firms, can contribute to disruption of activities at the point between trading partners where product is planned, ordered and replenished. As such, inter-organisational relationships provide a substantial opportunity for improved supply chain performance and should be viewed as a priority for firms adopting a supply chain management approach (Hervani, Helms & Sarkis, 2000:331). Therefore, it can be postulated that:

H5: There is a positive relationship between inter-organisational relationships and supply chain performance.

3.6 CONCLUSION

The overall objective of the chapter was to extend the understanding of the dynamic relationships between supply chain uncertainty, information sharing, inter-organisational relationships and performance in the supply chain. As supply chain is a network of three or more entities directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer, management of it is a complex task. Management of supply chain therefore requires the planning and control of activities to achieve a desired goal in shaping the organisation by coordinating activities, goals, interests and relationships to be able to resolve conflicts and make good decisions. It is clear from the literature underlying this chapter that supply chain dynamics studies require to further integrate the specific characteristics of the network under

study and to better understand their impact on the dynamics and the performance of the supply chain.

The purpose of this chapter was to give thorough literature or information on the study's variables, which are supply chain dynamism, information sharing, inter-organisational relationships and supply chain performance and their influence on each other. Hypotheses were also developed which are proven on the following chapter of this study. The next chapter is data analysis which includes results and interpretation of the data collected.

CHAPTER 4

RESEARCH METHODOLOGY AND RESEARCH DESIGN

4.1 INTRODUCTION

This chapter presents the research design and methodology adopted for the study. Methodology refers to the process and procedures of the research, which flows naturally from the researcher's position on ontology, epistemology and axiology (Ponterotto, 2005:126). The chapter begins with discussions of different philosophical and methodological positions in research before discussing the philosophical stance and methodological approaches adopted for this study. The research process, which comprises the research design, data collection and data analysis are also further discussed. Finally, the chapter highlights ethical considerations which were upheld throughout the study. The discussions in this chapter are relevant and important because they give a thorough understanding of various methods and principles utilsed in the study.

4.2 RESEARCH APPROACHES

Quantitative research strategies refer to research designs that employ numerical and objective measurements in addressing research questions. This, therefore, aligns with deductive reasoning (Creswell, 2009:130) where there is *a priori* formulation of theories or hypotheses that are operationalised and subjected to rigorous empirical testing. Qualitative strategies, however, refer to research designs that explore meanings and causal interactions through the use of textual rather than numeric data. Qualitative strategies align with inductive reasoning where there is no *a priori* hypotheses to be tested empirically as is done in deductive research (Creswell, 2009:130). With this regard this study has adopted the quantitative research approach. Quantitative research approaches focus on testing theories by examining the relationship between variables. There are two main quantitative research approaches: experiments and surveys, although according to Creswell (2009:129), there are also less vigorous experiments referred to as quasi-experiments that can also be undertaken. These methods of research involve numbers and classes that are analysed using statistics (Runeson & Höst, 2009:132).

For the purpose of this study, a quantitative approach was selected, since it tends to be based on larger sample sizes in order to produce results, which can be generalised to a wider population.

4.3 RESEARCH DESIGN

Bakerm (2000:373) defines research design as a blueprint for conducting a study with maximum control over the factors that may interfere with the validity of the findings. This study adopts a survey as its research design. Surveys involve the assessment of thoughts, feelings and opinions through the administration of questionnaire instruments. Questionnaires are usually administered to a representative sample selected from a wider population although census surveys can also be undertaken to collect information from everyone (Terwee, Bot, de Boer, van der Windt, Knol, Dekker & de Vet, 2007:34). The issue of statistical representativeness is a very important consideration in survey research. Surveys were chosen in this study because they offer several advantages such as that they are relatively inexpensive in reaching a large number of respondents in different geographical areas, and they are more likely to produce honest responses due to anonymity of respondents and are less likely to be influenced by the characteristics of the researcher (Behrend, Sharek, Meade & Wiebe, 2011:801).

4.4 SAMPLING DESIGN

Sampling is a process of selecting a subset of randomised number of members of the population of a study. Sampling design is a basic notion in sampling theory. It describes random selection of a sample from a finite population (Traat, Bondesson & Meister, 2004:397). Sampling design consists of the following: target population, sampling frame, sample size and sample method, which are discussed below.

4.4.1 Target Population

Atkinson and Flint (2001:2) describe target population as all elements that meet the criteria for inclusion in a study. A research population is generally a large collection of individuals or objects that is the main focus of a scientific query. It is for the benefit of the population that researches are done. However, due to the large sizes of populations, researchers often cannot test every individual in the population because it is too expensive and time-consuming. This study aims at investigating the influence of supply chain dynamism, information sharing and inter-organisational relationships on supply chain performance in manufacturing sector, service sector and mining sector in Gauteng. Therefore, this study target population were managers of manufacturing companies/organisations, service firms and mining companies in the Gauteng Province of South Africa.

4.4.2 Sampling Frame

Sampling frame defines a set of elements from which a researcher can select a sample of the target population (Kemper, Stringfield & Teddlie, 2003:274). Furthermore, a good sample frame includes all individuals in the target population, excludes all individuals not in the target population and includes accurate information that can be used to contact selected individuals. Due to the fact that a researcher rarely has direct access to the entire population of interest in social science research, a researcher must rely upon a sampling frame to represent all of the elements of the population of interest. This study's focus is mainly in the supply chain. A list of registered supply chain manufacturing, service and mining organisations around Gauteng province was obtained from the Certified Institute of Purchasing and Supply (CIPS) of South Africa.

4.4.3 Sampling size

The sample size refers to the number of elements to be included in the study (Sandelowski, 1995:179). Important factors that are considered in determining the sample size include: the importance of the decision; the nature of the research, the number of variables; and the nature of the analysis; sample sizes used in similar studies; completion rates; and resource constraints (Collins, Onwuegbuzie & Jiao, 2007:267). In this study 350 questionnaires were distributed across supply chain companies. This sample size was deemed relatively acceptable to perform structural equation modeling using Analysis of Moment Structures (AMOS) 22.0; 340 distributed questionnaires were found usable and useful data was obtained from them, 10 questionnaires were incompletely filled and for that reason they were not useful. These 10 inadequate questionnaires constitute a total of 2.86% of the questionnaires distributed and the 340 useful ones represent 97.14% of the questionnaires distributed, which actually helped yield more accurate results.

4.4.4 Sampling Method

Sampling is the scientific procedure of selecting those sampling units, which would provide the required estimates with associated margins of uncertainty, arising from examining only a part and not the whole (Christensen, Johnson & Turner, 2011:17). Sampling methods are used to select a sample from within a general population. Proper sampling methods are important for eliminating bias in the selection process. They can also allow for the reduction of cost or effort in gathering samples. Sampling methods are classified as either probability or nonprobability. In probability

samples, each member of the population has a known non-zero probability of being selected. Probability methods include random sampling, systematic sampling, and stratified sampling. In nonprobability sampling, members are selected from the population in some nonrandom manner. These include convenience sampling, judgment sampling, quota sampling, and snowball sampling. The advantage of probability sampling is that sampling error can be calculated. Hence, this study made use of probability sampling since it is appropriate for a quantitative study. Probability sampling methods include different types, namely, pure/simple random probability sampling, systematic probability sampling, stratified probability sampling and cluster probability sampling.

This study used pure/simple random probability sampling, which is the most basic among the probability sampling techniques, which was chosen because organisations were randomly selected or rather questionnaires were randomly distributed to different organisatons irrespective of the size of the company, how long it has been in existence and number of employees they have. Random sampling is the purest form of probability sampling. Each member of the population has an equal and known chance of being selected.

When there are very large populations, it is often difficult or impossible to identify every member of the population, so the pool of available subjects becomes biased. This sampling technique involves assembling a sample in such a way that each independent, same-size subset within a population is given an equal chance of becoming a subject (Csikszentmihalyi & Larson, 1987:527). Freedom from human bias and classification error remains one of the biggest advantages that simple random sampling offers as it gives each element of a population a fair chance of being selected. Furthermore,

4.5 DATA COLLECTION METHOD

Data collection is the process of gathering and measuring information on targeted variables in an established systematic fashion, which then enables one to answer relevant questions and evaluate outcomes (Bar-Ilan, 2001:7). The data collection component of research is common to all fields of study including physical and social sciences, humanities and business. While methods vary by discipline, the emphasis on ensuring accurate and honest collection remains the same. The goal for all data collection is to capture quality evidence that then translates to rich data analysis and allows the building of a convincing and credible answer to questions that have been posed.

Data collection is an important aspect of any type of research study. Inaccurate data collection can impact the results of a study and ultimately lead to invalid results. Data collection methods for impact evaluation vary along a continuum (Bar-Ilan, 2001:8). This study made use of questionnaires in order to collect data from respondents. Questionnaires can be handed out or sent by e-mail. This method can be adopted for the entire population or sampled sectors.

The questionnaires were self-administered, the researcher and research assistants physically distributed the questionnaires to different organisations. In order to maximise return rates, questionnaires were designed to be as simple and clear as possible, with targeted sections and questions. Most importantly, questionnaires were as short as possible. Study questionnaires were distributed to different manufacturing, service and mining orgnisations around Gauteng Province physically and some were emailed.

4.6 MEASUREMENT INSTRUMENTS

Instrument is the generic term that researchers use for a measurement device (survey, test, questionnaire, etc.). Measurement tools are instruments used by researchers and practitioners to aid in the assessment or evaluation of subjects (Kimberlin & Winterstein, 2008:2276). The instruments are used to measure or collect data on a variety of variables ranging from physical functioning to psychosocial wellbeing. Types of measurement tools include scales, indexes, surveys, interviews, and informal observations.

For this study's purpose the instruments were measured on 5-point Likert type scale which is anchored by 1-strongly disagree to 5-strongly agree to express the degree of agreement. The scale is based upon the assumption that each statement/item on the scale has equal attitudinal value, importance or weight in terms of reflecting attitudes towards the issued questions (Kimberlin & Winterstein, 2008:2277).

This study gathered data using a structured questionnaire. It consisted of five sections; information on the profiles of different organisations, supply chain dynamism, information sharing, inter-organisational relationships and supply chain performance. Section A was based on general information on the background of the organisation, this section consisted of three questions that requested respondents to indicate the number of employees in the organisation, the number of years the organisation has been operating and the type of industry the organisation competes in.

Section B focused on supply chain dynamism, which was measured using three (3) questions adapted from Zhou and Benton (2007:1360). Section C focused on information sharing which was measured using six (6) questions adapted from Li, Ragu-nathan, Ragu-nathan and Rao (2006:120). Section D focused on inter-organisational relationships which was measured using three (3) questions adapted from Li and Lin (2006:1650). Finally, section E focused on supply chain performance which was measured using six (6) questions adapted from Green, Whitten and Inman (2012:1015). The questionnaire used for the study is in Appendix 1.

4.7 DATA ANALYSIS APPROACH

Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains. Furthermore, it is a systematic approach to investigations during which numerical data is collected and/or the researcher transforms what is collected or observed into numerical data. It often describes a situation or event, answering the 'what' and 'how many' questions you may have about something.

For this study's purpose, data analysis procedure consisted of five stages. First, the collected data was coded in excel spreadsheet and then proceed to data cleansing. Second, coded data was transformed and descriptive statistics (profile data frequency table) extracted using Statistical Package for the Social Sciences (SPSS) 22.0 statistical software, third stage the research model fit was assessed using Analysis of Moment Structures (AMOS) 22.0 statistical software, while the fourth stage focused on performing Confirmatory Factor Analysis (CFA), again using AMOS 22.0 statistical software. The final stage was path modeling and also using AMOS 22.0 statistical software.

A confirmatory factor analysis and path modeling using AMOS 22.0 were performed to establish the model fit. Model fit indicates if the data fit to the conceptualised research model. Model fit indicators such as Chi-square/degrees of freedom, which indicates the amount of difference between expected and observed covariance matrices. A chi-square value close to zero indicates little difference between the expected and observed covariance matrices; in addition the probability level must be greater than 0.05 when chi-square is close to zero. Goodness of Fit Index (GFI),

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Augmented Goodness of Fit Index (AGFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), Composite Fit Index (CFI) and Random Measure of Standard Error Approximation (RMSEA) were also used to assess the model fit.

4.7.1 Chi-square

The chi-squared test indicates the difference between observed and expected covariance matrices. Values closer to zero indicate a better fit; smaller difference between expected and observed covariance matrices. Chi-squared statistics can also be used to directly compare the fit of nested models to the data. One difficulty with the chi-squared test of model fit, however, is that researchers may fail to reject an inappropriate model in small sample sizes and reject an appropriate model in large sample sizes (Satorra & Bentler, 2001:507). As a result, other measures of fit have been developed which are GFI, CFI, NFI etc. Therefore, the other measures were also employed in this study.

4.7.2 Goodness-of-Fit Index (GFI)

GFI ranges between 0 and 1. Nevertheless, the index in theory can produce meaningless negative values. Relatively, it is the percentage of observed covariance explained by the model. GFI is similar to R square in multiple regression, except that it cannot be interpreted as the percentage of error explained by the model. In other words, while R-squared in multiple regression deals with error variance, GFI on the other hand, deals with error in reproducing the variance-covariance matrix. GFI value increases when the sample grows larger. In principle, an acceptable model fit is reached where the GFI value is equal to or greater than 0.90 (Bollen, 1990:256).

4.7.3 The Norm Fit Index (NFI)

NFI was developed originally to CFI. It ranges from 0 to 1, with 1 representing a perfect fit. NFI reveals the proportion by which the researcher's model improves fit compared to the null model (random variables). In principle, NFI values below 0.90 show a need to re-specify the model (Hu, Bentler & Hoyle, 1995:78).

4.7.4 The Comparative Fit Index (CFI)

CFI is commonly referred to as the Bentler Comparative Fit Index. It is used to compare the existing model fit with a null model that assumes that the latent variables in the model are uncorrelated. The CFI index compares the covariance matrix posited by the model to the observed covariance matrix. In addition, it evaluates the null model with the observed covariance matrix in order to estimate the percentage of lack of fit which is accounted for by going from the null model to the researcher's SEM model. CFI varies from 0 to 1. A CFI value close to 1 indicates a very good model fit. In principle, CFI should be equal to or greater than 0.90 to accept the model, showing that 90 percent of the covariation in the data can be reproduced by the given model (Schreiber, Nora, Stage, Barlow & King, 2006:324).

4.7.5 The Incremental Fit Index (IFI)

IFI is basically computed in the same way as the NFI, except that it takes into consideration the degrees of freedom. It was developed by Bollen (1990) to deal with the NFI related limitations in the issues of parsimony and sample size. The recommended value for IFI that gives an acceptable model fit should be greater or equal to 0.9. However, the IFI value can also exceed 1 under certain circumstances (Hair *et al*., 2006:39).

4.7.6 Root Mean Square Error of Approximation (RMSEA)

RMSEA is an index whose value answers the question of how well the research model will fit the population covariance matrix if it were available, with unknown but optimally chosen parameter values (Cheung & Rensvold, 2002:233). It takes into consideration the error of approximation in the population. RMSEA expresses such discrepancies per degree of freedom, hence sensitising the index to the number of estimated parameters in the model. The recommended threshold value for RMSEA that yields a good model of fit should be less than or equal to 0.05. However, a value of less than, or equal to, 0.08 for the RMSEA index gives an adequate model fit (Cheung & Rensvold, 2002:234).

4.8 RELIABILITY AND VALIDITY

4.8.1 Reliability Test

The reliability of a research instrument concerns the extent to which the instrument yields the same results on repeated trials (Billinton, Kumar, Chowdhury, Chu, Debnath, Goel & Oteng-Adjei, 1989:1238). Yin (2013:48) suggested that reliability can be achieved by using a case study protocol as well as developing a case study database. Reliability in quantitative research can also be achieved when the research process is transparent and enough detail of the research strategy and data analysis methods are provided (Silverman, 2011:365). In order to test the reliability of the measurement instruments for this study, the Cronbach Alpha and composite reliability value were used.

Accordingly, Cronbach α is the most commonly used approach for assessing the reliability of a measurement scale with multi-point items. The value of α, which ranges from 0 to 1, signifies the level of reliability in the measurement. The closer the value of α is to 1, the higher the level of reliability. Alternatively, where the value of α is low, there may be too few items or little homogeneity among the items, although there are no fixed rules for evaluating the magnitude of reliability coefficients and, as such, depend on the purpose of the study (Iacobucci & Churchill, 2010:259). The composite reliability is a method used to assess the internal consistency of the measurement model, and is calculated using the following formulae proposed by Fornel and Larcker (1981:44): (CR): $CR\eta = (\Sigma\lambda yi)\,2\,/\,[(\Sigma\lambda yi)\,2 + (\Sigma\varepsilon i)]$

Composite Reliability = (square of the summation of the factor loadings) / {(square of the summation of the factor loadings) + (summation of error variances)}.

The coefficient emanated from the calculation is comparable to that of Cronbach's α. Nunnally (1967:1), establishes values of 0.5 and 0.6 as the thresholds assigned to CR index for basic research and exploratory research respectively. The values were subsequently reviewed to 0.7 in Nunnally's publication in 1978 and further endorsed by Hair, Anderson, Tatham and Black (2006:4).

4.8.2 Validity Test

Validity refers to the degree in which a test or other measuring device is truly measuring what it is intended to measure (Golafshani, 2003:597). Validity is concerned with the accuracy of a

measurement. Since one never has direct evidence of the true value of the concept under measurement, validity assessment is a complex issue. For the purpose of this study, three types of validity; which are content validity, predictive validity, and construct validity were considered.

4.8.2.1 Content validity

Content validity refers to the extent to which a measure represents all facets of a given social construct. It can also refer not to what the test actually measures, but to what it superficially appears to measure. Content validity requires the use of recognised subject matter experts to evaluate whether test items assess defined content and more rigorous statistical tests than does the assessment of face validity (Lawshe, 1975:564). Content validity was tested through piloting the questionnaire with a conveniently selected sample of 40 respondents.

4.8.2.2 Face validity

Face validity is the extent to which a test is subjectively viewed as covering the concept it supposed to measure (Holden, 2010:637; Gravetter & Forzano, 2012:78). It refers to the transparency or relevance of a test as it appears to test participants. In other words, a test can be said to have face validity if it "looks like" it is going to measure what it is supposed to measure. For this study's purpose, face validity was ascertained by subjecting the questionnaire to a review by three academics who are experts in SCM.

4.8.2.3 Predictive validity

Predictive validity is the extent to which a score on a scale or test predicts scores on some criterion measure. Predictive validity shares similarities with concurrent validity in that both are generally measured as correlations between a test and some criterion measure (Cronbach & Meehl, 1955:281). Predictive validity was measured through piloting the questionnaire with a conveniently selected sample of 40 respondents, after which they were then compared to the other questionnaires which were later distributed.

4.8.2.4 Construct validity

Construct validity is concerned with the extent to which a measure relates to other measures to which it should be related (Nosek, Greenwald & Banaji, 2005:167). To find this type of validity, two categories of construct validity normally need to be determined: convergent validity and

discriminant validity. Factor analysis is a common evaluator of both convergent and discriminant validity. Factor analysis is an interdependence analysis tool that simplifies data analysis by taking advantage of the correlations among the p-variables, extracting the data that overlaps and reducing the problem to just a few core variables (Iacobucci & Churchill, 2010:491). Convergent validity is an element of construct validity.

4.8.2.5 Convergent validity

Convergent validity is the degree to which an operation is theoretically similar to other operations (Cunningham, Preacher & Banaji, 2001:164). In the case of this study convergent validity was checked using item total correlation values, item loading values and average variance extracted (AVE) values. The recommended or acceptable value for assessing the individual item loadings for corresponding research construct is 0.5 (MacKenzie, Podsakoff & Podsakoff, 2011:294).

4.8.2.6 Discriminant validity

Discriminant validity refers to if a scale adequately differentiates itself or does not differentiate between groups that should differ or not differ based on theoretical reasons or previous research (Bagozzi, Yi & Phillips, 1991:422). This study assessed discriminant validity using average variance extracted compared to shared variance and inter construct correlation matrix as indicators, the Chi-square CFA test methods to check the discriminant validity of the research constructs were also employed. When research concepts are different their correlation value should be less than one (1.0). Yet, a correlation value between constructs of less than 0.7 is advocated for in the empirical literature to confirm the existence of discriminant validity (Nunnally & Bernstein, 1994:248).

4.9 ETHICAL CONSIDERATIONS

Ethical considerations in research are critical. Ethics are the norms or standards for conduct that distinguish between right and wrong. They help to determine the difference between acceptable and unacceptable behaviors on the part of the researcher. The integrity, reliability and validity of the research findings rely heavily on adherence to ethical principles. The readers and the public want to be assured that researchers followed the appropriate guidelines for issues such as human rights, animal welfare, compliance with the law, conflicts of interest, safety, health standards and

so on. The handling of these ethical issues greatly impact the integrity of the research project and can affect whether or not the project receives funding.

Ethical considerations must be made when designing case study research as it may often involve dealing with confidential information about an organisation or participant. Ethical considerations include informed consent, review board approval, confidentiality, handling of sensitive results, inducements and feedback (Runeson & Höst, 2009:132). In line with this, ethics procedures, guidelines and conduct in relation to confidentially, anonymity, and integrity as stipulated by the Vaal University of Technology are adhered to. This study adhered to the ethical regulations of VUT, and is structured in such a way that there are no disturbances to any other human being. It actually holds high status in terms of how it is written and interpreted and sources of information used are obtained ethically, using clear referencing. The questionnaires were completed anonymously and on a voluntary basis. The gathered data was regarded as confidential. The following ethical principles were adhered to:

- Participation in the study was voluntary.

- Personal data of individuals was processed fairly and lawfully and used only for the purpose of this study.

- The respondents' privacy was respected.

- Personal information from the individuals was ascribed to any individual.

- The questionnaire did not contain the names of the respondents.

- Professional competence in the data collection was maintained.

- Independent objectivity in the interpretation of the survey findings was upheld.

4.10 CONCLUSION

This chapter discussed the latent philosophical issues that have implications for design and conduct of research: the philosophical positions of this research i.e. subjective ontological position, and an interpretivist epistemological stance. The choice of a quantitative research methodology was used for this study. A detailed description of the research process and data analysis phase was also

presented. Regarding actual data collection the use of questionnaires have been highlighted. These discussions took into account issues of validity and reliability and how ethical standards were maintained throughout the study. The next chapter (Chapter Five) presents findings from the data analysis conducted.

CHAPTER 5

DATA ANALYSIS AND EMPIRICAL RESULTS OF THE STUDY

5.1 INTRODUCTION

In the previous chapter the research methodology and design are presented. This chapter presents the findings, analysis and interpretation of the quantitative data collected. The SPSS Version 22.0 was used to formulate frequency tables and descriptive analysis graphs. Amos Version 22.0 was used for structural equation modeling, which encompasses confirmatory factor analysis, path analysis and for the full latent variable model. Furthermore, a description of factors determining the reliability and validity of constructs is highlighted with the Cronbach's Alpha, the Composite Reliability (CR) value and the Average Value Extracted (AVE) used to check reliability and Factor Analysis is used to check convergent validity and correlation matrix for validity. Model fit assessment is ascertained through the following indicators: chi-square value, Goodness of Fit Index (GFI), Normed Fit Index (NFI), Lewis-Tucker Index (TLI), Incremental Fit Index (IFI), Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). The last section of this chapter tests the study's hypotheses.

5.1.1 The Main Focus and Scope of the Study

This study's purpose is to investigate the influence of supply chain dynamism, information sharing, inter-organisational relationships on supply chain performances. As discussed in the previous chapter, quantitative research techniques were employed in gathering data in order to obtain manufacturing, service and mining sector perceptions on supply chain performance and its influences. As such, the researcher first performed a descriptive analysis, which explored the manufacturing, service and mining sector characteristics.

5.1.2 Statistical Procedures

The two statistical procedures were tailed, the confirmatory factor analysis (CFA) and the structural equation modeling (SEM). CFA was utilised to evaluate the measurement model's item-total correlations, the Cronbach's coefficient alpha, the composite construct reliability as well as the average variance extracted (AVE) as tests for reliability. More so, the convergent validity and

discriminant validity of the five researches constructs: supply chain integration, collaborative planning, supply chain capabilities, firm competitiveness and firm performance were explored using CFA (Hoyle, 2000:465). The statistical package, AMOS 22.0 was employed to perform CFA and SEM. SEM tested the fitness of the proposed conceptual model and proceeded to test the research hypothesis. The study validated and supported five hypotheses: H1 (there is a positive relationship between supply chain dynamism and information sharing), H2 (there is a positive relationship between supply chain dynamism and inter-organisational relationships), H3 (there is a positive relationship between information sharing and inter-organisational relationships), H4 (there is a positive relationship between information sharing and supply chain performance) and H5 (there is a positive relationship between inter-organisational relationships and supply chain performance). The validation or non-validation of the research hypotheses is related to descriptive analysis.

5.2 DESCRIPTIVE ANALYSIS

A descriptive analysis incorporating the demographic information regarding the owners/managers of the manufacturing firms was conducted. This section comprises three aspects which is dealt with separately in the next section. The information starts from the type of industry the business operates in, number of employees and number of years the business has been operating. It was most important that the researcher first perform a descriptive demographic analysis as it improved the researcher's understanding of important aspects of key personnel and the firm. The descriptive results are presented in the table and figures below.

Table 5.1: Demographic Profile

Demographic Profile	Frequencies	Percentages (%)
Number of employees	20 people (50)	14.7
	21-50 people (80)	23.5
	50+ people (210)	61.8
Number of years	1-4 years (20)	5.9
	5-10 years (150)	44.1
	10 years+ (170)	50
Type of industry	Manufacturing (151)	44.4
	Service (150)	44.1
	Mining (39)	11.5

Source: Own compilation

In the above table various results are given. The results covers number of employees, number of years and type of industries in which these businesses operates in.
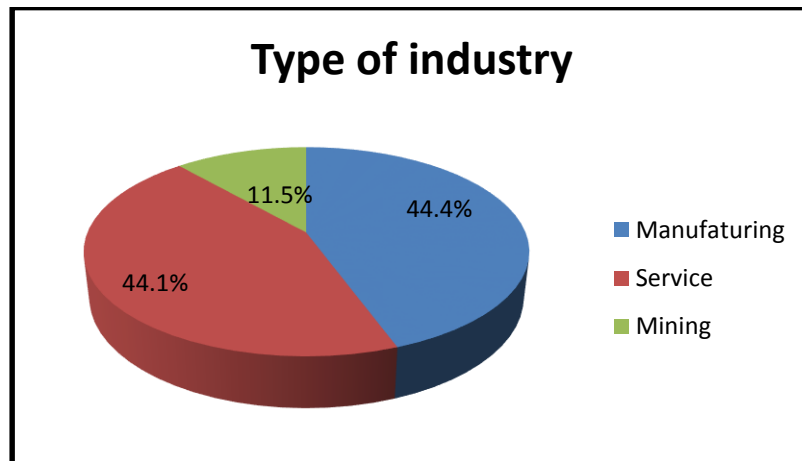
Figure 5.1: Reports on the type of industry the organisation competes in

Figure 5.1 shows that Majority of respondents were organisations from the manufacturing industry, 44.1% of them are in the service sector and 11.5 belong to the mining sector. From the figure above it is clear that manufacturing organistions are the ones dominating this study followed by service, then mining organisations in the Gauteng province.
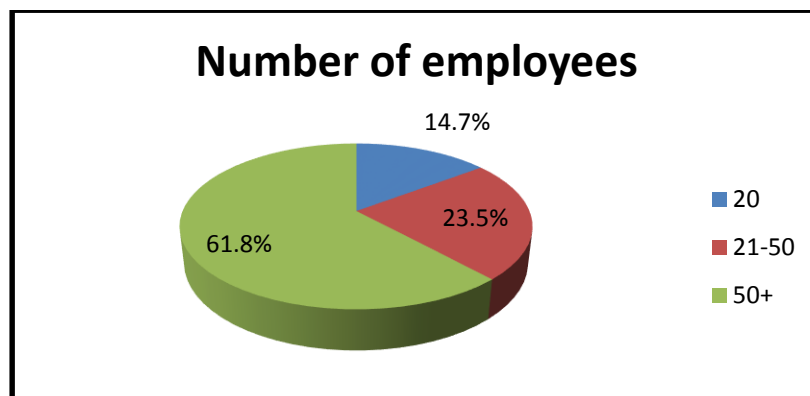
Figure 5.2: Reports on the number of employees in an organisation

As indicated in Figure 5.2 the number of employees employed in different organisations differs, the 14.7% represents companies with 20 and less employees, 23.5% represents companies with 21-50 employees and majority were companies where there are 50 and more employees. With

regard to these results we can safely say that most respondents were from organisations where there are 50 and more employees.
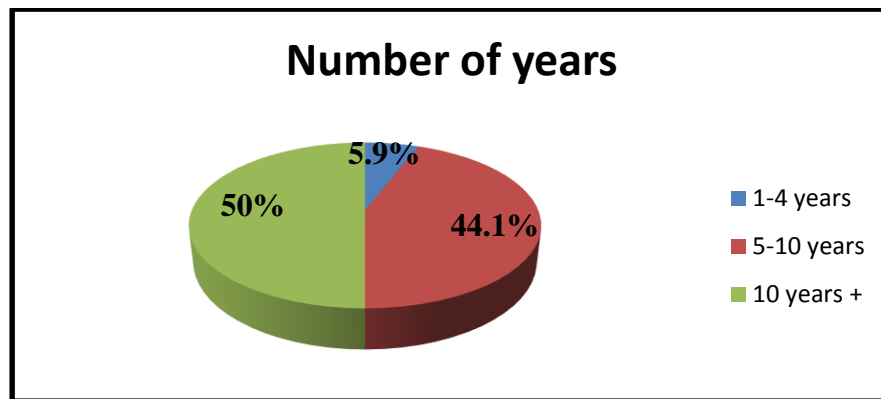
Figure 5.3: Reports on the number of years in business

The figure above represents the number of years the organisation has been in business, the results obtained indicates that 5.9% of respondents were from the companies that have been in existence for at least 1-4 years, then 44.1% represents companies that have been in existence for 5-10 years and 50% represents organisations that have been running for over 10 years.

5.2.1 Reliability Tests

Reliability refers to the similarity of results provided by the independent but comparable measures of the same object or construct, or an index of consistence (Riege, 2003:76). In this study the researcher employed item-total correlation values, Cronbach's coefficient alpha (α), composite reliability (CR) and average variance extracted (AVE) to check the measurement reliability.

5.2.1.1 Cronbach's coefficient alpha

Tavakol and Dennick (2011:53) described the Cronbach's coefficient (α) as one of the most common internal stability approaches that determine the mean reliability coefficient for all possible ways of splitting a set of items in half. Accordingly, Cronbach α is the most commonly used approach for assessing the reliability of a measurement scale with multi-point items. The value of α, which ranges from 0 to 1, signifies the level of reliability in the measurement. The closer the value of α is to 1, the higher the level of reliability. Alternatively, where the value of α is low, there may be too few items or little homogeneity among the items, although there are no

fixed rules for evaluating the magnitude of reliability coefficients and as such, depend on the purpose of the study (Liu, Wu & Zumbo, 2010:7).

The coefficient α for the different constructs in this study is computed using the reliability procedure in the SPSS (version 22.00) software. The researcher tested the internal reliability of each construct using the standardised Cronbach's coefficient alpha, where a higher level of Cronbach's coefficient alpha showed higher reliability of the measurement scale. Higher Item-Total correlations were employed in complement of the Cronbach's coefficient alpha and they revealed statistical agreement among the measured items. The results of scale reliability tests are shown in Table 5.2.

Table 5.2: Accuracy Analysis Statistics: Cronbach's Coefficient and Item-Total

Research construct		Cronbach's test item-total correlation	α value	Research construct	α value	Cronbach's test item-total correlation
SUPPLY CHAIN DYNAMISM (SCD)	SCD 1	.412	0.64	**INTER-ORGANISATIONAL RELATIONSHIP (IOR)**	0.78	IOR 1 .641
	SCD2	.534				IOR 2 .749
	SCD3	.540				IOR 3 .824
INFORMATION SHARING (IS)	IS 1	.764	0.79			
	IS 2	.694				
	IS 3	.703				
	IS 4	.716				
	IS 6	.744				
SUPPLY CHAIN PERFORMANCE (SCP)	SCP1	0.76	0.87			
	SCP 2	0.72				
	SCP 3	0.79				
	SCP 4	0.63				
	SCP5	0.82				
	SCP 6	0.77				

Source: own compilation

Table 5.2 indicates that the item-to-total values ranged from 0.412 to 0.824 and as such, were above the recommended threshold value of 0.3 (often $\leqq 0.3$) (Dunn, Seaker & Waller, 1994:145). Furthermore, Table 5.2 shows that the Cronbach's alpha coefficients ranged from 0.64 to 0.87. This indicates that the entire Cronbach's coefficient alpha exceeded the recommended threshold of 0.6 in previous studies (Nunnally & Bernstein, 1994:249; Gliem & Gliem, 2003:84) and thus, satisfies the reliability of the research measures. The item-total correlations and the Cronbach's coefficient alpha are complemented by the composite reliability checks.

5.2.1.2 Average variance extracted (AVE)

The AVE estimate indicates the overall amount of variance in the indicators accounted for by the latent construct (Kline, 2005:47). Thus the latent construct is well represented and revealed by higher values for the variance extracted estimate (greater than 0.50). Average Variance Extracted (AVE) is calculated using the formula below: $V\eta = \Sigma\lambda yi2/ (\Sigma\lambda yi2 + \Sigma\varepsilon i)$; where $V\eta$= Average Variance Extracted (AVE); $\Sigma\lambda yi2$= Summation of the squared of factor loadings; $\Sigma\varepsilon i$= Summation of error variances (Hair, Sarstedt, Ringle & Mena, 2012:420). The AVE estimates in this study are shown in Table 5.3, below.

Table 5.3: Average Variance Extracted (AVE)

Accuracy Analysis Statistics: Average Variance Extracted Research Construct	Average Variance Extracted
Supply chain dynamism (SCD) (SCD 1, 2 & 3)	0.66
Information sharing (IS) (IS 1,2,3,4, 5 & 6)	0.78
Inter organisational relationships (IOR) (IOR 1, 2 & 3)	0.76
Supply chain performance (SCP) (SCP 1, 2, 3,4,5 & 6)	0.82

Source: own compilation

Table 5.3 presents the average variance extracted for the following constructs supply chain dynamism, information sharing and inter-organisational relationship on supply chain performances. Average variance extracted (AVE) is commonly used to assess convergent validity. A variance extracted of greater than 0.50 indicates that the validity of both the construct and the individual variables is high. Therefore, the results above indicate that there is high level of validity for both the construct and the individual variables.

5.3 VALIDITY TESTS

Validity is concerned with whether an instrument or test actually measures the attributes that it is supposed to measure, given the context in which it is applied. It can be defined as the extent to which differences in observed scale scores reflect true differences between objects on the characteristics being measured, rather than systematic or random errors (Chung, Pillsbury, Walters & Hayward, 1998:576). Validity is concerned with the accuracy of a measurement. Since one never has direct evidence of the true value of the concept under measurement, validity assessment is a complex issue. Hence, there are three basic approaches employed to estimate the validity of an instrument: content validity, predictive validity, and construct validity. However, for the purposes of this study, the focus is primarily on testing construct validity.

5.3.1 Construct Validity

Construct validity is concerned with the extent to which a measure relates to other measures to which it should be related (Nosek *et al.,* 2005:167). To find this type of validity, two categories of construct validity normally need to be determined: convergent validity and discriminant validity. Factor analysis is a common evaluator of both convergent and discriminant validity. Factor analysis is an interdependence analysis tool that simplifies data analysis by taking advantage of the correlations among the p-variables, extracting the data that overlaps and reducing the problem to just a few core variables (Henson & Roberts, 2006:394). Convergent validity is an element of construct validity.

5.3.2 Convergent Validity

Convergent validity is the extent to which the scale items show homogeneity within the same construct being measured. Preferably, an item is expected to highly correlate with other items that measure the same constructs (convergent validity). In contrast, it is expected that these items do

not correlate too highly with items which measure different constructs (discriminant validity) (Duckworth & Kern, 2011:260). Convergent validity was assessed by checking whether individual item loadings for each corresponding research construct were above the recommended value of 0.5 (Cunningham, Preacher & Banaji, 2001:164). The results are shown in Table 5.4 below.

5.3.3 Discriminant Validity

Pike (2006:551) defines discriminant validity as to the extent to which scale items show heterogeneity between different constructs, which ensures that measures of unlike constructs load on separate constructs. This study employed the correlation matrix and the Chi-square CFA test methods to check the discriminant validity of the research constructs.

When research concepts are different their correlation value should be less than one (1.0). Yet a correlation value between constructs, of less than 0.7 is advocated for in the empirical literature to confirm the existence of discriminant validity (Nunnally & Bernstein, 1994:294). Otherwise, discriminant validity related to the correlation matrix can be tested by checking whether the Average Variance Extracted (AVE) for two constructs is greater than the square of the correlation between the constructs. The discriminant validity of the research constructs in this study was checked by evaluating whether the correlations among the latent constructs were less than 1.0. Table 5.4 below, provides examples of assessing discriminant validity.

Table 5.4: Correlations between Constructs

	SCD	IS	IOR	SCP
SCD	1.00			
IS	.697[**]	1.00		
IOR	.519	.638[**]	1.00	
SCP	.703	.669	.622	1.00

Source: own compilation

Note*: SCD= Supply chain dynamism, IS= Information sharing, IOR= Inter organisational relationships & SCP= Supply chain performance.*

Table 5.4 indicates the inter-correlation values for all paired latent variables which are less than 1.0, thus confirming the existence of discriminant validity. The table indicates the existence of discriminant validity among all the constructs.

5.4 CONFIRMATORY FACTOR ANALYSIS MODEL FIT/ACCEPTABILITY

Prior to the testing of the hypotheses, CFA was performed to observe scale accuracy (i.e. reliability, convergent validity, and discriminant validity) of the multiple-item construct measures using AMOS 22. Various model fit criteria have been developed to help in understanding the CFA and SEM in diverse model-building assumptions. For example, in the case of other multivariable procedural statistical approaches, such as the analysis of variance, multiple regression and discriminant analysis, the establishment of model fit in CFA and SEM is complex.

CFA and SEM fit indices are believed to have no single statistical check of significance that determines a correct model for specified sample data (Hoyle, 2000:466). This is due to the fact that alternative models can exist, and they would yield the exact same data to model fit. Consequently, the researcher employed a different model fit criteria as a combination of assessing model fit. This study employs six model fit criteria to check the overall fit of the research model starting with the chi-square index and the study follows the work of Cheung and Rensvold (2002:234).

Subsequently, the CFA model fit acceptability was indicated by the following indices: chi-square value over degree of freedom ($\chi2/df$) of value between 1 and 3, the values of Comparative Fit Index (CFI), Normal Fit Index (NFI), Incremental Fit Index (IFI), and Tucker-Lewis Index (TLI) equal to or greater than 0.90, and the Root Mean Square Error of Approximation (RMSEA) value to be equal to or less than 0.08 (see Table 5.5, below).

Table 5.5: Model Fit Criteria and Acceptable Fit Level

Model Fit Criteria	Acceptable Level	Interpretation
Chi-square ($\chi2$)	Tabled Chi-square values	Compares obtained Chi-square value with tabled value for given df
Tucker-Lewis Index (TLI)	Value equal to or greater than 0.90	0 (no fit) to 1 (perfect fit)
Norm-fit-index (NFI)	Close to 0 is good	Researcher defines level
Comparative fit index (CFI)	Value equal to or greater than 0.90	0 (no fit) to 1 (perfect fit)
Incremental fit index (IFI)	Value equal to or greater than 0.900 (no fit) to 1 (perfect fit)	0 (no fit) to 1 (perfect fit)
Root mean square error of approximation (RMSEA)	<0.05	Values less than 0.05 indicates a good model fit

Source: own compilation

Note: *c significance level - ***p-value<0.001, b significance level- **p-value<0.05, a significance level- *p-value<0.1.*

Table 5.6 outlines the levels of acceptance and the interpretation for six out of the eight model fit indices employed in this study.

Table 5.6: Reports the Confirmatory Factor Analysis Model Fit Results.

FIT INDEX	Results
Chi-Square/ d. f.	2.083
CFI (Comparative Fit Index)	0.975
RMSEA (Root Mean Square Error of Approximation)	0.053
NFI (Normal Fit Index)	0.995
TLI (Tucker Lewis Index)	0.949
IFI (Incremental Fit index)	0.978

Source: own compilation

Table 5.6 indicates that the measurement model yielded a ratio of chi-square value to degree-of-freedom of 2.083, NFI, IFI, TLI, CFI, and RMSEA of 0.995, 0.978, 0.949, 0.975, and 0.053 respectively. Based on the recommended statistics in Table 5.5, the overall-model assessment revealed an acceptable fit of the measurement model to the specified sample data, as shown in Table 5.6 above. The study then proceeded to the hypothesis testing stage through the SEM (using Amos 22.0 software, after obtaining an acceptable CFA measurement.

5.5 SEM CONCEPTUAL MODEL FIT ASSESSMENTS

The following section presents SEM results. It starts by establishing an acceptable model fit using the same indices as in CFA. These are discussed in detail below and the results are shown in Table 5.7. The Chi-square receives attention in the next section.

5.5.1 The Norm Fit Index (NFI)

NFI was developed originally to CFI. It ranges from 0 to 1, with 1 representing a perfect fit. NFI reveals the proportion by which the researcher's model improves fit compared to the null model (random variables). In principle, NFI values below 0.90 shows a need to re-specify the model (Hu, Bentler & Hoyle, 1995:76).

5.5.2 The Comparative Fit Index (CFI)

CFI is commonly referred to as the Bentler Comparative Fit Index. It is used to compare the existing model fit with a null model that assumes that the latent variables in the model are uncorrelated. The CFI index compares the covariance matrix posited by the model to the observed covariance matrix. In addition, it evaluates the null model with the observed covariance matrix in order to estimate the percentage of lack of fit which is accounted for by going from the null model to the researcher's SEM model. CFI varies from 0 to 1. A CFI value close to 1 indicates a very good model fit. In principle, CFI should be equal to or greater than 0.90 to accept the model, showing that 90 percent of the covariation in the data can be reproduced by the given model (Schreiber *et al.,* 2006:325).

5.5.3 Root Mean Square Residual (RMR)

RMR stands for the average residual value those results from the fitting of the variance-covariance matrix for the posited model to the variance-covariance matrix of the sample data. These residuals

are difficult to interpret, since they are relative to the sizes of the observed variance and covariances. Consequently, these residuals are best interpreted in the metric of correlation matrix. The outcome from the matrix embodies the average value across all standardised residuals and varies from 0 to 1. Therefore, an RMR value that is closer to 0 for the tested model improves the model fit (Hu & Bentler, 1999:2).

5.5.4 The Incremental Fit Index (IFI)

IFI is basically computed in the same way as the NFI, except that it takes into consideration the degrees of freedom. It was developed by Bollen (1990:256) to deal with the NFI related limitations in the issues of parsimony and sample size. The recommended value for IFI that gives an acceptable model fit should be greater or equal to 0.9. However, the IFI value can also exceed 1, under certain circumstances (Schreiber *et al*., 2006:326).

5.5.5 Root Mean Square Error of Approximation (RMSEA)

RMSEA is an index whose value answers the question of how well the research model will fit the population covariance matrix if it were available, with unknown but optimally chosen parameter values (Cheung & Rensvold, 2002:234). It takes into consideration the error of approximation in the population. RMSEA expresses such discrepancies per degree of freedom, hence sensitising the index to the number of estimated parameters in the model. The recommended threshold value for RMSEA that yields a good model of fit should be less than or equal to 0.05. However, a value of less than, or equal to, 0.08 for the RMSEA index gives an adequate model fit (Cheung & Rensvold, 2002:235). Table 5.7 shows the results.

Table 5.7: Structural Equation Modeling Model Fit Results

FIT INDEX	Results
Chi-Square/ d. f.	1.779
RMR (Root Mean Square Residual)	0.078
CFI (Comparative Fit Index)	0.952
RMSEA (Root Mean Square Error of Approximation)	0.065
NFI (Normal Fit Index)	0.944
TLI (Tucker Lewis Index)	0.962
IFI (Incremental Fit index)	0.973

Source: own compilation

From Table 5.7, the ratio of chi-square over degree-of-freedom was 1.779. This value is less than the recommended threshold of less than 3.0 and, therefore, confirms the model fit. Additionally, NFI, RMR, IFI, CFI, TLI and RMSEA values were 0.944, 0.078, 0.973, 0.952, 0.962 and 0.065. All these model fit measures were above the recommended marginally accepted threshold of greater or equal to 0.90 for NFI, RFI, IFI, CFI, TLI and less than 0.08 for RMSEA, which suggested that the proposed conceptual model converged well and could be a plausible representation of the underlying empirical data structure collected in the Gauteng Province of South Africa. Since the model fit was acceptable, the study proceeded to test the research hypotheses which are both linear and nonlinear, as shown in the conceptual model in the next section.

5.6 SEM RESULTS AND THE CONCEPTUAL MODEL

This section focuses on the linear relationships hypothesised between supply chain dynamism, information sharing and inter-organisational relationships on supply chain performance as shown in Table 5.8, below. Also, the hypotheses testing and results are discussed.

5.6.1 The Hypotheses Testing Stage and Results

In this section the five tested hypotheses are stated, and addresses their validation or non-validation based on the results tabulated in Table 5.8. After the modification of the full conceptual model, and results were obtained from it, the rest of the hypotheses were proved. The following are the results of all the hypotheses. Results are shown in Table 5.8 below.

Table 5.8: Hypotheses tests results

Path Coefficients	Hypothesis	Factor Loading	Significance	Decision
H1: Supply chain dynamism and information sharing	.697	.067	.010	Supported
H2: Supply chain dynamism and inter-organisational relationships	.519	.062	.050	Supported
H3: Information sharing and inter-organisational relationships	.638	1.177	***	Significant
H4: Information sharing and supply chain performance	.669	.972	***	Significant
H5: Inter-organisational relationships and supply chain performance	.622	.968	***	Significant

Source: own compilation

Table 5.8 shows the five hypothesised linear relationships which are discussed below:

5.6.1.1 H1: Supply chain dynamism and information sharing

H1: A positive relationship was hypothesised between supply chain dynamism and information sharing. This hypothesis was formulated from the objective that aimed to investigate the impact of supply chain dynamism on information sharing. The positive factor loading (0.67) confirms the existence of a positive linear. First, with increased information sharing and operational knowledge, firms can be more responsive to volatile demand resulting from frequent changes in competition, technology and regulation (Gunasekaran, Lai & Cheng, 2008:550). However, the existence of a positive factor loading accompanied by a p-value less than 0.05 resulted in the validation of H1. Therefore, H1hypothesis was supported and valid.

5.6.1.2 H2: Supply chain dynamism and inter-organisational relationships.

H2: Depicts that supply chain dynamism has an impact on inter-organisational relationships. The researcher hypothesised a linear relationship between supply chain dynamism and inter-organisational relationships as stated in H2 above. This hypothesis was formulated in an attempt to determine whether or not supply chain dynamism has an impact on inter-organisational relationship. This relationship (H2) was entirely validated based on the positive factor loadings (all above 0.5) and their significance level of p-values less than 0.5 (see Table 5.8). The results on the support of H2 are shown in Table 5.8. Therefore, this study validates and supports that supply chain dynamism has a positive impact on inter-organisational relationships.

5.6.1.3 H3: Information sharing and inter-organisational relationships

H3: Information sharing and supply chain performances were validated because they had a positive factor loading of 1.117 which is greater than the recommended value of 0.05 (Hair *et al.,* 2010:115). H3 was also supported because it was significant, with a significance level of less than 0.001 (c significance level with 3 stars ***). These results are consistent with previous research where information sharing is defined as a combination of different firms' resources and systems both tangible and intangible, which include the use of advanced supply chain networks (Yu, Yan & Edwin Cheng, 2001:114). The results on the support of H3 are shown in Table 5.8. Therefore, this study validates and supports that information sharing has a positive impact on inter-organisational relationships.

5.6.1.4 H4: Information sharing and supply chain performance

H4: Depicts that information sharing has an impact on supply chain performance. The researcher hypothesised a linear relationship between information sharing and supply chain performance as stated in H4 above. This relationship was entirely validated based on the positive factor loadings (all above 0.5) and the p-values less than 0.001 (c significance level with 3 stars ***). The results on the support of H4 are shown in Table 5.8. These results are relevant to the previous study of Zhao, Xie and Zhang (2002:25), which states that information sharing impacts the supply chain performance in terms of both total cost and service level. Lin, Huang and Lin (2002:258) further elaborate that the higher level of information sharing is associated with the lower total cost, the higher order fulfillment rate and the shorter order cycle time. Therefore, this study validates and supports that information sharing has a positive impact on supply chain performance.

5.6.1.5 H5: Inter-organisational relationships and supply chain performance

H5: The researcher hypothesised a linear relationship between the impact of inter-organisational relationship and supply chain performance. This hypothesis was formulated in an attempt to determine whether or not inter-organisational relationships influence supply chain performance. This relationship was entirely validated based on the positive factor loadings (all above 0.5) and the p-values less than 0.001 (c significance level with 3 stars ***). These results are relevant to the previous study of Whipple and Russel (2007:175), which depicts that firms' relationships can be interpreted as the ability of firms to link and work together by sharing information, resources and risks. The results on the support of H5 are shown in table 5.8. Therefore, this study validates and supports that inter-orgnisational relationships have a positive impact on supply chain performance.

5.7 CONCLUSION

Chapter five attended to six main issues: normality and linearity, descriptive analysis, testing for measurement accuracy and checking that the models fit to the specified sample data. It also tested the proposed hypotheses using Structural Equation Modelling (SEM). Eventually, the SEM results were evaluated. Generally, the measures were found to be adequately acceptable and, therefore, reliable and valid. In addition to this, the findings of the research model constituting this study indicate that the specified sample data fit the conceptualised model well. The study investigated

the impact of supply chain dynamism, information sharing and inter-organisational relationships on supply chain performance. The implications of these research findings and an overall conclusion are provided in Chapter six.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

The previous chapter presented the empirical results of the study. This chapter presents the conclusion as well as recommendations for the entire study. Firstly, it gives a brief review of the study, followed by conclusions of the study's variables, then conclusions on relationships between variables. Recommendations are also made with regard to the study's variables, limitations of the study are discussed as well and the implications for further research for academics who might want to conduct further research based on more or less the same variables. Finally, managerial implications are addressed.

6.2 REVIEW OF THE STUDY

The aim of this study was to investigate the influence of supply chain dynamism, information sharing and inter-organisational relationships on supply chain performance. The study consisted of six chapters. The first chapter introduce the study's variables (supply chain dynamism, information sharing, inter-organisational relationships and supply chain performance), stated the problem statement, purpose of the study, research objectives, justification, significance of the study and definition of key terms (study's variables). The second chapter highlighted the importance of supply chain and how it is linked to different sectors/industries (manufacturing, mining and service). The third chapter consisted of theoretical grounding (theory), empirical review (research variables), conceptual model, hypothesis development and statements. The fourth chapter focused on the research methodology and design of the study; related aspects are also discussed with regard to the target population, sampling frame, sampling size and measurement instruments as well as ethical considerations of the study. The fifth chapter clearly gave the empirical results and their interpretations. Finally, the last chapter which is the sixth, focused on conclusions, recommendations, limitations of the study and implications for future/further research.

6.3 CONCLUSIONS BASED ON EMPIRICAL OBJECTIVES OF THE STUDY

This section discusses conclusions based on the empirical objectives set in the first chapter of this study, which are:

- to investigate the influence of supply chain dynamism on information sharing in manufacturing, service and mining organisations in Gauteng Province;

- to determine the influence of supply chain dynamism on inter-organisational relationships in manufacturing, service and mining organisations in Gauteng Province;

- to ascertain the influence of information sharing on inter-organisational relationships in manufacturing, service and mining organisations in Gauteng Province;

- to determine the influence of information sharing on supply chain performance in manufacturing, service and mining organisations in Gauteng Province; and

- to investigate the influence of inter-organisational relationships on supply chain performance in manufacturing, service and mining organisations in Gauteng Province.

6.3.1 Conclusion on the relationship between Supply Chain Dynamism and Information Sharing

The first hypothesis of this study states that there is a positive relationship between supply chain dynamism and information sharing. It concludes that uncertainties which we cannot know predictably can easily influence supply chain operations. These findings are not without empirical support. Zhou (2003:48) attests that when supply chain dynamism increases, effective information sharing becomes more important. For example, delayed supply may affect production time and consequently influence delivery time and probably selling price. Changed demand quantity may induce production waste. Problems of vehicles (there aren't enough vehicles or vehicles are not frequently serviced) in distribution process will disturb directly distribution time. From these examples it can be stated that dealing with uncertainties is a very important theme in supply chain management and dealing with these uncertainties can be obtained through information sharing, which is a key driver of an effective and efficient supply chain, which speeds up the information flow, shortens the response time to customer needs, provides enhanced coordination and

collaboration and sharing the risks as well as the benefits. Furthermore, Grover (1993:606) and Van Hoek (1999:21) concluded that increasing unpredictability of the customer's demands leads an organisation to share more information with its supply chain partners in order to respond to customers' changing needs.

6.3.2 Conclusion on the relationship between Supply Chain Dynamism and Inter-organisational Relationships

The second hypothesis of this study states that there is a positive relationship between supply chain dynamism and inter-organisational relationships. This study concludes that organisations should create external relations to coordinate the flow of information across a set of business activities, which enable supply chain partners to obtain information supply chain regarding the activities and high and low levels of performances. It can also be noted that firms engaging in collaborative relationships achieve improved visibility, higher service level, increased flexibility, greater end-customer satisfaction and reduced cycle times. A previous study conducted by Fredricks, (2005:557) substantiates that as environmental uncertainty increases, various types of inter-functional expertise are required as more diverse skills and knowledge are needed to develop solutions and remain competitive. Consequently, inter-organisational relationships can be used to bring in complementary resources and create idiosyncratic ones that can enhance the competitive advantage of the organisation in the relationship. Idiosyncratic resources are developed during the lifetime of the alliance or relationship (Lambe *et al.,* 2002:141).

6.3.3 Conclusion on the relationship between Information Sharing and Inter-organisational Relationships

The third hypothesis of this study states that information sharing positively influences inter-organisational relationships. Therefore, this study concludes that in order to achieve the advantages of information sharing, it is of strategic importance for firms to understand those factors relating to inter-organisational relationships that affect the members' intention to exchange information. Thus it can be said that proper and timely information sharing among supply chain members causes partners to   manage their relationships with each other much better. Furthermore, consistency between supply chain partners can make information sharing in all levels of the supply chain clear and can give an organisation a good competitive advantage against other organisations in the

supply chain. These findings are not without empirical support. Stevenson and Spring (2009:948) attest that improving information exchange between companies gives partners greater visibility and time to respond to change. Daugherty *et al.,* (2006:63) concluded that firms engaged in inter-organisational relationships achieve improved visibility, higher service level, increased flexibility, greater end-customer satisfaction and reduced cycle times.

6.3.4 Conclusion on the relationship between Information Sharing and Supply Chain Performance

The fourth hypothesis of the study states that there is a positive relationship between information sharing and supply chain performance. This study therefore concludes that information sharing is an important dimension of supply chain performance. In order to achieve a competitive advantage, supply chains need to be managed appropriately, which can be obtained through management of materials, products and information flows through the supply chain which has a direct impact on the success of organisation strategies and the performance of the organisations. Information exchange is a common way to manage supply chains that improve their performances through effective use of their resources and capabilities, and companies that share information have increased visibility of their activities and are thus able to coordinate replenishment more effectively and streamline the flow of goods and services. Furthermore, it can also be noted that information sharing leads to an increase in information flow through the supply chain which significantly contributes in reducing supply chain costs, improving partnerships, increasing material flow, enabling faster delivery and also helping to improve the order fulfillment rate as a result. This contributes to customer satisfaction, enhances channel coordination and facilitates the achievement of competitive advantage. These results are also affirmed by Lin *et al.,* (2002:259) who maintain that the higher level of information sharing is associated with the lower total cost, the higher order fulfillment rate and the shorter order cycle time, which gives an organisation more competitive advantage over the others.

6.3.5 Conclusion on the relationship between Inter-organisational Relationships and Supply Chain Performance

The last hypothesis of this study states that there is a positive relationship between inter-organisational relationships and supply chain performance. This study therefore concludes that

inter-organisational relationships are established, maintained and enhanced to achieve competitive advantages for all parties involved, and activities for creating collaboration and cooperation in the supply chain lead to trust and commitment of the supply chain members to each other, which will ultimately lead to more significant members and undoubtedly improve supply chain performance. A previous study conducted by Ireland and Bruce (2000:81) attest that healthy relationships are vital business function that, when not strategically, systematically coordinated between firms, can contribute to disruption of activities at the point between trading partners where product is planned, ordered and replenished. As such, inter-organisational relationships provide a substantial opportunity for improved supply chain performance and should be viewed as a priority for firms adopting a supply chain management approach.

It can further be noted that proper management of relationships between supply chain partners improve and increase supply chain performance. These inter-organisational relationships among organisations on the management of various supply chain activities is also believed to be the current trend by some company executives to lead to a more competitive advantage over other supply chains. Most importantly, information sharing has increasingly become an important issue for the supply chains by making greater information available and sharing it among supply chain members such as suppliers or subcontractors; organisations can make better decisions on ordering, production planning, and capacity allocation so that the supply chain dynamics can be optimised. Finally, it can be noted that information sharing plays a key role in a supply chain since it helps organisations achieve specific objectives and benefits in terms of reductions in total costs and inventories to maximise profits and enhance supply chain performance. Mentzer *et al.,* (2001:6) conclude that a well-managed supply chain environment begins with forming inter-organisational relationships initially with immediate trading partners, then eventually with additional tiers in the supply chain.

6.4 RECOMMENDATIONS

The below mentioned recommendations could be useful when fully implemented and they apply to both small and large businesses, as the study's population consisted of both. Therefore, the considered sectors in this instance are manufacturing, mining and service.

6.4.1 Recommendations on the relationship between Supply Chain Dynamism and Information Sharing

Information sharing plays a vital role, especially when it comes to supply chain dynamism. Changes occur all the time in the supply chain therefore it is really important that organisations stay ahead of what happens in their environment and share information. It is suggested that organisations implement the following strategies to further circulate necessary information among supply chains:

- ✓ Organisations need to respond productively to rapid change, and must be aware of new information generated in their environment and adopt structures that enable fast decision making and practices that reduce information overload.
- ✓ Organisations need to invest heavily in information technologies to enhance their ability to manage information and knowledge across the supply chain.
- ✓ Connectivity creates the capability to share information because information transparency is of no value unless it is two-way process.
- ✓ The open sharing of information can help reduce uncertainty by allowing customers insights into the supplier's future plans, for example, early information about changes in a supplier's product line enables the customer to make timely changes in acquisition and operational procedures, thus avoiding costly crash programmes.

6.4.2 Recommendations on the relationship between Supply Chain Dynamism and Inter-organisational Relationships

The ability of a firm to effectively manage its key relationships is a strategic capability. This not only affects its ability to create and sustain successful supply chain partnerships but also influences helps in terms of being able to deal with any uncertainty that may occur in an organisation. Hence it can be suggested that:

- ✓ Organisations needs to have managerial ability to integrate and coordinate the intricate network of business relationships among supply chain members.
- ✓ Collaborative working for joint planning, joint product development, mutual exchange information and integrated information systems, cross coordination on several levels in the

organisations on the network can have the advantage of long term cooperation and fair sharing of risks and benefits.

✓ Continuous coordination, cooperation, and coordination among supply chain partners can be imperative for risk avoidance, such that the value and benefits created are maximised and shared fairly.

✓ Joint consideration of functions or processes by supply chain members at different levels to coordinate the supply chain can give an organisation more competitive advantage over others.

6.4.3 Recommendations on the relationship between Information Sharing and Inter-organisational Relationships

Sharing of relevant information between supply chain partners has proven to be very effective when it comes to building relationships among partners. Furthermore, it can also be suggested that different organisations try to implement the following strategies in order to maintain effectiveness of this relationship:

✓ To survive in today's global economy organisations need to definitely rethink their approach to cooperation and hence should provide ways to share up-to-date information within the enterprises.

✓ Members should have the willingness to participate in information sharing activities because nowadays, enterprises do not operate alone they have now been networked to many other partners.

✓ With advances in information technology, different network structures can be modeled to make the coordination within supply chain partners even closer. This partnership and coordination can lead to a more beneficial and profitable supply chain. Information flows will increase, the uncertainty will be reduced and the ultimate customers will receive higher quality products with lesser costs in a shorter period of time.

✓ Sharing information can also build and strengthens relationships and social ties among the information receivers and givers. Organisational efficiency and performance are other advantages of information sharing.

6.4.4 Recommendations on the relationship between Information Sharing and Supply Chain Performance

Information sharing has a great impact on the overall cost of running a successful supply chain, and improves the holistic management of supply chain activities and can further give an organisation more competitive advantage over others. Organisations need to pay specific attention to the following aspects as well:

✓ Organisations need to align supply chain practice with the level of their information quality in order to achieve enhanced overall business performance.

✓ Many organisations mistakenly concentrate their information sharing on only the hardware and software, ignoring the decision-making in the information sharing process hence it can be suggested that what makes the performance difference is how information is being used; knowledge is the key to the success of a supply chain as it affects decisions.

✓ Information sharing can be used to outsource much of an organisations inventory planning to suppliers who become responsible for monitoring inventory levels, planning replenishment, and suggesting new ideas to improve throughout.

✓ Organisations can invest on information technologies to enhance their ability to manage information and knowledge across the supply chain to gain a better competitive advantage.

6.4.5 Recommendations on the relationship between Inter-organisational Relationships and Supply Chain Performance

Inter-organisational relationships have proved to be resourceful when it comes to the supply chain performance because the more there are healthy inter-organisational relationships within the supply chain partners, the higher the level of supply chain performance. Most organisations are making use of this method in order to ensure that they maintain healthy relationships so that they reap competitive advantage over their rivals. As such, it can further be recommended that:

✓ Maintaining close relationships will be very beneficial because, channel participants share the risks and rewards and have willingness to maintain the relationship over the long term.

✓ Through a well-developed long-term relationship, a supplier becomes part of a well-managed supply chain and it will have a lasting effect on the competitiveness of the entire supply chain.

✓ Thus, for a supply chain to take full advantage of the benefits of information sharing, diverse firms that comprise the chain must cultivate a high degree of willingness among all key players, because willingness to share information is positively correlated to a company's performance.

✓ Establishing strong partnerships with third-party logistics can help an organisation to concentrate more efficiently on their core capabilities and abilities which may contribute significantly to the improvement of their organisation' overall performance in terms of responsiveness cost reduction.

6.5 LIMITATIONS OF THE STUDY

This study has some limitations. One major limitation of this study is its geographical restriction to Gauteng province of South Africa. While contextual issues have been taken into account through secondary information, empirical data (questionnaires) in this study concentrated on a few organisations or companies in the manufacturing, service and mining sector in Gauteng. The data were gathered from manufacturing, service and mining sector. The results would be more informative if data from other sectors were compared.

6.6 IMPLICATIONS FOR FUTURE/FURTHER RESEARCH

This study provides useful insights for managers in developing inter-organisational relationships to achieve a better competitive advantage. The findings of this study on the effects of information sharing and inter-organisational relationships are not only in line with prior research, but also reveal how supply chain performance is significantly influenced by these mediating variables. The most important implication for managerial and practical insights is that developing positive and effective inter-organisational relationships with business partners is the key to enhancing inter-organisational information sharing in supply chains.

Future studies may be conducted by using data from other different sectors. Furthermore, future researches can put more emphasis on supply chain dynamism and its effect on other related variables. Therefore, future research needs to consider the upshots of such variations when replicating this study in other settings. Further to this, a comparative investigation of this study matter between or among countries with different levels of development or cultures can provide

added insights and immensely contribute new knowledge to the existing body of supply chain performance.

6.7 MANAGERIAL IMPLICATIONS

The study's results have important managerial implications. Managers can now adopt different strategies such as maintaining close relationships with supply chain partners and establishing strong partnerships with third-party logistics which help an organisation to concentrate more efficiently on their core capabilities and abilities to strengthen particular functions or particular relationships. This work improves the ability of managers to diagnose their organisations and act upon the results. Furthermore, this study helps managers to influence or monitor the drivers that in turn will affect inter-organisational relationships.

Effective information sharing is important for assimilating supply chain dynamics' information by using that information to guide the use of an effective supply chain process. This is important for mediating the influence of effective information sharing on business performance. Executives must balance the investment in information sharing and supply chain process.

6.8 CONCLUSION

In this study the significance of information sharing and inter-organisational relationships in a supply chain has been elaborated. Information sharing may bring a significant amount of advantages to the three sectors at hand (manufacturing, service and mining) such as inventory reduction and efficient inventory management, cost reduction, increasing visibility (significant reduction of uncertainties), significant reduction or complete elimination of the bullwhip effect, improved services, quick response, reduced cycle time from order to delivery, better tracing and tracking, earlier time to market, expanded network, and optimised capacity utilisation. This last chapter of the study outlined different conclusions based on the empirical objectives of the study, and recommendations were also made, grounded from its empirical objectives. Limitations of the study were highlighted. Finally, the implications for future or further research are discussed, which can help different academics or supply chain professionals.

REFERENCES

AGRELL, P.J. & HATAMI-MARBINI, A. 2013. Frontier-based performance analysis models for supply chain management: State of the art and research directions. *Computers & Industrial Engineering*, *66*(3), 567-583.

ALADWANI, A.M. & PALVIA, P.C. 2002. Developing and validating an instrument for measuring user-perceived web quality. *Information & Management*, *39*(6), 467-476.

ALDRICH, H. 2007. *Organisations and environments*. Stanford University Press.

ALFALLA-LUQUE, R. & MEDINA-LOPEZ, C. 2009. Supply Chain Management: Unheard of in the 1970s, core to today's company. *Business History*, *51*(2), 202-221.

AMBROSINI, V. & BOWMAN, C. 2009. What are dynamic capabilities and are they a useful construct in strategic management? *International Journal of Management Reviews*, *11*(1), 29-49.

ANGELL, L.C. & KLASSEN, R.D. 1999. Integrating environmental issues into the mainstream: an agenda for research in operations management. *Journal of Operations Management*, *17*(5), 575-598.

ANGERHOFER, B.J. & ANGELIDES, M.C. 2006. A model and a performance measurement system for collaborative supply chains. *Decision Support Systems*, *42*(1), 283-301.

ARNOLD, K.A., BARLING, J. & KELLOWAY, K.E. 2001. Transformational leadership or the iron cage: which predicts trust, commitment and team efficacy? *Leadership & Organisation Development Journal*, *22*(7), 315-320.

ATKINSON, R. & FLINT, J. 2001. Accessing hidden and hard-to-reach populations: Snowball research strategies. *Social research update*, *33*(1), 1-4.

ATKINSON, S. & BUTCHER, D. 2003. Trust in managerial relationships. *Journal of Managerial Psychology*, *18*(4), 282-304.

AVIV, Y. 2002. Gaining benefits from joint forecasting and replenishment processes: The case of auto-correlated demand. *Manufacturing & Service Operations Management*, *4*(1), 55-74.

AWAYSHEH, A. & KLASSEN, R.D. 2010. The impact of supply chain structure on the use of supplier socially responsible practices. *International Journal of Operations & Production Management*, *30*(12), 1246-1268.

BACHMANN, R. & INKPEN, A.C. 2011. Understanding institutional-based trust building processes in inter-organizational relationships. *Organisation Studies*, *32*(2), 281-301.

BAGOZZI, R.P., YI, Y. & PHILLIPS, L.W. 1991. Assessing construct validity in organizational research. *Administrative science quarterly*, 421-458.

BAKER, M.J. 2000. Selecting a research methodology. *The Marketing Review*, *1*(3), 373-397.

BAR-ILAN, J. 2001. Data collection methods on the Web for info metric purposes- A review and analysis. *Scientometrics*, *50*(1), 7-32.

BARRATT, M. & BARRATT, R. 2011. Exploring internal and external supply chain linkages: Evidence from the field. *Journal of Operations Management*, *29*(5), 514-528.

BARRATT, M. 2004. Understanding the meaning of collaboration in the supply chain. *Supply Chain Management: an international journal*, *9*(1), 30-42.

BEHREND, T.S., SHAREK, D.J., MEADE, A.W. & WIEBE, E.N. 2011. The viability of crowdsourcing for survey research. *Behavior research methods*, *43*(3), 800-813.

BEN-ARIEH, D. & POLLATSCHECK, M.A. 2002. Analysis of information flow in hierarchical organisations. *International Journal of Production Research*, *40*(15), 3561-3573.

BILLINTON, R., KUMAR, S., CHOWDHURY, N., CHU, K., DEBNATH, K., GOEL, L. & OTENG-ADJEI, J. 1989. A reliability test system for educational purposes-basic data. *Power Systems, IEEE Transactions on*, *4*(3), 1238-1244.

BLACKHURST, J., WU, T. & O'GRADY, P. 2005. PCDM: a decision support modeling methodology for supply chain, product and process design decisions. *Journal of Operations Management*, *23*(3), 325-343.

BOLLEN, K.A. 1990. Overall fit in covariance structure models: two types of sample size effects. *Psychological bulletin*, *107*(2), 256.

BOLUMOLE, Y. 2000. SWP 4/00 Supply Chain Management: A review of relevant literature and theory.

BOONYATHAN, P. & POWER, D. 2007. The impact of supply chain uncertainty on business performance and the role of supplier and customer relationships: comparison between product and service organisations. In *DSI Mini Conference on Services Management, Pittsburgh, USA*.

BORCH, O.J. & MADSEN, E.L. 2007. Dynamic capabilities facilitating innovative strategies in SMEs. *International Journal of Techno entrepreneurship*, *1*(1), 109-125.

BRAUNSCHEIDEL, M.J. & SURESH, N.C. 2009. The organisational antecedents of a firm's supply chain agility for risk mitigation and response. *Journal of Operations Management*, *27*(2), 119-140.

BROHMAN, M.K., WATSON, R.T., PICCOLI, G. & PARASURAMA, A. 2003. Data completeness: a key to effective net-based customer service systems. *Communications of the ACM*, *46*(6), 47-51.

BULLINGER, H.J., KÜHNER, M. & VAN HOOF, A. 2002. Analysing supply chain performance using a balanced measurement method. *International Journal of Production Research*, *40*(15), 3533-3543.

BURGESS, K., SINGH, P.J. & KOROGLU, R. 2006. Supply chain management: a structured literature review and implications for future research. *International Journal of Operations & Production Management*, *26*(7), 703-729.

BURNS, W. & GROVE, S.K.E. 2003. *Witch hunts in Europe and America. An Encyclopedia, London*.

BUTCHART, A. 1996. The industrial panopticon: mining and the medical construction of migrant African labour in South Africa, 1900-1950. *Social Science & Medicine*, *42*(2), 185-197.

CACHON, G.P. & FISHER, M. 2000. Supply chain inventory management and the value of shared information. *Management Science*, *46*(8), 1032-1048.

CAI, J., LIU, X., XIAO, Z. & LIU, J. 200. Improving supply chain performance management: A systematic approach to analysing iterative KPI accomplishment. *Decision Support Systems*, *46*(2), 512-521.

CALDWELL, N.D., ROEHRICH, J.K. & DAVIES, A.C. 2009. Procuring complex performance in construction: London Heathrow Terminal 5 and a private finance initiative hospital. *Journal of Purchasing and Supply Management*, *15*(3), 178-186.

CAO, M. & ZHANG, Q. 2011. Supply chain collaboration: Impact on collaborative advantage and firm performance. *Journal of Operations Management*, *29*(3), 163-180.

CAO, M. & ZHANG, Q. 2011. Supply chain collaboration: impact on collaborative advantage and firm performance. *Journal of Operations Management*, *29*(3), 163-180.

CARTER, C.R. & DRESNER, M. 2001. Purchasing's role in environmental management: cross-functional development of grounded theory. *Journal of Supply Chain Management*, *37*(2), 12-27.

CARTER, C.R. & ROGERS, D.S. 2008. A framework of sustainable supply chain management: moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, *38*(5), 360-387.

CASTROGIOVANNI, G.J. 2002. Organisation task environments: Have they changed fundamentally over time? *Journal of Management*, *28*(2), 129-150.

CAVUSGIL, E., SEGGIE, S.H. & TALAY, M.B. 2007. Dynamic capabilities view: Foundations and research agenda. *The Journal of Marketing Theory and Practice*, *15*(2), 159-166.

CHAN, F.T., CHUNG, S.H. & CHOY, K.L. 2006. Optimisation of order fulfillment in distribution network problems. *Journal of Intelligent Manufacturing*, *17*(3), 307-319.

CHANDRA, C., GRABIS, J. & TUMANYAN, A. 2007. Problem taxonomy: a step towards effective information sharing in supply chain management. *International Journal of Production Research*, *45*(11), 2507-2544.

CHEN, F., DREZNER, Z., RYAN, J.K. & SIMCHI-LEVI, D. 1999. The bullwhip effect: managerial insights on the impact of forecasting and information on variability in a supply chain. *Springer US,* 417-439.

CHEN, F., DREZNER, Z., RYAN, J.K. & SIMCHI-LEVI, D. 2000. Quantifying the bullwhip effect in a simple supply chain: the impact of forecasting, lead times, and information. *Management science*, *46*(3), 436-443.

CHEN, I.J. & PAULRAJ, A. 2004. Towards a theory of supply chain management: the constructs and measurements. *Journal of Operations Management*, *22*(2), 119-150.

CHEN, I.J. & POPOVICH, K. 2003. Understanding customer relationship management (CRM) People, process and technology. *Business Process Management Journal*, *9*(5), 672-688.

CHEN, J.V., YEN, D.C., RAJKUMAR, T.M. & TOMOCHKO, N.A. 2011. The antecedent factors on trust and commitment in supply chain relationships. *Computer Standards & Interfaces*, *33*(3), 262-270.

CHEN, L. & LEE, H.L. 2009. Information sharing and order variability control under a generalized demand model. *Management Science*, *55*(5), 781-797.

CHEN, L., OLHAGER, J. & TANG, O. 2014. Manufacturing facility location and sustainability: a literature review and research agenda. *International Journal of Production Economics*, *149*, 154-163.

CHETTAYAR, K. 2002. Using customer information effectively. *Financial Executive*, *18*(3), 42-43.

CHEUNG, C.F., LEE, W.B., WANG, W.M., CHU, K.F. & TO, S. 2003. A multi-perspective knowledge-based system for customer service management. *Expert systems with applications*, *24*(4), 457-470.

CHEUNG, G.W. & RENSVOLD, R.B. 2002. Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, *9*(2), 233-255.

CHEUNG, G.W. & RENSVOLD, R.B. 2002. Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, *9*(2), 233-255.

CHOI, S.Y., LEE, H. & YOO, Y. 2010. The impact of information technology and trans-active memory systems on knowledge sharing, application, and team performance: a field study. *MIS Quarterly*, *34*(4), 855-870.

CHOPRA, S. & MEINDL, P. 2007. *Supply chain management. Strategy, planning & operation*, 265-275.

CHOU, Y.C. & SHAO, B.B. 2014. Total factor productivity growth in information technology services industries: a multi-theoretical perspective. *Decision Support Systems*, *62*, 106-118.

CHRISTENSEN, L.B., JOHNSON, B. & TURNER, L.A. 2011. Research methods, design, and analysis. *Allyn & Bacon,* 1-539.

CHRISTOPHER, M. & HOLWEG, M. 2011. Supply Chain 2.0: managing supply chains in the era of turbulence. *International Journal of Physical Distribution & Logistics Management*, *41*(1), 63-82.

CHRISTOPHER, M. & JÜTTNER, U. 2000. Developing strategic partnerships in the supply chain: a practitioner perspective. *European Journal of Purchasing & Supply Management*, *6*(2), 117-127.

CHRISTOPHER, M. 2000. The agile supply chain: competing in volatile markets. *Industrial marketing management*, *29*(1), 37-44.

CHRISTOPHER, M. & LEE, H. 2004. Mitigating supply chain risk through improved confidence. *International Journal of Physical Distribution & Logistics Management*, *34*(5), 388-396.

CHU, W.H.J. & LEE, C.C. 2006. Strategic information sharing in a supply chain. *European Journal of Operational Research*, *174*(3), 1567-1579.

CHUNG, K.C., PILLSBURY, M.S., WALTERS, M.R. & HAYWARD, R.A. 1998. Reliability and validity testing of the Michigan Hand Outcomes Questionnaire. *The Journal of Hand Surgery*, *23*(4), 575-587.

CHURCHILL, G.A. & IACOBUCCI, D. 2010. Marketing research: methodological foundations.

CLIFFORD DEFEE, C. & FUGATE, B.S. 2010. Changing perspective of capabilities in the dynamic supply chain era. *The International Journal of Logistics Management*, *21*(2), 180-206.

CLOSS, D.J., SPEIER, C. & MEACHAM, N. 2011. Sustainability to support end-to-end value chains: the role of supply chain management. *Journal of the Academy of Marketing Science*, *39*(1), 101-116.

COLICCHIA, C. & STROZZI, F. 2012. Supply chain risk management: a new methodology for a systematic literature review. *Supply Chain Management: An International Journal*, *17*(4), 403-418.

COLLINS, K.M., ONWUEGBUZIE, A.J. & JIAO, Q.G. 2007. A mixed methods investigation of mixed methods sampling designs in social and health science research. *Journal of Mixed Methods Research*, *1*(3), 267-294.

COOPER, M.C. & ELLRAM, L.M. 1993. Characteristics of supply chain management and the implications for purchasing and logistics strategy. *The International Journal of Logistics Management*, *4*(2), 13-24.

COOPER, M.C., LAMBERT, D.M. & PAGH, J.D. 1997. Supply chain management: more than a new name for logistics. *The International Journal Of Logistics Management*, *8*(1), 1-14.

COSTA, A.C. & BIJLSMA-FRANKEMA, K. 2007. Trust and control interrelations new perspectives on the trust-control nexus. *Group & Organisation Management*, *32*(4), 392-406.

CRAIGHEAD, C., BLACKHURST, J., RUNGTSUNATHAM, M.J. & HANDFIELD, R. 2007. The severity of supply chain disruptions: design characteristics and mitigation capabilities. *Decision Sciences,* 38(1), 131-156.

CRESWELL, J. 2009. Research design: qualitative, quantitative, and mixed methods approaches. *SAGE Publications, Incorporated.*

CRIÉ, D. & MICHEAUX, A. 2006. From customer data to value: what is lacking in the information chain? *The Journal of Database Marketing & Customer Strategy Management*, *13*(4), 282-299.

CRONBACH, L.J. & MEEHL, P.E. 1955. Construct validity in psychological tests. *Psychological Bulletin*, *52*(4), 281.

CSIKSZENTMIHALYI, M. & LARSON, R. 1987. Validity and reliability of the experience-sampling method. *The Journal of Nervous And Mental Disease*, *175*(9), 526-536.

CUNNINGHAM, W.A., PREACHER, K.J. & BANAJI, M.R. 2001. Implicit attitude measures: Consistency, stability, and convergent validity. *Psychological Science*, *12*(2), 163-170.

DAS, T.K. & TENG, B.S. 2001. Trust, control, and risk in strategic alliances: an integrated framework. *Organisation Studies*, *22*(2), 251-283.

DATTA, P.P. & CHRISTOPHER, M.G. 2011. Information sharing and coordination mechanisms for managing uncertainty in supply chains: a simulation study. *International Journal of Production Research*, *49*(3), 765-803.

DAUGHERTY, P.J., RICHEY, R.G., ROATH, A.S., MIN, S., CHEN, H., ARNDT, A.D. & GENCHEV, S.E. 2006. Is collaboration paying off for firms? *Business Horisons*, *49*(1), 61-70.

DEARSTYNE, B.W. 2005. Blogs: the new information revolution? *Information Management*, *39*(5), 38.

DEKKER, H.C. 2004. Control of inter-organisational relationships: evidence on appropriation concerns and coordination requirements. *Accounting, Organisations and Society*, *29*(1), 27-49.

DELONE, W.H. & MCLEAN, E.R. 1992. Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60-95.

DELONE, W.H. & MCLEAN, E.R. 2003. The DeLone and McLean model of information systems success: a ten-year update. *Journal of Management Information Systems*, *19*(4), 9-30.

DEO, S. & CORBETT, C.J. 2010. Dynamic allocation of scarce resources under supply uncertainty. *Available at SSRN 1619408*.

DESS, G.G. & DAVIS, P.S. 1984. Porter's (1980) generic strategies as determinants of strategic group membership and organisational performance. *Academy of Management Journal*, *27*(3), 467-488.

DING, H., GUO, B. & LIU, Z. 2011. Information sharing and profit allotment based on supply chain cooperation. *International Journal of Production Economics*, *133*(1), 70-79.

DOU, Y. & SARKIS, J. 2010. A joint location and outsourcing sustainability analysis for a strategic offshoring decision. *International Journal of Production Research*, *48*(2), 567-592.

DROGE, C., JAYARAM, J. & VICKERY, S.K. 2004. The effects of internal versus external integration practices on time-based performance and overall firm performance. *Journal of Operations Management*, *22*(6), 557-573.

DROGE, C., VICKERY, S.K. & JACOBS, M.A. 2012. Does supply chain integration mediate the relationships between product/process strategy and service performance? An empirical study. *International Journal of Production Economics*, *137*(2), 250-262.

DU, T.C., LAI, V.S., CHEUNG, W. & CUI, X. 2012. Willingness to share information in a supply chain: a partnership-data-process perspective. *Information & Management*, *49*(2), 89-98.

DU, T.C., LAI, V.S., CHEUNG, W. & CUI, X. 2012. Willingness to share information in a supply chain: A partnership-data-process perspective. *Information & Management*, *49*(2), 89-98.

DUCKWORTH, A.L. & KERN, M.L. 2011. A meta-analysis of the convergent validity of self-control measures. *Journal of Research in Personality*, *45*(3), 259-268.

DUNCAN, R.B. 1972. Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Science Quarterly*, 313-327.

DUNN, S.C., SEAKER, R.F. & WALLER, M.A. 1994. Latent variables in business logistics research: scale development and validation. *Journal of Business Logistics*, *15*, 145-145.

DYER, J.H. & CHU, W. 2000. The determinants of trust in supplier-automaker relationships in the US, Japan, and Korea. *Journal of International Business Studies*, 259-285.

EASTERBY-SMITH, M., LYLES, M.A. & PETERAF, M.A. 2009. Dynamic capabilities: Current debates and future directions. *British Journal of Management*, *20*(s1), S1-S8.

ELBANNA, S. & CHILD, J. 2007. The Influence of Decision, Environmental and Firm Characteristics on the Rationality of Strategic Decision-Making*. *Journal of Management Studies*, *44*(4), 561-591.

ELMUTI, D. 2002. The perceived impact of supply chain management on organisational effectiveness. *Journal of Supply Chain Management*, *38*(2), 49-57.

ELSENHARDT, K.M. & MARTIN, J.A. 2000. Dynamic capabilities: What are they? *Strategic Management Journal*, *21*(1), 1105-1121.

ENG, T.Y. 2005. The influence of a firm's cross-functional orientation on supply chain performance. *Journal of Supply Chain Management*, *41*(4), 4-16.

ERDEM, T. & KEANE, M.P. (1996). Decision-making under uncertainty: capturing dynamic brand choice processes in turbulent consumer goods markets. *Marketing Science*, *15*(1), 1-20.

ERIK ERIKSSON, P. & LAAN, A. 2007. Procurement effects on trust and control in client-contractor relationships. *Engineering, Construction and Architectural Management*, *14*(4), 387-399.

ESTAMPE, D., LAMOURI, S., PARIS, J.L. & BRAHIM-DJELLOUL, S. 2013. A framework for analysing supply chain performance evaluation models. *International Journal of Production Economics*, *142*(2), 247-258.

EWING, M.T., WINDISCH, L. & NEWTON, F.J. 2010. Corporate reputation in the People's Republic of China: A B2B perspective. *Industrial Marketing Management*, *39*(5), 728-736.

FABBE-COSTES, N. & JAHRE, M. 2007. Supply chain integration improves performance: the Emperor's new suit? *International Journal of Physical Distribution & Logistics Management*, *37*(10), 835-855.

FAWCETT, S.E., MAGNAN, G.M. & MCCARTER, M.W. 2008. Benefits, barriers, and bridges to effective supply chain management. *Supply Chain Management: An International Journal*, *13*(1), 35-48.

FAWCETT, S.E., OSTERHAUS, P., MAGNAN, G.M., BRAU, J.C. & MCCARTER, M.W. 2007. Information sharing and supply chain performance: the role of connectivity and willingness. *Supply Chain Management: An International Journal*, *12*(5), 358-368.

FIALA, P. 2005. Information sharing in supply chains. *Omega*, *33*(5), 419-423.

FLINT, D.J. & GOLICIC, S.L. 2009. Searching for competitive advantage through sustainability: A qualitative study in the New Zealand wine industry. *International Journal of Physical Distribution & Logistics Management*, *39*(10), 841-860.

FLYNN, B.B., HUO, B. & ZHAO, X. 2010. The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of operations management*, *28*(1), 58-71.

FOERSTL, K., REUTER, C., HARTMANN, E. & BLOME, C. 2010. Managing supplier sustainability risks in a dynamically changing environment-Sustainable supplier management in the chemical industry. *Journal of Purchasing and Supply Management*, *16*(2), 118-130.

FORNELL, C. & LARCKER, D. 1981. Structural equation models with unobservable variables and measurement error. *Journal of Marketing Research,* 18(1):39-50.

FORRESTER 1968. Industrial dynamics-a response to Ansoff and Slevin. *Management Science*, 14(9), 601-618.

FORSLUND, H. & JONSSON, P. 2007. The impact of forecast information quality on supply chain performance. *International journal of operations & production management*, *27*(1), 90-107.

FREDERICKS, E. 2005. Infusing flexibility into business-to-business firms: A contingency theory and resource-based view perspective and practical implications. *Industrial Marketing Management*, *34*(6), 555-565.

FYNES, B., DE BURCA, S. & MARSHALL, D. 2004. Environmental uncertainty, supply chain relationship quality and performance. *Journal of Purchasing and Supply Management*, *10*(4), 179-190.

FYNES, B., VOSS, C. & DE BÚRCA, S. 2005. The impact of supply chain relationship quality on quality performance. *International Journal of Production Economics*, *96*(3), 339-354.

GALLEGO, G. & ÖZER, Ö. 2001. Integrating replenishment decisions with advance demand information. *Management Science*, *47*(10), 1344-1360.

GAMBETTA, D. 2000. *Can we trust trust? Trust: Making and breaking cooperative relations*, 213-237.

GANESH, J., ARNOLD, M.J. & REYNOLDS, K.E. 2000. Understanding the customer base of service providers: an examination of the differences between switchers and stayers. *Journal of marketing*, *64*(3), 65-87.

GANESH, M., RAGHUNATHAN, S. & RAJENDRAN, C. 2014. The value of information sharing in a multi-product, multi-level supply chain: Impact of product substitution, demand correlation, and partial information sharing. *Decision Support Systems*, *58*, 79-94.

GANGULY, A., NILCHIANI, R. & FARR, J.V. 2009. Evaluating agility in corporate enterprises. *International Journal of Production Economics*, *118*(2), 410-423.

GARVIN, D.A. 1987. Competing on the 8 dimensions of quality. *Harvard Business Review*, *65*(6), 101-109.

GIBSON, B.J., MENTZER, J.T. & COOK, R.L. 2005. Supply chain management: the pursuit of a consensus definition. *Journal of Business Logistics*, *26*(2), 17-25.

GIUNIPERO, L.C. & BRAND, R.R. 1996. Purchasing's role in supply chain management. *The International Journal of Logistics Management*, *7*(1), 29-38.

GIUNIPERO, L.C. & BREWER, D.J. 1993. Performance based evaluation systems under total quality management. *International Journal of Purchasing and Materials Management*, *29*(4), 35-41.

GLIEM, J.A. & GLIEM, R.R. 2003. Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. *Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education.*

GOLAFSHANI, N. 2003. Understanding reliability and validity in qualitative research. *The Qualitative Report*, *8*(4), 597-607.

GOLDSBY, T.J. & GARCÍA-DASTUGUE, S.J. 2003. The manufacturing flow management process. *The International Journal of Logistics Management*, *14*(2), 33-52.

GRAVETTER, F.J. & FORZANO, L.B. 2012. *Research methods for the behavioral sciences*. Wadsworth, Cengage Learning. International Edition: ISBN-13, 978-1.

GREEN JR, K.W., INMAN, R.A., BROWN, G. & WILLIS, T.H. 2005. Market orientation: relation to structure and performance. *Journal of Business & Industrial Marketing*, *20*(6), 276-284.

GREEN, K.W., WHITTEN, D. & INMAN, R.A. 2012. Aligning marketing strategies throughout the supply chain to enhance performance. *Industrial Marketing Management*, *41*(6), 1008-1018.

GREYSER, S.A. 1999. Advancing and enhancing corporate reputation. *Corporate Communications: An International Journal*, *4*(4), 177-181.

GROVER, V. & MALHOTRA, M.K. 2003. Transaction cost framework in operations and supply chain management research: theory and measurement. *Journal of Operations management*, *21*(4), 457-473.

GUNASEKARAN, A., LAI, K.H. & CHENG, T.E. 2008. Responsive supply chain: a competitive strategy in a networked economy. *Omega*, *36*(4), 549-564.

HAIR, J.F., ANDERSON, R.E, TATHAM, R.L. & BLACK, W.C. 2006. *Multivariate Data Analysis*. 6th ed. London: Prentice-Hall.

HAIR, J.F., BLACK, W.C., BABIN, B.J., ANDERSON, R.E. & TATHAM, R.L. 2006. *Multivariate data analysis* (Vol. 6). Upper Saddle River, NJ: Pearson Prentice Hall.

HAIR, J.F., SARSTEDT, M., RINGLE, C.M. & MENA, J.A. 2012. An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, *40*(3), 414-433.

HALL, J. 2000. Environmental supply chain dynamics. *Journal of cleaner production*, *8*(6), 455-471.

HALLIKAS, J., VIROLAINEN, V.M. & TUOMINEN, M. 2002. Risk analysis and assessment in network environments: a dyadic case study. *International Journal of Production Economics*, *78*(1), 45-55.

HANDFIELD, R.B. & NICHOLS, E.L. 2004. Key issues in global supply base management. *Industrial Marketing Management*, *33*(1), 29-35.

HARIHARAN, R. & ZIPKIN, P. 1995. Customer-order information, lead times, and inventories. *Management Science*, *41*(10), 1599-1607.

HARLAND, C., BRENCHLEY, R. & WALKER, H. 2003. Risk in supply networks. *Journal of Purchasing and Supply Management*, *9*(2), 51-62.

HASSINI, E., SURTI, C. & SEARCY, C. 2012. A literature review and a case study of sustainable supply chains with a focus on metrics. *International Journal of Production Economics*, *140*(1), 69-82.

HE, H. & BARUCH, Y. 2010. Organisational identity and legitimacy under major environmental changes: Tales of two UK building societies. *British Journal of Management*, *21*(1), 44-62.

HELFAT, C.E., FINKELSTEIN, S., MITCHELL, W., PETERAF, M., SINGH, H., TEECE, D. & SIDNEY, G. 2007. *Dynamic capabilities: understanding strategic change in organisations*.

HELM, S. & SALMINEN, R.T. 2010. Basking in reflected glory: Using customer reference relationships to build reputation in industrial markets. *Industrial Marketing Management*, *39*(5), 737-743.

HENSON, R.K. & ROBERTS, J.K. 2006. Use of exploratory factor analysis in published research common errors and some comment on improved practice. *Educational and Psychological Measurement*, *66*(3), 393-416.

HERVANI, A.A., HELMS, M.M. & SARKIS, J. 2005. Performance measurement for green supply chain management. *Benchmarking: An International Journal*, *12*(4), 330-353.

HOEJMOSE, S.U., ROEHRICH, J.K. & GROSVOLD, J. 2014. Is doing more doing better? The relationship between responsible supply chain management and corporate reputation. *Industrial Marketing Management*, *43*(1), 77-90.

HOLDEN, R.R. 2010. Face validity. *Corsini Encyclopedia of Psychology*.

HOLMBERG, S. 2000. A systems perspective on supply chain measurements. *International Journal of Physical Distribution & Logistics Management*, *30*(10), 847-868.

HONG, P., YOUN, S. & NAHM, A. 2008. Supply chain partnerships and supply chain integration: the mediating role of information quality and sharing. *International Journal of Logistics Systems and Management*, *4*(4), 437-456.

HOULIHAN, J.B. 1985. International supply chain management. *International Journal of Physical Distribution & Materials Management*, *15*(1), 22-38.

HOYLE, R.H. 2000. Confirmatory factor analysis. *Handbook of applied multivariate statistics and mathematical modeling*, 465-497.

HU, L.T. & BENTLER, P.M. 1999. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: a Multidisciplinary Journal*, *6*(1), 1-55.

HU, L.T., BENTLER, P.M. & HOYLE, R.H. 1995. Structural equation modeling: Concepts, issues, and applications. *Evaluating model fit*, 76-99.

HUANG, G.Q., LAU, J.S. & MAK, K.L. 2003. The impacts of sharing production information on supply chain dynamics: a review of the literature. *International Journal of Production Research*, *41*(7), 1483-1517.

HUANG, Z. & GANGOPADHYAY, A. 2004. A simulation study of supply chain management to measure the impact of information sharing. *Information Resources Management Journal*, *17*(3), 20.

HUMAN, G. & NAUDÉ, P. 2009. Exploring the relationship between network competence, network capability and firm performance: A resource-based perspective in an emerging economy. *Management Dynamics: Journal of the Southern African Institute for Management Scientists*, *18*(1), 2-14.

IRELAND, R. & BRUCE, R. 2000. CPFR: only the beginning of collaboration. *Supply Chain Management Review*, *4*(4), 80-88.

IYER, K.N., GERMAIN, R. & CLAYCOMB, C. 2009. B2B e-commerce supply chain integration and performance: A contingency fit perspective on the role of environment. *Information & Management*, *46*(6), 313-322.

JARVENPAA, S.L. & SHAW, T.R. 1998. Global virtual teams: integrating models of trust. *Organisational virtualness*, 35-52.

JONES, B., TEMPERLEY, J. & LIMA, A. 2009. Corporate reputation in the era of Web 2.0: the case of Primark. *Journal of Marketing Management*, *25*(9-10), 927-939.

KAHN, B.K., STRONG, D.M. & WANG, R.Y. 2002. Information quality benchmarks: product and service performance. *Communications of the ACM*, *45*(4), 184-192.

KALE, P., SINGH, H. & PERLMUTTER, H. 2000. Learning and protection of proprietary assets in strategic alliances: Building relational capital.

KANDA, A. & DESHMUKH, S.G. 2008. Supply chain coordination: perspectives, empirical studies and research directions. *International journal of production Economics*, *115*(2), 316-335.

KARMARKAR, U.S. & APTE, U.M. 2007. Operations management in the information economy: Information products, processes, and chains. *Journal of Operations Management*, *25*(2), 438-453.

KELLE, P. & AKBULUT, A. 2005. The role of ERP tools in supply chain information sharing, cooperation, and cost optimisation. *International Journal of Production Economics*, *93*, 41-52.

KEMPER, E.A., STRINGFIELD, S. & TEDDLIE, C. 2003. Mixed methods sampling strategies in social science research. *Handbook of mixed methods in social and behavioral research*, 273-296.

KIM, S.W. 2007. Organisational structures and the performance of supply chain management. *International Journal of Production Economics*, *106*(2), 323-345.

KIMBERLIN, C.L. & WINTERSTEIN, A.G. 2008. Validity and reliability of measurement instruments used in research. *American Journal of Health System Pharm*, *65*(23), 2276-84.

KLEIN, R., RAI, A. & STRAUB, D.W. 2007. Competitive and cooperative positioning in supply chain logistics relationships*. *Decision Sciences*, *38*(4), 611-646.

KLEINDORFER, P.R. & SAAD, G.H. 2005. Managing disruption risks in supply chains. *Production and Operations Management*, *14*(1), 53-68.

KLINE, T.J. 2005. *Psychological testing: a practical approach to design and evaluation*. Sage Publications.

KOÇOĞLU, İ., İMAMOĞLU, S.Z., İNCE, H. & KESKIN, H. 2011. The effect of supply chain integration on information sharing: Enhancing the supply chain performance. *Procedia-Social and Behavioral Sciences*, *24*, 1630-1649.

KWON, I.W.G. & SUH, T. 2004. Factors affecting the level of trust and commitment in supply chain relationships. *Journal of Supply Chain Management*, *40*(1), 4-14.

KWON, O., IM, G.P. & LEE, K.C. 2007. MACE-SCM: A multi-agent and case-based reasoning collaboration mechanism for supply chain management under supply and demand uncertainties. *Expert Systems with Applications*, *33*(3), 690-705.

LA LONDE, B.J. & MASTERS, J.M. 1994. Emerging logistics strategies: blueprints for the next century. *International Journal Of Physical Distribution & Logistics Management*, *24*(7), 35-47.

LAAN, A., NOORDERHAVEN, N., VOORDIJK, H. & DEWULF, G. 2011. Building trust in construction partnering projects: An exploratory case-study. *Journal of Purchasing and Supply Management*, *17*(2), 98-108.

LAI, C.S., CHEN, C.S., CHIU, C.J. & PAI, D.C. 2011. The impact of trust on the relationship between inter-organisational collaboration and product innovation performance. *Technology Analysis & Strategic Management*, *23*(1), 65-74.

LAI, K.H., WONG, C.W. & CHENG, T.C.E. 2010. Bundling digitized logistics activities and its performance implications. *Industrial Marketing Management*, *39*(2), 273-286.

LAMBE, C.J., SPEKMAN, R.E. & HUNT, S.D. 2002. Alliance competence, resources, and alliance success: conceptualisation, measurement, and initial test. *Journal of the Academy of Marketing Science*, *30*(2), 141-158.

LAMBERT, D.M. & COOPER, M.C. 2000. Issues in supply chain management. *Industrial Marketing Management*, *29*(1), 65-83.

LAMBERT, D.M. & POHLEN, T.L. 2001. Supply Chain Metrics. *International Journal of Logistics Manag*ement, 12(1), 1-13.

LAMBERT, D.M., COOPER, M.C. & PAGH, J.D. 1998. Supply chain management: implementation issues and research opportunities. *The International Journal of Logistics Management*, *9*(2), 1-20.

LARSON, P.D. & ROGERS, D.S. 1998. Supply chain management: definition, growth and approaches. *Journal of Marketing Theory and Practice*, 1-5.

LASCELLES, D.M. & DALE, B.G. 1989. The buyer-supplier relationship in total quality management. *Journal of Supply Chain Management*, *25*(2), 10.

LAU, E. & ROWLINSON, S. 2009. Interpersonal trust and inter-firm trust in construction projects. *Construction Management and Economics*, *27*(6), 539-554.

LAWSHE, C.H. 1975. A quantitative approach to content validity1. *Personnel Psychology*, *28*(4), 563-575.

LEE, H.L. & WHANG, S. 2000. Information sharing in a supply chain. *International Journal of Manufacturing Technology and Management*, *1*(1), 79-93.

LEE, H.L. 2002. Aligning supply chain strategies with product uncertainties. *California Management Review*, *44*(3), 105-119.

LEE, H.L., PADMANABHAN, V. & WHANG, S. 1997. The bullwhip effect in supply chains1. *Sloan Management Review*, *38*(3), 93-102.

LEE, H.L., PADMANABHAN, V. & WHANG, S. 2004. Information distortion in a supply chain: the bullwhip effect. *Management Science*, *50*(12), 1875-1886.

LEE, H.L., SO, K.C. & TANG, C.S. 2000. The value of information sharing in a two-level supply chain. *Management Science*, *46*(5), 626-643.

LEWIS, M.A. & ROEHRICH, J.K. 2009. Contracts, relationships and integration: towards a model of the procurement of complex performance. *International Journal of Procurement Management*, *2*(2), 125-142.

LI, S. & LIN, B. 2006. Accessing information sharing and information quality in supply chain management. *Decision Support Systems*, *42*(3), 1641-1656.

LI, S., RAGU-NATHAN, B., RAGU-NATHAN, T.S. & RAO, S.S. 2006. The impact of supply chain management practices on competitive advantage and organisational performance. *Omega*, *34*(2), 107-124.

LI, S., RAO, S.S., RAGU-NATHAN, T.S. & RAGU-NATHAN, B. 2005. Development and validation of a measurement instrument for studying supply chain management practices. *Journal of Operations Management*, *23*(6), 618-641.

LIN, F.R., HUANG, S.H. & LIN, S.C. 2002. Effects of information sharing on supply chain performance in electronic commerce. *Engineering Management, IEEE Transactions on*, *49*(3), 258-268.

LIU, S., KASTURIRATNE, D. & MOIZER, J. 2012. A hub-and-spoke model for multi-dimensional integration of green marketing and sustainable supply chain management. *Industrial Marketing Management*, *41*(4), 581-588.

LIU, Y., WU, A.D. & ZUMBO, B.D. 2010. The impact of outliers on Cronbach's coefficient alpha estimate of reliability: Ordinal/rating scale item responses. *Educational and Psychological Measurement*, *70*(1), 5-21.

LOTFI, Z., MUKHTAR, M., SAHRAN, S. & ZADEH, A.T. 2013. Information sharing in supply Chain management. *Procedia Technology*, *11*, 298-304.

LUBATKIN, M.H., SIMSEK, Z., LING, Y. & VEIGA, J.F. 2006. Ambidexterity and performance in small-to medium-sized firms: The pivotal role of top management team behavioral integration. *Journal of Management*, *32*(5), 646-672.

LUMMUS, R.R., KRUMWIEDE, D.W. & VOKURKA, R.J. 2001. The relationship of logistics to supply chain management: developing a common industry definition. *Industrial Management & Data Systems*, *101*(8), 426-432.

LYDALL, M. 2009. Backward linkage development in the South African PGM industry: a case study. *Resources Policy*, *34*(3), 112-120.

MACKENZIE, S.B., PODSAKOFF, P.M. & PODSAKOFF, N.P. 2011. Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques. *MIS quarterly*, *35*(2), 293-334.

MADLBERGER, M. 2010. What drives firms to engage in inter-organisational information sharing in supply chain management? *E-Collaboration Technologies and Organisational Performance: Current and Future Trends: Current and Future Trends*, 101.

MALHOTRA, A., GOSAIN, S. & SAWY, O.A.E. 2005. Absorptive capacity configurations in supply chains: gearing for partner-enabled market knowledge creation. *MIS Quarterly*, 145-187.

MALONE, T.W. & ROCKART, J.F. 1993. How will information technology reshape organisations? Computers as coordination technology. Globalisation, Technology, and Competition: The Fusion of Computers and Telecommunications in the 1990s, *Harvard Business School Press, Boston*, 37-55.

MANSOORI, S., JAMSHIDINAVID, B. & HASHEMI, S.R. 2014. The Impact of Supply Chain Integration on Supply Chain Performance. *Journal of Applied Environmental and Biological Sciences,* 4(3), 229-237.

MANU, E., ANKRAH, N., CHINYIO, E. & PROVERBS, D. 2015. Trust influencing factors in main contractor and subcontractor relationships during projects. *International Journal of Project Management*, *33*(7), 1495-1508.

MANUJ, I. & MENTZER, J.T. 2008. Global supply chain risk management strategies. *International Journal of Physical Distribution & Logistics Management*, *38*(3), 192-223.

MATANDA, M.J. & FREEMAN, S. 2009. Effect of perceived environmental uncertainty on exporter-importer inter-organisational relationships and export performance improvement. *International Business Review*, *18*(1), 89-107.

MAYER, R.C., DAVIS, J.H. & SCHROORMAN, F.D. 2007. An integrative model of organisational trust, Im R.M. Kramer (ed.), *Organisational Trust: A Reader.* Oxford University Press, 82-108.

MCCARTHY, T.M. & GOLICIC, S.L. 2002. Implementing collaborative forecasting to improve supply chain performance. *International Journal of Physical Distribution & Logistics Management*, *32*(6), 431-454.

MCDERMOTT, P., KHALFAN, M. & SWAN, W. 2004. An exploration of the relationship between trust and collaborative working in the construction sector. *Construction Information Quarterly*, *6*(4), 140-146.

MCKNIGHT, D.H. & CHERVANY, N.L. 2006. Reflections on an initial trust-building model. *Handbook of Trust Research*, 29-51.

MEAGHER, R. 2003. Putting "strategic" into information management. *Information Management*, *37*(1), 51.

MENTZER, J.T., DEWITT, W., KEEBLER, J.S., MIN, S., NIX, N.W., SMITH, C.D. & ZACHARIA, Z.G. 2001. Defining supply chain management. *Journal of Business Logistics*, *22*(2), 1-25.

MENTZER, J.T., FOGGIN, J.H. & GOLICIC, S.L. 2000. Collaboration: the enablers, impediments, and benefits. *Supply Chain Management Review*, *4*(4), 52-58.

MENTZER, J.T., STANK, T.P. & ESPER, T.L. 2008. Supply chain management and its relationship to logistics, marketing, production, and operations management. *Journal of Business Logistics*, *29*(1), 31-46.

MERSCHMANN, U. & THONEMANN, U.W. 2011. Supply chain flexibility, uncertainty and firm performance: an empirical analysis of German manufacturing firms. *International Journal of Production Economics*, *130*(1), 43-53.

MILLER, D. & FRIESEN, P.H. 1983. Strategy-making and environment: the third link. *Strategic Management Journal*, *4*(3), 221-235.

MILLER, R.G. 2011. Future oil supply: The changing stance of the International Energy Agency. *Energy Policy*, *39*(3), 1569-1574.

MIN, H. & YU, W.B.V. 2008. Collaborative planning, forecasting and replenishment: demand planning in supply chain management. *International Journal of Information Technology and Management*, *7*(1), 4-20.

MISHRA, A.K. 1996. Organisational responses to crisis, In *Trust in organisations. Frontiers of theory and research*, 261-287.

MITCHELL, V.L. 2006. Knowledge integration and information technology project performance. *Mis Quarterly*, 919-939.

MOBERG, C.R., CUTLER, B.D., GROSS, A. & SPEH, T.W. 2002. Identifying antecedents of information exchange within supply chains. *International Journal of Physical Distribution & Logistics Management*, *32*(9), 755-770.

MOL, M.J. 2003. Purchasing's strategic relevance. *Journal of Purchasing and Supply Management*, *9*(1), 43-50.

MOLLENKOPF, D., RUSSO, I. & FRANKEL, R. 2007. The returns management process in supply chain strategy. *International Journal of Physical Distribution & Logistics Management*, *37*(7), 568-592.

MONCZKA, R.M., HANDFIELD, R.B., GIUNIPERO, L. & PATTERSON, J. 2008. *Purchasing and supply chain management*. Cengage Learning.

MONCZKA, R.M., PETERSEN, K.J., HANDFIELD, R.B. & RAGATZ, G.L. 1998. Success Factors in Strategic Supplier Alliances: The Buying Company Perspective*. *Decision Sciences*, *29*(3), 553-577.

MORASH, E.A. 2001. Supply chain strategies, capabilities, and performance. *Transportation Journal*, 37-54.

MUDULI, K., GOVINDAN, K., BARVE, A. & GENG, Y. 2013. Barriers to green supply chain management in Indian mining industries: a graph theoretic approach. *Journal of Cleaner Production*, *47*, 335-344.

NORRMAN, A. & JANSSON, U. 2004. Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident. *International Journal Of Physical Distribution & Logistics Management*, *34*(5), 434-456.

NOSEK, B.A., GREENWALD, A.G. & BANAJI, M.R. 2005. Understanding and using the Implicit Association Test: II. Method variables and construct validity. *Personality and Social Psychology Bulletin*, *31*(2), 166-180.

NUNES, B.M., ANNANSINGH, F., EAGLESTONE, B. & WAKEFIELD, R. 2006. Knowledge management issues in knowledge-intensive SMEs. *Journal of Documentation*, *62*(1), 101-119.

NUNNALLY, J.C. 1967. *Psychometric Theory*. New York: McGraw-Hill.

NUNNALLY, J.C. & BERNSTEIN, I.H. 1994. The assessment of reliability. *Psychometric Theory*, *3*, 248-292.

NYAGA, G.N., WHIPPLE, J.M. & LYNCH, D.F. 2010. Examining supply chain relationships: do buyer and supplier perspectives on collaborative relationships differ? *Journal of Operations Management*, *28*(2), 101-114.

OKE, A. & GOPALAKRISHAN, M. 2009. Managing disruptions in supply chains: A case study of a retail supply chain. *International Journal of Production Economics,* 118, 168-174.

OLTEAN-DUMBRAVA, C., WATTS, G.R. & MIAH, A.H.S. 2013. "Top-Down-Bottom-Up" Methodology as a Common Approach to Defining Bespoke Sets of Sustainability Assessment Criteria for the Built Environment. *Journal of Management in Engineering*, *30*(1), 19-31.

OVERBY, E., BHARADWAJ, A. & SAMBAMURTHY, V. 2006. Enterprise agility and the enabling role of information technology. *European Journal of Information Systems*, *15*(2), 120-131.

OWEN, N.A., INDERWILDI, O.R. & KING, D.A. 2010. The status of conventional world oil reserves-Hype or cause for concern? *Energy Policy*, *38*(8), 4743-4749.

PALANSKI, M.E., KAHAI, S.S. & YAMMARINO, F.J. 2011. Team virtues and performance: An examination of transparency, behavioral integrity, and trust. *Journal of Business Ethics*, *99*(2), 201-216.

PETERAF, M.A. & BARNEY, J.B. 2003. Unraveling the resource-based tangle. *Managerial and Decision Economics*, *24*(4), 309-323.

PHILLIPS, R. & CALDWELL, C.B. 2005. Value Chain Responsibility: A Farewell to Arm's Length*. *Business and Society Review*, *110*(4), 345-370.

PICCOLI, G. & IVES, B. 2005. Review: IT-dependent strategic initiatives and sustained competitive advantage: a review and synthesis of the literature. *Mis Quarterly*, *29*(4), 747-776.

PIERCY, N.F. & LANE, N. 2009. Corporate social responsibility: impacts on strategic marketing and customer value. *The Marketing Review*, *9*(4), 335-360.

PIKE, G.R. 2006. The convergent and discriminant validity of NSSE scalelet scores. *Journal of College Student Development*, *47*(5), 550-563.

PILBEAM, C., ALVAREZ, G. & WILSON, H. 2012. The governance of supply networks: a systematic literature review. *Supply Chain Management: An International Journal*, *17*(4), 358-376.

POLONSKY, M. & JEVONS, C. 2009. Global branding and strategic CSR: an overview of three types of complexity. *International Marketing Review*, *26*(3), 327-347.

PONTEROTTO, J.G. 2005. Qualitative research in counseling psychology: a primer on research paradigms and philosophy of science. *Journal of Counseling Psychology*, *52*(2), 126.

PORTER, M.E. & KRAMER, M.R. 2006. The link between competitive advantage and corporate social responsibility. *Harvard Business Review*, *84*(12), 78-92.

PREUSS, L. 2009. Addressing sustainable development through public procurement: the case of local government. *Supply Chain Management: An International Journal*, *14*(3), 213-223.

RAGHUNATHAN, S. 2001. Information sharing in a supply chain: A note on its value when demand is non-stationary. *Management Science*, *47*(4), 605-610.

RAINBIRD, M. 2004. Demand and supply chains: the value catalyst. *International Journal of Physical Distribution & Logistics Management*, *34*(3/4), 230-250.

RAJAGURU, R. & MATANDA, J.M. 2009. Influence of inter-organisational integration on business performance: The mediating role of organisational-level supply chain functions. *Journal of Enterprise Information Management*, *22*(4), 456-467.

RAY, G., MUHANNA, W.A. & BARNEY, J.B. 2005. Information technology and the performance of the customer service process: A resource-based analysis. *MIS quarterly*, 625-652.

RICE, J.B. & HOPPE, R.M. 2001. Supply chain vs. Supply chain: The hype and the reality. *Supply Chain Management Review, 5*(5), 46-54.

RIEGE, A.M. 2003. Validity and reliability tests in case study research: a literature review with "hands-on" applications for each research phase. *Qualitative Market Research: an International Journal*, *6*(2), 75-86.

ROEHRICH, J.K. & LEWIS, M.A. 2010. Towards a model of governance in complex (product-service) inter-organisational systems. *Construction Management and Economics*, *28*(11), 1155-1164.

ROGERS, D.S., LAMBERT, D.M. & KNEMEYER, A.M. 2004. The product development and commercialisation process. *The International Journal of Logistics Management*, *15*(1), 43-56.

ROH, J., HONG, P. & MIN, H. 2014. Implementation of a responsive supply chain strategy in global complexity: The case of manufacturing firms. *International Journal of Production Economics*, *147*, 198-210.

ROH, J., HONG, P. & MIN, H. 2014. Implementation of a responsive supply chain strategy in global complexity: The case of manufacturing firms. *International Journal of Production Economics*, *147*, 198-210.

ROSENZWEIG, E.D., ROTH, A.V. & DEAN, J.W. 2003. The influence of an integration strategy on competitive capabilities and business performance: an exploratory study of consumer products manufacturers. *Journal of Operations Management*, *21*(4), 437-456.

ROUSSEAU, D.M., SITKIN, S.B., BURT, R.S. & CAMERER, C. 1998. Not so different after all: A cross-discipline view of trust. *Academy of Management Review*, *23*(3), 393-404.

RUNESON, P. & HÖST, M. 2009. Guidelines for conducting and reporting case study research in software engineering. *Empirical Software Engineering*, *14*(2), 131-164.

SABEL, C.F. 1993. Studied trust: building new forms of cooperation in a volatile economy. *Human Relations*, *46*(9), 1133-1170.

SAHIN, F. & ROBINSON, E.P. 2002. Flow coordination and information sharing in supply chains: review, implications, and directions for future research. *Decision Sciences*, *33*(4), 505-536.

SAHIN, F. & ROBINSON, E.P. 2005. Information sharing and coordination in make-to-order supply chains. *Journal of Operations Management*, *23*(6), 579-598.

SAMBAMURTHY, V., BHARADWAJ, A. & GROVER, V. 2003. Shaping agility through digital options: Reconceptualising the role of information technology in contemporary firms. *MIS quarterly*, 237-263.

SANDELOWSKI, M. 1995. Sample size in qualitative research. *Research in Nursing & Health*, *18*(2), 179-183.

SATORRA, A. & BENTLER, P.M. 2001. A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*, *66*(4), 507-514.

SCHOENHERR, T., TUMMALA, V.R. & HARRISON, T.P. 2008. Assessing supply chain risks with the analytic hierarchy process: Providing decision support for the offshoring decision by a US manufacturing company. *Journal of Purchasing and Supply Management*, *14*(2), 100-111.

SCHREIBER, J.B., NORA, A., STAGE, F.K., BARLOW, E.A. & KING, J. 2006. Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of Educational Research*, *99*(6), 323-338.

SEDDON, P.B. 1997. A re-specification and extension of the DeLone and McLean model of IS success. *Information Systems Research*, *8*(3), 240-253.

SEURING, S. & MÜLLER, M. 2008a. From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, *16*(15), 1699-1710.

SEURING, S. & MÜLLER, M. 2008b. Core issues in sustainable supply chain management-a Delphi study. *Business Strategy and the Environment*, *17*(8), 455-466.

SEZEN, B. 2008. Relative effects of design, integration and information sharing on supply chain performance. *Supply Chain Management: An International Journal*, *13*(3), 233-240.

SHARIFI, H. & ZHANG, Z. 2001. Agile manufacturing in practice-Application of a methodology. *International Journal of Operations & Production Management*, *21*(5/6), 772-794.

SILVERMAN, D. 2011. Interpreting qualitative data: A guide to the principles of qualitative research. *Los Angeles, CA: Sage.*

SIMANGUNSONG, E., HENDRY, L.C. & STEVENSON, M. 2012. Supply-chain uncertainty: a review and theoretical foundation for future research. *International Journal of Production Research*, *50*(16), 4493-4523.

SIMATUPANG, T.M. & SRIDHARAN, R. 2002. The collaborative supply chain. *The International Journal of Logistics Management*, *13*(1), 15-30.

SIMCHI-LEVI, D. & KAMINSKY, P. 2008. Designing and managing the supply chain. In *Concepts, Strategies and Case Studies, 3rd ed.,* Boston, Mass.

SIMPSON, D., POWER, D. & SAMSON, D. 2007. Greening the automotive supply chain: a relationship perspective. *International Journal of Operations & Production Management*, *27*(1), 28-48.

SKIPPER, J.B. & HANNA, J.B. 2009. Minimising supply chain disruption risk through enhanced flexibility. *International Journal of Physical Distribution & Logistics Management*, *39*(5), 404-427.

SODHI, M.S., SON, B.G. & TANG, C.S. 2012. Researchers' perspectives on supply chain risk management. *Production and Operations Management*, *21*(1), 1-13.

SONG, J.S., ZHANG, H., HOU, Y. & WANG, M. 2010. The effect of lead time and demand uncertainties in (r, q) inventory systems. *Operations Research*, *58*(1), 68-80.

SOOSAY, C.A., HYLAND, P.W. & FERRER, M. 2008. Supply chain collaboration: capabilities for continuous innovation. *Supply Chain Management: An International Journal*, *13*(2), 160-169.

SPEKMAN, R.E., KAMAUFF JR, J.W. & MYHR, N. 1998. An empirical investigation into supply chain management: a perspective on partnerships. *International Journal of Physical Distribution & Logistics Management*, *28*(8), 630-650.

SRIRAM, V., KRAPFEL, R. & SPEKMAN, R. 1992. Antecedents to buyer-seller collaboration: An analysis from the buyer's perspective. *Journal of Business Research*, *25*(4), 303-320.

SRIVASTAVA, S.K. 2008. Value recovery network design for product returns. *International Journal of Physical Distribution & Logistics Management*, *38*(4), 311-331.

STEIN, T. & SWEAT, J. 1998. Killer supply chains. *Information Week*, *708*(9), 36-46.

STEVENSON, M. & SPRING, M. 2007. Flexibility from a supply chain perspective: definition and review. *International Journal of Operations & Production Management*, *27*(7), 685-713.

STEVENSON, M. & SPRING, M. 2009. Supply chain flexibility: an inter-firm empirical study. *International Journal of Operations & Production Management*, *29*(9), 946-971.

STOCK, J.R. & BOYER, S.L. 2009. Developing a consensus definition of supply chain management: a qualitative study. *International Journal of Physical Distribution & Logistics Management*, *39*(8), 690-711.

STOCK, J.R., BOYER, S.L. & HARMON, T. 2010. Research opportunities in supply chain management. *Journal of the Academy of Marketing Science*, *38*(1), 32-41.

STVILIA, B., TWIDALE, M.B., SMITH, L.C. & GASSER, L. 2008. Information quality work organisation in Wikipedia. *Journal of the American society for information science and technology*, *59*(6), 983-1001.

SWAFFORD, P.M., GHOSH, S. & MURTHY, N. 2008. Achieving supply chain agility through IT integration and flexibility. *International Journal of Production Economics*, *116*(2), 288-297.

TANG, C. & TOMLIN, B. 2008. The power of flexibility for mitigating supply chain risks. *International Journal of Production Economics*, *116*(1), 12-27.

TANG, O. & MUSA, S.N. 2011. Identifying risk issues and research advancements in supply chain risk management. *International Journal of Production Economics*, *133*(1), 25-34.

TAVAKOL, M. & DENNICK, R. 2011. Making sense of Cronbach's alpha. *International Journal Of Medical Education*, *2*, 53.

TAYLOR, D.H. 2000. Demand amplification: has it got us beat? *International Journal of Physical Distribution & Logistics Management*, *30*(6), 515-533.

TEECE, D.J. 2007. Explicating dynamic capabilities: the nature and micro foundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319-1350.

TEECE, D.J., PISANO, G. & SHUEN, A. 1997. Dynamic capabilities and strategic management.

TERWEE, C.B., BOT, S.D., DE BOER, M.R., VAN DER WINDT, D.A., KNOL, D.L., DEKKER, J. & DE VET, H.C. 2007. Quality criteria were proposed for measurement properties of health status questionnaires. *Journal of Clinical Epidemiology*, *60*(1), 34-42.

TRAAT, I., BONDESSON, L. & MEISTER, K. 2004. Sampling design and sample selection through distribution theory. *Journal of Statistical Planning And Inference*, *123*(2), 395-413.

TURNER, K.L. & MAKHIJA, M.V. 2006. The role of organisational controls in managing knowledge. *Academy of Management Review*, *31*(1), 197-217.

VERBEKE, W., DEJAEGER, K., MARTENS, D., HUR, J. & BAESENS, B. 2012. New insights into churn prediction in the telecommunication sector: A profit driven data mining approach. *European Journal of Operational Research*, *218*(1), 211-229.

VICKERY, S.K., JAYARAM, J., DROGE, C. & CALANTONE, R. 2003. The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships. *Journal of Operations Management*, *21*(5), 523-539.

VIJAYASARATHY, L.R. 2010. Supply integration: an investigation of its multi-dimensionality and relational antecedents. *International Journal of Production Economics*, *124*(2), 489-505.

VOGEL, R. & GÜTTEL, W.H. 2013. The dynamic capability view in strategic management: a bibliometric review. *International Journal of Management Reviews*, *15*(4), 426-446.

VOGT, J.J, PIENAAR, W.J. & DE WIT, P.W.C. 2002, In Business logistics management: Theory and practice, *Cape* Town: Oxford Umiversity Press.

VONDEREMBSE, M.A., UPPAL, M., HUANG, S.H. & DISMUKES, J.P. 2006. Designing supply chains: Towards theory development. *International Journal of Production Economics*, *100*(2), 223-238.

WALTERS, D. & LANCASTER, G. 2000. Implementing value strategy through the value chain. *Management Decision*, *38*(3), 160-178.

WANG, G., HUANG, S.H. & DISMUKES, J.P. 2004. Product-driven supply chain selection using integrated multi-criteria decision-making methodology. *International Journal of Production Economics*, *91*(1), 1-15.

WAZED, M., AHMED, S. & NUKMAN, Y. 2009. Uncertainty factors in real manufacturing environment. *Australian Journal of Basic and Applied Sciences*, *3*(2), 342-351.

WEBER, M., HIETE, M., LAUER, L. & RENTZ, O. 2010. Low cost country sourcing and its effects on the total cost of ownership structure for a medical devices manufacturer. *Journal of Purchasing and Supply Management*, *16*(1), 4-16.

WEELE, A.J. & RAAIJ, E.M. 2014. The future of purchasing and supply management research: About relevance and rigor. *Journal of Supply Chain Management*, *50*(1), 56-72.

WHIPPLE, J.M. & RUSSELL, D. 2007. Building supply chain collaboration: a typology of collaborative approaches. *The International Journal of Logistics Management*, *18*(2), 174-196.

WIECZOREK, E. 2012. Supply Chain Risks. In *Emerging Risks: A Strategic Management Guide*, 141-181.

WILBURN, D.R. & BLEIWAS, D.I. 2004. Platinum-group metals-World supply and demand. In *US geological survey open-file report*, *1224*, 2004-1224.

WILDING, P., KRICKA, L.J., CHENG, J., HVICHIA, G., SHOFFNER, M.A. & FORTINA, P. 1998. Integrated cell isolation and polymerase chain reaction analysis using silicon micro filter chambers. *Analytical Biochemistry*, *257*(2), 95-100.

WILSON, D.T. & VLOSKY, R.P. 1998. Inter-organisational information system technology and buyer-seller relationships. *Journal of Business & Industrial Marketing*, *13*(3), 215-234.

WINSTANLEY, D., CLARK, J. & LEESON, H. 2002. Approaches to child labour in the supply chain. *Business Ethics: A European Review*, *11*(3), 210-223.

WONG, C.Y., BOON-ITT, S. & WONG, C.W. 2011. The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management*, *29*(6), 604-615.

WONG, E.S., THEN, D. & SKITMORE, M. 2000. Antecedents of trust in intra-organisational relationships within three Singapore public sector construction project management agencies. *Construction Management & Economics*, *18*(7), 797-806.

WU, F., YENIYURT, S., KIM, D. & CAVUSGIL, S.T. 2006. The impact of information technology on supply chain capabilities and firm performance: A resource-based view. *Industrial Marketing Management*, *35*(4), 493-504.

WU, L.Y. 2010. Applicability of the resource-based and dynamic-capability views under environmental volatility. *Journal of Business Research*, *63*(1), 27-31.

XU, Y., YEN, D.C., LIN, B. & CHOU, D.C. 2002. Adopting customer relationship management technology. *Industrial Management & Data Systems*, *102*(8), 442-452.

YILDIZ, T. & YERCAN, F. 2011. Logistics systems and optimisation strategies under uncertain operational environment. *International Journal of Decision Sciences, Risk and Management*, *3*(3-4), 327-346.

YIN, R.K. 2013. *Case study research: Design and methods*. Sage publications.

YOUN, S., YANG, M.G.M., HONG, P. & PARK, K. 2013. Strategic supply chain partnership, environmental supply chain management practices, and performance outcomes: an empirical study of Korean firms. *Journal of Cleaner Production*, *56*, 121-130.

YU, Z., YAN, H. & EDWIN CHENG, T.C. 2001. Benefits of information sharing with supply chain partnerships. *Industrial management & Data Systems*, *101*(3), 114-121.

ZAHEER, A., MCEVILY, B. & PERRONE, V. 1998. Does trust matter? Exploring the effects of inter-organisational and interpersonal trust on performance. *Organisation Science*, *9*(2), 141-159.

ZAHEER, A., MCEVILY, B. & PERRONE, V. 1998. Does trust matter? Exploring the effects of inter-organisational and interpersonal trust on performance. *Organisation Science*, *9*(2), 141-159.

ZHAO, X., XIE, J. & ZHANG, W.J. 2002. The impact of information sharing and ordering co-ordination on supply chain performance. *Supply Chain Management: an International Journal*, *7*(1), 24-40.

ZHOU, H. 2003. The role of supply chain processes and information sharing in supply chain management. (Electronic Thesis or Dissertation). Retrieved from https://etd.ohiolink.edu/

ZHOU, H. & BENTON, W.C. 2007. Supply chain practice and information sharing. *Journal of Operations Management*, *25*(6), 1348-1365.

ZHU, Q., CORDEIRO, J. & SARKIS, J. 2013. Institutional pressures, dynamic capabilities and environmental management systems: Investigating the ISO 9000-Environmental management system implementation linkage. *Journal of Environmental Management*, *114*, 232-242.

ZHU, W., GAVIRNENI, S. & KAPUSCINSKI, R. 2009. Periodic flexibility, information sharing, and supply chain performance. *Iie Transactions*, *42*(3), 173-187.

ZSIDISIN, G.A. & RITCHIE, B. 2009. Supply chain risk management-developments, issues and challenges. In Supply Chain Risk. *Springer US,* 1-12.

ZSIDISIN, G.A. 2003. A grounded definition of supply risk. *Journal of Purchasing and Supply Management*, *9*(5), 217-224.

Vaal University of Technology

Supply chain dynamism, information sharing and inter-organisational relationships, and their effect on supply chain performance

The purpose of this study is to investigate the influence of supply chain dynamism, information sharing and inter-organisational relationship, and their effect on supply chain performance. I am therefore, requesting for your assistance to complete the questionnaire below. The research is purely for academic purposes and the information will be kept confidential. It will take you approximately 10 minutes to finish the whole questionnaire.

Researcher: Mashiloane M.W

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SECTION A

GENERAL INFORMATION

This section is asking your organisation's background information. Please indicate your answer by ticking (x) on the appropriate box.

A.1 Please indicate the number of employees in your organisation

20	
21-50	
50 & more	

A.2 Please indicate number of years your organisation has been operating

1-4 years	
5-10 years	
10+ years	

A.3 Please indicate the industry your company is competing in

Manufacturing	
Service	
Mining	

SECTION B

SUPPLY CHAIN DYNAMISM

Below are statements about supply chain dynamism. You can indicate to what extent you agree or disagree with the statements by ticking the corresponding number in the 5 point scale below:

1	2	3	4	5

Strongly disagree	Disagree	Moderately agree	Agree	Strongly agree

Please tick only one for each statement

To what extent do you agree with the following statement?

B1	New products account for a high fraction of total revenue	1	2	3	4	5
B2	Products and services are innovated frequently	1	2	3	4	5
B3	The innovation rate of operating process is high	1	2	3	4	5

SECTION C

INFORMATION SHARING

Below are statements about information sharing, where you are required to indicate the extent to which you agree or disagree with the statement by ticking the appropriate number in the five point scale below:

1	2	3	4	5
Strongly disagree	Disagree	Moderately agree	Agree	Strongly agree

Please tick only one for each statement

To what extent do you agree with the following statement?

C1	We inform our trading partners in advance of changing needs	1	2	3	4	5
C2	Our trading partners share proprietary information with us	1	2	3	4	5
C3	Our trading partners keep us fully informed about issues that affect our business	1	2	3	4	5
C4	Our trading partners share business knowledge of core business with us	1	2	3	4	5
C5	We and our trading partners exchange information that helps establishment of business planning	1	2	3	4	5

C6	We and our trading partners keep each other informed about events or changes that may affect the other partners	1	2	3	4	5

SECTION D

INTER-ORGANISATIONAL RELATIONSHIPS (*TRUST IN TRADING PARTNERS*)

Below are statements about inter-organisational relationships. You may agree or disagree with each statement by ticking the appropriate number provided below:

1	2	3	4	5
Strongly disagree	Disagree	Moderately agree	Agree	Strongly agree

Please tick only one for each statement

To what extent do you agree with the following statement?

D1	Our trading partners have been open and honest in dealing with us	1	2	3	4	5
D2	Our trading partners respect the confidentiality of the information they receive from us	1	2	3	4	5
D3	Our transactions with trading partners do not have to be monitored	1	2	3	4	5

SECTION E

SUPPLY CHAIN PERFORMANCE

Below are statements about supply chain performance. You can indicate to what extent you agree or disagree with the statements by ticking the corresponding number in the 5 point scale below:

1	2	3	4	5

Strongly disagree	Disagree	Moderately agree	Agree	Strongly agree

Please tick only one for each statement

To what extent do you agree with the following statement?

E1	This organisation's primary supply chain has the ability to deliver zero-defects to final customers	1	2	3	4	5
E2	This organisation's primary supply chain has the ability to deliver value-added services to final customers	1	2	3	4	5
E3	This organisation's primary supply chain has the ability to eliminate late, damaged and incomplete orders to final customers	1	2	3	4	5
E4	This organisation's primary supply chain has the ability to quickly respond to & solve problems of the final customers	1	2	3	4	5
E5	This organisation's primary supply chain has the ability to deliver precise quantities	1	2	3	4	5

THANK YOU FOR YOUR TIME!!!!

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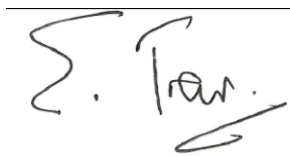Faculty of Management Sciences
Vaal University of Technology
Vanderbijlpark.

24 Novemberer 2015

LANGUAGE EDITING

This is to certify that I language-edited the dissertation "Supply chain dynamism, information sharing and inter-organisational relationships and their effect on supply chain performance" by M. W. Mashiloane for her M Tech degree in Logistics Management.

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