



**POLYTECHNIC OF NAMIBIA
HAROLD PUPKEWITZ GRADUATE SCHOOL OF BUSINESS**

Towards an Integrated Information Communication Technology Framework:

Linking Namibian Rural Based Small and Medium Entreprises to

Global Value Chains

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Thesis presented in partial fulfillment of the requirements of the Master in International
Business Degree in the Harold Pupkewitz Graduate School of Business at the
Polytechnic of Namibia

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February 2014

Declaration of original work

I Colin Moses Nyandoro, declare that this thesis is my own unaided work. Any assistance that I received has been duly acknowledged in the thesis.

It is submitted in partial fulfillment of the requirements of the Master in International Business degree of the Harold Pupkewitz Graduate School of Business of the Polytechnic of Namibia. It has not been submitted before to any other degree or examination at this or any other institution of Higher Learning.

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Dedicated to my supervisor Dr Heike Winschiers-Theophilus

I am what I am because of you

*You were my eyes when I couldn't see
You were my voice when I couldn't speak
You fought for me when no one else could*

Also for

Mimie and Josh my two little angels

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List of Acronyms

3G	Third Generation
4G	Fourth Generation
ADSL	Asymmetric Digital Subscriber Line
B2B	Business to Business
B2C	Business to Consumer
BCS	Basic Communication Service
DWDM	Dense Wavelength Division Multiplexing
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
Gbits	Giga Bits per Second
GIS	Geo Information Systems
GPRS	General Packet Radio Service
GSM	Global System for Mobile
HSDPA	High Speed Downlink Packet Access
ICT	Information Communication Technology
IP	Internet Protocol
IP/MPLS	Multiprotocol Label Switching
IT	Information Technology
LBS	Location Based Service
Mbits	Mega Bits per Second
MTC	Mobile Telecommunications Company
NOC	Network Operations Center
OPGW	Optical Ground Wire
PoP	Point of Presence
SAT-3	South Atlantic 3
SCADA	Supervisory Control and Data Acquisition
SDH	Synchronous Digital Hierarchy
SME	Small and Medium Enterprise
SMS	Simple Message Service
STM-4	Synchronous Transport Module
VSAT	Very Small Aperture Terminal
WACS	West Africa Cable System
WiMAX	Worldwide Interoperability for Microwave Access

Abstract

The globalization of supply chains has increased the complexity of logistics and supply chain management. In today's business world, geographic boundaries have become less relevant and the logistic networks now transcend borders and significantly permeate into other economies. As enterprises worldwide grapple to embrace these changes, Small to Medium Entrepreneurs in marginalized rural communities in Namibia are yet to reap the benefits of the ongoing logistics evolution. Instead they face a number of challenges. Issues such as the digital divide, under-developed market facilities, e.g. storage equipment, and the large distances that have to be travelled to reach economic hubs are just a few examples. Moreover, the skewed income distribution between urban and rural communities and the spatial demographic locations of alternative market segments has restricted rural based Small and Medium Enterprises (SMEs) to being primary service providers to disadvantaged people. This research critically examines the state of logistics in the Namibian rural market. It provides anecdotal illustrations of how existing public and private sector ICT infrastructure may be mobilized and effectively applied to the entire supply chain. It furthermore highlights the importance of IT applications in supply chain management and its impact on profitability to rural based enterprises. Based on this, the research concludes by developing and presenting an integrated ICT framework that promotes the participation of rural SMEs in the robust global supply chains.

General Terms

Management, Measurement, Documentation, Performance, Design, Economics, Reliability, Experimentation, Security, Human Factors, Standardization, Languages, Theory, Legal Aspects, Verification.

Keywords

Infrastructure, ICT, Namibia, Business, Rural area, Industry collaboration, education, framework.

1. Chapter One: Introduction and Overview

1.1 Introduction

Fierce competition; the need to reduce costs; and of late the diversification of consumption patterns have increased the complexity of supply chain management. Although supply chains have been in existence since time immemorial, the impact of globalization on them today, is far greater than it was before. Since the mid-1990's, supply chains have experienced tremendous and rapid changes (Murphy & Wood 2008). Issues such as rising standards of living, multinational trade alliances and the advent of new technology have all contributed to the intricacy of supply chains. In today's business world, geographic boundaries have become less relevant and the logistic networks now transcend borders and significantly permeate into other economies. Consequently, as enterprises worldwide grapple to embrace these changes, focus has been shifted to techniques and management tools that optimize the use of the distribution networks. Contemporary tools currently in use include cloud computing, enterprise resource planning systems, electronic commerce and computer supported collaborative procurement systems.

1.2 The Country in perspective

Namibia covers 825 000 square kilometers (km) and it has one of the lowest population densities in the world, that is approximately 2.5 people per square km. According to the European Union (2010) country report, in 2009 Namibia had a total population of 2.1 million people of which approximately 69% were based in rural areas. Emongor (2008) further explains that due to the semi-arid and fragile agro-ecological conditions, the greater part of the landscape is uninhabited and the rural populations are conspicuously concentrated near perennial rivers which form the country's northern

borders, and around flood plains and sometimes along pipelines and water systems such as the Eastern National Water Carrier, which supplies water to residents in the dry areas in eastern and central Namibia. According to the Ministry of Trade and Industry Report (2010), the country is divided into 13 administrative regions, and the physical infrastructure within the regions is fairly developed. Pricewaterhouse (2011) estimates that 5 450 km of the roads are tarred while 37 000 km are gravel. The railway network covers 2 615 km. A few airports exist mainly in Windhoek and the other major towns, while numerous airstrips are dotted across the country.

1.3 The ICT landscape in Namibia

According to the Telecom report (2012), the country has good ICT infrastructure. The country has a Dense Wavelength Division Multiplexing (DWDM) platform that provides high capacity long distance payload carriage. An Optical Ground Wire (OPGW) fiber cable connects routes between Katima Mulilo and Buitepos. The network backbone supports Asymmetric Digital Subscriber Lines (ADSL), Worldwide Interoperability for Microwave Access (WiMAX) and Very Small Aperture Terminals (VSAT). More recently the country commissioned the Swakopmund Cable System. The cable link is part of the West Africa Cable System (WACS). WACS, is a submarine cable that now connects Namibia to the rest of the world.

From a networking perspective, the country has Multiprotocol Label Switching (IP/MPLS) points-of-presence (PoPs), which were previously the base of the country's Internet Protocol (IP) network. They are now being upgraded from 1Gbps to a 10Gbps platform. According to Sherbourne and Stoke (2010), the country also has infrastructure establishment consisting of modern Global System for Mobile 900/1800 (GSM), General Packet Radio Service (GPRS), and Third Generation (3G) High Speed Downlink Packet Access (HSDPA) telecommunication systems. The urban telecommunication system

and rural communication services are equipped with microwave radio relay links. Connections to other populated places are done using open wire and automated digital network. According to the Telecom Namibia Report (2010) there are over 160,000 fixed telephone lines rationing approximately 10 people per telephone. On the mobile telephone system, Sherbourne and Stoke estimate that there are 1,637,530 active SIM cards in circulation and the mobile cellphone subscriber base is approximately 1.6 million. At the moment Namibia has roaming agreements with 142 countries (Telecom, 2011). Subscribers on both the fixed and mobile network have direct dialing facilities to 240 countries. On the other hand, Mobile Telecommunication Company (MTC) the country's leading mobile phone service provider is currently extending its coverage to include all major roads. At the moment it has 80 base stations set up around the country. These are able to cater for remote areas (e.g. farms) by using an extended cell feature which allows transmission of signals within a 100 km radius of the base station. The internet speeds are relatively fast with a threshold bandwidth of 4-10Mbits per second (Sherbourne & Stoke 2010).

1.4 Logistics and the rural business model

In Namibia, despite the availability of ICT infrastructure, rural based SMEs still employ traditional business models to manage their supply chains (Nyandoro, 2012). For instance according to Mwiringi (2010), the majority of rural based SMEs rely on casual walk-in customers who in most cases have no tangible allegiance to the enterprises. This means the SMEs merely serve a common pool of clients who could be served by anybody at any time. As a result there are no meaningful relationships between the enterprise and the customer. Thus the enterprises do not benefit from issues such as constructive criticism and advice that usually stem from a committed relationship.

From a procurement perspective, most of the SMEs purchasing and information needs are serviced by ubiquitous middle men. As such, and depending on the physical remoteness of the SMEs' location, there could be as many as six intermediaries between the raw material supplier and the rural based SMEs (Belleza, Keeler, & Talvitie, 2003). In essence the function of each intermediary is to facilitate the transportation of raw materials to the SMEs without adding any value to the goods as they move through the value chain. As a result, the procurement costs are amplified at each supply chain node as the goods change hands. According to Mkandawire (2008), this challenge is radically animated by the phenomenon that these middlemen due to their opportunistic attributes, do not offer the SMEs any information or advice on the availability of cheaper alternative procurement sources, nor do they attempt to directly link the SMEs with the raw material suppliers due to the fear of losing business. This trend significantly increases the procurement costs and eventually erodes the SMEs profit margins.

1.5 The role of ICT in supply chain management

In the Namibian context, based on the prevailing ICT infrastructure, Sherbourne and Stoke argue that the current strategic gap in the application of viable rural business systems can be filled by mobilizing the current ICT infrastructure. According to Rohita (2006), the broad strategic aspects which need to be supported by ICT in a rural context are the crashing of lead times, reduction of procurement costs, diminution of turnaround time, improved customer relations, proper inventory management and the removal of middle men. Apart from these strategic aspects, Ajay and Maharaj (2010) also introduce the concept of an emerging ICT enabled information supply chain. They explain that first, by applying ICT in information sharing, compelling customer value propositions can be personalized within the enterprise's product range and thereby increase the SMEs market share. Secondly, by applying ICT in information sharing the various activities in

the supply chain can be properly synchronized thereby allowing vertical linkages between domestic and multinational enterprises.

1.6 Problem statement

Despite the availability of a vast array of ICT enabled supply chain management techniques, Namibian rural based SMEs still employ traditional management paradigms and until today, they have to some extent remained far isolated from the events occurring in global supply chains. According to Emongor (2008), although significant levels of adaptation have been recognized in urban based firms, such success has not been replicated in rural based enterprises. Mkandawire (2008) cites issues such as the digital divide, under-developed market facilities e.g. storage equipment, and the large distances that have to be travelled to reach trade centers as having all contributed to the current deficit in rural supply chains. Moreover the use of ubiquitous middle men as a strategy to mitigate some of these challenges has proved expensive and at times alienated some entrepreneurs from mainstream supply chains.

However, there are several studies that attempt to explain the causes of this problem from a socio-techno point of view. Stork (2010) attributes the problem to the inadequate utilization and coordination of existing ICT infrastructure. Ramsden (2010) associates the problem to the digital divide and argues that the digital divide restricts the SMEs from adapting and implementing modern ICT based applications.

While these different studies seem to give different explanations, a common theme tends to emerge. A significant number of these studies concur that ICT plays a major role in augmenting rural supply chain management. This notion is grounded on the supposition that ICT adaption will result in efficient and effective rural supply chain management. In this regard, Nyandoro (2012) provides an interesting and potentially insightful remark when he highlights that despite the validity of ICT in rural supply chain

management, the actual problem is the absence of an integrated framework that bridges the digital divide in a rural context. At the moment there is no framework that harmonizes existing ICT applications and packages them into a single easy to use model that is applicable to the Namibian rural context.

The purpose of this research, therefore, is to design an integrated ICT framework that will facilitate the participation of rural based SMEs in the robust global supply chains. This research will attempt to solve the current problems by addressing the following research questions

1. How can an integrated ICT framework be used to link rural based SMEs to global value chains?
2. How will an integrated ICT framework be used to manage upstream and downstream activities in rural supply chains?
3. Will the existing ICT infrastructure in Namibia be able to support the framework?
4. How can SMEs apply the framework in their daily operations?

1.7 Aims and Objectives

The main aim of this research is to build an integrated ICT framework that will link Namibian rural based SMEs to global value chains and as such manage upstream and downstream activities in their supply chains.

The following are the sub objectives

1. Explore the current state of supply chains in rural areas in Namibia.
2. Identify the challenges experienced by rural based SMEs in managing supply chains in Namibia.
3. Assess the existing ICT infrastructure and determine whether it will be able to support rural supply chain management.

4. Establish performance indicators that will be used to evaluate the performance of rural based SMEs.
5. Design an integrated ICT framework.

1.8 Benefits of proposed framework

It is envisaged that the integrated ICT framework suggested in this research will unbundle information from the traditional value chain and provide a coherent cooperate strategy, which will manage upstream and downstream relationships within the supply chain. Given today's markets where the proactive role of the customer is gradually changing; the bidirectional features in the framework will enable it to adapt to the environmental dynamics. In essence the framework will be functional in markets characterized by volatile demand and high variety of consumer tastes as well as in markets where demand is predictable and the product variety is low. By systematically adapting to the environment, the framework will enable rural based SMEs to reduce costs appropriately through activities such as strategic sourcing, lean manufacturing (i.e. "doing more with less"), and the use of a just-in-time purchase and supply approach.

From analysis, the underlying logic of the framework conceptualizes products and services as being most valuable when brought to the right production complex at the right time and in the right quantities. This thought process when applied to the status quo results in the fusion of supply chain management with market intelligence. Through this fusion, the SMEs will be able to link existing supply chains with the relevant customer segments and then personalize their value propositions into the product range. Ultimately in so doing, the SMEs will enhance customer satisfaction and subsequently increase the market share. Furthermore, by continuously focusing on efficient supply chain management which tends to be cost oriented, major cost savings accrued from the production cycle will be translated

into greater contribution margins. Notably as the market share increases and the cost structures improve, the profitability of the SMEs will also be greatly enhanced.

Seen from a broader rural economic development perspective, the framework will facilitate the mobilization of existing ICT and logistics infrastructure. Once in operation the framework will coordinate the use of facilities such as airstrips, computer networks, and market infrastructure. As the framework becomes fully functional the training of SMEs in aspects such as ICT will be intensified. Such initiatives will go a long way in trying to mitigate the effects of the existing economic structural barriers such as the digital divide.

From a social perspective, the framework will promote the collaboration of SMEs into strategic alliances such as Group Purchasing Schemes. These alliances will enable SMEs to get greater discounts by buying inputs in bulk. Moreover, such business alliances will give SMEs greater bargaining and negotiating power during transactions. Also by forming alliances, information sharing will be simplified. The traditional barriers that discourage the seamless flow of information such as lack of trust, poor communication infrastructure and information poverty will resultantly be overcome.

1.9 Methodology

In order to investigate the research objectives, several methods were adopted. In this context both quasi and phenomenological approaches were pursued in order to effectively analyze historical and quantitative data. Different tools such as questionnaires, literature reviews, interviews and surveys were employed selectively to achieve each research objective. The target population was sampled from SMEs operating in Erongo, Kavango, Omusati and Kunene regions. A sample of 50 SMEs were randomly selected from these regions and interviewed. Due to the research being

largely qualitative, a thematic approach was adopted. The following seven themes were identified and investigated.

1.9.1 The current state of supply chains in rural areas

In order to get insights into the current state of supply chains in rural areas, a triangulation of three methods was employed. First, a comprehensive literature review was undertaken. The literature review was done so as to probe current and previous research on Namibian rural supply chain management. Secondly, 20 interviews were conducted to a sample of 50 SMEs selected randomly from the four regions. The interviews primarily focused on obtaining firsthand information on how the SMEs managed their supply chains. Thirdly, an observation was done on 10 SMEs selected randomly from the target population. The aim of the observation was to scrutinize how the SMEs managed their supply chains

1.9.2 The challenges experienced by rural based SMEs in managing supply chains

In order to analyze the challenges experienced by the SMEs, face to face interviews and structured questionnaires were used. The face to face interviews were administered to 20 SMEs selected at random from the target population. While the structured questionnaires were dispensed to 50 SMEs also randomly selected from the target population.

1.9.3 Identifying the ICT infrastructure and evaluating its capacity to support rural supply chains

The existing ICT infrastructure was established by means of a systematic review of documented ICT infrastructure reports obtained on the internet mixed with primary and secondary data obtained from the Ministry of Information Communication Technology. Once the infrastructure was identified, a case study

was analyzed so as to determine how other countries that faced similar challenges utilized their infrastructure.

1.9.4 Establishing performance indicators to evaluate the performance of rural based SMEs

A literature review was conducted in order to establish performance indicators. These indicators coupled with feedback obtained during the publication of the thesis were then used as metrics to do a hypothetical evaluation of the integrated framework.

1.9.5 Designing the Integrated ICT framework

The Integrated ICT framework was designed using the findings gathered from the literature review and the results of the research survey.

The table below depicts a pictorial overview of the methodology

Objectives	Methodology
Determine the existing state of supply chains	Questionnaire survey Interviews Observation
Identify challenges in supply chain management	Interviews Questionnaire
Identify the existing ICT infrastructure	ICT Audit Literature review
Identify how the existing infrastructure maybe mobilized to support supply chain management	literature review
Establishing performance indicators	Literature review
Outline a method of integrating ICT in rural supply chains management.	Report writing
Design an integrated ICT framework	Logical reasoning
Evaluate the Framework	Conference feedback

Table 1 Overview of Research Methodology

1.10 Delineation of research

It must be noted that throughout this research, the target population was sampled from four industrial sectors namely small scale mining, the textile industry, carpentry, and agriculture. These four industrial sectors were chosen as the target for empirical

analysis, mainly for three reasons. First, it was identified that these sectors were highly SME-dominated and used traditional business models that were intermediary-oriented. Secondly, there existed a significant amount of historical data about these sectors from various sources. Thirdly, it was noticed that in a Namibian context, these sectors for the past 10 years had grown faster than any other sectors in terms of SME participation and overall contribution to the Gross Domestic Product (World Bank, 2012). Given this scenario, it is therefore important to share concerns over potential complications that could arise in an attempt to generalize the results obtained from this research to all other industrial sectors in Namibia.

1.11 Structure of the Thesis

The thesis follows a six chapter format.

1.11.1 Chapter 1 Introduction

This chapter gives a general overview of the problem area, research questions and an explanation of the significance of the research approach and contributions to the Namibian community. Limitations and assumptions are also provided in this chapter. An overview of the methodology is presented.

1.11.2 Chapter 2 Literature Review

This chapter conducts a comprehensive survey of prior research and outlines recent developments in supply chain management. It analyzes other frameworks that have been developed elsewhere and determines how best such knowledge may be applied in the Namibia context. The chapter concludes by giving performance indicators that are to be used to hypothetically to evaluate the framework.

1.11.3 Chapter 3 Research Methodology

This chapter gives an outline of the research design. It also provides a detailed account of how the research questions were answered and how the hypothesis was tested.

1.11.4 Chapter 4 Results

This chapter presents the findings of the survey. Quantitative data is displayed through graphs and tables. Mathematical techniques are used to analyze the data and draw conclusions. The chapter concludes by evaluating and outlining the limitations of the methods used to collect the data.

1.11.5 Chapter 5 Discussion

This chapter discusses the meaning of the data found in chapter 4. It compares and contrasts the data obtained against the findings of the literature review. It outlines the implication of the data to the Namibian context.

1.11.6 Chapter 6 Conclusion and Recommendations

This chapter summarizes the thesis and highlights the major contributions made by the results. Recommendations are given and the chapter concludes by providing suggestions for further research.

2. Chapter Two: Literature review

2.1 Introduction

This chapter imparts the findings of a literature review conducted in order to acknowledge existing research, work and thoughts of experts within the supply chain field. It begins by briefly examining the supply chain construct and how it has evolved in recent times. The chapter then explores the state of supply chains in Namibian rural areas, together with the various socio-technical paradigms that govern rural business processes. It then proceeds to undertake a comprehensive analysis of the ICT landscape together with an assessment of how ICT could be used to facilitate rural supply chain management. The chapter then shifts focus to examine case studies from countries that once faced similar challenges. It concludes by critically analyzing and drawing key learning points from these case studies.

2.2 Definition of a supply chain

Various definitions of the term supply chain have been offered over the past few decades as the concept has gained widespread recognition. Cox, Tygar, and Sirbu (1995), describe the supply chain as a chain of processes starting from the initial raw materials to the ultimate consumption of the finished product and the functions within and outside a company that enable the chain to avail products and provide services to the customer.

Another source Lummus and Alber (1997) define a supply chain as, the network of entities through which material flows. Those entities may include suppliers, carriers, manufacturing sites, distribution centers, retailers, and customers.

More recently, The Supply Chain Council (2012) used a similar definition but look at supply chain from a logistical perspective. They define a supply chain as a process that encompasses every effort involved in producing and delivering a final product. Four

basic processes namely planning, sourcing, making, and delivering broadly define these efforts.

Kotabe and Mol (2006) define the supply chain as all of those activities associated with moving goods from the raw-materials stage to the end user. This includes sourcing, procurement, production scheduling, order processing, inventory management, transportation, warehousing, and customer service. Importantly this definition also embodies the information systems necessary to monitor all of these activities.

While the term supply chain has been broadly defined, some authors have gone beyond the mere definition and further introduced the concept of supply chain management. Humphrey and Sturgeon (2005) define the management aspect of a supply chain as an integrating philosophy that can be used to administer the total flow of a distribution channel from supplier to consumer. Monczka, Petersen, Handfield, and Ragatz (1998) conceptualize supply chain management as a macro level process that involves tracing back and reconnecting all the processes and activities that are needed to provide the customer with value in a horizontal way. They argue that supply chains, and not firms, should therefore compete and that the strongest competitors are those who are able to effectively manage the reconnection process.

From these definitions and conceptualizations, a common theme tends to emerge. It seems therefore that a supply chain is a neat sequence of value-adding stages, consisting of bi-lateral linkages, reverse loops and two-way communication channels. The value adding stages as such are mainly focused on all the activities involved in delivering a product to the customer. These activities include the sourcing of raw materials, manufacturing, warehousing, inventory tracking, order entry, order

management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities.

Therefore, supply chain management as a technique coordinates and integrates all of these activities into a seamless process. It links all the agents in the chain with external partners such as suppliers, carriers, third-party companies, and information systems providers. A key point in supply chain management as alluded to by Casson (2012) is that the entire process must be viewed as one system. Any inefficiency incurred across the supply chain affects the functionality of the whole system.

2.3 The evolution of supply chain management

Supply chain management has gradually evolved since the early 1960's (Oliver & Webber, 1982). Through its evolution, supply chain management has constantly evoked the need for firms to reflect on how they conduct business and how they perceive various business functions (Ellinger, 2000). Traditionally, enterprises viewed themselves as having two agents' customers and suppliers that were subjected to a pool of competing firms (Vollmann & Raabe, 1995). As such, firms competed aggressively and did not consider the potential for establishing partnerships (Cooper & James, 1997). Resultantly, firms operated in isolation and encapsulated data and information about their suppliers and customers. As such collaboration was perceived to be a non-viable strategic action.

Beginning in the 1960s and early 1970s research such as (Martin & Grbac 1961; Kaldor, 1970) led to a new movement of supply chain management. Firms began to view themselves and rival enterprises as closely linked functions whose joint purpose was to serve their customers. In order to prepare themselves for possible collaboration with competitors, firms began to integrate their internal operations. This internal integration was referred to as materials logistics management or materials management (Cooper & James, 1997). In this structure those internal management functions that were linked

included purchasing, manufacturing, and distribution (Neely, 1998). According to Fisher (1992) the main aim for this internal integration was to improve customer service while lowering transaction and operating costs. Those firms that successfully integrated these functions and collaborated with other competing firms improved in performance (Lee, Padmanabhan, & Whang, 1997). In the 1980s and 1990s more firms began to adopt collaborative supply chain management practices, as it became clear that companies participating in this integration process were able to increase their profit margins (Cross & Lynch, 1988).

2.4 Modern Supply Chain Management

Modern literature on supply chain management (e.g. Flynn, Huo, & Zhao, 2010; Frohlich & Westbrook, 2001; Thun, 2010; Wagner, 2003) suggests that the power of supply chain management nowadays vests in its ability to acknowledge and include customers and competing firms as partners in the value creation process. Other proponents of supply chain management such as Barney (2012), Priem and Swink (2012) highlight that the market arena has ceased to be composed solely of competing firms. They argue that competitive rivalry between individual firms of late has been supplemented by industry collaboration around matters of shared concern. As such, the industry has raised its level of integration and is developing into a knowledge driven cluster (Stallkamp, 2005). As Wen, Li, and Bai (2007) put it, success is now based on a reversal of the traditional business mindset. While competition still counts, collaborative advantages predominate and they have been amplified through linkages with customers (Langabeer & Rose, 2001). Moreover collaboration being a multifaceted construct, has succeeded in bestowing collective efficiencies within supply chain clusters. In essence collaboration with the customer has been found to be decisive in establishing sustained success (Rainbird, 2004).

2.5 The role of customers information integration

According to Wagner (2003), customer information is data that has been analyzed in some manner so that there is insight into the needs of the customer. Casson (2012) gives an abstract analogy and illustrates that in the typical supply chain, the further an agent is from the end of the supply chain continuum, the less understanding the agent has of the needs of the customer. This increases the supply chain agent's indecision and obscures the demand forecasting process. Neureuther, (2009) highlights that firms respond to such indecision differently. Some firms may increase inventory while others may increase lead times. Either feat diminishes their capacity to respond to their customers (Ajmera & Cook, 2009). By improving the information flow in the supply chain, firms have less uncertainty to resolve during the planning process. This allows the firms to reduce waste costs.

2.6 The modern role of customers

Cognitive literature such as Holweg, Disney, Holmstrom, & Smaros (2005), suggest that integrating the customer into the management of the supply chain has several advantages. Today, due to multinational trade alliances and the rise in living standards, the value orientation is more prevalent than ever before. Success is now strongly correlated to customer value-creating processes (Wiengarten, Humphreys, Cao, Fynes, & McKittrick, 2010; Carter & Rogers 2008). In markets with dwindling lifecycles that are characterized by a transfer of power from the supplier to the customer, the knowledgeable customers prescribe what they want, where and why (Tai, Ho, & Wu, 2010). According to Sanders (2008), the value of products or services is determined by the customer using them. He argues that in using the products or services, the customer proactively completes the value chain cycle i.e. the final value creating process. In this logic, the firm can only make value propositions, but the customer must determine value, and participate in creating it. Two earlier theoretical foundations, the customer value

theory of the firm (Slater, 1997), and the customer value theory (Woodruff, 1997) have been used to emphasize the importance of a customer centric value creation mechanism. According to these two theories, companies must understand the dynamics in which customers perceive value and then produce products and services using these customer value propositions.

2.7 Interest in supply chains

Why has managing the supply chain become an important concept since the 1990s? According to supply chain literature such as Croxton, Garcia-Dastugue, Lambert, and Rogers (2001); Stock et al. (2010); Mentzer (2004); Lambert (2008), the answer could stem from the fact that only a few companies continue to be vertically integrated. Companies are gradually drifting away from the concept of owning their supply sources and are becoming more specialized (Gelderman, 1989; Burgess, Sigh, & Koroglu, 2006). Lavie (2006) emphasizes the point that organizations have become conscious of the fact that whenever a company collaborates with another company that performs the next activity of the supply chain both stand to benefit from the transaction.

Another reason vests in what Wang, Tai, and Wei (2006) term the increase in regional and international competition. Customers now have multiple sources from which to choose from. According to Neureuther (2009), companies previously mitigated this multiple choice phenomenon by maintaining inventory at various nodes throughout the chain. However nowadays, Tummala, Rao, Phillips, & Johnson (2006) argue that the dexterity of the business environment makes holding inventory risky and unprofitable. Consumer behavior and purchasing trends are constantly changing, and competitors are continually improving, adding and deleting products (Lee, Padmanabhan, & Whang, 1997). Such fluctuations in supply and demand therefore make it difficult for companies to have the correct inventory levels. The cost of holding any inventory on the other hand

also has a significant impact on the pricing policy. This means that companies who are unable to manage their inventory cannot provide a low cost product.

Synthesizing the literature reviewed so far, one can conclude that successful firms work together to make the whole supply chain competitive. They have the facts about the market, they know a lot about competition, and they coordinate their activities with those of their trading partners. They use technology to gather information on market demands and exchange information between organizations so as to reduce inventory. Nowadays furthermore it seems that the ability to fuse digital integration with the other agents of the supply chain is of paramount importance.

2.8 The role of digital integration

The term digital highlights that the supply chain processes are connected by information technology applications (Giannakis, Davis-Sramek, Lonial, & Raju, 2011). Information technology is thus a catalyst of the integration process. The role of information systems in supply chain management integration is widely acknowledged (Gunasekaran & Ngai, 2005). Supply chain management ICT applications typically have a number of functions, among them a forecasting functionality, tools to analyze and compute operational costs as well as collaboration applications to connect parties in the supply chain (Chen & Su, 2011). These components aim to increase the flow of information and thereby improve collaboration throughout the supply chain (Barney, 2012). Without the ability to compute and accurately forecast on aspects like demand and supply in real time, the supply chain will depend on inventory and resultantly increase waste costs (Rabinovich, 2007).

In summary having looked at the various literatures surrounding supply chains in general, focus will now be shifted to supply chains in Namibian rural areas.

2.9 Supply chains in selected sectors

Literature on Namibian rural supply chains such as Hansholm (2006), indicate that rural supply chain processes such as procurement, manufacturing, storage, transportation, and distribution are fragmented and not well coordinated. As a result the pricing policies adopted in rural firms largely differ from those found in urban areas. The First Capital Food Index (2010) demonstrates such price disparities between urban retail outlets and rural based retail outlets in the food sector. (See table 2).

Good	Description	Average Urban Outlet	Average Rural Outlet
		Jan 2010	Jan 2010
Meat/kg	Pork/Beef	38.65	59.99
Mealie-Meal	12.5kg (Top Score)	81.99	83.99
Milk	Farm Fresh (1L)	12.74	14.99
Cooking Oil	(750ml)	12.74	14.49
Tea	Five Roses (250g)	23.89	33.89
Rice	Tastic (2kg)	38.50	48.50
Sugar	Brown (1kg)	9.98	15.60
Washing Powder	Surf (2kg)	38.50	44.90

Table 2 Price Analysis Urban vs. Rural firms *Adapted from First Capital Food Price Index (2010)*

The comparative analysis above shows that in the food industry, commodities on average are more expensive in rural based retail outlets. Hansholm attributes this to process fragmentation and poor linkage to cheaper procurement sources. As a result, the procurement requirements for the SMEs are serviced by ubiquitous middle men who provide the link to value chains that are out of reach of the rural SMEs.

Meanwhile looking at other rural sectors in general, a submission by Merz, C., Friedland, C., de Louw, R., Dorflinger, J., Maritz, J., van Rensburg (2007), highlights that almost across all the other industrial sectors, rural based SMEs purchase stock in small quantities and in exceptionally quick cycles so as to meet the high demand. Yet the market conditions require that they buy stock in larger volumes and minimize the procurement cycles so as to reduce transaction costs i.e. transport and effort. As a consequence of this business model, the World Bank (2010) country report indicates that the SMEs suffer from a) low financial liquidity resulting from distorted cost structures, b) lack of creditworthiness resulting from high insolvency risk, c) poor information on issues such as demand and international trends resulting from the opportunistic behavior of the ubiquitous middle men. Hansholm (2006) points out that during the majority of the transactions the SMEs contribution margins are narrowed when the overheads emanating from inefficient procurement systems are factored into costs. In a nutshell, following Hansholm's observation, one can conclude that the high prices witnessed in rural retail outlets are in actual fact a hallmark of an inherent logistical deficit in rural supply chain management.

While the review above has focused on Namibian rural supply chains in general, the next section critically investigates the state of supply chains in specific rural industrial sectors. Due to time constraints, only four key sectors were investigated. This thesis envisaged the four key sectors to be the textile industry, agriculture, mining, and carpentry. These four industrial sectors were considered to be the key sectors mainly for three reasons. First, it was identified that these sectors were highly SME-dominated and used traditional business models that were intermediary-oriented (Stork, 2010; World Bank, 2012; Ramsden, 2010). Secondly, there was access to a significant amount of historical data about these sectors from various sources (Ministry of Trade and Industry, 2012; World Economic Forum, 2012; World Bank, 2012; Bank of Namibia, 2012). Third,

in a Namibian context these sectors for the past 10 years had grown faster than any other sectors in terms of SME participation and overall contribution to the Gross Domestic Product (Ministry of Trade and Industry, 2012; World Economic Forum, 2012; World Bank 2012).

2.9.1 Textile

In the textile sector Belleza, Keeler, and Talvitie (2003), observed that the majority of SMEs were conspicuously scattered throughout rural areas and often worked alone or in small family units. Given this scenario and the demographic location of raw material suppliers, the study revealed that depending on the physical remoteness of the SMEs location, there could be as many as six intermediaries between the raw material supplier and the rural based SMEs. In essence, the function of each intermediary was to facilitate the transportation of raw materials to the SMEs without adding any value to the goods as they moved through the value chain. As a result the procurement costs were amplified at each supply chain node as the goods changed hands. According to Mkandawire (2008), this challenge was radically animated by the phenomenon that these middle men due to their opportunistic attributes, did not offer the SMEs any information or advice on the availability of cheaper alternative procurement sources, nor did they attempt to directly link the SMEs with the raw material suppliers. This trend, significantly eroded the SMEs profit margins to such an extent that it consequently degraded textile work and embroidery craft to an auxiliary source of family income for most rural based SMEs in this trade. To make matters worse, the World Bank (2010) also observed that a majority of the entrepreneurs in this sector were women whose business operations were strongly linked to their traditional livelihoods. As a result, from a cultural context, they found it difficult to diversify operations beyond their home regions.

To sum up Cockroft (2003) unveiled that in the textile industry a significant proportion of the problem was detected mostly by the dynamics of logistics and supply chain management. In view of this, his findings suggest that the success of these isolated SMEs was thus strongly correlated to their ability to manage upstream activities in their supply chains. Hence supply chain management and market intelligence skills invariably became normative benchmarks against which the success of these SMEs could be evaluated. Cocroft's study notably concludes by highlighting that despite most of the SMEs being in possession of the relevant skills essential to produce competitive artifacts, such skills in the end were not fully exploited due to their inability to manage activities and bottlenecks within their supply chains.

2.9.2 Agriculture

In analyzing the state of supply chains in agriculture Emongor (2008) revealed that, while farmers in the northern region were engaged in mixed farming activities, and produced field crops such as mahangu (millet), maize, sorghum and horticulture crops, they were forced to sell their surplus products to their immediate communities at very low prices. This was mainly due poor supply chain linkages and a lack of immediate markets for fresh farm produce. According to LRRRI (2004), even though other markets elsewhere could offer better prices, high transaction costs (i.e. cost of transportation of produce from production to consumption areas and the preservation requirements for perishable products) discouraged farmers from participating in these inter regional supply chains. According to Stork (2010), further augmenting this problem was the fact that the SMEs were poorly linked to markets and other supply chain agents and they overly lacked knowledge about alternative market segments for their products. As a result, they eventually produced in the hope that their products would sell. Thus harvesting would first take place, and then a frantic search for the market would follow.

In another similar study on the beef supply chain, Emongor discovered that rural based SMEs seldom sold their livestock. These infrequent sales were largely influenced by the imbalance between supply and demand. On the market there was a vast amount of cattle meaning supply was high while at macro level the country's small population meant demand was low. In the end, these conflicting forces of supply and demand culminated in a producer-surplus which significantly lowered the equilibrium price. To further compound to this problem, Emongor also discovered that due to some misconstrued commercial notions in communal areas, animals and livestock were generally considered to be symbols of social and political prestige. In this context, the wealth of a farmer was measured in terms of the number of livestock and not the amount of money the farmer could obtain when disposing the livestock. As a result by comparing and contrasting the equilibrium price per beast, against the socio-cultural roles of livestock such as cattle, the SMEs were in a dilemma. Thus in the end they did not optimize the potential cash flows that could be realized over the lifespan of the animals.

2.9.3 Mining

In the mining sector, a World Bank (2010) report highlighted that most small scale miners' sales were principally based on a narrow product range consisting mainly of unprocessed raw materials. These raw materials were susceptible to erratic price swings on both the local and international market, thus making the operating environment dynamic and unpredictable. Such dexterity in the sector had an inhibiting effect rather than a catalytic one. To most SMEs, this dexterousness ushered in pitfalls and challenges that made it difficult to manage and project key cross functional processes such as production, marketing, sales, and distribution.

On a different front a study by Mkandawire (2008) observed that small scale miners especially those dealing with gemstones often sold their stones at very low producer prices. According to this study, these low prices were strongly correlated to a

variety of factors such as mediocre pricing policies, inaccurate demand forecasts, and imprecise knowledge on contemporary buying trends. In an era of transient management themes, these factors eventually became autonomous variables that affected the elasticity of demand. Thus despite the price of the minerals being attractive, the volume of customers trading with SMEs was astoundingly small (World Bank, 2010). The resultant operating environment thus left SMEs immensely vulnerable. To this end, the low customer densities coupled with financial instability meant that during transactions, SMEs were under pressure to sell their stones and offset operating costs. As such customers were the main drivers of the price while SMEs were passive price takers (EU report, 2011). On the other hand, the security costs and logistical complexities involved in transporting the stones discouraged SMEs from selling their products in other markets.

In a different context, Ramsden (2010) argued that further buttressing the vulnerabilities of SMEs in this sector, was the fact that with developing global trends, buyers now preferred a significant degree of supplier diversity in their buying portfolios. Unlike in the past they no longer wanted to be overly dependent on one source. Hence by failing to produce a diversified range of products and more so by being unable to orchestrate various cross functional processes in their supply chains, the SMEs in the end produced a narrow product range and thus missed the opportunity to increase their market share.

2.9.4 Carpentry

In the carpentry sector existing interrelated literature streams such as Biggs, Miller, Otto, and Tyle (2010); and Mukandawire (2008), suggest that small to medium entrepreneurs face relatively high production costs as a result of small volume production. In this regard the industry does not take advantage of economies of scale, nor does it exploit the enhanced capitalization that come with increased supply chain

linkages. In an endeavor to trace and establish the cause of this scenario Biggs, Miller, Otto, and Tyle (2010) identified that for most handicrafts producers in Namibia, the investment costs of setting up a new factory were enormous and prohibitive. While on the other hand the World Bank (2010) report, argued along similar lines and highlighted that the coordination of small handicraft producers to supply as a group was complicated especially when considering the stringent quality requirements of large scale commercial companies who buy in bulk. In the final analysis after opting to supply as a group, the challenge was that each of these small scale enterprises produced different items in terms of quality and product specifications. This brought about additional overheads as far as conformity monitoring and quality assurance was concerned.

From a different front Mkandawire (2008) observed that the carpentry sector as a whole was plagued by huge lead times and possible shortages of raw materials as most of the inputs were procured from other regions. Furthermore, he noted that this sector was also heavily dependent on tourism and in recent times the international customers were showing growing concern on issues such as environmental conservation. Thus initiatives and programs to conserve the ecosystems were now part of the marketing mix. The absence of such programs within the SMEs marketing portfolios, mainly due lack of information greatly disadvantaged entrepreneurs in this industry.

2.10 The challenges of managing supply chains

It is easy to infer from the discussion so far that transactions costs in rural areas are high due to aspects such as a non-conducive business environment, low population density, and uncoordinated infrastructure. Other underlying constraints include lack of information on variables such as prices, competitors, and consumer preferences. On a different note, judging from the findings in some supply chain literature, for example Emongor (2008), it appears as if relations between agents in rural supply chains are significantly asymmetric, leading for example to considerable dependence of small producers on

intermediaries and local traders. All in all such issues seem to weaken competition and to make matters worse, policies at macro level generally tend to protect consumers, and not producers. As a result the status quo coupled with consumer centric policy formulations, results in operational bottlenecks.

From a demographic front, the rural to urban migration cited in supply chain literature such as the Ministry of Trade and Industry Report (2010), implies that a significant number of large corporates are concentrated in urban areas, and only a few operate in rural areas. This creates a situation whereby the few corporate buyers in rural areas have command over prices and other delivery modalities, which typically exerts downward pressure on the price of the rural product. The end result is that high value added activities and decision making power in value chains tend to occur outside rural area domains.

In order to vividly describe this situation, Vorley, Ferris, Seville, and Lundy (2009) provide a kaleidoscopic view of the rural business scene. They visualize on one hand an environment which is characterized by numerous and widely dispersed producers, who serve a common pool of customers, have diversified livelihoods, operate in the informal sector, have low access to services such as finance, information and ICT infrastructure, and on the other hand a downstream industry that operates in a concentrated formal economy, with large-scale standardized procedures which are highly risk averse. According to Vorley et al.'s conceptual view, a thick layer of ubiquitous middle men then interfaces the two environments. In this analogy the thick interface acts as a semi permeable membrane that allows diffusion between the two industrial sectors without any value creation mechanism.

It is clear whichever way one looks at it that Vorley et al.'s highly abstract but encompassing description not only provides an important conceptual archetype, but it

also introduces a useful mnemonic that can be employed to analyze the dynamics of the rural business environment.

In synthesizing the various submissions above and also taking into consideration Vorley et al.'s conceptual view, one can therefore argue that the present set of challenges experienced by rural based SMEs in Namibia can be solved by applying ICT in rural supply chain management. In this regard ICT will provide a more efficient link between the upstream and downstream agents of rural supply chains. In light of this, the next section will review literature on the ICT landscape in Namibia and also undertake a comprehensive analysis of how ICT may be integrated into rural supply chain management.

2.11 The ICT landscape in Namibia

Namibia has good ICT infrastructure establishments. According to the Telecom Report (2012), the country has an Optical Ground Wire (OPGW) fiber cable that is managed by Nampower. This wire provides long distance fiber cable capacities to various routes. At the moment the 8 000km OPGW cable runs from Katima Mulilo to Buitepos via Grootfontein, Otjiwarongo, Windhoek, and Swakopmund. Plans are underway to extend it to other areas in the south of the country. As part of the network upgrade, a Dense Wavelength Division Multiplexing (DWDM) platform was deployed to provide high capacity long distance payload carriage.

Several other developments are underway. During 2011, Telecom the country's main telecommunications provider, expanded and upgraded its Internet Protocol (IP) backbone network with solid and state-of-the-art infrastructure. It is hoped that with this great IP backbone in place, the continuous roll-out of broadband access networks (ADSL, WiMAX and VSAT) will focus on connecting customers and homes to faster global network services (Telecom Report, 2012).

Another milestone involved the commissioning of the Swakopmund Cable System in June 2012, was undoubtedly the biggest achievement in the country's ICT in a couple of years. The cable link is part of the West Africa Cable System (WACS) which landed on the Namibian shores on 8 February 2011 (Telecom Report, 2012). With WACS, Namibia will now be directly connected by a submarine cable to the world for the first time. Another development involves the acquisition of a virtual point-of-presence (PoP) link, equipped with the SDH cross-connect protocol. This acquisition was established in partnership with Jasco and Newtelco, and offers two additional IP circuits of STM-4 capacity. This new link caters for IP Internet traffic and makes it possible for the introduction of a high speed broadband link (Telecom Report, 2012).

From a housekeeping perspective the existing IP/MPLS points-of-presence (PoPs), which were the base of the country's IP network, are being upgraded from 1Gbps to a 10Gbps platform. This is being done mainly to satisfy the growing demand for larger bandwidth on the national network and also to match to the upgraded 10Gbps DWDM transport network. These new PoPs will be established in Swakopmund, Otjiwarongo, Grootfontein, Gobabis and Aus by early 2014. It must be pointed out that with this state-of-the-art and powerful transport network, Namibia will be connected to two other major submarine fibre cable routes, namely SEACOM, and SAT-3. It is anticipated that these connections will strengthen global connectivity and maximize the use of spare capacity (Telecom Report, 2012).

2.11.1 Access network

In terms of access network, a total of 166 DSLAMs are in service with a total port capacity of about 33,000. During the year 2012, nine new WiMAX stations were commissioned, while 10 stations were in the rollout phase and the exercise was expected to be completed by the end 2013 and early 2014. In addition to ADSL and WiMAX, 466 VSAT terminals were commissioned mainly in Swakopmund and Windhoek, while the rest were strategically deployed to key areas countrywide. Some of these key areas include Swakopmund, Khorixas, Otjiwarongo, Grootfontein Katima Mulilo, Buitepos, and Gobabis (Telecom Report, 2012).

2.11.2 SCADA

From a risk management perspective, the country has a Supervisory Control and Data Acquisition (SCADA) platform. The SCADA system collects and transmits domestic alarms from remote telecommunication sites for possible response and restoration. The current system was built in two phases during 2012. In the first phase 142 sites countrywide were equipped with the new SCADA system and connected to the Network Operations Centre (NOC). In the subsequent phase 114 other sites were equipped with SCADA (Telecom Report, 2013).

2.11.3 Mobile phone

On the mobile phone services, MTC claims to cover 98% of Namibia's population with more than 650 base stations (MTC, 2011). Telecom Namibia asserts that it has 178 towers, nearly as many as LEO, which has about 200 base stations. With regards to customer base, MTC announced in its latest annual report MTC (2011a) that it had 1.5 million subscribers. At that point LEO and Telecom did not disclose subscriber figures but Leo stated that it had a 15% market share a figure that would translate to 225 000 customers. These figures suggest a cellphone penetration rate of nearly 100%.

2.11.4 Mobile Internet

Mobile internet usage is popular in Namibia and is on its way to becoming the dominant form of accessing the internet. Ninety two percent of mobile owners use their phones to access the internet. MTC claims to have 250 000 mobile subscribers that access the internet. Interestingly 98.9% of the rural population has access to a mobile phone, either by means of owning or by means of sharing. Of this rural population about 11% have access to a mobile handset that is capable of browsing the internet (MTC Report, 2011a).

2.11.5 Digital literacy

Traditionally, computer literacy means the ability to use a computer and its associated applications (Beyers & Koorbanally, 2009). However, the revolution in communications media in the past two decades has resulted in the entire world gradually moving towards digital communication through applications or gadgets such as mobile phones, computers, emails, internet, radio, television, tablets, touch screens, text messages, and voice calls. In this context, digital literacy would then provide a more encompassing term by which the usage of such media could be referenced. By that measure, 98% of Namibia's urban population would be said to be digitally literate (Stork, 2009), while 96% of the rural population would be referred to as being digitally literate (ITU 2009a). According to NCC (2011), if one was to look at functional literacy i.e. one that extends beyond the ability of rudimentary usage e.g. mere reading and then focus more on the ability to locate, organize, understand, evaluate, and analyze information in mainstream activities such as business processes, then only 40% the population would be functionally literate. Interestingly in a related study Stork (2009) estimated that 26% of the rural population had access to a computer either by means of owning or sharing, while 99% had access to a radio or television and 98% had access to a cellphone.

2.12 The role of ICT in supply chain management

Several studies such as Rohita (2006), suggest that ICT can be used to solve many rural supply-chain problems associated with ordering, invoicing, payment, logistics, storage, and transport. Ajay and Maharaj (2010) further highlight that ICT applications, guided by business logic, can foster SMEs' inclusion in supply chains by making a variety of interventions. These interventions include the reduction of procurement costs, the increase in transparency and decision making, the reduction of transaction costs, and the increase in accuracy when it comes to demand forecasts. In

Namibia such interventions have been mainly driven by the private sector and as such large organizations have ICT applications that manage their supply chain activities. However the lack of context-appropriate software, the prohibitive cost of hardware, and the lack of coordination of supporting infrastructure has excluded rural based SMEs from global value chains.

2.12.1 Key ICT Enablers

While ICTs may create opportunities to incorporate rural SMEs more effectively into global supply chains, impact will be limited without the requisite supporting infrastructure, policy, and a culture of collaboration. The next few paragraphs describe the key ICT enabling factors associated with using ICT to manage supply chains and integrate rural SMEs.

Infrastructure coordination is particularly critical for ICTs, which often require reliable electrical power and telecommunications networks. The presence of complementary infrastructure such as roads, storage facilities, transportation, and financial infrastructure, among others also has much to do with the success of ICT interventions. According to Rohita (2009), commercial value chains prosper in an enabling business environment. As such policies that incubate such an environment are vital to the effectiveness of ICT applications in supply chains.

In other studies public-private partnerships have proven critical in developing ICT applications targeted toward smallholder inclusion (Cunningham & Herselman, 2009). Public organizations lack the technical capacity, and may not have sufficient incentive to reach out to SMEs, and technology companies are reluctant to absorb the risk of producing products unless they are assured of markets. An important role of the public

sector might be to incentivize SMEs inclusion and provide guidance on technologies that can be used.

In conclusion one can argue that in Namibia given the penetration of mobile phones, interventions that focus on the use of applications that run on mobile phones or other low-cost ICT devices, could result in the inclusion of rural based SMEs on mainstream supply chains.

However before ICT may be introduced in rural supply chain management, it is imperative to temporarily shift attention to places that once had similar challenges and then review how they dealt with them.

2.13 A Case study to learn from: The Sekhukhune Rural Living Lab

The paragraphs below provide synoptic narrations of how South Africa, a country that once had similar challenges addressed them. In this view apart from merely highlighting the prevalence of the problem, the case study below provides some enlightening insights into how Namibia may best resolve its current rural logistic challenges. In order to limit the discussion, the thesis will arbitrary review and extract key learning points from experiences encountered in the Sekhukhune Rural Living Lab in South Africa.

2.13.1.1 Background

The Sekhukhune Rural Living Lab was launched in 2006 under the auspices of SAP research (Cunningham and Herselman, 2012). Being part of the ambitious Lisbon agenda, its main aim was to provide incubator services which would foster entrepreneurship and enhance retail supply chain management in rural areas and remote regions in the Limpopo Province (Merz et al., 2009). Prior to the launch of this pilot project, a study by De Louw and Dörflinger (2009) revealed that in South Africa, as

in most emerging economies, rural based SMEs experienced challenges mainly related to lack of adequate infrastructure, disconnection to economically strong markets, relatively high transport and transaction costs due to long distances from economic hubs, low supply chain volumes, limited economies of scale, inadequate managerial skills, non-awareness of business opportunities, financial instability and lack of credit worthiness. The Sekhukhune Rural Living Lab project was thus launched as a technological response to these challenges.

2.13.2 Methodology

In order to accomplish the objectives of the living lab, a mobile enabled e-procurement prototype was developed (Merz, C et al, 2009). The prototype consisted of a virtual buying application that could enable entrepreneurs to procure stock via low cost mobile phones through text message (De Louw & Dörflinger 2009). From a functional perspective, a typical process in the prototype was triggered at the rural retail outlet (Spaza shop) with an order placement via a structured text message. To achieve structured text messaging, shop owners were given a username, unique id, and provided with a paper based product catalogue. On this catalogue each product was assigned a unique product code. In this context a valid structured text message consisted of a “username” “unique id” “product amount x product code”. The structured text message was then forwarded to a remote SMS-C (SMS centre) server where all orders were stored until an Infopreneur logged into the GIS procurement application to synchronize the order list. An Infopreneur was basically a middle man who linked the SMEs to the various suppliers. The Infopreneur’s main task was to manage and forward order requests to the suppliers. The GIS procurement application of the prototype allowed the Infopreneur to manage the Spaza shops’ business data and geographical information, while on the other hand it also made it possible for suppliers to deliver products at the SMEs doorsteps (Merz et al., 2009).

This mobile enabled procurement system went live in January 2009, involving about 30 spaza shops and 2 Infopreneurs responsible for the Sasko delivery route in Kgautswane (Merz et al, 2009). The live trial run comprised of a product catalogue with 9 products. During the live trial run, Infopreneurs provided feedback regarding the ability of the application to track orders and the effectiveness of the submission of bulk orders to the suppliers (Merz et al, 2009).

2.13.3 Evaluation and Impact assessment of the living lab

The Sekhukhune Living Lab went through all four different phases of the living lab lifecycle, making it possible to assess and validate the impact of the project (Friedland et al, 2010). According to the results of the pilot project as cited by Merz et al (2009), during the test period, SMEs experienced an increase in turnover. The number of actively ordering Spaza sh.ops on a regular basis increased. The system proved to be stable in a 24 hour, 7 days a week live operation. The participating Infopreneurs made an extra salary of approximately between 200 to 500 South African Rands (in full first) per month, depending on their performance, while suppliers experienced a 2% increase in sales.

From a managerial front, the live operation showed that regular change management and end user interaction were most important for the sustainability of the business and technology models. The introduction of a combination of different measures such as information intermediaries, technological innovations, and a franchise-like organizational structure demonstrated the potential of reducing procurement costs on the SMEs side coupled with a radical compression of the order lead time. Beyond that, a systematic analysis by Merz et al. (2009), revealed that despite some of these noted successes, challenges such as low literacy levels, erratic network coverage, low bandwidth, and unreliable infopreneurs were identified during the pilot phase.

2.13.4 Learning points from the Pilot Phase

According to Merz et al. (2009) the pilot phase highlighted that for the project to be sustainable improvements were needed in the field of network coverage and bandwidth enhancement. The provision for more training to those Spaza shop owners and infopreneurs who had little education was still essential. Also there was need to reduce the two short message service (SMS) that were needed to finish the ordering process to one SMS due to a lack of airtime. In addition, due to popular demand, the language of the SMS was to be changed into *Sepedi*, a local dialect. On a technical front, more modules could be added in order to enhance the functionality of the system. The next section explores the ICT solutions available in a Namibian context.

2.14 Solutions currently available

In the ICT sector in Namibia, there are four fast emerging technologies. They are Voice Systems, Electronic Data Interchange (EDI), Bar Code System (BCS), and Enterprise Resource Planning (ERP) systems. These systems facilitate efficient functioning of logistics and supply chain management. They can be broken down into their constituent modules and the diagram below depicts this break down.

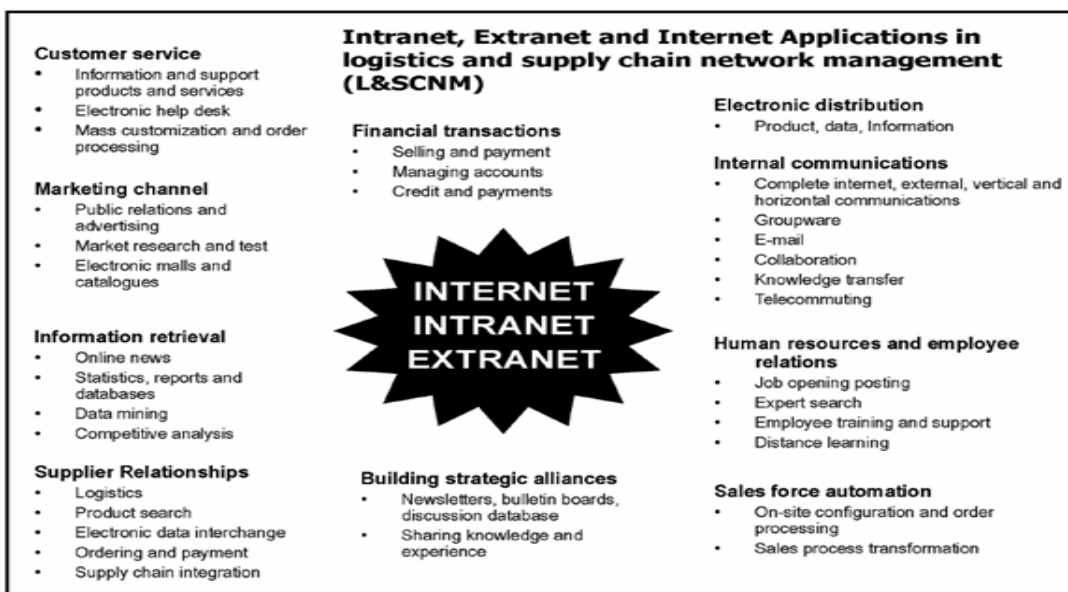


Figure 1: Current ICT solutions Adapted from Narain (2013)

It is clear from the diagram above that while these ICT supply chain solutions may exist, they could become more effective if they were integrated into a single model that would manage both upstream and downstream supply chain activities. The current scenario is that these supply chain solutions are used in isolation by individual companies and as such their benefits do not permeate to rural based enterprises. A sustainable initiative would be the development of a framework that would coordinate these technologies into a single supply chain solution.

2.15 How to validate the performance of SMEs

The following few paragraphs discuss the performance metrics that will be used to evaluate the impact of the framework on rural based SMEs. To achieve this, a literature review on performance metrics was undertaken.

Literature on measuring the performance of firms (e.g. Hunter, 2001; Lipsey & Wilson, 2001; Fabbe-Costes & Jahre, 2008; Van der Vaart & van Donk, 2008) indicates that there is no universally agreed method of measuring performance. Chen and Paulraj (2004) argue that the use of accounting data to measure performance has drawbacks since it ignores opportunity costs and disregards the time value of money. They suggest that instead business performance should be measured by financial indices e.g. stock market evaluation data. Other economists such as (Germain, Davis-Sramek, Lonial, & Raju, 2011; Vickery, Jayaram, Droge, & Calantone, 2003) disagree and point out that the use of financial indices provides a measurement of a firm's performance via the market's valuation of the firms securities. As such since future cash flows of the business cannot be explicitly determined, the results are in fact misleading. They consequently nominate accounting techniques e.g. return on assets or return on investments i.e. the Du Point method as reliable measures of business performance. On the other hand, while Jahera and Lloyd (1992) observed that return on investment or return on assets was a valid performance metric for midsize firms, Tobin and Brainard

(1968) earlier challenged its validity as a performance measure. They argued that a firm's financial leverage can affect its return on investment to such a degree that it renders comparison between firms meaningless. Moreover return on investment also ignores opportunity costs and the time value of investments. In other literature, also obtained, Tobin (1969) postulated an interesting performance metric, the Tobin's q ratio. This metric evaluates the ratio of the market value of a firm to the replacement cost of its assets. It seems this metric despite its innovativeness has not enjoyed widespread recognition mainly because of the difficulties of obtaining accurate measures of a firm's market value and the replacement cost of its assets. As such to calculate Tobin's q ratio is a tedious and problematic process.

Given the lack of consensus regarding a valid cross industry metric of corporate performance, performance in this study will be measured by comparing order lead time, profit, inventory costs, and procurement cost.

2.16 Theoretical Framework

A threshold step in this study involved establishing relevant theories affecting the research. The theories obtained provided the framework within which facts, causes, and processes were identified and investigated. This section introduces two broad families of theories that were identified. One was the neo classical group which currently dominates public policy formation, and the second was, the institutionalist theory, which has only emerged in recent years.

2.16.1 The Neo-Classical theory

The neo-classical theory postulates that a market is constituted by an exchange, which is mediated by a price (Ricardo, 1817). According to this theory, there exists some interdependence between the market archetype and commodity price in the value-adding process (Thirlwall & Pacheco-López, 2008). As such, Jagdish and Bhagwati

(2001) argue that price-based exchange influence consumer behavior and induce innovation in products and processes. The rationale of the theory implies that the removal of impediments to market exchange is the right modus operand to achieve economic growth and foster consumer well-being. In this view, early proponents such as Heckscher (1919) and Ohlin (1933) postulated that expanding the role of market forces, and removing inhibitions to their operation, would catalyze growth and entrepreneurial success. Moreover, the model proposed by Solow (1956) supports this notion and implies that the consequent enhancement of the market archetype and the continual investment in product innovation transcends any other possible outcome based supply chain endeavors such as the creation of vertical linkages.

According to the orthodox theory, the impersonal character of market operations facilitates elasticity (Dowrick, 1997). As such, efforts that attempt to speculate market functions are seen to risk substantial opportunity costs and encourage the distortion of equilibrium prices (Rodrik, 1988). However, these conclusions are based on several judgments that stem from the founding assumptions of the neo-classical theory. The neo-classical theory is founded on several assumptions. Firstly, it assumes the existence of economic rationality. Economic rationality presupposes that all relevant market information is available fairly and accurately and that preferences are determined autonomously. This means that all agents follow a common choice process as they strive to maximize their profits. Secondly, the neo classical theory assumes that related and supporting markets e.g. capital markets, and overseas markets are appropriately perfect and undistorted. Thirdly, the theory assumes that transaction costs being distinct from production costs do not significantly influence entrepreneur decisions, in other words the theory assumes that market agents suffer from transactional price illusion.

2.16.2 The Comparative advantage theory

The competitive advantage theory was developed so as to mitigate the shortfalls of the neo classic theory (Helpman, 1991). According to Deraniyagala and Fine (2001), unlike the neo-classical theory, the comparative advantage theory shifts focus from the commodity price and assumes that natural endowments, and not created advantages, are fundamental to levels of trade, and to the competitive success of individual firms in regional and international markets. Stiglitz (2006) substantiates this point when he illustrates that the philosophy embedded in this theory, conceptualizes trade as being a relative attribute and not an absolute one. As such, Stiglitz hypothesizes that all participants should therefore benefit. The comparative advantage theory has been the basis for trade liberalization in recent years and has contributed significantly to the spread of economic prosperity. However, critics such as Chang (2005) argue that from a functional perspective, the comparative advantage theory is static. It assumes that the advantages that any country or entrepreneur have at a particular point in time are fixed. In a classic Ricardian example, for instance when a multinational company buys raw materials from an SME and further processes the raw material into finished products, both firms benefit from the exchange. But processing of raw materials into finished products involves high technology, high growth, and a high value adding industry. The theory then assumes that the SME will persist in producing only the raw material and as such remain permanently locked into lower levels of the supply chain. The theory does not consider political or trade initiatives such as nationalization or export processing zones that could encourage the SME to add value to the raw materials. In most developing countries, trade liberalization as suggested by the comparative advantage theory, may be problematic as most SMEs are financially and technologically vulnerable and cannot compete with multinational companies.

2.16.3 Institutional Perspectives

Moving on to the next theoretical group, Institutional theories have emerged in recent years as a supplement to neo-classical and comparative advantage perspectives (Clemens & Cook, 1999; Amenta, 2005). Interest in institutions has burgeoned, spreading across a variety of disciplines, including economics, political science and sociology (Hall & Taylor 1996). According to North (1990), Institutional theories start from the inter-subjective character of social, economic and political interaction. They thus abandon the neo-classical premises of methodological individualism and instrumental rationality. Institutional analysts such as Aoki (2007) and Hodgson (2006) direct attention back from firms, towards the institutions or systems in which they are embedded. According to Paul (2009), markets are one important institutional setting, but they are not the only component that is relevant to competitiveness. Political, financial, education and social systems may all contribute resources or capabilities that are more or less pertinent to the competitiveness of a particular enterprise.

Furthermore Paul (2011) eloquently sums up when he points out that the historically derived pattern of any of these systems may be consistent with present competitive requirements. According to Paul, this approach shifts attention from an exclusive focus on markets to the wider institutional components in which particular firms and industries are embedded.

To sum up, one can conclude that from an institutional perspective, prices have specific limitations as instigators of supply chain linkages. Likewise transaction costs are pervasive and of equal importance to the formation of collaborations. While on the other hand, market forces are deficient mediators of innovation. These findings therefore attack the foundations of neo-classical theories and thereby emphasize conventional wisdom about the role of collaboration in supply chains. They amplify substantially the

inherent weakness of the market force philosophy which coincidentally is the hallmark of the neo-classical theory.

This highly abstract, but encompassing analysis, invites attention to arrangements that might enhance collaboration, supplement market based coordination and reduce transaction costs. As such it provides a general theoretical framework within which particular patterns of collaborative activity such as those considered by this thesis were evaluated.

3. Chapter Three: Research Methodology

3.1 Introduction

This chapter outlines the research methodology that was utilized in order to accomplish the research objectives. It begins by providing an overview of the research techniques employed to examine each particular objective. It then elucidates the philosophical considerations that governed the overall research methodology. Based on constructivism paradigm, the chapter discusses the rationale that motivated the use of a qualitative approach to examine rural socio techno issues, and the use of quantitative techniques thereafter to analyze and triangulate the data. Furthermore the chapter embarks on a heuristic inquiry and undertakes a comprehensive critique of the validity, reliability, and the limitations of the research methodology. The chapter concludes by illustrating the research ethics, social customs and axiological convictions that influenced the fieldwork.

3.2 Defining the research questions

The research questions of this study were established after realizing the challenges experienced by Namibian rural based SMEs in managing their supply chains. Several factors influenced the definition of the research questions. The factors ranged from the researcher's ontological position, prior knowledge, beliefs, past experiences, cognitive dissonance, and philosophical persuasions. The first research question was defined after the preliminary literature review while the others were developed during the research process as further literature reviews indicated the necessity of conducting the study in contextual themes. The following research questions were eventually developed.

1. How can an integrated ICT framework be employed to link rural based SMEs to global value chains?

2. How will an integrated ICT framework be used to manage upstream and downstream activities in rural supply chains?
3. Will the existing ICT infrastructure in Namibia be able to support the framework?
4. How can SMEs apply the framework in their daily operations?

In an attempt to answer these research questions, the investigation began by outlining the ontological, epistemological, and methodological inclinations of the research. This was important as these philosophical orientations later influenced the research design and the research methodology. Moreover they also defined the scope within which theories and assumptions were considered and investigated. The diagram below depicts the research design framework.

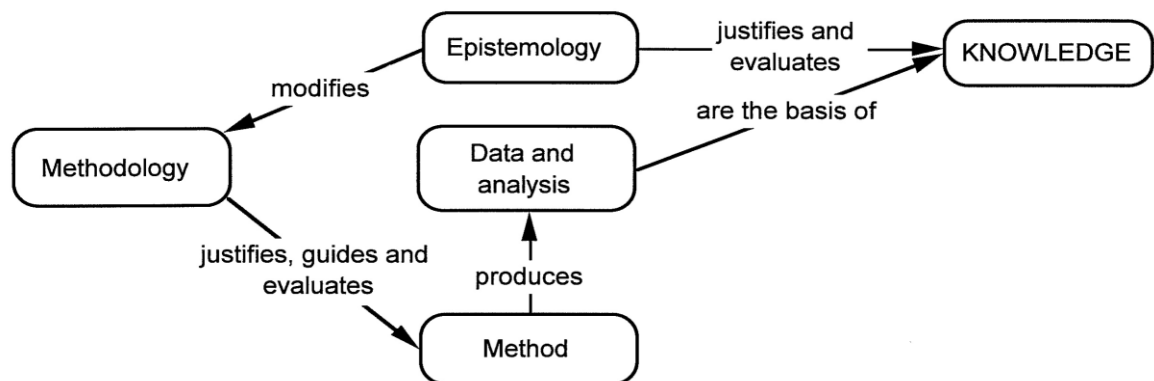


Figure 2: Research design adapted from Bryman and Bell (2007)

3.3 Ontological position

By definition ontology is a branch of metaphysics dealing with the nature of being (Oxford dictionary, 2012). According to Bryman and Bell (2007), ontology is concerned with the nature of social entities and the meanings of social phenomena where the central tenant of orientation is objectivism or constructivism.

The ontological stance taken in this research was constructivism. The choice of this standpoint was dictated mainly by three considerations.

Firstly, from the literature reviewed e.g. (Crotty, 1998; Bryman and Bell, 2007), it emerged that constructivism being socially oriented, enabled supply chains to be studied as social systems. To corroborate this concept, Emmongor (2008) also argued that supply chains were constructed by social agents and in fact, it was these social agents that gave meaning to the supply chain's very existence. This line of argument as a result gave a suitable framework within which the objectives of this research could be investigated.

Secondly, according to Rohita (2006), the management, governance, and development of rural supply chains in essence required an understanding of contextual subjectivity. As such the sustainability of rural supply chains activities were deeply rooted in the environmental contexts in which they emerged. Patton (2002) earlier substantiated this point when he highlighted that the constructivist ontology was the most suitable philosophy in studying contextual subjectivity. This reasoning became pertinent in this research since the study was contextually intensive. Moreover literature such as Kvale and Brinkmann (2009) also indicated that while particular supply chain architectures could be sustainable in a specific society they were unsustainable in others. In the final analysis, the synthesis of these submissions greatly influenced the decision to choose the constructivist ontology as the guiding philosophy in this research.

Thirdly, it became clear from further literature reviews that several rural supply chain researchers had previously employed the constructivist philosophy to investigate their research objectives (see Mkandawire, 2008; Emongor, 2009; Belleza et al., 2003; Mwirungi, 2010; Ramsden, 2010). As such, the constructivist ontology was chosen.

3.4 Epistemological position

Epistemology is the philosophy of knowledge and involves the study of what knowledge is and how it is obtained (Kvale and Brinkmann, 2009). The main orientation in epistemology is positivism or interpretivism i.e. anti-positivism or relativism (Bryman and Bell, 2007).

The epistemological stance taken in this research was mainly anti-positivistic with some elements of positivistic epistemology later on. In the anti-positivistic stance, the research on one hand studied themes and challenges pertaining to sustainability, while on the other hand it scrutinized the social aspects of the supply chain agents. Studying supply chains in this manner was perceived to be logical given the various extrinsic factors affecting rural supply chains such as the digital divide.

From a positivistic front the study embarked on a quantitative approach in order to analyze the data and infer meaning. The idea of using both positive and anti-positive orientations was earlier supported by Patton (2002) when he illustrated that:

“Processes and phenomena, where human beings are involved, are not simply a sequence of mechanical devices which can be assumed to work along positivistic beliefs, but are instead a complex network of living, innovative, creative and evolving creatures which react and adapt dynamically to their perceived environment, and try proactively to create what they themselves, or collectively with others, find to be beneficial to their own interests.” (p.106)

In view of Patton’s contribution, the epistemology chosen in this research had positivistic and anti-positivistic traits.

3.5 Theoretical perspective

Theoretical foundation studies on supply chains such as Buckley and Hashai (2004) indicate that holistic and system thinking is a central concept underlying most theoretical perspectives of logistics and supply chains management. According to Buckley and Hashai (2004), system thinking necessitates a holistic view of systems and analyzes the subsequent components that make up the system. Proponents of system thinking such as Patton (2002) argue that supply chain components are interdependent so much that changes in one component lead to changes in other components of the supply chain.

With this in mind, this research chose the institutionalist perspective as the guiding theory of the research. This choice was influenced by the fact that unlike the system thinking approach, the institutionalist theory went one step further and reflected the openness of systems, their boundaries, and the institutions affecting them. To substantiate this Paul (2009) highlighted that institutions such as political, financial, educational and other social establishments all contributed resources or capabilities that were more or less pertinent to the competitiveness of enterprises.

As such, the theory was useful to this research as it illustrated in one hand why changes in the institutional setup influenced supply chain functionality, and on the other hand how it impacted on the nonlinear dynamics of interconnections. In the end the theory proved vital in untangling and investigating rural supply chain paradoxes highlighted in chapter 2.

To sum up, further justification of choosing the institutionalist theory was obtained from literature reviews which indicated that a growing number of researchers such as (Paul2009;Buckley and Hashai (2004),Patton, 2002) were applying institutional theories and approaches in their studies. Hence, given this growing tendency, and all the

submissions above, the institutionalist theory was selected as the theoretical perspective governing this research.

3.6 Research strategy

By defining the research questions, ontological standpoints, and the theoretical perspective, the research strategy emerged. The strategy was both quantitative and qualitative. According to Bryman and Bell (2007), quantitative research entails the collection of numerical data, and the use of this data to test the research hypothesis. Whereas, qualitative research is a research strategy that usually emphasizes words rather than quantification in the collection and analysis of data. Qualitative researchers have mostly an inductive view of the relationship between theory and research, whereby the former is generated out of the latter. In this context the epistemological position usually is interpretivism and the ontological position usually is constructivist.

The strategy undertaken in this research was both qualitative and quantitative. It was qualitative due to the constructionist ontological assumptions during the data gathering stage and quantitative during the data analysis phase. The logic behind the research was mainly inductive. The inductive approach meant letting the themes, challenges, and further propositions emerge out of the study of rural supply chains in a generic manner. Interestingly, this reasoning approach was also discovered in previous studies in the logistics literature (see Rogers, 2003).

However as the research progressed the discussion about management, governance, and development of sustainable supply chains activities reflected in chapter 4 and 5 became predominantly deductive as inference was drawn from the data collected.

3.7 Design of the research

By definition the research design presents a structure that guides the execution of research methods and the analysis of the subsequent data. Bryman and Bell (2007) outline five prominent research designs: experimental, cross-sectional, longitudinal, case study, and comparative. However, from literature such as Patton (2002), there is no perfect research design. As a result this research adopted a dominant cross-sectional design. According to Bryman and Bell (2007):

“A cross-sectional design entails the collection of data on more than one case (usually quite a lot more than one) and at a single point in time in order to collect a body of data in connection with two or more variables (usually many more than two), which are then examined to detect patterns of association.” (p. 225)

By using the cross sectional design approach, a pattern of themes and challenges in rural supply chains emerged out of the data collected. As explained in the next section, data were collected from different sources. Themes and challenges were generalized from literature and interviews. The diagram below conceptualizes the research design.

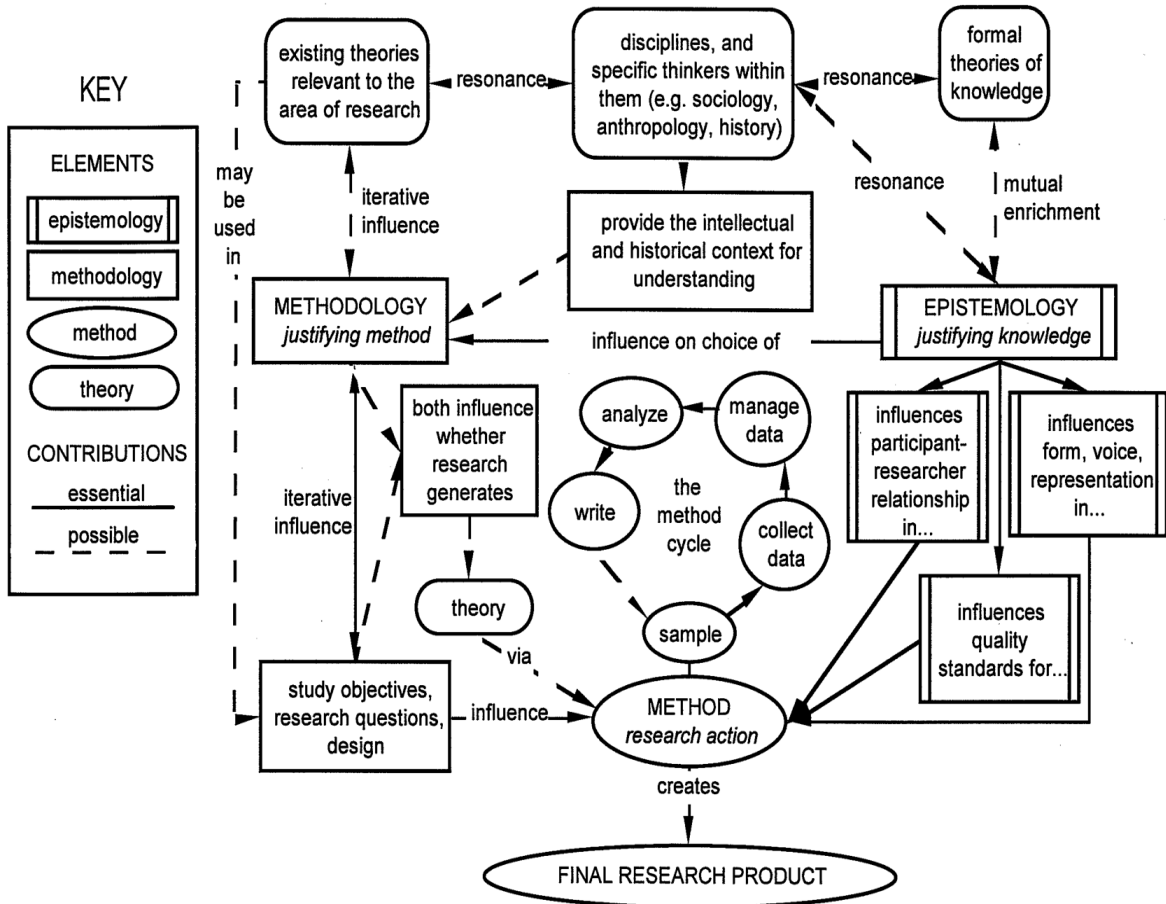


Figure 3: Research design conceptualization adapted from Bryman and Bell (2007)

The diagram above depicts the frame work that was used to conceptualize the research objectives. In this context both constructivist and anti-positivist philosophies were adopted in order to effectively analyze historical and quantitative data. Different instruments such as questionnaires, literature reviews, interviews and surveys were employed selectively to achieve each research objective.

3.8 Population Sampling

Due to time constraints convenience sampling was used. This sampling method was employed not only to obtain a reliable and relevant population of the SMEs but also considered the availability and accessibility of these SMEs. Using this technique the target population was sampled from SMEs operating in Erongo, Okavango, Omusati and Kunene regions. A sample of 50 SMEs were selected from these regions and interviewed. Due to the initial phase of the research being largely qualitative, a thematic

approach was adopted. The following seven themes coinciding with the research objectives were identified and investigated.

3.9 Methods

3.9.1 Thematic investigation of the research objectives

3.9.1.1 Objective 1: The current state of supply chains in rural areas

In order to get insights into the current state of supply chains in rural areas, a triangulation of three methods was employed. First, a comprehensive literature review was undertaken. The literature review was done so as to probe current and previous research on Namibian rural supply chain management. Secondly, 20 interviews were conducted to a sample of 50 SMEs selected at random from the 4 regions. The interviews primarily focused on obtaining first-hand information on how the SMEs managed their supply chains. Thirdly, an observation was done on 10 SMEs selected at random from the target population. The aim of the observation was to scrutinize how the SMEs managed their supply chains

3.9.1.1.1 Objective 2: The challenges experienced by rural based SMEs in managing supply chains

In order to analyze the challenges experienced by the SMEs, face to face interviews and structured questionnaires were used. The face to face interviews were administered to 20 SMEs selected at random from the target population. While the structured questionnaires were dispensed to 50 SMEs also randomly selected from the target population.

3.9.1.2 Objective 3: Identifying the ICT infrastructure and evaluating its capacity to support rural supply chains

The existing ICT infrastructure was identified by means of document analysis and a literature review. Once the infrastructure was identified, a case study was analyzed so

as to determine how other countries that faced similar challenges utilized their infrastructure.

3.9.1.3 Objective 4: Establishing performance indicators to evaluate the performance of rural based SMEs

A literature review was conducted in order to establish performance indicators. These indicators were then used as metrics to do a hypothetical evaluation of the integrated framework.

3.9.1.4 Objective 5: Designing the Integrated ICT framework

The Integrated ICT framework was designed using the findings of the literature review and the results of the survey

3.9.1.5 Objective 6: Hypothetical evaluation of the framework

After the design of the framework, a hypothetical evaluation of the framework was done basing on the feedback obtained during the publication of a paper containing the framework. Mathematical techniques such as regression analysis, T test, Scheffe tests and multivariate analysis were then employed to compare the data sets.

2.6 Data Sources

In this research data was collected by a triangulation of different research methods. As a result, data was collected from a variety of sources, by different researchers on some occasions, and by different methods. The triangulation technique was also identified in a variety of studies considered in this research (e.g. Patton, 2002).

3.9.2 Literature review

Literature reviews were used extensively during this research. The purpose of exploring the existing literature was to investigate prior knowledge about the research area, the main concepts, theories, themes, significant controversies and unanswered research questions.

The literature reviewed was mainly from secondary sources. Examples of these sources were:

3.9.2.1 Peer reviewed journal and conference articles

A variety of articles were used from different accredited journals and peer reviewed conference proceedings such as E-print archives, JSTOR, IEE/IEEE standards and proceedings, and the Proquest ABI database.

3.9.2.2 Books, licentiate and doctoral theses

Some hard copy, electronic books, as well as licentiate were read during the data collection and analysis phases.

3.9.2.3 Documents and reports from selected websites

Relevant documents e.g. public, organizational, as well as mass media outputs, and websites were also read.

3.9.3 Primary sources

Some primary sources of literature like doctoral theses from the University of Pretoria PhD database, reports, and book chapters written by various authors were considered during the collection of data.

3.10 Content analysis

Notably the third research objective required an ICT infrastructure audit. In order to achieve this outcome, the study utilized a content analysis. The next paragraph justifies the use of this approach.

A content analysis is a set of research tools for the scientific study of written communications with the objective of determining key ideas and themes contained within them (Chamarz, 2006). Content analysis can be both qualitative and quantitative, where the latter seeks “*to quantify content in terms of predetermined categories and in a systematic and replicable manner*” (Bryman and Bell, 2007). On the other hand

qualitative content analysis can satisfy the inductive assumptions of qualitative researchers. Qualitative content analysis comprises an exploration of underlying themes in the materials being analyzed. The aim is to be systematic and analytical. With qualitative content analysis there is continuous movement between conceptualization, data collection, analysis and interpretation (Bryman and Bell, 2007). The process of content analysis in this case was mainly qualitative, as the area of investigation was complex. As a result the content analysis approach was used to investigate the third research objective.

3.11 Interview design

Qualitative semi-structured interviews were used as a method of data collection. The semi-structured interview technique typically involves a context in which the interviewer has a series of questions, often referred to as an interview guide (Bryman and Bell, 2007).

The main reason of selecting this type of interview technique was to understand themes and challenges experienced by rural based SMEs in managing their supply chains. The interviewees were encouraged to describe their current activities, future strategies, and challenges experienced in managing and optimizing their supply chains.

The interview guide was designed based on the seven stages of a qualitative interview investigation suggested by Kvale and Brinkman (2009) which are thematizing, designing, interviewing, transcribing, analyzing, verifying, and reporting.

3.12 Data Analysis and Design

Analytic induction was the main strategy for data analysis and design in this research. The aim was to draw inference from the data collected and then evaluate the research hypothesis.

The Integrated ICT framework was designed using findings from the literature review and the results of the survey. The framework was evaluated by the feedback received from academics during the publication of a paper containing the framework.

3.13 Communication of results

The final step of the research process was the communication of synthesized, aggregated and substantiated knowledge that contained valid and reliable answers to the research questions as well giving provisions for further research. The results of the research were communicated by submission and subsequent publication of this thesis.

3.14 Research quality

3.14.1 Authenticity

In line with Bryman and Bell (2007) in order to evaluate the authenticity of the research, the following criteria were considered:

3.14.2 Fairness

In this research fairness was increased by using a diverse sample of journals, articles, and interviewees. This was done to ensure that the research fairly represented different viewpoints among members of different social settings.

3.14.3 Catalytic authenticity

In this research catalytic authenticity attempted to establish if the research acted as a catalyst to influence members to change their circumstances. From the impact analysis in chapter 6, it was evident that almost all stakeholders agreed that the research had ushered in operational benefits and as such influenced them to use the framework in their daily activities.

3.15 Limitations of the Methodology

Due to time constraints, the research techniques used in this study were designed for a rapid assessment of rural supply chains in Namibia. As such, emphasis

was placed on developing a broad qualitative understanding of the rural supply chain system. However, the use of convenience sampling, small sample sizes, limited geographic coverage, and reliance on historical data led to sacrifices in statistical rigor.

There were also potential biases inherent in the collection of information from specific demographic locations. From the demographic setup, it was clear that problems in some areas such as long distances, poor roads, and relatively low market thresholds, were fundamentally a function of the apartheid history. Moreover in recent times, indications were that political initiatives in some areas were perpetuating a degree of economic dualism.

As the research progressed, these barriers could be seen to operate at different levels within the same geographical areas, creating a series of divides between entrepreneurs. The end result was that from the same area, some entrepreneurs were better positioned to compete in mainstream economic circuits, while their counterparts were marginalized and relied on subsistence activities. There were no easy methods of investigating or working across these divides. To mitigate this challenge, the research assumed uniformity within supply chain agents. However, this implicit assumption inherently risked the potential of distorting the inductive inference drawn from the aggregated data.

Meanwhile, during some interviews, it is highly likely that some respondents might have withheld or misrepresented information when it became apparent that such information would be published and made available to the public. This was most noticeable when the investigation probed the SMEs financial records. For these reasons, a triangulation of methods was used. Against this backdrop, it therefore became difficult to explicitly quantify the amount of error correction the triangulation technique achieved.

In conclusion, it must be noted that throughout this research, the target population was only sampled from four industrial sectors, namely, small scale mining,

the textile industry, carpentry, and agriculture. The research therefore shares concern over potential complications that could emanate if the statistical analysis from this research were to be applied to other sectors in general. It is therefore advisable at macro level, to exercise caution when employing the aggregated data from this research to other sectors not considered in this study.

4. Chapter Four: Results

4.1 Introduction

This chapter provides the results of the data collected from the research survey in form of interviews and questionnaires as outlined in chapter 3. The survey contained detailed questions on the demographic background of the interviewee, their preferred marketing channel, and their relationship with other players in the supply chain. Additional questions pertained to market variants such as commodity prices, transactional costs, quality of the product, and quantity assessments by buyers. The survey ended with questions on the effectiveness of wholesale market practices in general. A total of 120 questionnaires were sent out into the field and 103 questionnaires were returned. This translated into a response rate of approximately 86%. The responses were predominantly elicited from four industrial sectors i.e. agriculture, small scale mining, carpentry, and the textile industry.

4.2 Demographic details

Table 3 provides an overview of the general demographics and operation details of the SMEs who participated in the survey. As expected there was a marked demographic difference between the entrepreneurs across the four sectors. Interestingly SMEs in agriculture on average seemed to have operated for a longer period i.e. 10 years, versus 6 years for the other sectors. Meanwhile the income levels and sizes of the enterprises were similar.

In terms of liquidity, farmers seemed slightly poorer with 39% of them living below the poverty datum line. This compared to 29% for entrepreneurs in the Textile industry, 24% for Carpentry and 15% for Mining. The table below gives an overview of the demographics and operation details.

	Unit	Agriculture		Carpentry		Mining		Textile	
		Average	Standard deviation	Average	Standard deviation	Average	Standard deviation	Average	Standard deviation
Demographics									
Gender	% male	57	5	86	9	85	6	26	8
Firm Size	Workers	5	3	7	3	8	2	6	3
Experience	Years	15	6	6	5.8	7	6.3	2	6.4
Wealth Income	N\$	>5 000	3	>10 000	3	<10 000	5	<10 000	5
Profit	N\$	>5 000	6	>10 000	5	<10 000	7	<10 000	3
Sales Turnover	N\$	>5 000	2	>10 000	7	<10 000	4	<10 000	8
Market share	%	same		up		up		up	
Poverty line	% below	39	6	15	8	15	4	29	6

Table 3: General Demography and Operation Details

4.3 State of Supply chains in Rural Areas

While the demographic results above were informative and gave insights into the operations of the SMEs, it was important to examine the state and nature of supply chain relationships in rural areas. In order to investigate this phenomenon, survey respondents were asked to select an existing supply chain alliance and identify whether the alliance was with a material supplier, a customer, or a service provider. It was discovered that 58 of the 105 alliances were developed with material suppliers, 19 were with customers, and 28 were with service providers. The strategic motive of entering into these alliances varied across the four sectors according to firm characteristics and multiple environmental factors. Table 4 summarizes a list of the alliance objectives.

Table 4 Motives to Enter a Strategic Alliance

- Market seeking
- Acquiring means of distribution
- Gaining access to new technology, and converging technology
- Learning & internalization of tacit, collective and embedded skills
- Obtaining economies of scale
- Achieving vertical integration,
- Extending supply links in order to adjust to environmental changes
- Diversifying into new businesses
- Restructuring, improving performance
- Cost sharing, pooling of resources
- Developing products, technologies, resources
- Risk reduction & risk diversification
- Developing technical standards
- Achieving competitive advantage
- Cooperation of potential rivals, or pre-empting competitors
- Complementarity of goods and services to markets
- Co-specialization
- Overcoming legal / regulatory barriers
- Legitimation, bandwagon effect, following industry trends
- Reduction of lead time
- Equipment utilization
- Supply demand stabilization
- Research and development

Given the diversity and varied nature of objectives cited above, the respondents were then asked to rank the objectives. A five point scale was used where 1 equaled “least important” and where 5 equaled “most important” The mean scores and standard deviations for each objective are summarized in Table 5. For simplification, the table is organized based on the rank scores of the alliances objectives obtained by the Friedman’s test.

Alliance Motive	Responses ranked from most important			
	n=55, chi-square = 50.486 overall cluster's mean = 5.632			
	Friedman's Test	Rank deviation	Mean	Standard
Supply/Demand Stabilization	3.89	1	6.364	0.910
Reduction in Inventory	3.18	2	6.036	0.793
Reduction of Lead time	2.88	3	5.782	1.013
Reduction in Procurement costs	2.81	4	5.379	2.62
Access to New markets	2.24	5	5.073	1.562
Plant Utilization	2.13	6	5.031	1.261
Leveraged Capital	1.97	7	4.832	0.831
Increased Profit margins	1.83	8	4.351	1.232
Market Share Growth	1.63	9	4.291	0.359
Research and Development	1.42	10	3.352	0.331

Table 5: Rankings of alliance motives Friedman's Rank Test

4.4 Rural supply chain alliances

The Friedman's rank scores in Table 5 above indicate that in rural supply chain alliances, reductions in inventory and supply/demand stabilization were both the principal alliance formation motives. Two other prominent motives were the reduction of procurement costs and the diminution of lead time. Noticeably while these objectives were ranked differently across the four sectors, they were relatively important attributes ranked in the top ten in all sectors.

In order to facilitate valid inference, the research further investigated whether these alliance formation motives were accomplished. From the interview responses it became clear that across all the four sectors, motives such as increased utilization of equipment capacity, access to new markets, and leveraged capital investment were not achieved to any great degree. Furthermore, objectives such as increased profit margins and market share growth received low mean scores. As a result it was not a surprise that these objectives were also not achieved and therefore severely affected the

operations of the SMEs. During the same survey it also became apparent that despite concerted efforts to enhance supply chain collaboration such as the establishment of group purchasing schemes, or the introduction of alliance formation incentives in some Government tender processes, such incentives had little or no impact on the success of the alliances. One potential explanation to this was that in the majority of alliances observed, the SMEs could not sustain the costs required to maintain a meaningful alliance. For the SMEs, such alliance costs were an additional expense that bore intangible results. As such the SMEs eliminated these waste costs by randomly entering into transactions with almost anyone without establishing meaning relationships.

However, in a few instances some SMEs achieved their alliance objectives. It appears that in these exceptional cases, success was scored in alliances that predominantly focused on relational objectives e.g. reciprocal interdependency. While less success was achieved on broader strategic objectives e.g., coordinated risk management. This could suggest that the supply chain alliances investigated in this study were still at the initial development stages where relational objectives were to be achieved prior to focusing on broader strategic initiatives.

When the SMEs were asked for their opinion in this regard, interestingly 86% of them attributed the failure of the alliances to physical remoteness and the demographic location of their enterprises. The next paragraph evaluates the validity of this belief.

4.5 The role of physical remoteness in alliance formation

In order to investigate whether or not the physical location of a company's facilities had any effect on its ability to form successful supply chain partnerships, the data was examined by dividing the respondents into groups based on the place where they were located. It was observed that from the demographic setup some SMEs were located nearer to suppliers and customers while others were located further away. The Scheffé test was then applied and used to compare the data sets. Table 6 illustrates the

comparison of the data sets. Interestingly there were no significant differences found among the groups based on location alone. A possible explanation to this could be that as it was earlier cited in the literature review, the geographical distance between upstream and downstream supply chain processes were growing larger due to the increase in decentralization. The distance dimension therefore was gradually being offset by the time construct. According to Delfmann (2012), in supply chains today the geographical distances expressed in kilometers were being construed in terms of the logistics capabilities of the supply chain infrastructure. To give a hypothetical example, let's say due to logistical complexities it took a longer time to get products from a place X that was just next to the destination Z, while at the same time it took relatively less time to get products from a place Y that was many kilometers away from the same destination Z, in this context Y was said to be logistically closer to Z even though it was geographically further away. Thus a distance defined by logistic routes became a time distance which expressed the time expense required to overcome the distance. The factor time thereby became not only a decisive parameter of logistic decisions but a general metric of distance. As such cost of time and not cost of transportation over a particular distance were currently dominating supply chain alliance formation.

4.6 Statistical validation of differences in alliance achievements

While time and distance were central tenets to supply chain alliance formation, a salient success construct seemed to be the diversity of alliance formation motives. Results in Table 6 indicate the diverse range of the alliance formation motives. When the successes of these motives were examined relative to a specific sector, some remarkable differences in alliance achievements rankings were observed. For example, access to research and design expertise was achieved to some degree in agriculture but not in carpentry. These differences were interesting, but it was unclear if they were

statistically relevant. To validate this difference a statistical analysis was undertaken. In order to facilitate comparison, it was hypothesized that:

H1: No significant differences existed between the achieved objectives in alliance formation across the four sectors.

ANOVA was used to test each of the objectives so as to provide cross-sector comparisons.

Table 6 shows the cross sector comparisons.

Alliance Motive	ANOVA Test			
	Agriculture	Mining	Carpentry	Textile
Supply/Demand Stabilization	3.89	3.73	3.66	3.91
Reduction in Inventory	3.18	2.91	3.03	3.79
Reduction of Lead time	2.88	3.0	2.78	2.93

Table 6: Statistical validation of differences

No significant differences were found (where $\alpha = .05$) across the four sectors and between the mean of the paired group scores. When Scheffé tests were applied to the same data sets, again no significant differences were found to attributes such as reduced cycle time/lead-time, increased customer service, increased supplier/customer involvement, stabilized supply/demand, increased customer loyalty, improved quality, access to information technology, increased utilization of equipment/capacity, access to new markets, and leverage/share capital investment. Interestingly, the mean score for leveraging/sharing capital investment was below a neutral response of 3.00 for all the four sectors, indicating that this objective was not achieved to any great degree. This was in agreement with earlier predictions given in the literature review.

4.7 Implications of the supply chain alliance results

From the results and discussions so far, it seems as if SMEs have not benefited much from alliances within their supply chains. As such they continue to experience small profit margins low liquidity and rely more on subsistence activities. Also as a result of low liquidity, it was observed that decision making within the alliances was not equal and in most cases the SMEs were price takers. On the other hand while sound logistics networks existed across the country (see chapter 2), such infrastructure was not coordinated in a manner that would enable the SMEs to gain voice and exploit the opportunities within their alliances. As a consequence of these factors, the SMEs were unable to utilize their partners resources e.g. use their technology and expertise. As cited earlier in the literature review, supply chain partners can provide sophisticated inventory management software and information technology that could be used to reduce inventory levels (Masters, LaLonde, & Williams 1991). However, the full optimization of alliance offerings was not achieved in all the four sectors. In order to illustrate this scenario, the next section outlines the state and nature of the relationships between the SMEs and other upstream and downstream supply chain agents.

4.8 Relationships with downstream supply chain agents

In downstream alliances, both interview and questionnaire results indicated that the majority of SMEs from the four industrial sectors predominantly maintained relationships with a single buyer. In most cases this buyer was a local middleman. In the Agriculture sector, about 55% of the SMEs sold their produce to local intermediaries, while about 15% sold to buyers from other regions. Interestingly the remainder traded with various types of buyers, thereby diversifying risks while at the same time gaining access to regional value chains. A similar trend was observed in the Textile industry. In this case approximately 51% of the SMEs sold their garments and embroidery artifacts to their local communities while 23% ventured onto regional markets.

However, as expected the trend was different in the Carpentry and Mining sectors. In this context a higher percentage of SMEs sold to exporters. In the Mining sector alone, 63% of the SMEs sold their stones to regional and international buyers while in the Carpentry sector 78% of the SMEs traded with customers from outside their home regions. Table 7 gives an overview of this trend.

Unit	Agriculture %	Mining %	Carpentry %	Textile %
Middlemen	55	10	58	51
Exporters	8	19	6	15
Regional buyers	13	43	12	23
Home region	22	8	22	8
International buyers	2	20	2	3

Table 7 Procurement Trends

4.9 Transportation

In the case of transportation, little or no transportation alliances were recorded across the four sectors. As a result for many SMEs the process of transporting products to the buyers implied both risk and considerable out-of-pocket expense. In general approximately 88% of the SMEs interviewed transported their products by means of public transport. This often involved loading the products on top of a bus. 92% of the respondents complained that this mode of transport exposed their products to environmental effects such as rain, and possible contamination from other goods. The situation was worse in the agricultural sector as this mode of transportation exposed the harvest to moisture which led to mold growth, which in turn resulted in price penalties or outright rejection in mainstream markets. To make matters worse, interview results also indicated that the time tables of this mode of transport were erratic and in some cases,

SMEs reported hauling their products to the bus station, only to be informed that the bus had already left and that they would have to wait until the following day for the next available bus.

4.10 Diversification of relationships with suppliers

In supplier alliances, questionnaire responses revealed that in all the four sectors the SMEs used various options for procuring stock. Some procured from suppliers from their local communities, while some bought direct from mainstream suppliers and others from high volume middlemen. Surprisingly, about 76% of the SMEs maintained relations with only one supplier while only 24% maintained relationships with at least two suppliers.

Most suppliers demanded cash upon delivery, and results indicate that the commodity prices were predominantly set by big companies in main stream economic circuits and the SMEs were basically price takers. The local middlemen inflated such prices so as to make their profit. Middlemen that sold on commission only received a percentage of the difference between the buying and selling price of each product they received or delivered to the big companies.

With regards to the behavior of the middlemen, 94% of the SMEs complained that they exhibited opportunistic attributes and as such they had an ad hoc operational business model. They encapsulated information about suppliers and customers, and more so they did not have a transparent pricing policy. As a result their buying prices fluctuated haphazardly, making planning a difficult and cumbersome process.

4.11 Supplier Service

Only a few raw material suppliers provided unique services to the SMEs. Interestingly about 2% of suppliers provided credit facilities, while 13% delivered the raw materials to the SMEs. The average size of the total credit portfolio in a production year

was approximately N\$100 000.00. Requirements to access such credit varied across the four industrial sectors and the requirements were largely influenced by the size of the SME. The median interest rate on loan repayments was high being roughly about 11.5% per month. However, in the agricultural sector, government subsidies at times provided low-cost access to cash and mostly mitigated harvest-related expenses. Such credit was generally provided without formal land titles or other forms of collateral. On the other hand the fact that most raw material suppliers of agricultural implements were also buyers of basic grains allowed for flexibility in loan repayments. As such if the SMEs did not have cash, they used their harvested grain to repay the loan.

4.12 Product Quality

Interviews with market buyers suggested that in all the four industrial sectors, the increase in global standards had influenced buyers to alter their buying procedures. The most common change was the reluctance to purchase contaminated goods. Other improvements included increased scrutiny for physical defects. However given this development, 92% of the SMEs complained that the local middlemen now had a tendency of condemning their products of having defects or failing to meet the required standards, but surprisingly still proceeded to buy the products at extremely reduced prices. In the absence of a governing body, this behavior continued unabated much to the detriment of the SMEs.

Information based on results from 18 key informant interviews carried out on-site with buyers suggests that 89% of SMEs depended on these middlemen for information regarding the quality requirements of the regional and international markets. However, because of the loose ties between the SMEs and the middlemen, the middlemen were unable to offer reliable and accurate information that the SMEs required at certain instances. Surprisingly, only 3% of the SMEs maintained direct relationships with mainstream exporters.

Given this scenario, the SMEs were asked their motivations for selling products to local middlemen despite citing widespread challenges, and their responses presented below illustrated diverse reasons. The most common responses suggested that SMEs were not aware of other market segments and depended on the middlemen to access regional and international markets. Some responses seemed to highlight the SMEs financial instability and the need to quickly offset both personal and production expenses while others blamed the lack of an information hub or a business portal. Below are some quotes from SMEs in the agriculture and textile sectors.

Question: Why do you keep selling your products to local middlemen despite the challenges that you have cited?

SME #1: "I don't have any other option. They are the only people that can buy our things and besides I have to pay workers after harvest time."

SME #2: "I cannot afford to travel to the city and look for buyers with a better price. I don't even know where to start looking for them. If only there was an information hub that we could use"

SME #3: "It would be better if other people would know about our products. That would improve the price, but advertising is expensive we have to travel to the city to advertise. If only there was a portal were we could place our adverts things would be better"

SME #4: "Because my brother needed money, so I sold mahangu in the market to resolve his need."

SME #5: "the other places are far and it is expensive to carry my goods there"

SME #6: "I don't know anyone else who would be interested in my products and would offer a better price. There is no place on internet or a business portal that I could communicate with other buyers"

SME #7: "Low production and lack of money to send our children to school."

SME #8: "Our production was low. If we had not sold to the local middle men we would not have received any income and our existing debt with the supplier was due."

Similarly the most common type of responses from SMEs in the mining and carpentry sector also related to logistical problems, the need to cover production expenses, poor links to regional value chains, the strict quality requirements that are enforced by large-scale commercial buyers and the absence of a business portal. Below are some quotes from these two sectors.

Question: Why do you keep selling your products to local middlemen despite the challenges that you have cited?

SME #8: "The big companies only buy in bulk and besides it is difficult to talk to them and they think we are too small. They also want perfect things."

SME #9: "Other places are far and I don't know anyone who would buy my products. If there was a place to advertise online or a business portal maybe we would eliminate these middlemen"

SME #10: "There is no reliable and secure transport to carry the goods."

SME #11: "What else can we do? I don't know any other place where I can sell my things. There is no central place or business portal to help us with information"

SME #12: "I do not have a car to carry my goods. The bus is expensive and not safe at least these middlemen come to buy from us."

SME #13: "the middle men at least are nearby and they pay cash."

SME #14: "I had expenses to pay."

4.13 ICT Survey

A survey was conducted to investigate the ICT usage in the four selected sectors. To facilitate comparison the results obtained were compared to those obtained in 2004 and 2007.

Table 8 below depicts the findings.

Aspect	Urban				Rural		
	2004	2007	2011		2004	2007	2011
Electricity	34%	46%	45%		6%	19%	22%
Land line	13%	17%	11%		2%	8%	5%
Radio	77%	72%	78%		70%	66%	66%
TV	31%	37%	40%		5%	15%	19%
Computer	4.6%	11%	15%		1%	2%	6%
Internet	2%	3.3%	12%		0%	1%	2%

Table 8: ICT usage in selected sectors

Interestingly, more rural based SMEs had access to electricity, a landline, a television, a computer and an Internet connection in 2011 compared to 2007. The only ICT access indicator that did not show significant variation was the percentage of people using a radio. This could be attributed to the wider use of televisions and their associated complementary gadgets such as DVD players. With regards to computer usage, approximately 1% of the rural population surveyed had access to a computer. This finding substantiates earlier propositions highlighted in the literature review. As suggested in main stream supply chain literature, the cost of computer hardware and software applications in most cases prohibited SMEs from purchasing computers. A further noticeable trend was the decline in the use of fixed land line telephones. This could be credited to the penetration and widespread use of mobile phones.

4.13.1 ICT application in supply chain management

The table below depicts the ICT usage in supply chain management.

ICT Aspect	Percentage
Owns a mobile phone	89%
Owns a handset capable of browsing internet	35%
Use a mobile phone to read/write emails	15%
Use mobile phones for business	68%
Continuous replenishment	3%
Vendor management inventory	1%
E-Commerce	1%
Automated purchase	0.5%
Demand forecasting	4%
Market research	2%
Planning	2%
Inventory management	3%

Table 9: ICT Usage

The use of mobile phones was by far the most popular supply chain communication method. Approximately 90% of the SMEs interviewed used a mobile phone to communicate with supply chain agents. While 35% owned a handset that was capable of browsing the internet, only 15% used the phone to read and write emails to their supply chain partners.

As expected only a few SMEs used ICT applications to do electronic commerce. In this case only 3% of the SMEs surveyed used ICT applications to conduct continuous replenishment. 1% used ICT to manage vendor inventory and 0.5% used ICT to do automated purchases. This low usage of ICTs in electronic commerce was earlier alluded to in the literature review and could be caused by the costs of procuring the applications and the lack of coordination within supply chain agents. This trend was similar when it came to demand forecasting. In this case only 4% of the SMEs used ICT

tools to forecast on demand, while 2% used ICT to plan and do inventory management.

4.14 Role of non-marketing factors for building social capital

Results so far suggest that access to value chains for related products and services only partially explained the ties between SMEs and the middlemen. Suggestions from the interviews indicate that the strength of these ties depended as much, if not more, on the ability of alliances to be harmonized into what the SMEs termed a central ICT enabled business portal. According to the SMEs such a portal would then increase transparency, link the SMEs to regional value chains, provide 24 hour reliable information, while enhancing their resilience to external shocks.

4.15 Limitations observed

During the survey, the process of obtaining accurate results was plagued by contextual limitations. Because of the heterogeneous nature and the operating environment of rural supply chain alliances, investigating motivational diversity and the personality traits of entrepreneurs proved to be a challenging task.

4.15.1 Measuring less successful entrepreneurs and enterprise failure

Although this study had the tendency to study “successful supply chain ventures” as an important outcome of the entrepreneurial process, the issue of supply chain exit, which does not necessarily mean failure, was not taken into account. Defining supply chain closure or “failure” is a major problem and a variety of definitions have been utilized (Keasey & Watson, 1991). There is no universally accepted definition of the point in time when an organization can be said to have closed or “failed” its supply chain endeavors. For example, the development of supply chain buy-outs by other competing companies within the same supply chain suggests that although a firm may relinquish its supply chain efforts, it was still possible to resurrect itself in an alternative supply chain.

4.15.2 Lack of audited financial statements

Another limitation related to the inability to obtain audited financial statements. There was reluctance on the part of respondents to hand over audited financial statements for a variety of reasons. Therefore performance indications could not be cross-referenced with actual audited financial figures. While the data analysis was guided by the responses received on the various items, it was impossible to accurately verify the validity of the responses. There was also a risk that entrepreneurs with poorer performance misrepresented performance information, which in turn could have led to bias in the results.

4.16 Concluding comments

The results of the survey disclosed how rural supply chain practices influenced business performance. The results also validated the strength of some of the key linkages and existing supply chain beliefs found in the literature review. From an academic perspective the results enriched the current supply chain literature and made a significant contribution in untangling some rural supply chain paradoxes. In addition, the results provided solid evidence to make explicit what other researchers might have assumed. From a functional perspective, the empirical results of this study support some long-standing theories and substantiate anecdotal evidence concerning the relationships between the exogenous supplier partnership and the endogenous result based performances. The results invariably lend credibility to a variety of causal hypotheses that postulate that improving internal supply chain processes leads to improvements in external business performance. As such this study helps in simplifying controversy and definitional constrains pertaining to measuring the performance of firms. Performance being a multifaceted construct should be studied contextually through a system thinking approach. Moreover by adopting contextual performance measuring techniques and by strengthening supply chain partnership in business practices,

improved performance will likely occur. In conclusion the overarching rationale is that SMEs should emphasize greater attention on the continuous improvement of the strategic supplier partnership in supply chain management processes as well as the management of support services in supply chain linkages.

5. Chapter Five: Discussion

5.1 Introduction

This chapter discusses the main findings of the research project in relation to the three principle aims of the study. It outlines the implications and impact of the work, as well as provides a critical evaluation of the research. The chapter concludes by outlining an integrated ICT framework a tool that could link rural based SMEs to global value chains.

5.2 The current state of supply chains in rural areas

The state of supply chains and the amelioration of their linkages were explored as outlined in the last chapter. To evaluate their impacts, both qualitative and quantitative data was analyzed and comparisons with other supply chains in roughly comparable circumstances were sought. From the demographic data, it seemed reasonable to infer that at macro level the business scene consisted of a dual environment. One was characterized by numerous and widely dispersed rural producers, who served a common pool of customers, had diversified livelihoods, operated in the informal sector, had low access to services such as finance, information and ICT infrastructure, while the other environment was characterized by numerous players who competed in a downstream industry that operated in a concentrated formal economy, with large-scale standardized procedures which were highly risk averse.

The motivation to investigate the operational environment was undertaken based on neo-classical logic. According to the logic if the competitive environment was the central cause of performance, as the theory implies, then rates of performance between entrepreneurs from the same environment should not vary excessively. If they did, this implied the presence of other factors. However, the evidence from the survey pointed strongly to the presence of additional factors to market forces. Contrary to the neo classical theory, both quantitative and descriptive data vindicated the theory and in turn reflected the

existence of formal or trade based interdependencies that affected performance. These interdependencies could be classified into seven core dimensions of the supply chain construct: markets, specialization, key resources, asset mobility, organization, production, and the government. These dimensions gave rise to alliance capitalism within supply chains, which in turn incubated challenges from a rural context.

From a fiscal front it seems reasonable to infer that the interdependencies cited above had causal effects on rural entrepreneurial performance. Discussions with the entrepreneurs revealed that the rural environment faced formidable logistical difficulties. From such discussion forums it was easy to conclude that many of these challenges were a function of low market densities, uneven economies of scale, poor information, and the use of a business model that relied heavily on expending middle men to access regional and global value chains. The resultant effect was that logistical services such as storage, transportation, ordering, and delivering became prohibitively expensive, thereby marginalizing and excluding many SMEs from mainstream supply chains.

5.3 Operation and customer relations management

It was not a surprise that from an operational perspective, the use of middle men to access external markets resulted in the SMEs adopting a wait and see attitude. The ad hoc behavior of the middle men compelled the SMEs to purchase stock in small quantities and in exceptionally quick cycles so as to meet the high demand. Yet the market conditions required that they buy stock in larger volumes and minimize the procurement cycles so as to reduce transaction costs i.e. transport and effort.

On the other hand from a customer relations management view, the majority of rural based SMEs relied on casual walk-in customers who in most cases had no tangible allegiance to the enterprises. This meant the SMEs were merely serving a common pool of clients who could be served by anybody at any time. As a result there were no

meaningful relationships between the enterprise and the customer, meaning the enterprises did not benefit from issues such as constructive criticism and advice that usually stem from a committed relationship.

5.4 Current coping strategies and their limitations

Given the challenges cited above, it was observed that some rural entrepreneurs attempted to mitigate some of these challenges by establishing group purchasing schemes or by forming alliances with the ubiquitous middlemen. However, given the formidable structural constraints, such as poor coordination and lack of accountability on the part of the middlemen, such implicit coping strategies were not efficient and at times not sustainable. Moreover, given the mere fact that these middlemen existed primarily to optimize their financial interests, the persistent use of their services meant that many entrepreneurial and economic opportunities were being lost.

To make matters worse, the coping strategies implemented by the SMEs mostly aspired to get the best out of a particular situation, rather than attempting to transform the situation as a whole. In the end most SMEs failed to cope with the situation, and as such became locked in a survivalist poverty cycle. They then exhibited high dependence on state welfare grants such as pension pay-outs or urban-rural remittances. In this context many of these SMEs were often highly indebted to these local traders or middlemen, a scenario that retarded their participation in regional and global value chains.

In the final analysis the majority of the SMEs suffered from a) low financial liquidity resulting from distorted cost structures, b) lack of creditworthiness resulting from high insolvency risk, c) poor information on issues such as demand and international trends resulting from the opportunistic behavior of the ubiquitous middle men.

5.5 Understanding the different operating principles

Results from the survey also substantiated earlier propositions outlined in the literature review, which suggested that in mainstream economic circuits', competing products and services were most valuable if they could be brought to the right production complex or market, at the right time and in the right combinations. The failure by most SMEs to follow this underlying logic meant that they could not fully exploit all the competing opportunities available.

This suggests the merit of considering the rural operation principles through the lens of the supply chain constructs such as those concerned with competition, transaction costs, and clustering. Their common ground lies in an emphasis on market-enhancing collaboration as a complement to robust competition in product markets. In these perspectives, market conditions are the ultimate determinants of action and market outcomes the ultimate arbiters of performance. But within this framework, collaboration and competition, mixed according to relevant contingencies, constituted a performance enhancing strategy.

To summarize the discussion so far, one can conclude that any future rural supply chain solution endeavors should focus heavily on a system that offers information and logistical support, while at the same time ensuring that the right markets can be targeted, and products can be delivered to the right places when prices are best.

5.6 The inferior supply chain paradox

One interesting phenomenon that came up during interviews was the inferior supply chain paradox. Interestingly during the survey most SMEs were of the opinion that mainstream or urban supply chains were inherently superior in terms of efficiency and product quality, while their rural supply chains were inferior. Interestingly the raw data from the survey dismissed this implicit assumption. Instead the survey results highlighted that the whole supply chain was a set of equally important interacting entities whose mandate

was to optimize economic benefits. Coincidentally this was the logic which formed the core principle of sustainable economic empowerment initiatives earlier found in literature. As such local resources and supply chain proceeds were to be valued in their own right, and not in terms of their origin.

5.7 Towards a holistic multi-level approach

Whilst recognizing and decrying the various inequalities and other negative consequences of the current challenges, it may be possible to turn some of these negatives into positives. Based on the results, as well as analysis from the literature review, one may postulate that a solution may be achieved through a holistic multi-level approach. What this could mean is that the current rural problems could be solved by increased recognition of the need for an integrated local economic approach. Such an approach will be characterized by a strong emphasis on private-public partnerships, and community development initiatives at various supply chain levels.

With this approach in mind, key rural supply chain constructs were identified. They comprised of social, human, financial, and monetary aspects. Physical supply chain nodes were also identified. These nodes were the basic means of linking different stages of resource transformation - i.e. extraction, production, and distribution over time and space, and therefore enabled the creation of supply circuits. The following were the physical nodes:

5.7.1 Central place facilities

The central places comprised of the facilities from which community services such as health, education, voting, welfare, information, financial, trade, postal, police and fire protection services were provided.

5.7.2 Linkage infrastructure

The linkage infrastructure comprised of transportation and communication media, as well as storage and shipment facilities. Other physical assets included all resources pertaining to capital means of production, ranging from machines, livestock, factory buildings, reticulation infrastructure e.g. water and sanitation, electricity, computer infrastructure, and road networks.

5.8 Spatial organizational issues

From the interview discussions it became clear that for any solution to work, some investment in the linkage of assets and logistical services was required. As such one of the pivotal issues was the sequence of development. For instance at the local level, there were bound to be trade-offs, requiring one to choose where and how to invest the village-level facilities. This type of dilemma in particular on where and how to focus on investment introduced a range of spatial organizational issues that should be highlighted.

At the broad district or wider regional level, the results showed that the infrastructure of major and minor towns was typically well developed, as was the network of major and minor roads connecting them. Beyond that, there was typically a large gap in comparison to infrastructure in remote villages. An immediate predicament then, was the apparently haphazard dispersal of lower- order central place facilities within these remote villages. Another related, but very important consequence, was the relatively large distances from the remote villages to the town centers. For most small or embryonic enterprises that did not have their own transport the distances involved were often too great to viably deliver and sell their products.

5.9 Pro-active development of local supply circuits and hubs

Against this background, it is important to explore the strategies that could ideally be employed for the pro-active development of local supply chain circuits, and the possible use of these as springboards for accessing mainstream value chains.

5.9.1 Characteristics of a viable solution

By analyzing the results and also by referring to case studies in the literature review, it is interesting to note that communities that initiated and successfully implemented rural supply chain solutions had the following principles underlying the initiatives. The principles can be summarized as follows:

- clustering
- one-stop
access hub
- sharing of resources
- harnessing of information and communication technologies (ICT).

The principle of a hub located centrally in high-demand areas, linked to smaller, lower-order nodes or a satellite serving individual communities, seemed to be a central tenant in rural supply chain solutions observed. To justify this, results from the survey coupled with findings from the literature review indicated that the reason why current challenges existed in rural areas was because the initiatives cited above were still not met or were uncoordinated and as such could not carry the anticipated supply chain payload.

5.10 Usability considerations

Data from the literature review also warns against problems that could be caused by inadequate involvement of community structures and the lack of capacity to develop locally tailored interventions, which take into account the unique contexts in which SMEs

operate. The logistic solutions should therefore be evaluated specifically in terms of the needs of small-scale rural producers, and their associated requirements within their local supply circuits. The preferred approach would be to plan the deployment of a supply chain solution as part of a community coordinated agenda. According to the literature review the following should be considered as guiding principles or key success factors:

1. Establishment of logistical services provided by rural multi-purpose centers focusing particularly on contextual distribution requirements.
2. The development of logistical services within the context of a periodic market system, giving particular attention to individual contexts and the coordination of transport services.
3. Information provision in support of the coordinated schedules, and services.
4. The exploitation of opportunities arising from the ongoing rapid advancements in communications and information technologies (ICT) to create a range of hub-satellite arrangements with ICT linkages between the hub and satellite centers.
5. Coordinated planning of linkage infrastructure transport and other allied nodal infrastructure aimed at providing an appropriate, integrated platform for rural logistics services.
6. Capacity building of district councils to undertake linkage development planning, establish public-private partnerships and/or issue contracts for the provision of integrated rural logistics services.

5.11 Proposed solution

Given the submissions cited above, and also after analyzing the data from the survey and the literature review, the study now proposes an integrated ICT framework, a tool that could link the SMEs to global value chains while improving on the current challenges. The framework will consist of three platforms; these are an access link, an

automated broker, and an online business repository. The diagram below illustrates an overview of the proposed framework.

5.11.1 Proposed framework overview

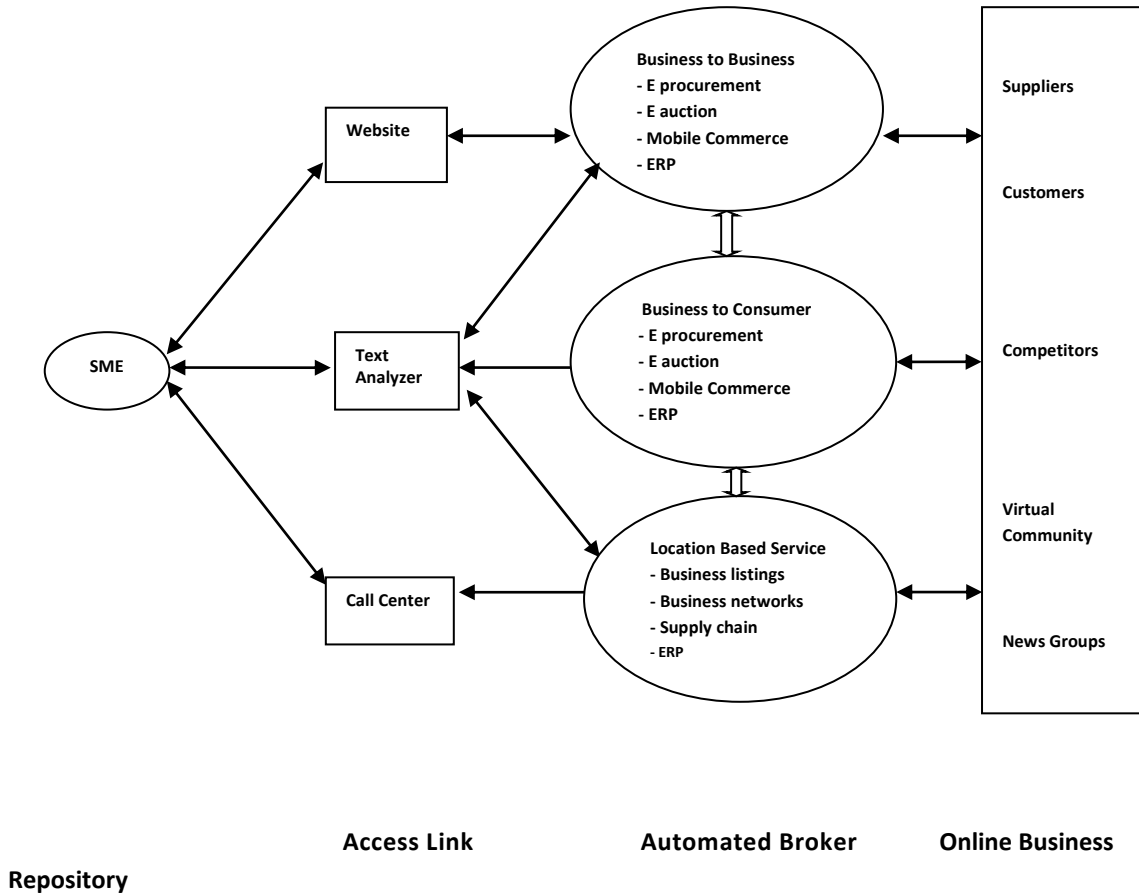


Figure 4: Conceptual framework overview

The next few paragraphs elaborate the functionality of the framework.

5.11.2 Functional summary

The framework will consist of two sales portals; these are a B2B and a B2C sales portal. The SMEs will use low cost mobile phones to access these portals. The portals will link the SMEs to a virtual community comprising of customers, suppliers, competitors and news groups. A Location based service module in the framework will provide the SMEs data and information about activities occurring in their supply chains, and more so

it will help the SMEs identify the exact location of these activities. On the other hand, the Location based service module will aid suppliers and customers to establish the location of the SMEs during transactions such as purchasing and delivery. All the services of this proposed framework will be accessible via low cost mobile phones. The main components of the framework will be the access link, the automated broker and the online business repository.

5.11.2.1 Access link

The Access link will provide a mobile enabled interface between the SMEs and the system. It will primarily consist of three modules i.e. a Website, a Text Analyzer, and a Call Center. The functionality of each module is discussed in depth below.

5.11.2.2 Website

The website will enable the SMEs to logon to the sales portals via their mobile phones. Through the sales portals, the SMEs will be able to browse and trigger transactions with the virtual community. The website will also facilitate communication amongst the SMEs themselves.

5.11.2.3 Text analyzer

The Text Analyzer will primarily function in instances where the SMEs opt to access the system through text message. The text analyzer will receive the message, analyze it and then route it to the appropriate sales portal. If the analyzer fails to decode the text message it will forward the message to the call center.

5.11.2.4 Call center

The call center will comprise of a switchboard where SMEs can call and submit requests. The call center will also from time to time receive and track un-decoded messages from the text analyzer. Upon receipt of an un-decoded message, the call

center will track the source of the messages and then call and establish the needs of the SME and if need be then link the SMEs to the appropriate sales portal.

5.11.3 Automated broker

The Automated broker will provide a digital environment where the SMEs will meet other buyers and sellers. It will network and facilitate trade between rural based SMEs and other enterprises of similar size in terms of liquidity and general corporate demands and thus foster equality during trade and negotiation. It will consist of three modules. A B2B sales portal, a B2C sales portal and a Location based service.

5.11.3.1 B2B sales portal

The B2B Sales portal will enable the SMEs to purchase inputs and products from suppliers and get the best value for money. The B2B sales portal will consist of the following sub modules

5.11.3.2 E-procurement

This sub-module will enable SMEs to procure materials online. It will also facilitate the attainment of the best price for products from suppliers.

5.11.3.3 E-auction

This sub-module will provide an online bidding facility that will allow the SMEs to bid or submit bids for products. This tool will allow the SMEs to sell their products to customers bidding with the highest price.

5.11.3.4 Mobile commerce

This sub module will focus on marketing strategies that will bring the message directly to the customers at the point of need. It will also allow the SMEs to embark on wireless advertising.

5.11.3.5 ERP

This sub module will enable chronological order tracking and will facilitate the optimization of inventory through better demand forecasts, better decision making, improved response times to queries and better customer goodwill.

5.11.3.6 B2C

This module will allow the SMEs to access global markets and hence sell their products to more customers. Beyond that, it will also avail opportunities for disintermediation, resulting in lower product prices.

5.11.4 Location-based service

This module will provide information and data to the SMEs based on their geographical position. For instance if an SME is looking for used wheels to purchase, by sending a text message with this request to the Location Based Service, the service will return a map showing all suppliers selling the requested product, within the SMEs proximity.

5.11.5 Online business repository

The online business repository will primarily consist of the virtual community, suppliers, customers and competitors. To the SMEs, this module will open up new lines of communications with customers and suppliers in a manner that is mutually beneficial.

5.12 Possible outcomes

The combined result of the framework and community focused interventions could be the establishment of a hub or satellite structure where up-to-date learning and resource processing occurs on a geographically dispersed basis, whilst also allowing people and products to periodically come together for the necessary face-to-face interchanges. The following items illustrate other possible outcomes:

1. Establishment and maintenance of village or district road

infrastructure

2. Establishment of multi-purpose service hub and satellite centers, linked with multi-media Telecom links; and supported by the development of periodic markets, education and resource centers
3. Introduction of freight services at village level
4. Promotion of service contracts with suppliers and customers
5. Promotion of multi-use tractor-trailers, or other intermediate means of hinterland-village transport and agricultural traction
6. Introduction of ICT training centers

The resultant outcome will be a coordinated periodic market system, together with small-enterprise logistical support (e.g. storage facilities, mini-containers, and transport brokers located at a multi-purpose centers). This could create opportunities for enterprises in different micro-regions to specialize and cost-effectively market their produce within the whole district or region.

5.13 Evaluation of the framework

Large sections of this research were published and presented at the International Development Informatics Association Conference (IDIA) in 2012. The conference took place from the 6th to the 8th of September 2012 at Beykent University in Istanbul Turkey. A significant number of academics and industrialists attended this conference. The theme of the conference was *alleviating digital poverty with ICT innovation in emerging economies*. The next few paragraphs present the feedback that academics and industrialists gave during the presentation of the framework. This feedback serves as the initial evaluation of the research.

5.13.1 Feedback and comments

5.13.1.1 Use a development approach

Dr. Jacques Steyn from Monash University acknowledged that while the design of the framework was consistent with value chain analysis, his major concern was that the framework should seek to accommodate existing supply chain dynamics. Thus an important consideration was to consider the power relationships among actors in the supply chain. As such the framework should facilitate collaboration instead of introducing entirely new power dynamics within supply chain agents.

5.13.1.2 Identify initiatives with a strong business case

Dr. Khene, from Rhodes University, lamented that the underlying business context must be competitive if the framework interventions were to be sustainable. She suggested that within the business environment the most competitive value chains and niches must be identified and the framework should be tested in a competitive environment. She argued that for testing purposes a vibrant environment would form the most suitable test bed.

5.13.1.3 Use a step-wise approach

Boitumelo Nkaenang from SAP South Africa highlighted that the framework should facilitate a stepwise approach. As such the solution developed from the framework should follow an incremental approach. Such a technique would allow the independent deployment, evaluation and testing of specific modules of the framework. The project/programme should plan for the transition from poor coordinated supply chain activities to commercially well collaborated supported services, with defined milestones and a clear timelines.

5.13.1.4 Framework must be flexible

Professor Graham Jonhson from Monash University Australia suggested that the framework should follow a holistic approach rather than act as a single instrument or recipe to

be followed. This involved the systemic analysis of the entire value chain and the relationship among its actors. The actual tools used and their application depended on the particular collaboration contexts. These tools change with conditions and the framework must therefore be capable of modification during programme implementation to suit the interests and capacity of the partners selected.

5.13.1.5 Identify an effective lead partner in the value chain

Professor Chrisanthi Avgerou from the London School of Business advised that a value chain framework is more robust if developed in conjunction with a leading actor within the chain. In designing and assessing interventions, it was critical to understand where the initiative originated. In a producer-driven initiative, the main challenge was to turn ad hoc collaboration into sustainable integration. In a buyer-driven model, the challenge was to identify competitive initiatives of sellers and then transform them into profitable collaborative ventures. A vital strategy was to therefore identify and work with a leading supply chain actor who was prepared to invest time and resources in using the framework to build relationships between suppliers and buyers.

5.13.1.6 Work towards a clear separation of roles

Melih Kirlidog from Turkish Telcom recommended that the framework should outline the roles of facilitators, financial service providers and other support agents. These roles should be clearly defined, especially in emerging value chains where their functions are not yet institutionally separated. For instance, if the finance function was performed by a chain actor, such as a farmers' marketing cooperative, attention should be paid to separating such a role in terms of institutional capacity, and governance. Another reason for a clear demarcation of roles was the need to build capacity without threatening the viability of the actors concerned.

6. Chapter 6: Conclusion and Recommendations

6.1 Introduction

This chapter concludes the research. It summarizes the main points of the study and highlights their impact and relevance to rural supply chains. It begins by giving an overview of the research objectives coupled with a summary of the key findings. The chapter then proceeds to outline the contributions of the study to the Namibian industry before concluding by giving suggestions and proposing recommendations for future research.

6.2 Overview of the research objectives

This study explored the current state of supply chains in rural areas in Namibia. It identified the challenges experienced by rural based SMEs in managing their supply chains. After this the research assessed the existing ICT infrastructure and determined whether such infrastructure was able to support rural supply chain management initiatives. The research then proceeded to undertake a qualitative and quantitative survey of the rural supply chain system before examining the contribution of two key success factors – collaboration and clustering. The research concluded by proposing an integrated ICT framework a tool that could be used to link SMEs to global value chains.

6.3 Summary of key findings

A prominent idea that emerged from this study pertained to the potential power of supply chain collaboration. From the results, it was reasonable to infer that the competitive strength of individual firms could be augmented by collaborating with other supply chain nodes. The leverage or stretch derived from such supply chain linkages could be decisive to success at any operational level of the firm.

The study also discovered that in Namibia, contemporary conditions made attention to collaboration knowledge and clustering especially salient. The most prominent conditions for growth were globalization as the source of economic opportunities, and

supply chain collaboration as the driver of competitive success. However, recent cognitive literature revealed that conditions that currently govern policy formation in Namibia assumed that domestic competitive activities were primary. They also assumed that, if the domestic competitive regime was relatively undistorted, and if a market was generally free from regulation, participation in global markets would therefore naturally follow. But this approach did not recognize the problematic nature of these activities in a rural context.

From the literature review, the study established that present Namibian public policy approaches were based on theories that were developed when national boundaries were significant economic barriers, and when technological change was periodic or episodic, rather than primary and continuous. Globalization and knowledge-based economies have since undermined both conditions. Although national boundaries are now much less significant barriers to economic activity, in rural areas structural barriers such as the lack of coordination of available resources still remained large. This made participation in global markets much more problematic for rural based firms.

While geographic boundaries were relatively less significant barriers to economic activity, many firms resultantly became more footloose. As such supply chain linkages, and logistical infrastructure thus acquired much greater importance in anchoring firms to particular regions or markets. This phenomenon created a wider public interest for new policy approaches.

Finally, the study revealed that the real power of rural supply chain collaboration was not in material investment. It was rather in establishing how rural based SMEs could be encouraged to bootstrap their own aspirations, goals and performance and were allowed to participate and contribute in regional and global value chains. The rationale for such an approach was thoroughly grounded in recent developments in scholarly theory. By such means, the competitiveness of an array of rural entrepreneurs could be developed and their contribution to broader public policy objectives renewed. The next section outlines the

potential contribution of the study.

6.4 Contribution of the Study

It is envisaged that the framework suggested in this study will unbundle information from the traditional value chain and provide a coherent cooperate strategy, which will manage upstream and downstream relationships within the supply chain. Given today's markets where the proactive role of the customer is gradually changing; the bidirectional features in the framework will enable the framework to adapt to environmental dynamics. In essence the framework will be functional in markets characterized by volatile demand and high variety of consumer tastes, and also in markets where demand is predictable and the product variety is low. By systematically adapting to the environment the framework will enable rural based SMEs to reduce costs appropriately through activities such as strategic sourcing, lean manufacturing, which is "doing more with less", and the use of a just-in-time purchase and supply approach.

From analysis, the underlying logic of the framework conceptualizes products and services as being most valuable when brought to the right production complex at the right time and in the right quantities. This thought process when applied to the status quo results in the fusion of supply chain management with market intelligence. Through this fusion the SMEs will be able to link existing supply chains with the relevant customer segments and then personalize their value propositions into the product range. Ultimately in so doing the SMEs will enhance customer satisfaction and subsequently increase the market share. Furthermore by continuously focusing on efficient supply chain management which tends to be cost oriented, major cost savings accrued from the production cycle will be translated into greater contribution margins. Notably as the market share increases and the cost structures improve, the profitability of the SMEs is also greatly enhanced.

Seen from a broader rural economic development perspective, the framework will facilitate the mobilization of existing ICT and logistics infrastructure. Once in operation the framework will coordinate the use of facilities such as airstrips, computer networks, and market infrastructure. As the model becomes fully functional the training of SMEs in aspects such as ICT will be intensified. Such initiatives will go a long way in trying to mitigate the effects of the existing economic structural barriers such as the digital divide.

From a social perspective, the framework will promote the collaboration of SMEs into strategic alliances such as Group Purchasing Schemes. These alliances will enable SMEs to get greater discounts by buying inputs in bulk. Moreover such business alliances will give SMEs greater bargaining and negotiating power during transactions. Also by forming alliances, information sharing will be simplified. The traditional barriers that discourage the seamless flow of information such as lack of trust, poor communication infrastructure, and information poverty will resultantly be overcome.

6.5 Recommendations

6.5.1 Community involvement in implementing solution

To develop a viable and sustainable supply chain solution, concern must be shared against problems that could be caused by inadequate involvement of community structures and all the other supply chain nodes. The logistics solutions should therefore be developed specifically to meet the needs of small-scale rural producers and their counterparts in the supply chain. The ideal approach would be to plan the deployment of a supply chain solution as part of a community coordinated nodal and linkage development agenda.

6.5.2 The role of the state in supply chain collaboration

The State could play a catalytic role in supply chain collaboration by offering collaboration incentives. Government industry policy incentives could be based on minimum levels of participation of firms in the supply chain. There might be specific incentives for firms who collaborate more. The percentage of incentives might depend on the achievement of specific targets (e.g. exports).

From the government's point of view supply chain linkages could be further encouraged through commitment to the following outcomes:

- Greater investment in training for both management and workforce;
- Increased local sourcing from remote areas
- Employment expansion;
- Networking with others in the same or complementary sectors;
- Productivity growth.

A positive analysis and assessment might lead to the development of collaborative frameworks involving such steps as:

- Establishing a developmental strategy and detailed strategic industry objectives for export development, thus creating awareness (and motives) for expansion in individual firms and providing analysis to stimulate their supply chain participation.
- Promoting local products and indigenous technology development. This would ensure technology development that all firms have access to, and are stimulated by, product or process innovations.
- Expanding industry promotion, marketing and brand recognition on a national level.
- Enhancing product quality by establishing and monitoring industry-wide standards.

The significance of internalizing the underlying concepts cited above has already been noted. The role of the government in this scenario would be that of a catalyst facilitator, and not of primary actor or sole sponsor.

In summary, the theory and practice reviewed in this study suggests a comprehensive framework through which the government role in economic development might be pursued. A role that is consonant with contemporary imperatives. Historically, such a role was critical both to the development of the rural economy and the uplifting of rural livelihoods. This study has suggested new ways in which such roles could be pursued.

6.6 Critical Evaluation of the Research

The main limitations of the research pertained to the enormity of the given subject matter in as far as the application of ICT to supply chain management was concerned. The domain of ICT was found to cover a wide spectrum of tools. It was therefore difficult to test all the ICT tools to the different scenarios in the collaborative setup. Other limitations of the study were considered to be:

- a. A deficient level of interface between the social and technical aspects of rural collaborative working.
- b. The inability to include or compare the chosen ICT methodologies against other available approaches.
- c. The lack of inclusion of all the various applications due to the enormous numbers available within the industry.

6.7 Future Research

Based upon the foregoing research findings and conclusions, the following recommendations are submitted for future research.

1. Further research on additional industrial sectors is required in order to obtain a more encompassing target population.
2. Appropriate time and effort should be expended in the development of the protocols that will govern the supply chain solution.
3. Teams responsible for developing procedures and processes should identify the contextual requirements of the communities.
4. In the absence of an industry defined framework, project teams are advised to adopt the principles of early community involvement and ensure all parties are engaged in the development of a protocol at the earliest opportunity.
5. Protocols must provide equal reflection of companies, projects and extranet system procedures and not sacrifice one at the expense of the others.
6. Organizations whose work increasingly depends on collaborating via multiple frameworks should seek to develop their own internal framework; ensuring that it is generic enough for any project scenario.
7. There is need to build a model that will evaluate the success of the solution.
8. There is need to develop the actual system that will house the supply chain solution.

6.8 Conclusion

This research has highlighted that the expedient movement of goods through the supply chain can greatly increase the profitability of rural based enterprises. On the other hand while modern information technology provides new cost effective ways of supply chain management, such technology has not been adopted by the majority of rural based SMEs in Namibia. This has culminated in distorted cost structures and inefficient procurement systems. Rural based SMEs therefore need to be assisted in order to embrace the benefits of the ongoing logistics evolution. The framework suggested in this research will be an influence towards establishing a new era of ICT enabled collaborative business environments for rural based SMEs in Namibia and beyond.

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8. Appendix

8.1 Rural Supply Chain Management Questionnaire

General demography and operation details

1. Please give your job title. _____

2. Your Gender

Male Female

3. Are you the owner of the company?

Yes No

4. Which legal entity best describes your company?

Sole Proprietor Close Cooperation Private Company Public
Company

Partnership

5. When was your company established? _____

6. Which region do you operate from? _____

7. How many employees do you have? _____

8. Which sector best classifies your operations?

Agriculture Mining Carpentry Textile Other

9. Please tick the category that best describes your company's monthly sales income.

Less than N\$5000

Between N\$5000 and N\$10000

Above N\$10000

10. On a scale of 1-5 how would you rate the development of your company over the past three years in the following areas, sales turn over, profit, and market share growth? (1=significant decline, 2=decline, 3= remained the same, 4=increased, 5=significant increase)

	1	2	3	4	5
Sales turnover	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Profit

Market Share growth

Procurement

1. Approximately what percent of your products were purchased or sold under some form of contract? (Note: Contract, means any agreement where multiple orders were placed over time, e.g. an entire season or year, at a predetermined price and/or quantity.)

% of purchases/sales under contract

0% between 1% and 10% between 11 and 25% above 25%

2. Do you have any service level agreements with your customers?

Yes No

3. If the answer to question 2 is yes, how many service level agreements do you have_____?

4. Do you have any service level agreements with your suppliers?

Yes No

5. If the answer to question 4 is yes, how many service level agreements do you have_____?

6. Which communication media do you use to communicate with your suppliers?

Cell Phone EDI Internet E-mail Fax

Other (specify) _____

7. Which communication media do you use to communicate with your customers?

Cell Phone EDI Internet E-mail Fax

Other (specify) _____

8. When you purchase your raw materials or inventory, what is the average order cycle lead time (in days)

Note: Order cycle time is defined as the number of business days, on average, from when an order is placed until an order is received at the distribution

9. What is the percentage of your procurement costs to your monthly sales on average?

Suppliers

1. What percentage of your company's products is purchased from each of the following sources on average?

Direct from your company _____

Via Broker/Middlemen _____

Wholesaler _____

Export Market _____

Other (specify) _____

2. What percentage of your company's products is purchased by the following category of customers?

Customers from your region _____

Customers outside your region _____

Customers from other countries _____

Transportation

1. Do you have any formal transportation contracts with your suppliers?

Yes No

2. On average, what is the percentage of your transportation cost to your sales on average?

3. What percentage of your product purchases are received directly at your company?

4. Approximately what percentage of your purchases is delivered “on-time”?

% delivered on time

5. Approximately what percentage of your purchases is rejected or unusable on delivery?

% rejection

Technology

1. Please estimate the percentage of your product purchases that rely on the following initiatives:

Electronic Data Interchange (EDI) _____

Internet _____

Continuous Replenishment (CRP) _____

Vendor Managed Inventory (VMI) _____

Automated Purchase Order System _____

B2B E-Commerce _____

2. Please estimate the percentage of your sales that rely on the following initiatives:

Electronic Data Interchange (EDI) _____

Internet _____

Continuous Replenishment (CRP) _____

Vendor Managed Inventory (VMI) _____

Automated Purchase Order System _____

B2B E-Commerce _____

3. Within your company, what priority do you place on the use of Information Technology?

Select a priority number (1-5) from the scale below and write it in the space provided.

Low Priority Neutral High Priority

1 2 3 4 5

Responsibilities

1. Who in the production and distribution system do you believe has the major responsibility for each service below? (Please write the number of the corresponding sector in the blanks provided below.)

Responsibility lies with: SMEs/Retailers = 1 Shared = 2
Suppliers = 3

Demand forecasting _____

Market research _____

Promotion support/planning _____

Supply chain management _____

Productivity analysis _____

Transportation _____

Inventory management _____

Thank you for completing this survey. Please return it in the pre-addressed envelope.

8.2 Interview Guide

SECTION ONE: OPERATION PROFILE

Questions:

- 1.1 What position / title do you hold?
- 1.2 How many employees does your company employ?
- 1.3 How would you describe the performance of your company over the past three years?
- 1.4 What type of work is your company mainly involved in?
- 1.5 Which region do you operate from?
- 1.6 What is your approximate sales turnover per month?

SECTION TWO: SUPPLY CHAIN COLLABORATIVE WORKING PRACTICES

Questions:

- 2.1 Do you have service level agreements with suppliers or customers?
- 2.2 How effective do you believe these contracts are?
- 2.3 What do you believe are the benefits of partnerships within the supply chain?
- 2.4 What do you believe are the challenges of establishing these partnerships?
- 2.5 What is your order lead time?
- 2.6 Approximately when you procure stock or raw materials, how much do you spend on transport costs?
- 2.7 What percentage of your customers is from your region?
- 2.8 What percentage of your customers is from other regions?

2.9 What percentage of your customers is from other countries?

2.10 Which media do you use to communicate with you customers?

2.11 Do buy stock from middlemen?

2.11 How reliable are these middlemen?

2.12 Are you part of a group purchasing scheme?

SECTION THREE: INFORMATION TECHNOLOGY APPLICATION IN SUPPLY CHAIN COLLABORATIVE WORKING PRACTICES

3.1 Do you consider ICT to be important in supply chain management?

3.2 Do you use ICT in your company?

3.3 What communication media do you use to communicate with your
suppliers/customers?

3.4 Do you think your employees are adequately trained to use ICT in their daily
operations?