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The origins, functioning and business model impact of the Sustainable Cotton Cluster in South Africa

By

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Submitted in partial fulfillment for the degree

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DECLARATION

I, **Mkhanyisi Erick Dlamini** declare that this thesis which I submit for the MSc. degree in Agricultural Economics at the University of Pretoria, is my own work and has not been previously submitted for a degree at this or any other tertiary institution.

Signature .....Date: .....

Mkhanyisi Erick Dlamini

Approved by:

Signature: .....Date: .....

Dr Daniel du Plessis Scheepers Jordaan

DEDICATION

This thesis is dedicated to my late mother, whose nurturing and wise teachings continue to inspire and motivate me up to this day.

ABSTRACT

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Cotton is produced in several countries globally for its economic benefit predominantly to manufacture a wide variety of fabrics suitable for wearing apparel, home furnishings, and for other industrial applications. However, over the past two decades, the production of cotton in South Africa has declined from over 25,000 metric tonnes in the 2004/2005 season to only about 5,000 metric tonnes in 2013/2014 a staggering 80% drop in yields. Farmers had switched to producing alternative crops because cotton was no longer profitable and was susceptible to high fluctuations in world cotton prices. Providentially, the formation of the Sustainable Cotton Cluster in the South African cotton value chain turned around the production of cotton locally and significant increase in yields were realised after the 2013/2014 season.

This study investigated the origins, functioning and impact of the Sustainable Cotton Cluster in the revival of the cotton industry in South Africa. The study employed a qualitative research design and more specifically a case study approach to investigate in greater depth the understandings and/or perspectives on origins, functioning and impact of Sustainable Cotton Cluster in South Africa. It specifically applied thematic analysis for

the concise explanations and understanding of the complex issues that have emerged on the existence of the cotton cluster.

Results of the research showed that the cluster was formed mainly to revive the competitiveness of the cotton industry, to serve local market, to overcome high production costs, and to close gaps on information flow. Fundamentally, cotton clusters eliminated information asymmetries across the cotton production value chain and aided the establishment of a profitable business venture for both small-scale and large-scale cotton producers.

Keywords: Cotton, cluster, virtual, integration, sustainable

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Table of Contents

DECLARATION i

DEDICATION ii

ABSTRACT iii

ACKNOWLEDGEMENT v

Table of Contents vi

LIST OF TABLES xi

LIST OF FIGURES xii

LIST OF ACRONYMS xiii

CHAPTER 1 1

GENERAL INTRODUCTION 1

1.1 Introduction 1

1.2 Background of cotton in South Africa 5

1.3 Problem Statement 9

1.4 Objectives of the study 11

1.5 Propositions 11

1.5.1 Proposition 1 12

1.5.2 Proposition 2 12

1.6 Organization of the Study 12

CHAPTER 2 14

REVIEW OF LITERATURE 14

2.1 Introduction 14

2.2 Cotton Production and Marketing in Sub-Saharan Africa 14

2.3 Cotton Production and Marketing in SA 14

2.4 Cotton value chain analysis: the movement from farm to fabric/ Understanding the cotton value chain. 17

2.6 Supply Chain governance: Virtual integration an alternative for vertical integration 21

2.8 Supply chain innovation 22

2.9 A transaction cost approach to inter-organizational relationships, collaborations and alliances in agricultural systems 24

2.10 Inter-organizational relationships in supply chains/ Supply chain collaboration 27

2.11 Benefits of Supply Chain Collaboration/ Practices 29

2.11.1 Information sharing 29

2.11.2 Joint decision making 30

2.11.3 Incentive sharing 30

2.11.4 Goal congruence 31

2.11.5 Joint knowledge creation 31

2.11.6 Collaborative communication 32

2.12 Supply chain collaboration/ inter-organizational relationships in agricultural supply chains 32

2.12.1 Producer organizations, farmer cooperatives and associations 32

2.12.2 Clusters and agro-based clusters 34

2.12.3 The role of government in agriculture clusters 36

2.13 Summary 36

CHAPTER 3 38

METHODS AND PROCEDURES 38

3.1 Introduction 38

3.2 Research design 38

3.3 The population 42

3.4 Data and data collection 45

3.5 Data analysis 46

3.6 Pilot study 48

3.7 Scientific rigour in qualitative research 48

3.8 Ethical considerations 49

CHAPTER 4 51

RESULTS AND DISCUSSION 51

4.1 Introduction 51

4.2 The Rationale and Factors on the Formation of Sustainable Cotton Cluster 52

4.2.1 Factors that led to the decline in the Cotton Industry 53

4.3 The impact of the Sustainable Cotton Cluster on the cotton industry 55

4.4 The functioning of the cluster: Unpacking the business model 57

4.4.1 Product identification 57

4.4.2 Supply chain mapping 58

4.4.3 Supply chain costing 58

4.4.4 Implementation 58

4.4.5 The role of Information technology on the business model 59

4.5 Challenges faced by the Cotton Cluster 62

4.6 Conclusion 63

CHAPTER 5 65

CONCLUSION, SUMMARY AND RECOMMENDATIONS 65

5.1 Introduction 65

5.2 Discussion of research propositions 65

5.2.1 Unprofitability and uncertainty versus virtual integration 66

5.2.2 Virtual integration versus Supply chain risks 66

5.3 Overall conclusion 67

5.3.1 Other conclusions 68

5.4 Recommendations 68

REFERENCES 70

ANNEXURES 85

Annexure 1: Consent form 85

Annexure 2: Interview agenda 86

LIST OF TABLES

TABLE 1-1: WHY COTTON MATTERS 1

TABLE 1-2: TOP TEN COTTON PRODUCERS IN 2019/2020 4

TABLE 2-3: COTTON PRODUCTION DISTRIBUTION IN SOUTH AFRICA - 2016/2017 PRODUCTION YEAR 17

TABLE 2-4: TYPOLOGY OF INTER-ORGANIZATIONAL RELATIONSHIPS 27

TABLE 2-5: BENEFITS OF AN AGRICULTURE CLUSTER FOR A SHF 35

TABLE 3-6: OPTIONS, ADVANTAGES, AND LIMITATIONS OF QUALITATIVE INTERVIEWS 42

TABLE 3-7: FARMERS THAT PARTICIPATED IN THE FOCUS GROUP DISCUSSION FOR PRIMARY PRODUCTION 44

TABLE 3-8: PARTICIPANTS OF THE INTERVIEWS 45

TABLE 3-9: STEPS FOR GOOD THEMATIC ANALYSIS 47

LIST OF FIGURES

FIGURE 1: MAIN COTTON-PRODUCING AREAS IN SOUTH AFRICA AS OF 2016/17 PRODUCTION YEAR 16

FIGURE 2: THE CONVERSION PROCESS OF COTTON FROM FARM TO FABRIC 18

FIGURE 3: THE COTTON VALUE CHAIN 18

FIGURE 4: THE COTTON CYCLE FROM PLANTING TO HARVESTING 19

FIGURE 5: BASIC TYPES OF DESIGNS FOR CASE STUDIES 41

FIGURE 6: POPULATION AND SUB-POPULATIONS 43

FIGURE 7:FACTORS THAT LED TO THE FORMATION OF THE SUSTAINABLE COTTON CLUSTER 52

FIGURE 8: SUMMARY OF FACTORS THAT LED TO THE DECLINE IN THE COTTON INDUSTRY .54

FIGURE 9: IMPACT OF THE COTTON CLUSTER IN SOUTH AFRICA 56

FIGURE 10: THE CLUSTER'S BUSINESS MODEL 57

FIGURE 11: STAKEHOLDER LINKAGES IN THE SCC 59

FIGURE 12: CHALLENGES FACED BY THE CLUSTER IN THE NEW BUSINESS MODEL 63

LIST OF ACRONYMS

BCI	-	Better Cotton Initiative
CMAAE	-	Collaborative Masters in Agricultural and Applied Economics
CR	-	Continuous Replenishment
DALRRD	-	Department of Agriculture, and Reform and Rural Development
DTI	-	Department of Trade and Industry
ECR	-	Efficient Customer Response
FAO	-	Food and Agriculture Organization
GAP	-	Good Agricultural Practice
GDP	-	Gross Domestic Product
HVI	-	Heavy Volume Instrument
ICAC	-	International Cotton Advisory Committee
ICM	-	Integrated Crop Management
IPM	-	Integrated Pest Management
ISCP	-	Integrated Supply Chain Platform
IT	-	Information Technology
ITC	-	International Trade Centre
MIT	-	Massachusetts Institute of Technology

OPVIS	-	Operations Visibility Solutions
RBV	-	Resource-Based View
RFID	-	Radio Frequency Identification
SA	-	South Africa
SACI	-	South African Cotton Industry
SAPPO	-	South African Pork Producers Organization
SCC	-	Sustainable Cotton Cluster
SHF	-	Smallholder Farmer
SSA	-	Sub-Saharan Africa
TCE	-	Transaction Cost Economics
UNCTAD	-	United Nations Conference on Trade and Development
UNDP	-	United Nations Development Programme
USA	-	United States of America
WAC	-	Writing-Across-the-Curriculum
WTO	-	World Trade Organization

CHAPTER 1

GENERAL INTRODUCTION

1.1 Introduction

Cotton is among the leading crops produced in many countries in the world and it is the widely used natural fibre accounting for a third of the total fibres manufactured worldwide (Voora, Larrea &Bermudez, 2020). This crop is specifically produced for its economic benefit to countries and it is used to manufacture a wide variety of fabrics suitable for wearing apparel, home furnishings, and industrial usage. Fabrics made from cotton are appreciated for several reasons, among other reasons these fabrics are known to be strong, water absorbent and very comfortable (Voora et al., 2020). The economic importance of cotton has forced governments of almost all countries producing it to adopt strategic policies or programmes to enable sustained production. Cotton is beneficial to almost every individual in the world, these benefits can either be direct or indirect. During world cotton day on the 7th of October 2019 different organizations were quoted saying why cotton matters to each of them. The quotations are shown in table 1.1.

Table 1-1: Why cotton matters

Organization	Statement on Cotton matters
1. World Trade Organization (WTO)	Cotton is present in every aspect of our life, from our clothing to our meals. However, this extraordinary plant is capable of producing more than textile fibers, animal feed, and culinary oil. Cotton is a truly international product. Cotton production and processing are key contributors to economic stability and employment creation in 75 countries, including several least-developed countries (LDCs).

2. Food and Agriculture Organization (FAO)	Cotton is a crucial industry for FAO for a variety of reasons. In many nations around the world, particularly in the least-developed, this sector has been a major economic component and engine of economic growth and development. The worldwide cotton business employs about 100 million family farmers in 75 countries and generates more than USD 50 billion in raw materials annually. Cotton is an important source of income and employment for millions of smallholder farmers and their families. It is an important source of export earnings for some of the world's poorest countries, allowing them to pay for their food import expenditures.
3. United Nations Conference on Trade and Development (UNCTAD)	Cotton is a cash crop with a lot of promise to help people get out of poverty and improve their economies. Cotton is a drought-resistant crop with a quick market, allowing small farmers to pay for school fees, medical services, and other vital expenses with consistent cash revenue. Cotton has a long value chain with many processing phases that lead to investment, employment development, and industrial upgrading. Cotton-growing technology advancements provide opportunity to reduce waste and boost value-added. Consumers around the world continue to seek cotton products at the end of the chain, resulting in lucrative business prospects.
4. International Trade Centre (ITC)	Cotton is a key source of foreign exchange profits and gives income to millions of people in Africa, particularly those living in rural regions, including women.

5. International Cotton Advisory Committee (ICAC)	Cotton provides a living for hundreds of millions of people around the world, either directly or indirectly, therefore guaranteeing its future is crucial to their survival.
6. Cotton -4	Cotton, a symbol of the Doha Round of global trade talks, plays an important role in the economic and commercial operations of the nations that have signed on to the Cotton Sectoral Initiative (C 4). Cotton accounts for 8% to 12% of the gross domestic product (GDP), 40% of overall export revenue, and 70% of agricultural export revenue in the C 4 countries.

Source: WTO, 2019

Cotton is grown in several countries around the world, but over 90 per cent of the world output is accounted for by countries in the Northern hemisphere. Cotton production from developing countries accounts for greater than two-thirds of the world's production (Baffes, 2004). In the period between 1960 and 2001, the world production of cotton doubled from 10.2 million tonnes to 20 million tonnes (*ibid*). The major cotton producers in the world are India, China and the United States of America (USA). Table 1.2 below shows the top ten cotton-producing countries in the 2019/2020 production year.

Table 1-2: Top ten cotton producers in 2019/2020

Country	Production (1000'metric tonnes)
India	6000
China	5800
US	4377
Brazil	2755
Pakistan	1350
Turkey	815
Uzbekistan	641
Mexico	369
Argentina	358
Greece	317

Source: International Cotton Advisory Committee (ICAC), 2021

It is of little surprise that two of the world's largest cotton producers are also the world's largest consumers. Countries with the largest textile industries in the world are China which consumed 8050 000 metric tonnes, India which consumed 5 535 000 metric tonnes and Pakistan which consumed 2 358 000 metric tonnes as of the 2019/2020 season. Despite being the fourth major consumer of cotton, Bangladesh is also the world's third-largest importer of cotton. Bangladesh's cotton imports rose from 1 055 000 metric tonnes in 2012/13 to 1 614 000 metric tonnes in 2019/2020. The US is the world's largest cotton exporter with 3 592 000 metric tonnes exported in the 2019/2020 season. It is worth noting that South Africa has moved up the ranks. The ICAC data portal shows that South has moved from number 42 in 2010/2011 to number 36 in 2019/2020 (ICAC, 2021).

Given the fact that cotton is an internationally traded product, it is important to monitor the direction and trends of global cotton prices. In the period between 2010 and 2020,

cotton prices were declining with temporal increases. On the peak side, the price of cotton reached US$ 2.05 per kilogram in 2011 which was the highest in the defined period. Whereas, on the lean side, the lowest price of cotton observed was US$ 0.54 per kilogram in the year 2020 (Macrotrends, 2021).

Therefore, it is of national importance that the cotton value chain should always be on the agenda of sustained agricultural production because of the value it has on the entire economy. Information gathered from Cotton SA shows that the textile industry which houses cotton represents 12% of the total employment in South Africa. The industry also generated export revenue worth R 11 937 000 in 2019 (Cotton SA, 2021).

1.2 Background of cotton in South Africa

Over the past two decades, the production of cotton in South Africa has been declining and as a result, the country's internal production could not meet the local demands for this important fibre. Cotton in terms of lint production decreased from over 25 kilotons in the 2004/2005 season to approximately five kilotons in the 2013/2014 season (Cao et al., 2017). This decline is equivalent to an 80% decrease in the production of cotton and this occurred in less than a decade. Despite the very low contribution of around 1%, to the agricultural sector in the gross domestic product of South Africa, the importance of the sector cannot be ignored.

The South African cotton industry employs a considerable number of people throughout the value chain (Malinga, 2019). At the farm, employees consist of seasonal and permanent employees. The downstream of the industry consists of the textile and apparel sector. The number of apparel industry employers decreased from 1042 in 2003 down to 865 in 2013. This decline in employers decreased the number of employees from 96 960 in 2003 to 52 656 in 2013 which is equivalent to a 46% decrease (Morris & Barnes, 2014). According to Malinga (2019) and the Ministerial Committee to Review Agricultural Marketing (2006) the decline in production was not a consequence of the deregulation of the cotton industry alone but rather a case of changes in international markets and trade liberalization (According to Malinga (2019) challenges or constraints that led to the decline in the industry are as follows:

1. Competition from other countries where governments subsidize agriculture: in other countries prices of cotton is affected by the support that the government offer to farmers including input subsidies. These kinds of support are given based on the difference between market prices and prices to producers and these incentives encourage farmers to focus on cotton production. Due to the limited support in South Africa, young people have difficulties accessing funds to venture into farming.
2. Market competition from other crops: the world market and the exchange rate movements continue to affect domestic prices. The plummeting of international cotton prices has forced some of the farmers in South Africa to switch to more profitable crops like maize, wheat, sunflowers, oats, and sugar cane.
3. Relatively high input costs: most of the cotton grown in South Africa is Bt cotton but there is no evidence suggesting that it reduces the cost of production like pesticide use. It is also alleged that farmers pay a high fee for the Bt technology. The lack of skills and expertise required for the Bt cotton management makes it even more expensive for the farmers. Other constraints to cotton production are the inputs like fertilizer, pesticides, and labour.
4. High costs of harvesting or picking cotton: handpicking is more expensive than using machinery in South Africa; however, most small-scale farmers use handpicking which further erodes the profit margin. The general minimum wage for farm workers is set to R 18 per hour thus reducing the profit for smallholders.
5. Low-cost imports: illegal imports, incorrectly declared items and cheaper imports from Asia have also negatively affected the South African textile sector. With high costs of labour, the local products face steep competition against imported products.

All these factors have affected the growth of the sector. These factors have forced farmers to switch to other crops, processors to import a big share of their raw materials and thus driving to the ground the sector and mostly the primary production of cotton in South Africa. Nonetheless, the industry has since realized some progress in turning the situation around, the cotton output and area under production have since been increasing. According

to Malinga (2019), the production has increased from 25 000 bales in 2013 to 180 000 bales in 2018. Cotton hectares planted on dry land in South Africa have increased by 329 per cent since the cluster was established, owing to the availability of cotton stripper harvester technology, which was successfully proven under the Cotton Cluster. The output increased by approximately 50% in terms of bales compared to the 2015/16 season (Cotton SA, 2017).

South Africa's cotton industry is under the coordination of the industry body, Cotton South Africa (Cotton SA). After the deregulation of agricultural marketing in South Africa in the 1990s, the statutory Cotton Board was dissolved, and Cotton SA was formed to replace it. Cotton SA is a non-profit organization that brings together firms in the cotton value chain from both the private and public sectors. Producers (farmers), organized labour, consumer organizations, and service providers are among those whose goal is to stabilize employment and increase the industry's overall competitiveness. Cotton SA performs the following tasks: (Cotton SA, 2017):

- Collects and put together information and renders information services to role players,
- Promotes cotton production and usage,
- Maintains the quality standards and the norms and provides training,
- Coordinates cotton-related research in South Africa,
- Facilitates the development of the small-holder cotton farming sector,
- Serves as the forum for discussion of cotton matters, and
- Act as a governance body for the sustainable cotton cluster,

In 2014 a program was developed by the industry stakeholders collectively as a way of turning around the industry’s declining cotton production. The programme brought together all the value chain actors starting from the farmer to the consumer (represented by the retailer). The programme was funded by the department of trade and industry (dti) and was termed the Sustainable Cotton Cluster (SCC). The cluster aimed to establish an enabling environment for cotton producers and manufacturers to supply local and international customers with fully traceable and sustainable cotton products (Cotton SA, 2017, Malinga, 2019). In the quest to create an enabling environment, the SCC designed

a new business model to run the cotton industry and achieve its objectives. The cluster designed and adopted a virtual integration model, which will be discussed further in chapter two section 2.6. The objectives of this cluster were as follows (Cotton SA, 2015):

- Building capacity in the Southern African cotton industry value chain,
- Stabilizing employment and improving the overall competitiveness in the cotton industry,
- Reviving the cotton sector
- Creating jobs, as well as,
- Incubating opportunities for fragile business participation throughout the value chain.

In the process of reviving the industry, several observations can be made concerning how cotton was traded before. Firstly, how cotton was traded before changed from a short-term contracting form to an integrated platform or long-term contract, stated the Cotton SA Chief Executive officer (Bruwer, 2017). According to before the cluster, cotton was marketed in one of the following three ways:

1) The grower sold seed cotton to a ginner, who gins the cotton and then sells cotton lint to spinners (and seed to processors) for his account, either directly or through agents.; or

2) The grower contracted the ginner to gin the seed cotton on his behalf at a ginning fee. In this case, the cotton lint and seed remained the property of the producer who then either marketed it himself or contracted the gin or someone else to market the cotton lint (or seed) on his behalf.

3) If the growers owned their gins, then they ginned cotton themselves. Afterwards, they could either market the cotton lint and seed themselves or out-source this exercise as well.

Since the formation of the SCC, the independent action of players has been reduced; actors are now linked by an information technology (IT) platform called the integrated supply chain platform (ISCP). The actors are linked by contracts that govern their transactions. The SCC developed a new business model which ensures that the supply chain actors work

together. The integrated supply chain planning (ISCP) model enables joint planning of all activities. The programme is supported by technology that supports a demand planning module, a traceability module and a governance of compliance to standards module. The programme through these modules ensures triple bottom line sustainability across the entire chain. The triple bottom line means sustainability with the economic, social and environmental perspectives (Reichel, 2017).

1.3 Problem Statement

In the course of a decade (2003/2004 – 2013/2014) the cotton-producing industry in South Africa was considered to have become a moribund industry. The national output had declined so much that most of the cotton feeding the South African textile industry was imported. Lint production declined by 80% from 25 000 tons in 2004/2005 to only about 5 000 tons in 2013/2014 (Cao et al., 2017). Cotton-producing South African farmers had switched to producing other crops because producing cotton was reportedly no longer profitable and also risky owing to the high fluctuations of the world cotton prices. According to Fok et al. (2007), the better prices which resulted in higher profits offered by competing crops (maize, soya beans) contributed to the decline. Also, cotton prices had become so volatile and would change several times between the planting and the marketing season (Bruwer, 2017).

According to Cotton SA (2017), the cotton output has, however, increased significantly since 2013/2014 and so too has the number of farmers producing the crop. This comes after the formation of the Sustainable Cotton Cluster (SCC). The SCC developed with the assistance of the national department of trade and industry (dti) is believed to have contributed to the turnaround in the local production of cotton at the primary level. The dti injected a grant of R200 million into the development of the SCC. The grant supported a five-year plan to create momentum for the growth of the cotton fibre industry in South Africa. The SCC worked together with the private and public organizations in the country that are engaged in the cotton industry value chain, which includes producers, organized labour, processors, consumer organizations, and service providers (Cotton SA, 2017). South African cotton production seems to have reversed its downturn and has attracted back to it many farmers and the accompanying number of hectares planted to cotton.

The cotton industry in SA faced a huge decline in production which resulted in increased imports of raw materials to feed the industry value chain (Malinga, 2019). The stakeholders of the value chain then decided to come together and form a cluster in a bid to revive or turn around the situation, a new business model was developed. The cluster then launched a five-year pilot period to see if their new business model will work. In the course of piloting the clusters business model the industry's primary production increased and hectares under cotton production increased. A new business model according to Reichel (2017) reflects the DNA of a particular company, a justification behind how an organization creates value and ensures gains and profits from the generated value.

The main research question that motivated this study was the desire to know how the Cluster initiative managed to bring back the cotton sector through its new business model. In a bid to answer that question the researcher found it worthwhile to look further back to the roots of the cluster, how it was conceived, how it functions (within the new business model) and what impact has the cluster had on the sector, especially the primary production.

Several studies have been conducted in the cotton industry in South Africa. These studies include two studies conducted on the contextual appraisal of GM cotton (Fok et al, 2007) and impact on farm incomes after the adoption of Bt cotton (Gouse et al.,2003). A study on sustainability of the apparel supply chain where the triple bottom line sustainability was use to evaluate the supply chain (Cao et al., 2017). Throughout the reviewed literature, there is no study that was done to study the impact of the SCC, the impact of the SCC's business model which is virtual integration. Most studies have given a closer look to vertical integration without the virtual concept. Making this study unique is the interest it showed towards the virtual integration aspect of the SCC, beside contributing improving the SCC business model this study will increase the body of literature specifically on the South African cotton industry. The study further reduces the gap that exists in supply chain collaboration literature on virtual integration.

1.4 Objectives of the study

The main objective of this study was to investigate the origins, functioning and impact of the Sustainable Cotton Cluster on the South African cotton industry. Specifically, the study aimed to analyse the cluster's business model to get an understanding of how its application to the cotton industry changed the situation. To deepen this understanding, this study draws interest to the background of the cotton industry that necessitated the formation of the Sustainable Cotton Cluster and also the impact the cluster has had on the cotton industry.

The specific objectives are to:

- Identify the rationale and factors that led to the formation of the SCC for all stakeholders
- Describe the functioning of the SCC business model from all stakeholder's perspectives
- Assess whether the profitability and uncertainty of the local cotton chain have improved through the SCC business model
- Assess whether the SCC business model has had any impact on supply chain risks faced by the cotton supply chain in South Africa before the cluster was formed.

1.5 Propositions

A proposition according to Avan & White (2001) is a declarative statement, a statement that serves to identify a relationship between concepts and characteristics that are required to that level. A statement that can be judged true or false by observation, a tentative and conjectural relationship between constructs, based on the logic deduction, and a proposition should be testable using data (Bhattacherjee, 2021). The study builds upon the following propositions:

1.5.1 Proposition 1

Today's dynamic nature of competition posits that competing amongst suppliers/markets has become a thing of the past, competition now is amongst supply chains which are very difficult to coordinate when independently (Salhieh, 2011; Fish, 2011). For this reason, supply chains are faced with high uncertainties, and low profitability which ultimately affects the overall performance of the supply chain (Salhieh, 2011). The concept of collaborations in supply chains with specific interests in virtual integration has been observed by different authors to effectively address supply performance issues especially uncertainty and low or no profitability (*ibid*). In line with the investigation of the SCC's impact on profitability and uncertainty, the following proposition was formulated:

- ***The unprofitability and uncertainty in the South African cotton supply chain can be addressed by adopting a virtual integration model in supply chains***

1.5.2 Proposition 2

Every single actor in a supply chain encounter certain risk, facing and addressing those risks can be very frustrating for individual actors. When supply chain players come together, they share the risks, and it becomes easier for everyone. These risks include but are not limited to information asymmetry, and the bullwhip effect (Theus and Zeng, 2012; Yu et al., 2013). Since the study aims to study the SCC's business model which is virtually integrated the following proposition was formulated:

- ***Virtual integration in the SCC supply chains is an effective tool for reducing supply chain-related risks***

1.6 Organization of the Study

The study is structured into six chapters with the first chapter presenting the introduction and background on the cotton industry and sustainable cotton cluster in South Africa. The chapter also presents the objectives and defines the problem statement. Chapter 2 presents

a review of literature on the production of cotton internationally and a review of the institutions for the formation of clusters locally and in other selected countries. Chapter 3 presents the methodological framework and approaches adopted to investigate the origins, functioning and price impacts of cotton clusters in the country. Chapter 4 and chapter 5 presents the findings and outcome of the study's investigation. The last chapter, Chapter 6 presents the summary and recommendations.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

This section of the study gives an overview of the cotton industry from the global level down to the South African level. Discussed under this section are the production and marketing of cotton internationally, in Sub-Saharan Africa and South Africa. It also extends to analysing the South African cotton industry supply chain with special emphasis on the chain that is under the SCC pilot program.

2.2 Cotton Production and Marketing in Sub-Saharan Africa

Cotton is not only a key cash crop in Sub-Saharan Africa (SSA), but it is also a substantial source of foreign exchange for various countries in the region. Cotton is, predictably, the main source of income for millions of rural households, as well as one of the few African export products to have seen a rise in global market share in recent decades (Baffes, 2009; Boughton et al., 2003). Cotton is mostly grown by smallholder farmers in Sub-Saharan Africa, and is consequently thought to play a critical role in rural development and poverty alleviation on the continent (Badiane et al., 2002; Moseley & Gray, 2008). Cotton production is mostly concentrated in Francophone nations in Sub-Saharan Africa. As a result, they are mostly found in West and Central Africa, with a few in Eastern Africa. Burkina Faso, Mali, and Cote d'Ivoire are the top three cotton producers in SSA. According to the International Cotton Advisory Committee (ICAC), the three African giants produced 151 000, 185 000, and 95 000 tonnes of cotton in 2012 respectively. (ICAC, 2012).

2.3 Cotton Production and Marketing in SA

Cotton production in the Republic of South Africa is mainly dominated by commercial farmers, unlike other African countries where over 70% of the production is by small-scale farmers. In South Africa, since 1997 cotton was selected as a carrier wave for the

development of small-scale farming in Northern KwaZulu, the Limpopo Province and the Mpumalanga Lowveld (Hofs & Kirsten, 2002).

Cotton-growing areas in South Africa include the Springbok flats from Bela-Bela to Makopane in the Limpopo province, the Taung, Stella, Delareyville, and Maratsane in the North West province, and the lower Orange River, Vaalharts, Douglas, and Prieskadistrics in the Northern Cape. Small-scale farmers can be found primarily in Kwazulu Natal's Makhathini Flats and Mpumalanga's Tonga area (Gouse et al., 2006; DALRRD, 2016, Malinga, 2017).

Figure 1 shows the places where cotton is produced in South Africa. As shown in this figure, cotton production is not distributed evenly country-wide but rather located in selected regions. This can be explained by the crop's selective nature when it comes to climatic conditions. Cotton favours temperatures above 25 degrees Celsius. It is also a drought-tolerant crop that can survive with just below 500mm rainfall in a season and performs well in deep, highly fertile and sandy loam soils with good drainage (DALRRD, 2016). On the figure, the size green dots indicate cotton is grown under irrigation and the red dots symbolise rain-fed cotton, the sizes of the dot indicate the production scale at which cotton is grown in that area.

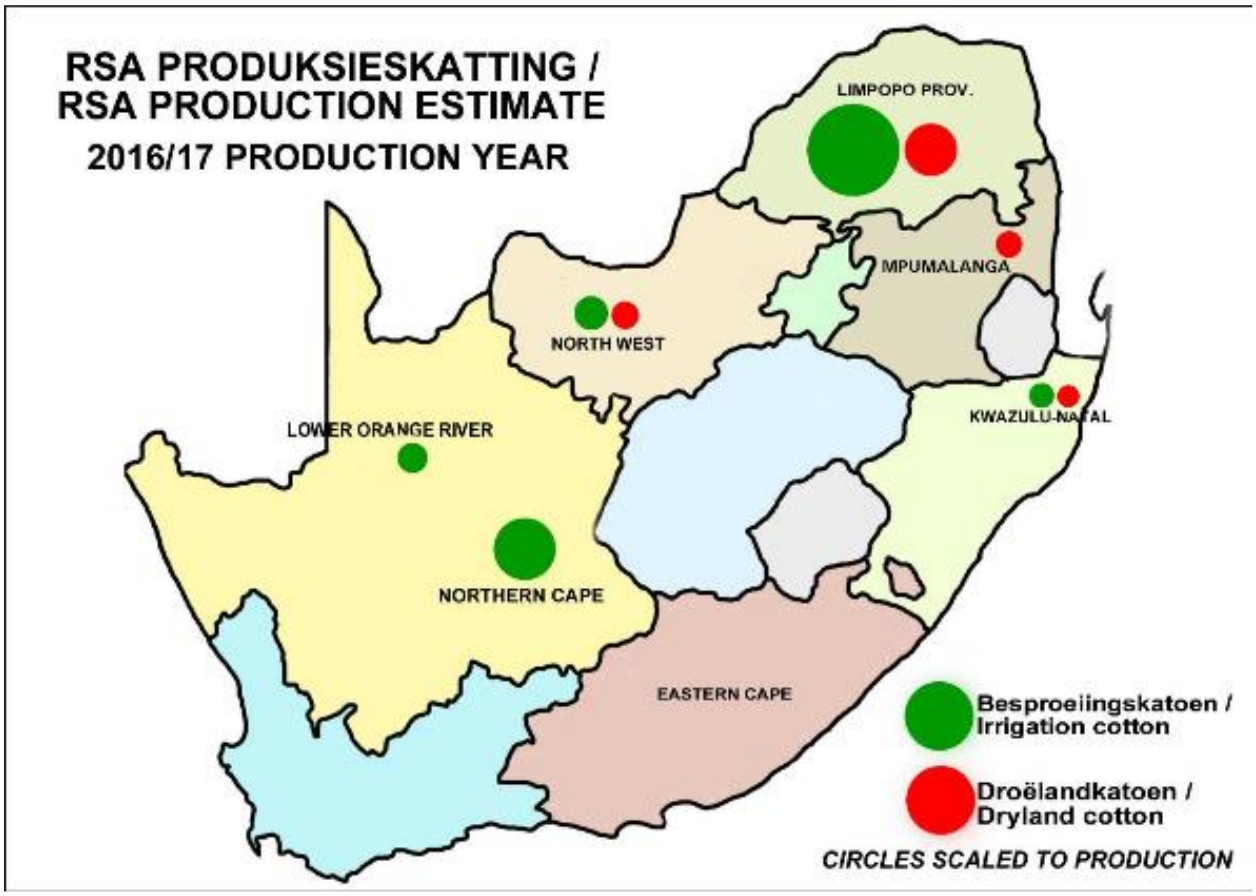

Figure 1: Main cotton-producing areas in South Africa as of 2016/17 production year

Source: Cotton SA, 2017

Most of the cotton produced in South Africa comes from the Limpopo province which has the largest area under cotton production as shown in Table 3 below. The province has the largest area under irrigation. The country's total area under production shows a huge decline in the 2016/2017 production season when compared to the 2001/2002 production season of 9,451 hectares under irrigation and 22,105 hectares of dryland cotton production (Gouse et. al, 2003).

Table 2-3: Cotton production distribution in South Africa - 2016/2017 production year

Area	Hectares (irrigation)	Hectares (dryland)
Mpumalanga	0	2657
Limpopo	4079	2000
Northern Cape	1980	0
KwaZulu Natal	380	1500
North West	522	1207
Total	**6961**	**7364**

Source: Cotton SA, 2017

Despite the many areas producing cotton in South Africa, the output in the production of seed cotton has been decreasing over the years. This decrease is attributed to the fact that the cotton industry was not viable mostly because of the low prices and revenue received by the farmers. The production of lint has reached 5,000 tonnes which is the lowest in the history of cotton production in South Africa.

2.4 Cotton value chain analysis: the movement from farm to fabric/ Understanding the cotton value chain.

This section discusses the activities of the supply chain right from the farm to the point where the product is ready for human consumption. The activities are divided into the number of stakeholders and details of each node will be discussed. Understanding this sequence is important for the identification of the points where the SCC made a difference.

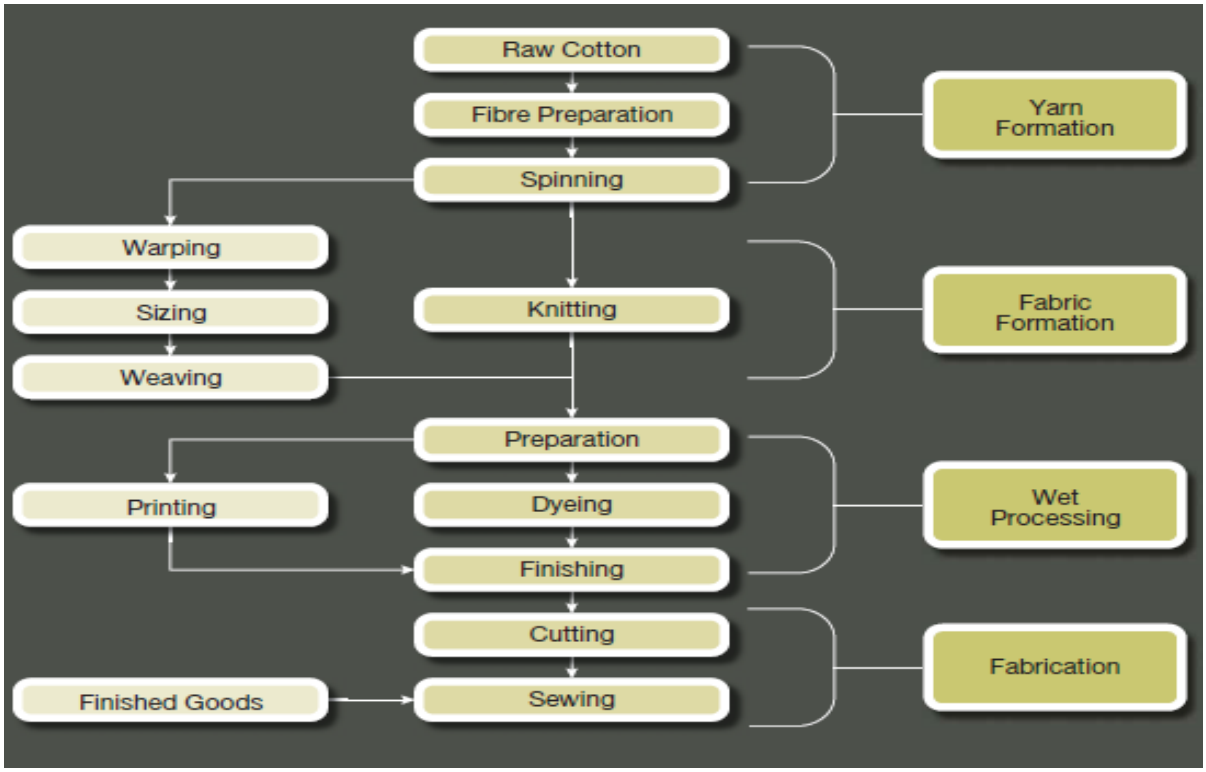

Figure 2: The conversion process of cotton from farm to fabric

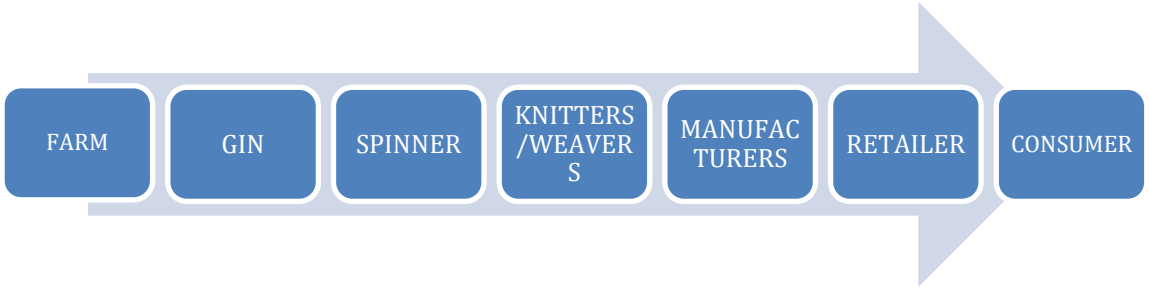

Figure 3: The cotton value chain

2.5.1 Cotton farming

At the farm level, two main activities take place, the production and the harvesting of seed cotton. The production of this cash crop depends significantly on the weather and conditions of the soil. Cotton does not thrive in pure sandy soils and clay soils. The conditions in South African cotton-producing areas favour the production of different

cultivars (DALRRD, 2016). Most cultivars produced in South Africa are Bt-cotton cultivars (genetically modified cotton). When the cotton bolls have sprouted and are dry, cotton can be harvested either by handpicking which is commonly used by small-scale farmers or by the combined harvester. Handpicked cotton is put in bales of 150-200kg and stored in that form before being delivered to the gin. Cotton harvested using combined harvesters is stored on modules that can weigh up to 25000kgs. Figure 2.2 shows the cotton cycle from planting to harvesting.

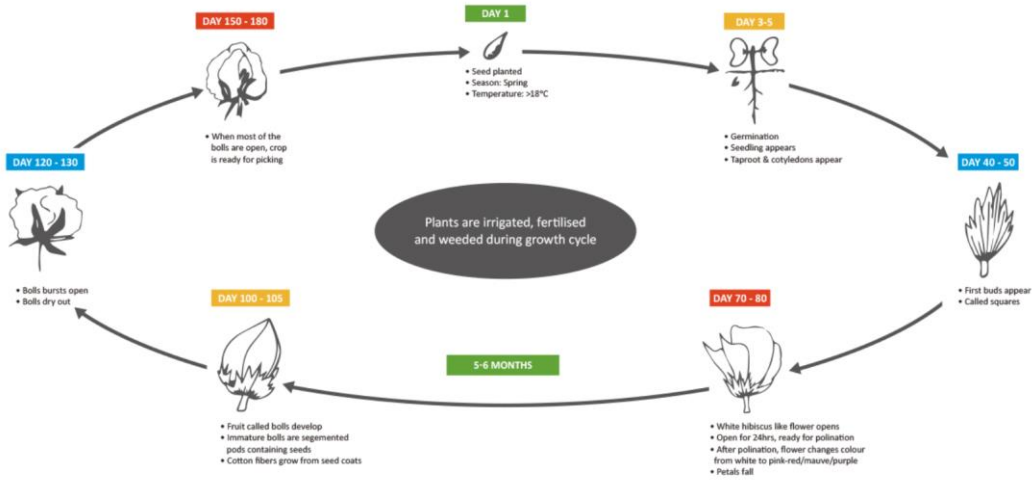

Figure 4: The cotton cycle from planting to harvesting

Source: Cotton SA, 2021

According to Gouse, Kirsten and Jenkins (2003) cost incurred in cotton production in South Africa includes the cost of land preparation, seeds, fertilizer, chemicals (pesticides and herbicides), labour, and irrigation costs (especially for commercial farmers), seasonal workers for handpicking. Public standards governing the production and marketing of agricultural products in South Africa are the Agricultural Product Standard Act, 1990, as well as the Marketing of Agricultural Products Act, 1996. These regulations set out clear mandates on the production and marketing of agricultural products (cotton included) in South Africa. Cotton production in South Africa is also regulated by a private standard which is the Better Cotton Initiative (BCI).

2.5.2 Cotton ginning

Cotton is delivered at the gin packed in spherical bales or modules. Upon arrival, the cotton is vacuumed into tubes that transport it to the dryer. Ginning prerequisites are that cotton must have a moisture level of 5%. Therefore, cotton is either dried if the moisture levels are too high, or water is added to raise the moisture content to the required 5%. Afterwards, the cotton undergoes several stages whereby it is cleaned to remove leaf trash, sticks, dirt and any foreign matter (Cotton Australia, 2017). The cotton is then put into the gin where seeds are separated from the lint. Each ton of seed cotton yields about 350-400 kilograms of lint and 600-650 kilograms of seeds (Bennet & Greenberg, 2011). The lint is pressed into bales of about 227kg. Samples are taken for testing at HVI laboratories for grading.

2.5.3 Spinner

Cotton arrives at the spinner in bales. During the spinning of lint into yarn, the lint undergoes five different stages. First, the bales are laid down open and blended using machines to ensure a consistent blend of fibres. Thereafter, the blended fibre is transferred into another machine which will now clean the fibre and remove the leaf, sticks, boll parts, and bark and seed fragments. Carding is the second process the fibre is put into a carding machine which aligns, individualizes and further cleans them into single, continuous, loose ropes called silver. Thirdly, the fibre undergoes a drawing process whereby the fibres are blended and straightened, and the number of fibres is reduced to the required density. This process also increases the silver evenness. On the fourth step which is combing the fibre, it is further cleaned and made finer, stronger, smoother and more uniform. Before the actual spinning, the fibre goes through the roving process where it is condensed into finer strands. This process draws out the silver into a thickness of a few millimetres and inserts a small amount of twist to hold it together. It is the wound onto a bobbin in preparation for spinning. Finally, the silver is spun to yarn. There are three main forms of spinning: rotor spinning, ring spinning and air-jet spinning. After spinning, the yarn is ready to be woven or knitted.

2.5.4 Knitters/Weavers and Cut, Manufacture and Trim (CMT)

At this stage, the yarn is now knitted or woven into fabric. Weaving is the traditional technique for making fabric. Despite the development of modern weaving techniques, the essential idea of interlacing yarns has remained unchanged. Hand looms were used to weave cloth in the past, using a wooden shuttle moving horizontally back and forth across the loom, interlacing the filler yarn horizontally and lengthwise warp yarn. In today's mills, high-speed shutterless weaving machines weave at tremendous speeds, producing an infinite variety of fabrics. Knitting is a fabric-making technique that involves interlocking yarn loops with a sequence of needles. (Cotton counts, 2017). It can be hand done or with a machine. The fabric is then manufactured to the desired product. From here, the finished product goes to the retailer, who in this case, represents the final consumer.

2.6 Supply Chain governance: Virtual integration an alternative for vertical integration

According to Kirsten et al., (2009), governance structures consist of all institutional organisations that govern the rights and ownership of resources, goods, and services and specifically the terms of exchange and access to these resources. Governance structures are determined by the institutional environment in which they are set. Kirsten et al. (2009) also suggest that governance structures are tools that can be used to lower transaction expenses.

For the smooth running and operation of supply chains to increase flexibility, the profitability of the entire chain, and curb risks governance is an essential dimension. Proper governance will increase the performance of the entire chain and ultimately introduce improvements in the competitiveness of the chain, particularly because competition is higher among supply chains these days (Wever et al., 2010). Additionally, Wever *et al.* (2010) highlighted the essence of properly aligning inter-firm governance structures to guarantee quality management and that any form of misalignment of these structures will lead to inefficiencies and higher transaction costs.

The generic South African cotton supply chain is mostly characteristic of the spot market and contract-based exchanges which makes it different from the supply chain of interest

in this study. Therefore, this study focuses on how the SCC pilot supply chain is governed rather than focusing on the generic one. The SCC pilot programme supply chain does not operate as a spot market and does not fit into a vertical integration but has adopted a newly proposed governance structure that falls somewhere along the continuum called virtual integration (Bruwer,2017).

The literature on virtual integration is not yet well developed as this is an emerging form of governance structure and supply chain management. Wang *et al*. (2006) define virtual integration in the supply chain context as a mechanism that enables firms to exchange ownership for partnership by incorporating a set of upstream actors (suppliers) through information technology (IT) for a stronger collaborative operation, and execution, planning and control. In agreement with this, virtual integration is defined as the use of technology and information to break down traditional supply chain barriers between suppliers, manufacturers, distributors, and end-users (consumers) (Li, 2007).

Wang *et al.*, (2006) proposed virtual integration as an alternative governance mechanism over the common vertical integration or hierarchy. In developing their argument, they stated that in as much as vertical integration reduces price uncertainty and lowers transaction costs, it can also result in low flexibility while incurring extra administrative and production costs related to the obligatory adaptability. The study opined that virtual integration can attain both manufacturing flexibility plus cost advantages by increasing internal and external control.

2.8 Supply chain innovation

The time for competition among products is no more, nowadays competition amongst supply chains has become more sustainable. This is because, as compared to new product introductions, resources committed to supply chain development tend to deliver higher cost savings and have a better long-term impact. (MIT centre for transport and logistics, 2012). In the quest to be highly competitive, firms have been left with no other option but to be innovative along their supply chains. This has resulted in the concept of supply chain innovation becoming a critical area for companies (Mandal, 2015).

Supply chain innovation is defined by Bello et al. (2004) and the MIT centre for transport and logistics (2012) as the integration of advances in information technology and related technologies with new logistic and marketing strategies to increase operational efficiency and service effectiveness. Supply chain innovation, according to Arlbjorn et al. (2011), is an incremental or dramatic change in the supply chain network or processes that can occur in a firm function to better create value for stakeholders. Some examples of technological innovations in supply chains include radio frequency identification (RFID) (MIT centre for transport and logistics, 2012), efficient customer response (ECR), continuous replenishment (CR), and the automatic ordering system amongst others (Bello et al., 2004).

The two definitions provided above both mention the use of technology and the introduction of new developments in operations or processes to enhance value creation for stakeholders. For this present study, the first definition (Bello et al., 2004; MIT centre for transport and logistics, 2012) will be used to define supply chain innovation. What makes this definition more relevant is the emphasis it puts on improving operational efficiency and service effectiveness. The SCC is mostly founded on this concept which will consequently help them deliver better value for their consumers.

Supply chain innovation is not confined to intra-organizations[1] but also inter-organizations[2]. Intra-organizational innovation can be defined as the use of modern technology in planning and forecasting, whereas inter-organizational innovation can be

[1] Intra-organisational innovation refers to innovation that takes place within one organisation, it may be across departments in the same firm.

[2] Inter-organisational innovation refers to innovation that occurs in two or more distinct firms. Firms can jointly be involved in creating a product or forming an organisation that will jointly benefit all of them. This is the form of innovation that is observed in the South African cotton industry which resulted in the Sustainable Cotton Cluster.

defined as the use of integrated product development, in which upstream and downstream members of a supply chain become involved in product development and the implementation of advanced planning tools (Arlbjorn et al., 2011). Companies seeking to increase their competitiveness have repeatedly used inter-organizational innovation as a lever (Lavastre et al., 2014).

2.9 A transaction cost approach to inter-organizational relationships, collaborations and alliances in agricultural systems

Inter-organizational linkages can be described to be a set of organizations or firms along with the relations that bind them together. These links can exist either vertically, horizontally or across industries. Horizontal linkages link firms of similar industries or markets (competing firms) whilst vertical linkages relate buyer and supplier relationships on supply chains and the cross-industry relationship links refer to firms operating in several sectors of industries (Fischer & Hartman, 2010). Menard (2004) stated that the vocabulary of such relationships is not yet well developed but terms that are normally met in the literature include “hybrids, intermediate forms, alliances, buyer-supplier relationships, inter-organizational collaboration, chains, channels, networks, clusters, among others”.

On elaborating on types of collaborations or alliances including relationships, Fischer & Hartman (2010) state that these are not just contracts between firms but rather collective arrangements. There are approximately five basic types of alliances, which allow for a generic classification of these inter-organizational interactions. Two of them are based on the partners' equity positions (equity or non-equity), while the rest are based on the parent firms' alliance relationships. Partners' ties are also important in distinguishing forms of alliances; rivals develop horizontal relationships, while non-competing enterprises form vertical or cross-industry relationships.

Non-equity inter-organizational relationships are often referred to as a contractual governance form in which parent firms have no asset control and ownership. This type of alliance can be horizontal, vertical or maybe cross-industry and can take various contractual forms of agreements. In equity-oriented relationships, parent companies split

residual claims and also rights of control over the assets. Similarly, these can also span vertical, horizontal and cross industries. Equity alliances most times will involve the emergence of a different legal body or organization (Fischer & Hartman, 2010).

The literature on transaction cost economics states that vertical collaborations fall within the intermediary form of governance (Williamson, 1991). Vertical alliances/collaboration will only occur in the supply chain between the supplier and buyer. The idea of a vertical setup is that one supplier being the upstream will supply some input to the downstream partner. This partner will therefore manufacture products using the input and market them downstream (Chaddad, 2009; Min, Roath, Daugherty, Genchev, Chen, Arndt & Richey, 2005).On the other hand, two or more firms that compete or have the potential to compete at the same level form horizontal alliances. Firms with a rivalry will join a horizontal arrangement to either produce or market services and products at a particular level in the marketing chain (Chaddad, 2009, Min et al., 2005).

Cross-industry alliances can be defined as cooperative agreements within firms that operate under dissimilar sectors or industries. There are two types of cross-industry alliances, the first one being amongst firms operating in the same supply chain however being placed in non-subsequent levels or stages. Such firms will not make transactions among themselves but rather make transactions outside the organization. The second one is among firms in different supply chains (Chaddad, 2009, Min et al., 2005).

In the transaction cost economics theory and the governance structure, the market and the hierarchy form the two polar forms (Williamson, 1991). Fischer & Hartman (2010) argue that this conceptualization does not include horizontal and cross-industry alliances. Vertical relationships between organizations are viewed to be intermediary forms lying between the market and the hierarchy. In Williamson's (1991) classification, markets are defined as a field whereby transactions are autonomous, and the price serves as a mechanism of coordination. Hybrids are long-term partnerships between parties who rely on contracts to safeguard and sustain their transactions. According to Fischer & Hartman (2010), the hybrid exists in a form of a continuum between the market and the hierarchy, the idea is that the hybrid forms are a combination of characteristics of both pure market and hierarchy. In the idea of a continuum, relationships with no equity are positioned

nearer to the market whilst those alliances that are equity-based are placed closed to the hierarchy.

Horizontal inter-relationships can also be put in a continuum. In this continuum firms that are direct competitors (competing in one industry) are put on one end of the spectrum while unification occupies the opposite side. Horizontal inter-relationships falling under the unification classification typically involve partners with formal contracts including equity agreements, like the classic joint venture, and clear cooperation rules. Direct competitors, on the other hand, even though they may still have some form of simplistic contract, do not include the allocation of equity amongst the associate members. Bureaucratic costs and the degree of cooperation tend to rise from the direct competitors to the unification category. In this case, the alliance consists of actual competitors this typically leads to the clustering of structures to support the industry. (Fischer & Hartman, 2010).

According to Fischer & Hartman (2010), cross-industry is business connections among companies that work in different business sectors. Here, the unifying goal is to achieve synergistic benefits by amalgamating firms' abilities as well as creating a platform for knowledge sharing. This could also lead to firms finding their niches as they try to reduce similarities to the works of other companies. The cross-industry continuum consists of different, non-connected businesses on one end without any form of interaction, while on the other hand, you have unification where you have a diversified portfolio of firms working as a single (united) entity.

As highlighted in the previous sections, inter-organizational relationships can be considered to be intermediate forms under the market-hierarchy continuum and/or unification. The inter-organizational relationships presented herein are summarized in Table 4 below. Four variables are used to describe the vertical, horizontal and cross-industry relationships. The arm's length relationship, unification (merger or acquisition), and intermediary collaboration relationships between corporations are examples of these. The key distinctive features highlighted in this summary that creates clear contrasts are the levels of interactions and agreements. Noteworthy is that no market interaction favours

diversification and attracts non-equity contracts and vice versa. (Fischer & Hartman, 2010).

Table 2-4: Typology of inter-organizational relationships

MODE OF GOVERNANCE	Inter-Organizational Relationships		
	VERTICAL	HORIZONTAL	CROSS-INDUSTRY
Market (Arm's Length Relationship)	Spot transactions	Competition	No interaction
	Repeated Transactions		
Intermediate Forms	Non-Equity Contracts*	Non-Equity Contracts*	Non-Equity Contracts*
	Equity-Based Contracts Autonomous Equity Joint Venture*	Equity-Based Contracts Autonomous Equity Joint Venture*	Equity-Based Contracts Autonomous Equity Joint Venture*
Hierarchy Or Internal Organization (Major Or Acquisition)	Vertical Integration	Horizontal Integration	Diversification

* Settings in which there can exist inter-organizational relationships

Source: Fischer & Hartman, 2010

2.10 Inter-organizational relationships in supply chains/ Supply chain collaboration

Cao & Zhang, (2011) define supply chain collaboration as the establishment of long-term partnerships such that supply chain stakeholders function as one unit and exchange resources, information and risk to realise common objectives. The concept of supply chain collaboration is becoming the most customary rule or method for countless companies across the world like the vegetable cluster and flower cluster in China, the smallholder

farmers cluster in the Philippines and agricultural clusters in the Netherlands (Oakeshott, 2019; Schouten, 2011;Ramanathan & Gunasekaran 2014). Collaboration in supply chains is found to mostly inspire partaking in activities such as replenishment, forecasting, planning, information sharing, resource sharing and incentive sharing Wee *et al.*, (2016). Furthermore, it is argued that the use of the supply chain collaboration process can cut down on running costs (Adams *et al*. 2014; Wee *et al*. 2016) and improve the implementation of agreed-on decisions (Kim & Lee, 2010; Swink e*t al*., 2007). Supply chain collaboration can be viewed from four different angles, and these are (i) uncertainty reduction, (ii) transaction cost economics (TCE), (iii) resource-based view (RBV), and (iv) learning and knowledge perspectives. These viewpoints give intuitions regarding the nature, forms, and contents of supply chain collaboration (Cao et al., 2009)

With regards to uncertainty reduction, uncertainty is defined by Simangunsong *et al*., (2012) to be insecurities that may include risks that can take place at any position in a global supply chain. This uncertainty is usually a result of the decision-maker lacking information about the supply chain or may be bounded rationale which will result in the inability to make accurate predictions. Williamson (1975), states that uncertainty is a determinant of excessive transaction prices. It is argued that collaboration in supply chains is most likely to successfully reduce uncertainty via improved information sharing which is the key objective of collaboration (*Cao et al., 2009;* Holweg *et al., 2005).* Furthermore, Cao *et al*., proceed to mention that correspondence among supply chain stakeholders suppresses opportunism. As a result, when firms are faced with uncertainty along their supply chains they tend to collaborate and establish long-term relationships (*ibid*).

When viewing collaboration from the transaction cost perspective, there are two ways in which firms can organize their events and these are the use of markets and hierarchies (Williamson, 1975). The decision on whether to move from market to vertical integration is affected highly by the monitoring costs arising from bounded rationality and uncertainty which results from the self-interests of the partner and opportunism. Supply chain collaboration serves as a mechanism of lowering opportunism and monitoring costs which are natural in market transactions; this is achieved through integration and reciprocated trust which in turn increases partners' interest in the collaboration (Cao, *et al*., 2009).

Competition in businesses has ceased to be between organizations or products, arguments presented lately are for the idea that competition is now among supply chains that support competitive priorities (Salhieh, 2011). An affirmation using Resource-Based View (RBV) is that investing towards relation-specific assets as well as pooling together complementing resources that are hard to find can create distinct products and services. The RBV theory also argues that differences in how firms perform can be described in strategic resources like that core competencies. The act of pooling supply chain stakeholders' resources becomes difficult for competitors to imitate (Cao et al. 2009). According to Park et al., (2004), supply chain collaboration makes it possible for the firms to put emphasis on what they excel in and further add value to the process in the entire supply chain.

2.11 Benefits of Supply Chain Collaboration/ Practices

It is believed that cooperation within supply chain associates benefits the entire supply chain. These benefits include improved information and incentive sharing. Other benefits are combined knowledge creation, collaborative communication, joint decision making and goal congruence. The SCC as a supply chain collaboration is expected to enjoy these benefits or be geared towards them to improve their competitiveness.

2.11.1 Information sharing

Information sharing in supply chains is the transfer of information amongst supply chain stakeholders. The speed at which information is shared matters but most importantly is the quality of the information shared (Eldridge & Sartipizadeh, 2013). Cao *et al*. (2009) describe information sharing to be the degree whereby firms and the supply chain regularly share various relevant ideas; which may be correct, fully developed opinions, concepts and practices. There is a variety of information that can be shared along supply chains; these include information about orders, demand, inventory, and shipment (Shaw & Yang, 2001). According to Shaw & Yang (2001), an increasing number of companies have realized that sharing information among supply chain stakeholders improves the performance of the supply chain. The reduced inventory costs, among other indicators, are evidence of this practice. It has been argued that poor information sharing has in most cases resulted in the

bull whip effect in supply chains. Radical increments in demand variance towards the supply chain from the customers to the firms are known as the bullwhip effect. (Chatfield et al. 2009). Supply collaboration is effective in increasing the rate of sharing information within supply chains. This coming together of supply chain stakeholders makes it easy for them to share information and thus improving the performance of the supply chain (Skjott-Larsen, Thernoe & Andresson, 2003).

2.11.2 Joint decision making

The practice whereby supply chain stakeholders come together and make collective decisions to plan and operate to benefit the entire supply chain is called joint decision making (Wee et al., 2016). Joint decision-making in supply chains also includes pool planning and information sharing, solving conflicts and forming new institutions (Cao and Zang, 2011; Wee et al., 2016). Again, joint decision-making also plays a paramount role in reducing the bullwhip effect. The independent decision making of supply chain stakeholders tends to result in sub-optimal supply chain performances like the bullwhip effect (Ding et al., 2011). Biehl et al. (2006) argue that joint decision-making is also a more sophisticated form of information exchange and that it requires a high degree of trust and transparency.

2.11.3 Incentive sharing

Incentives according to the United Nations Development Program, UNDP (2006) are external measures that are set up and implemented to influence the motivation and behaviour of individuals, groups or even organizations. In the concept of supply chain collaboration, these incentives are needed to initiate the collaboration process and to ensure participation. Supply chain stakeholders need to be incentivised to share information, for example. According to Wee et al., (2016), incentive sharing is the practice whereby risks, costs, and benefits are distributed to supply chain stakeholders. The supply chain members in collaboration are most likely to develop short-term or long-term planning for risk reduction, improve quality and enhance innovation thus improving the supply chain's overall performance. It is also argued that the understanding of a fruitful partnership should entail equal allocation of profit and losses to members. This helps

influence partners' rational actions to realize the goals of the supply chain that were originally contracted by both parties (Wee et al., 2016). For an efficient incentive sharing scheme Scholten and Schilder (2015) recommend that the supply chain members should take into account three fundamental questions which are: how to successfully link the incentive to the entire performance, the reimbursements of incentives and also how such incentives are disbursed.

2.11.4 Goal congruence

Goal congruence indicates the level of agreement among different aims of the supply chain stakeholders with the global objectives of the supply chain. This conveys that supply chain members believe that their objectives will be fulfilled when the overall objectives are met (Mandal, 2015; Scholten and Schilder, 2015; Wee et al., 2016). Goal congruence involves defining the duties and responsibility assignments of every member, creating of common targets, mutual aims, performance metrics, and normalisation of information technology, formalizing data sharing and mutually implementing the proposal (Wee et al., 2016). For a successful collaboration through goal congruence, the member must be in line with the vision of the entire supply chain and the key business processes (*ibid*).

2.11.5 Joint knowledge creation

This is the level whereby supply chain members acquire an improved comprehension of the market competitive environment and response thereof as they learn and work with each other as a team (Mandal 2015; Scholten & Schilder 2015). Cao et al. (2009) and Wee et al. (2016) states that mutual knowledge creation happens at the moment when supply chain stakeholders identify the prerequisite for interconnected skills and resources. They further mention that knowledge creation is divided into two types: knowledge exploration and knowledge exploitation. In defining the two, Wee, et al. (2016) define knowledge exploration as the searching and process of acquiring pertinent information and exploitation as the assimilation as well as application of the relevant knowledge.

2.11.6 Collaborative communication

Collaborative communication refers to the interactions and information exchange process between supply chain members characterized by the frequency, mode, direction and influence strategy (Cao et al., 2009). Frequency is the quantity of contact among members over a specified period while direction characterizes whether information oscillates upwards or downwards in the supply chain hierarchy. The method of transmission is the mode. Mohr et al., (1996) opined that collaborative communication refers to the bond that binds supply chain members together. He continued to claim that effective communication between firms in a supply chain is a sign of commitment.

Given the above-discussed benefits of supply chain collaboration, several forms of collaborative relationships exist in the agricultural industry. The next section will discuss some of the common collaborations in agricultural supply chains and then attempt to identify some of these relationships in the cotton industry of South Africa.

2.12 Supply chain collaboration/ inter-organizational relationships in agricultural supply chains

This section discusses the collaborations that are common along agricultural supply chains starting from the farmers down to the retailers. These will be discussed along with examples and the specific reasons why they are usually formed. The most common ones are producer organizations, cooperatives (normally owned by farmers), and associations and clusters (normally formed by other supply chain stakeholders). The last part will try to discuss virtual integration and integration with information technology platforms.

2.12.1 Producer organizations, farmer cooperatives and associations

Discussed in this section are mostly horizontal forms of collaborations but they are recognised for their input in network theory thus their inclusion. Producer organizations are defined by Eaton et al., (2007) as an arrangement among farmers to coordinate some activities such as joint purchasing of inputs and delivery of produce to output markets. Falkowski and Ciaian (2010) define producer organizations as rural businesses belonging to and regulated by producers and involved in the collecting of marketing information and

conducting market activities. Producer organizations are further defined by the food and agriculture organization, FAO, (2010) as formal rural organizations whose members are small-scale farmers who organize themselves aiming to increase farm revenues via advanced and better production methods, marketing efforts and local processing. These three definitions all point in the same direction, they have in common the farmers as participants, voluntary participation, and joint activities. Examples of producer organizations in South Africa include the South African Pork Producer Organization (SAPPO) and the Red meat producer organization.

Cooperatives are defined by Ortmann and King (2007) as autonomous associations of people voluntarily united to achieve their economic, social and cultural goals and aspirations through a co-owned and constitutionally managed business venture. The description of the producer organization and the cooperative explains that these are separated by a thin line if they are not the same. This is further verified by Falkowski and Ciaian (2010), who list the following names as other names of producer organizations: farmer organizations, producer or marketing groups, the producer and marketing group, an agricultural cooperative, and a producer-owned enterprise, or member-owned firms.

These forms of interrelationships are normally horizontal and are supposed to benefit members equally. Producer organizations and cooperatives both reduce transaction costs incurred by farmers. They achieve this through joint input purchasing and joint product delivery (Eaton et al., (2007); FAO, (2010). These also increase the market power and welfare of members in both input and output markets, they also ensure that the quality that is delivered is better. In that way, even the consumers benefit. It is also argued that producer organizations and cooperatives facilitate small-scale farmers' access to output markets and raise the voice of farmers in issues of policy both nationally and internationally (Eaton et al., 2007; Falkowski & Ciaian, 2010; Ortmann & King, 2007).

A cooperative formation analysis reveals dual reasons for the creation of agriculture-based cooperatives. These are (i) to resolve market failures and (ii) to fix distortions along the supply chain. Market failures generally occur when market intermediaries exploit individual producers and farmers. Consequently, the farmers do not receive the market remunerative prices. Supply chain distortions also result in intermediaries targeting to

receive double profits first from the procurement of agricultural inputs (raw materials) and secondly from the produce sale to the market, a scheme leading to self-enrichment (DALRRD, 2012).

2.12.2 Clusters and agro-based clusters

Clusters are defined by Theus and Zeng (2012) as "agglomerations or networks of production occupied by strongly interdependent firms within a value-adding production chain". Sharma and Anupam (2014) define clusters as geographic concentrations of interconnected companies and institutions in a field. In relation to agriculture, clusters are referred to as agro-based clusters. These are defined by Sharma and Anupam (2014) and Yu *et al*. (2013) as concentrations of producers (farmers), agribusinesses and institutions that are involved in similar agricultural or agro-industrial sub-sector and form value networks tackling familiar issues and pursuing common opportunities.

The concept of the cluster has received recognition for the ability to increase the competitiveness of sectors and has proved to be an effective policy instrument in that they allow for a pooling of resources as demonstrated by the vegetable and flower clusters in China. The agro-based clusters have been hailed as a tool to address issues of market imperfection and access to markets, especially for small-scale farmers (Theus and Zeng, 2012; Yu et al., 2013). According to Wares & Hadley (2008), the cluster initiative can reduce transaction costs for members. The concept of clusters in agriculture is not new but has gained much recognition in the past few decades. The concept has been used in China to develop a vegetable cluster which today has become the most famous vegetable cluster in Shouguang, China. Through the cluster, the area under vegetable production has risen from 3,000 ha in 1989 to 56,000 ha in 2012 (Yu et al., 2013). The formation of this cluster was motivated by three factors namely (1) to influence the distribution of inputs through economies of scale, (2) to take advantage of the locally available labour, and (3) to enable an improved flow of ideas and knowledge exchange consequently fostering technological spill over and growth (Yu et al., 2013).

Narrowing down to South Africa, there is the example of the wine cluster which was established in the 1990s. Between 1992 and 2002, the exports of the cluster rose from 20

to 177 million litres and table wine production increased by 33%. Two policy initiatives are cited as foundations of the above-mentioned success. First, the abolition of the quota systems exposed the industry to increasing global demand and secondly, macroeconomic policies such as the liberalization of trade, deregulation, land reforms, reduction of direct subsidies and the introduction of minimum wage for farmers (Theus & Zeng, 2012). Table 5 shows the benefits of clusters for smallholder farmers in the Philippines (Oakeshott, 2019).

Table 2-5: Benefits of an agriculture cluster for a SHF

Obstacles	**Smallholder farmer benefits from joining a cluster**
Production	Economies of scale; the potential for cheaper input and service costs; Access to the skills, networks, and resources of other members; Cluster becomes a convenient entrance point for the government, as well as public and private assistance organizations. 'Co-opetition' refers to a competition for improvement among cluster stakeholders. Increase productivity through gaining access to specialized suppliers, expertise, and data; As the cluster's manufacturing process improves, innovation becomes more important. The cluster's expansion is drawing new enterprises and suppliers; New items and clients could be on the horizon; Donor assistance programs provide indirect access to discounted inputs. Improved pest, disease, IPM, ICM, and GAP knowledge; Access to market data is more readily available, which enhances adaptability. Increasing innovation; gaining financial access;
Post-harvest	Implementation of standards and quality assurance; Warehousing, grading, packing, processing and value-adding to the product; Opportunities for infrastructure developments;
Marketing	Collaboration between growers, marketers, and retailers; branding and image

	development; improved market access; increased bargaining strength; Harvests can be scheduled and the danger of under/oversupply is reduced by spreading suppliers out across clusters. A better grasp of consumer value as well as the value of their product;
Knowledge	Dissemination of innovation and ideas, as well as their quick transmission and acceptance Knowledge and equipment sharing, as well as the overall development of human capability; Talent, expertise, and information are shared. Their understanding of the food system has improved;
Decision making	Sharing risk and uncertainty - emboldening; Empowerment and self-determination; Personal recognition and validation

Source: Oakeshott, 2019)

2.12.3 The role of government in agriculture clusters

According to Wickham (2004), governments play an important role in facilitating the development of agricultural clusters. Wickham argues that governments as policymakers must create enabling environments for clusters to strive, governments also provide incentives like subsidies to assist agricultural development. Zhao, Ruan and Shi (2021) also contend that governments' industrial policy should support industries in achieving development goals and also should allocate resources to development incentives for the economy. The government of the Philippines spends over Php 1 billion on providing farmers with insurance which is recommended for clusters but there is an argument that government-provided insurance deters private companies from developing products that are tailored to the smallholders' customer needs (Oakeshott, 2019).

2.13 Summary

The literature reviewed in this chapter has provided several insights regarding cotton production, the cotton value chain, agricultural and supply chain relationships, innovation in supply chains, virtual integration, supply chain collaboration, agro-clusters and the role

of government in the development of clusters. It is evident from the literature that the concept of supply chain collaboration is not new at all and has been there for quite some time. The benefits that supply chains have enjoyed over the years prove that the concept is viable and has helped transform some economies and agricultural sectors from around the world. The business models that these supply chain collaborations use may differ but the results are similar, reduced transaction costs, increased information flow, and reduced uncertainty, to mention a few. Challenges faced by supply chains from different places cannot be very different, collaborations in supply chains have been hailed for their potential to address supply chain challenges, align supply chain goals, share supply chain risks etc. Furthermore, virtual integration literation also has been reported as an effective intervention that supply chains have used to bring positive changes to their performances. This study used the information obtained here to select and develop a methodology that will be used to study and understand the Sustainable Cotton Cluster in South Africa. The next chapter, chapter 3 presents a detailed account of how the cluster was studied.

CHAPTER 3

METHODS AND PROCEDURES

3.1 Introduction

In chapter 3, the research methods and procedures adopted for the investigation of the origins, functioning, and impacts of SCC on the cotton value chain of South Africa are introduced. The methodology adopted was informed by the objectives of the study and to answer the specific research questions. Approaches from other relevant studies also influenced the research method decision. The content of this chapter includes the research design, population, data collection, data analysis procedures, considering ethical aspects of the research, and ways to ensure that scientific rigour was applied thoroughly.

3.2 Research design

The primary goal of this research was to learn more about the Sustainable Cotton Cluster's (SCC) origins, operations, and impact on the South African cotton sector. Researchers can use one of three types of research procedures for their studies: qualitative, quantitative, or mixed methods (Creswell, 2014, Kabir, 2016). Quantitative research is a method for quantitatively investigating the correlations between variables to test the objectivity of hypotheses. These variables are commonly measured using instruments, allowing numerical data to be analyzed using statistical methods. Mixed methods research combines qualitative and quantitative data, with the two types of data being combined using designs that may include philosophical assumptions and theoretical frameworks. (Bitsch 2001; Creswell, 2014). The qualitative method study methodology is used to explore and understand the meaning individuals and groups attach to a social and human problem, according to Creswell (2014). This method entails the development of new questions and methods; data is often acquired in the participant's environment, with analysis inductively progressing from specifics to broad themes. It is also stated that the qualitative method approach is useful in the description and interpretation of new or understudied subjects (Bitsch, 2001).

To achieve the objectives of this study and answer the research questions, the qualitative method research was adopted because it suits the nature of the research.

According to Creswell (2014), qualitative research has a basic characteristic that forms the core of being classified as qualitative research:

i. Natural setting: qualitative researchers collect data on the issue or problem under examination directly from the field or site.
ii. Researcher as a key instrument: qualitative researchers gather data themselves through studying documents, observing behaviour, and interviewing participants.
iii. Multiple data sources: Researchers can collect data in a variety of formats, including interviews and observations, among others. They do not rely solely on one source of information.
iv. Inductive and deductive analysis: qualitative researchers develop themes by grouping data into increasingly abstract information units.
v. Participant meaning: the researcher focuses on learning the meaning or perspective that the participants have regarding the problem throughout the process.
vi. Emergent design: Because qualitative research is emergent, the starting plan cannot be precisely described. After the researcher enters the field and begins collecting data, the techniques may modify or adapt.
vii. Reflexivity: A qualitative researcher should be attentive to how their role, background, culture, and experiences may influence how they interpret data.
viii. Holistic account: researchers attempt to create a comprehensive picture of the subject or issue under consideration. This entails reporting on various points of view, identifying numerous aspects at play in a scenario, and creating the bigger picture that emerges.

Several forms of research designs exist for qualitative research. These designs include narrative, phenomenology, ethnography, case study, and grounded theory. For this research, a case study design will be adopted because it fits the nature of the research objective, which is to investigate the origins, functioning, and impact of the Sustainable Cotton Cluster (SCC) on the cotton industry of South Africa. Yin (2014) offers two definitions of a case study, one that focuses on the scope and the other on the characteristics. In terms of scope, a case study is a research project that empirically

analyzes a current phenomenon in depth and within its real-world environment, particularly when the boundaries between phenomenon and context are blurred. A case study is defined as an investigation into a technically unique situation in which there are more variables of interest than data points, and one result relies on multiple sources of evidence with data requiring triangulation, and another result benefits from the prior development of theoretical propositions to guide data collection and analysis. A case study, according to Creswell (2014), is a design in which the inquirer investigates a program, event, activity, process, or one or more individuals in depth.

The cases are separated by time and activity, and researchers collect detailed data utilizing a variety of data collection methodologies and time intervals. This approach unlocks the potential to uncover and explain several aspects of the phenomenon (Baxter & Jack, 2008). Baxter & Jack (2008) and Yin (2003) argue that a case study design must be taken into consideration when; (i) the emphasis of the analyses is to find answers to "how" and "why" questions, (ii) the behaviour of study participants will not be influenced, (iii) contextual conditions must be concealed due to their relevancy to the phenomenon being investigated, or (iv) phenomenon and context do not have distinct boundary lines.

According to Damen, 2017, there are two types of case study designs, single case study designs, and multiple case study designs. These can further be broken down into holistic (single units of analysis) and embedded (multiple units of analysis) as shown in Figure 3.1 below:

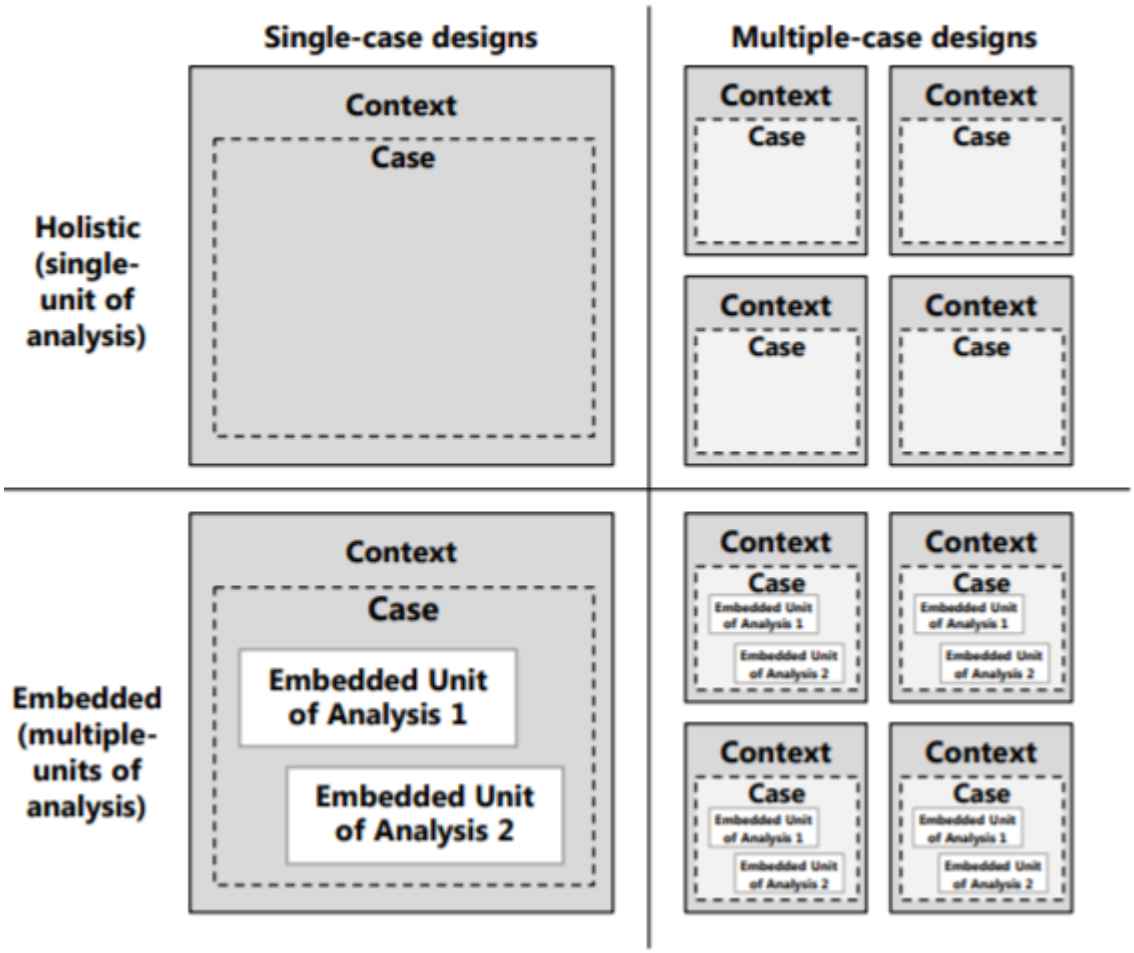

Figure 5: Basic types of designs for case studies

Source: (Damen, 2017**)**

Considering the requirements to achieve the objectives of this study, the single case study with multiple units of analysis was selected. The single case in this study is the SCC supply chain and the units of analysis are the stakeholders of the supply chain either directly or indirectly dealing with the cotton. Both the approach and design selected for this study fit the research objectives with its limited units of analysis. According to Creswell (2014), qualitative research usually includes a very small number of units of analysis, four to five units. According to Creswell (2014), the researcher conducts personal interviews with participants, and interviews are typically conducted in the participants setting. Interviews as data collection tools have the following strengths and limitations (Creswell, 2014), as is shown in Table 3.1 below.

Table 3-6: Options, advantages, and limitations of qualitative interviews

Options	Advantages	Limitations
• In-person interview, face-to-face, one on one • Telephone • Focus groups • Email	• When participants cannot be watched directly, this method is useful. • Able to offer historical data • Provides the researcher with complete control over the path of enquiry.	• Provides filtered indirect information based on respondents' perspectives. • Provides knowledge in a controlled environment rather than in a natural situation. • The presence of researchers may bias responses. • Not everyone has the same level of articulation and viewpoint.

Source: Creswell, 2014

3.3 The population

The Sustainable Cotton Cluster (SCC) under investigation consists of a value chain running from the farm to the retailer. Supporting structures of the chain can be divided into consultants and related bodies. The consultants include IQ Logistica and Operations Visibility Solutions (OPVIS) who are developers of the IT platform that virtually links the supply chain participants. Related bodies include Cotton SA which is a regulatory body of the cotton industry in South Africa and houses the laboratories where the cotton is graded, the Department of Trade and Industry (DTI), which funded the SCC initiative, and

Organimark, who is a cotton trader, along the value chain. These individuals/organisations form the population for this study. The population is further logically divided into two sub-populations, firstly primary production (farmers) and secondly, Industrial production (industry and other related bodies) as shown in Figure 3.1.

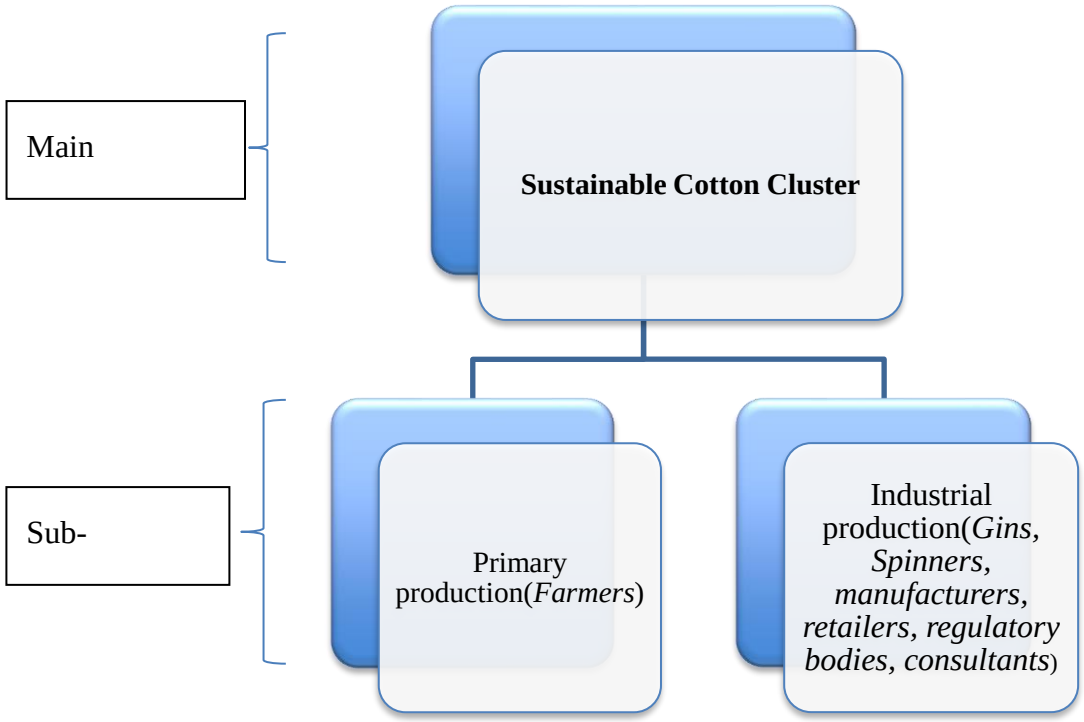

Figure 6: Population and sub-populations

Participants from both sub-populations were requested to participate in the study because they collectively possess substantial information about the SCC initiative.

The primary production side, which consists of farmers, has approximately 260 farmers in the Limpopo region (Loskop gin, 2018). These farmers sell their cotton through the Loskop Gin. These farmers are composed of both commercial and small communal farmers, irrigation and dryland farmers. Means of getting to the farmers in person proved futile since they are not closely located, it was also not possible to send the questionnaire to them. The researcher through the gin requested to meet 30 of the farmers at the gin but could only meet with 6 farmers. According to Krueger and Casey (2009), a focus group for market research should consist of 10 to 12 people traditionally but they argue that this

number is too large for non-commercial research. They suggest some five to eight participants in a group to allow for equal participation. There was no specific criterion used to select the 6 farmers except that they are the only ones that came. Even though the number of farmers that attended is too small, the researcher found that they represent the population in that they have both communal and commercial farmers and also dryland and irrigation farmers. Furthermore, the researcher found that data saturation was reached. Data saturation according to Fusch and Ness (2015) is reached when the ability to obtain new additional information is attained; this means that continuing to collect data after this point will not add new information. Fusch and Ness (*ibid*) further assert that data saturation can be reached from as little as 6 participants, but it is recommended that for focus groups the group must include between 6 and 12 participants. Table 3.3 presents the list of the six farmers (primary production) alongside their ages, gender, experience, type of farmer, farm size, and education level. Table 3.2 presents those that participated in the interviews from the secondary production.

Table 3-7: Farmers that participated in the focus group discussion for primary production

FARMER ID	**AGE**	**GENDER**	**EXPERIENCE (years)**	**LAND TENURE**	**PRODUCTION METHOD**	**FARM SIZE**	**EDUCATION LEVEL**
1	23	M	3	Communal	Dryland	100ha	Tertiary
2	69	M	30	Commercial	Irrigation	490ha	Tertiary
3	64	M	18	Communal	Dryland	150ha	PS
4	65	M	4	Communal	Dryland	19ha	Tertiary
5	69	M	2	Commercial	Irrigation	40ha	Tertiary
6	40	M	4	Communal	Both	110ha	Tertiary

Table 3-8: Participants of the interviews

Identification number	Organization	Position at the time of interview	Province	Gender
1	Organimark	Chief Executive Officer	Gauteng	Male
2	Cotton SA	Chief Executive Officer	Gauteng	Male
3	IQ-Logistica	Chief Executive Officer	Gauteng	Male
4	Loskop Gin	Chief Executive Officer	Limpopo	Male
5	Prilla	Chief Executive Officer	Kwazulu Natal	Male

3.4 Data and data collection

To fully address the objectives of the study, two data collection instruments were initially developed, a questionnaire to be filled in by participants, and a semi-structured interview schedule. Both tools were informed by literature on supply chain collaboration (Han and Chu, 2009; Kamar, 2016), who argued that collaboration in the supply chain can improve the performance of the entire chain and reduce risks and uncertainty of the chain. Initially, both the questionnaire and the interview were intended to be administered at every tier but it soon became evident during the pilot phase that the questionnaire had to be abandoned since most of the respondents were not in a position to respond to the questionnaire meaningfully. This was so because of the length of the interview and the fact that some of the information required needed to be verified by their financial personnel. It is also worth noting that the participants are very busy people who are not easy to get hold of. This did not come as a surprise since one characteristic of a qualitative study is that it is emergent (Creswell, 2014) and may change as data collection begins The semi-structured interview was composed of open-ended questions (Creswell, 2014) to address the objectives of the

study but allowing participants to give a historical account of their experiences and proved to be working as a meaningful data collection instrument. As a result, the questionnaire was only completed by very few farmers in a group and also responded to the interview as a group.

3.5 Data analysis

According to Radovic-Markovic and Alecchi (2017), qualitative researchers should use analysis methods that are explicit and systematic. They further argue that experts believe that in qualitative research, one researcher is sufficient to perform data collection and analysis. Before the data is analysed the data must be coded either by hand or using computer software (Creswell, 2014). According to Braun and Clarke (2006) and Kiger & Varpio(2020) thematic analysis is a qualitative research data analysis technique that involves scanning through a data set to identify, analyse and report repeated patterns or phrases. For this study, thematic analysis was used as a data analysis technique.

According to Braun and Clarke (2006) and Kiger & Varpio (2020) thematic analysis follows six steps before the actual reporting takes place. These six steps include familiarizing yourself with the data, coding the data, searching and formulating themes, reviewing the themes, defining and naming the themes, and finally producing a report. These steps were followed to analyse the data collected using face interviews for this research.

Table 3-9: Steps for good thematic analysis

Step of thematic analysis	Brief description of the process
1. Familiarizing yourself with data	Transcribing interviews, repeated re-reading the data to generate initial codes
2. Code generation	Coding features of interest across the data set, collating relevant data to each code
3. Searching for themes	Organizing codes into possible themes, gathering all data relevant to each theme
4. Reviewing themes	Checking if themes operate with coded extracts and creating an analysis thematic map
5. Defining and naming themes	Fine-tuning specifics of each theme, articulating perfect descriptions and labels of each theme
6. Producing final report	Ultimate enquiry of extracts, connecting analysis to research objectives and literature, generating a report for the analysis

Source: Braun and Clarke, 2006; Kiger & Varpio, 2020

Codes and themes were generated across the data and used to interpret and reporting of the findings of the study. According to Creswell (2014), codes in qualitative data or text transcripts can be in three categories; (i) expected codes based on literature and common sense (ii) unanticipated codes or surprising codes, and (iii) unusual codes. Researchers can develop their codes as they emerge or from predetermined codes or a combination of both. In traditional social science, approach codes are allowed to emerge during data analysis. The codes developed were then combined to form themes that ultimately provided answers to the objectives of the study. Five themes were formulated to account for the decline of the industry, the reasons behind the formation of the cluster, how the cluster functions, the IT platform, and its role, and challenges faced by the cluster.

3.6 Pilot study

A pilot study that aims to test the data collection tools to be used was carried out before the main study. According to Janghorban, Roundsari, and Taghipour (2014), a pilot study is a small-scale investigation of a full survey for a specific instrument, such as a questionnaire or interview guide. Pilot studies could be used in qualitative, quantitative, or mixed methods research, according to the argument. The purposes of a pilot study can be summarized in four basic areas (i) to find problems and barriers related to participant selection, (ii) to be engaged in qualitative research as a researcher, and (iii) to assess acceptability and ease of administering the tool, and (iv) to determine the methods and epistemology of the research (Janghorban et al., 2014). Since the sample size in qualitative research is usually small (Creswell, 2014), only one participant was considered for the pilot study of this research.

3.7 Scientific rigour in qualitative research

Qualitative research has been criticized for its lack of scientific rigour. Scientific rigour is defined as a theoretical approach used to enhance confidence in the accuracy of findings (Casadevall and Fang, 2016, Cypress, 2017). It is also argued that rigour refers to the strength of the research design, and the appropriateness of the method to address the research objectives. Scientific rigour consists of different components such as credibility, trustworthiness, transferability, and dependability (Morse, 2015).

i) *Credibility* ensures that the research assesses what is desired and is a true reflection of the participants' social reality. (Morse, 2015). It evaluates the authenticity and accuracy of the data and findings. Through credibility the researcher questions if the data and the findings are suitable to make conclusions or claims by taking into consideration the number of participants, the depth and range of data, and what is felt and heard, and viewed to have credibility (Ghafouri and Ofoghi, 2016). The credibility of this study will be established by reviewing transcripts of individuals and looking for similarities within and across participants. Qualitative research is regarded as credible when it provides a detailed depiction of a human experience that people who have had similar experiences would recognize right away (Thomas and Magilvy, 2011).

ii) *Trustworthiness* is a criterion that questions the reliability and validity of the findings of a study (Morse, 2015). To ensure the reliability of the findings of this study, the researcher will compare some of the information gathered with information on Cotton SA publication. Cotton SA publishes on their quarterly documents from different stakeholders that are relevant to the cotton industry. Also, during the data collection process the researcher was accompanied by a consultant, the consultant did not interfere with the interview process but would only make comments when the interview was complete. The consultant would verify the collected information to be true.

iii) *Transferability* is the possibility of transferring the original findings to another context or individuals (Morse (2015), Maher et al. (2018), Thomas and Magilvy (2011). Transferability of research is determined by the readers of the research, this principle does not require broad claims by researchers but instead, invites readers of the research to establish connections between elements of the study and their own experiences (WAC Clearinghouse, 2021).

iv) *Dependability* can be widely defined as the consistency and possibility of repeating the research process of data collection, interpretation, and analysis and still obtaining the same results (Morse, (2015), Maher et al. (2018)). what makes this study dependable is that it adopted a research design that has been used by other researchers in agricultural economics (Bistch, 2001), health sciences, social sciences (Creswell, 2014). Furthermore, the data collection reached data saturation (Fusch and Ness, 2015) in that the variation in the responses of participants was getting smaller as little new information was contributed by more participants.

3.8 Ethical considerations

In all research projects, the protection of human participants must be ensured by the use of proper ethical principles. In qualitative research, the application of ethical considerations is of particular importance because of the in-depth-ness of the study process (Arifin, 2018). Research ethics have two distinct branches, one that deals with the protection of human subjects and the other regarding professional standards (Kyngas, Mikkonen, Kaarianen, 2020). Participation in any study is voluntary and depends on the

individual's willingness to share his or her experiences (Orb, Eisenhauer, and Wynaden, 2001). Qualitative studies are usually conducted in places involving the participation of people and their daily environment thus it is very important to be aware of the ethical issue that may be derived from such interactions (Arifin, 2018 and Orb et. al, 2001). Arifin (*ibid*) emphasises that participants should consent to participation, that consent should be given freely (voluntary), participants should also be adequately informed about the study and lastly, participants should be aware that they have the power to decide whether they participate, decline to participate or that they can stop at any time during the interview process.

For this study, it was decided that interviews in person would be conducted because in qualitative research the researcher is also a tool. Approval was obtained from the ethics committee of the University of Pretoria before data collection was started. Furthermore, a non-disclosure agreement was signed between the researcher and the participants as a precondition for conducting the research. The agreement defined how the data obtained can be handled and utilised and to protect the identity of all the participants but due to is confidentiality it is not possible to add a complete copy (See Annexure 3). In emails sent to participants, a consent form (See Annexure 1) was attached and required signing before the interview date was set. In the form, it was explicitly stated that participation in the research is voluntary and that the study has no harm to participants.

Appointments were made with participants by means of emails and interviews were conducted in person by the researcher at the participant's setting. The interviews were recorded using the voice recorder application; participants were made aware that the interviews will be recorded before the start of the interview session. To further ensure that participants privacy was achieved these recordings were kept in a password protected device.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

The overview of the South African Cotton Industry (SACI) provided in chapter 2 indicated that the supply chain was composed of different actors with different functions but still provided very little information on their roles towards the operations of the Sustainable Cotton Cluster (SCC). It also provided limited information on how each actor interacts with the platform and how they realize varying benefits from their participation in the initiative. The analysis discussed in this chapter discusses is based on perceptions and knowledge of the stakeholders and key informants. This chapter outlines the historical background of the cluster including views on what exactly caused the decline in the industry, how the cluster functions and operates, and the role of IT in the cluster. Additionally, this chapter also examines the benefits of the cluster initiative as observed by the participants of the study and concludes by looking at the challenges faced by the cluster.

The data used for the study was collected using an interview schedule, this schedule was composed of open-ended questions to allow the respondents to give detailed accounts. The interviews were recorded and later transcribed from the recordings into paper. Thematic analysis was used for data analysis and that required that the data must be coded. The data for this study was hand-coded and they analysis followed the steps presented on Table 3.2 on chapter 3.

The data from the thematic analysis is presented using spider graphs or radar plots. This type of graph is suitable for presenting unrelated points, in this case, the numbers will show the number of respondents who said something relevant to that particular theme. Some quotations from interviewees that were identified to be compelling are included to emphasize specific points.

4.2 The Rationale and Factors on the Formation of Sustainable Cotton Cluster

The analysis of the rationale and factors that led to the formation of the sustainable cotton cluster helped to define and describe the origination of the sustainable cotton cluster in South Africa. A thematic analysis was undertaken at which six themes were identified to be prominent towards the reasons leading to the formation of the sustainable cluster. All the reasons gathered from the key informants and the focus group discussion are summarized in Figure 4.1.

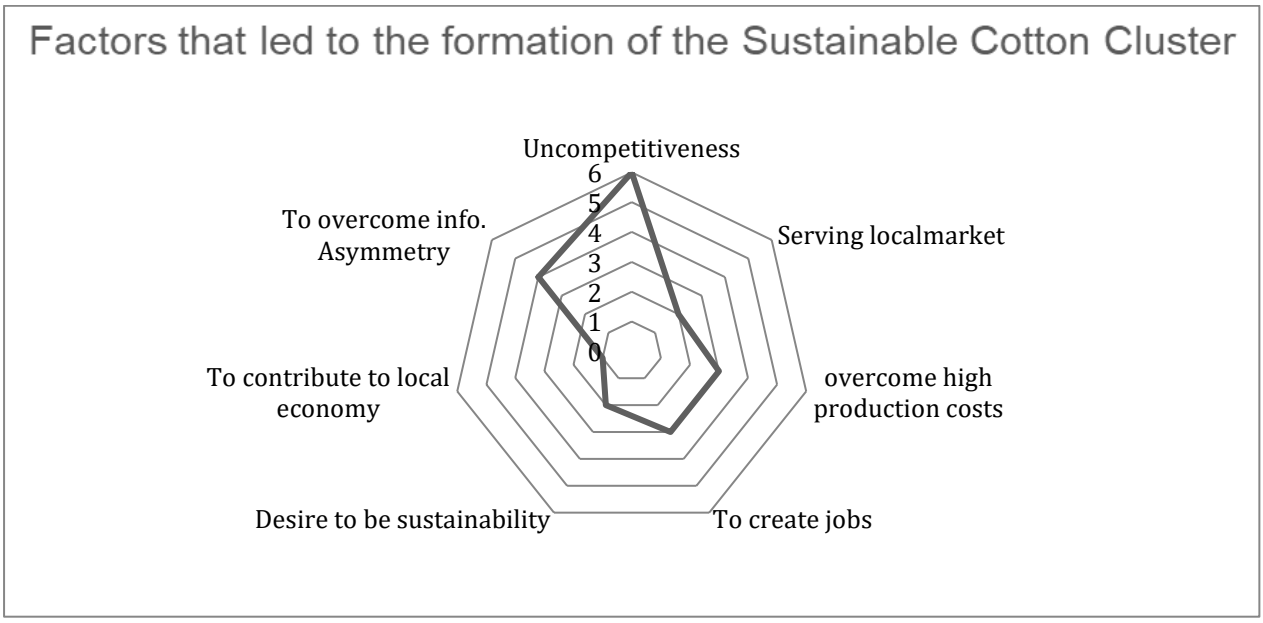

Figure 7: Factors that led to the formation of the Sustainable Cotton Cluster

Of all six respondents, two claimed that the SCC was formed so that South Africa can become a source of sustainable cotton while another pair stated that they desired to supply the local market. They asserted that most of the raw materials for the textile industry were now imported, when probed further about sustainability they mentioned the triple bottom line sustainability of people, profit and planet. The triple bottom line sustainability ensures that all parties in the supply chain make a profit and employees get well compensated, and the environment is safe. Also, out of the six, 50% cited that the SCC was formed to create job opportunities. These respondents asserted that the decline in the industry resulted in the loss of many jobs and that they wanted to create jobs by reviving the cotton industry.

Another factor that stood out was the desire to overcome the high production costs that were associated with cotton production where three of the six respondents mentioned this reason. The high production costs are said to have forced farmers to shift to other crops that had lower production costs. The high production costs were also cited as a reason for low profits. All the interviewees consented that the industry became uncompetitive and it needed reviving, the industry was rendered uncompetitive because of several factors. The cotton industry was surrounded by high price uncertainties, low national output, and cheap imports from other countries. Furthermore, four respondents contended that the cluster was also formed to overcome the information asymmetry that the industry was experiencing. These respondents were of the view that a poor flow of information harms the performance of a supply chain. Of all six respondents, one believed that the cluster was also formed to surge the input of the cotton sector to the economy of South Africa. As agriculture contributes to the South African GDP and employment, this respondent was of the view that reviving the industry will increase their contribution to the national economy.

4.2.1 Factors that led to the decline in the Cotton Industry

It was observed during the interview that the decline of the industry was a very concerning issue for everyone and the researcher decided to also collect information that would summarize the decline of the cotton industry, the summary is presented in Figure 4.2.

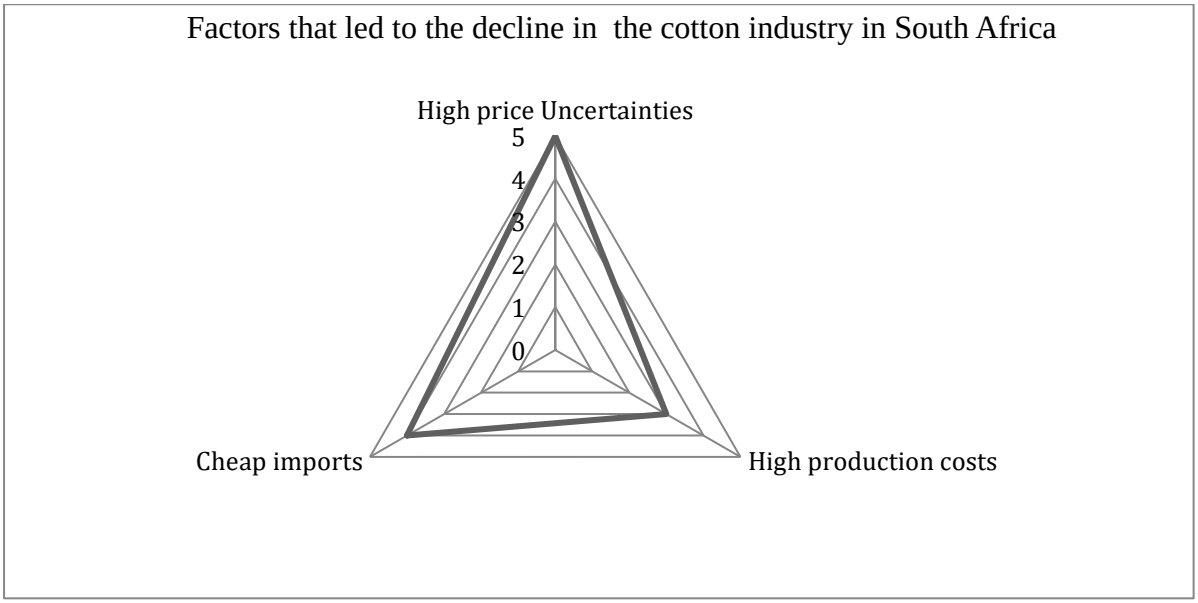

Figure 8: Summary of factors that led to the decline in the cotton industry

Of the six interviewees, four believed that high price uncertainties contributed to the decline. One interviewee was quoted saying "the price would change many times between planting and harvesting." This was due to the exchange rate fluctuations since the cotton price received by farmers was controlled by the international prices. This made it difficult for the farmers to decide whether to grow cotton or not to grow because during planting the prices would be promising high returns but only to find that during harvesting the price has plummeted and a loss is guaranteed. Another three of the six interviewees cited high production costs as one of the causes for the decline in the industry. These respondents argue that the high production costs reduced profitability and for this reason, many farmers decided to stop producing cotton and opt for other crops that were more profitable like maize, sunflower, and soya beans. Lastly, four of the six respondents also cited the cheap imports from countries where governments subsidized the production of cotton. One respondent took us back to the deregulation of the cotton sector and the opening of the World Trade Organization (WTO) to China citing those cheap imports from China forced South African farmers to charge low prices lest buyers will opt for imports.

4.3 The impact of the Sustainable Cotton Cluster on the cotton industry

Another objective of this research was to investigate the impact of the cluster initiative on the cotton industry. This objective seeks to determine what the initiative has achieved in resuscitating the cotton industry.

All six respondents consented that the cluster has had a significant impact in increasing the area under production, increasing the yields and increasing the profitability of cotton farming in South Africa. The interviewees contended that the cluster's business model has managed to make the industry attractive to farmers. The model allows for sustainable costing among all supply chain stakeholders, this ensures that all stakeholders make a profit by participating in the supply chain. Sustainable costing gives the farmers the price with which their cotton will be bought after harvesting even before they plant and this has played an important role in bringing back confidence to the farmers and has made cotton production more profitable or competitive again. With price assurance, more farmers started growing cotton again and thus increasing the area under production and subsequently the yields. Of the six interviewees, four stated that the cluster has also been able to reduce price uncertainties and another four contended that the cluster has reduced the production costs. A reduction in production costs was achieved through technology adoption. For instance farmers can now access a combine harvester which is a cheaper method of harvesting cotton compared to hand picking. Small scale farmers can also come together in their locations and use the harvester to harvest their cotton. Farmers also experience better knowledge sharing now on technologies that reduce production costs like the use of herbicides for weed control among others. The installation of a new gin through the cluster helped reduce logistic costs as well. Another challenge that was faced by the farmers before the cluster is the late payments by the gins. One interviewee was quoted saying "farmers would sometimes have to plant again having not been paid for the previous season". This challenge brought frustration to the farmers since they sometimes had no funds to purchase inputs for the next season. Through the cluster business model farmers are guaranteed a partial payment soon after delivering their bales at the gin and then later receive the balance. Also, four of the six respondents contended that since the formation the cluster to some extent has been able to create jobs. As the area under

production increases the farmers needed more casual and permanent employees. Since the cotton production hectares increased, one would expect that the number of temporal and permanent employees should follow suit. But perhaps they were restored to previous levels hence some farmers did not claim this to be an increase in our surveys. Or perhaps the introduction of machineries did not require more human resources. Regarding the desire to be the source of sustainable cotton, two respondents stated that through the cluster they have obtained a Better Cotton Initiative (BCI) accreditation which certifies them a source of sustainable cotton. Two respondents further stated that the cluster initiative has made it possible to have insurance for the cotton through an insurance pool. Lastly, one respondent mentioned that since the formation of the cluster local sourcing of raw materials has increased and another respondent mentioned that quick response has also been achieved. The issue of orders called the bullwhip effect has been reduced also through the use of the IT platform which has a module that enables order tracking along the chain. Figure 4.3 presents a summary that was drawn from the interviews.

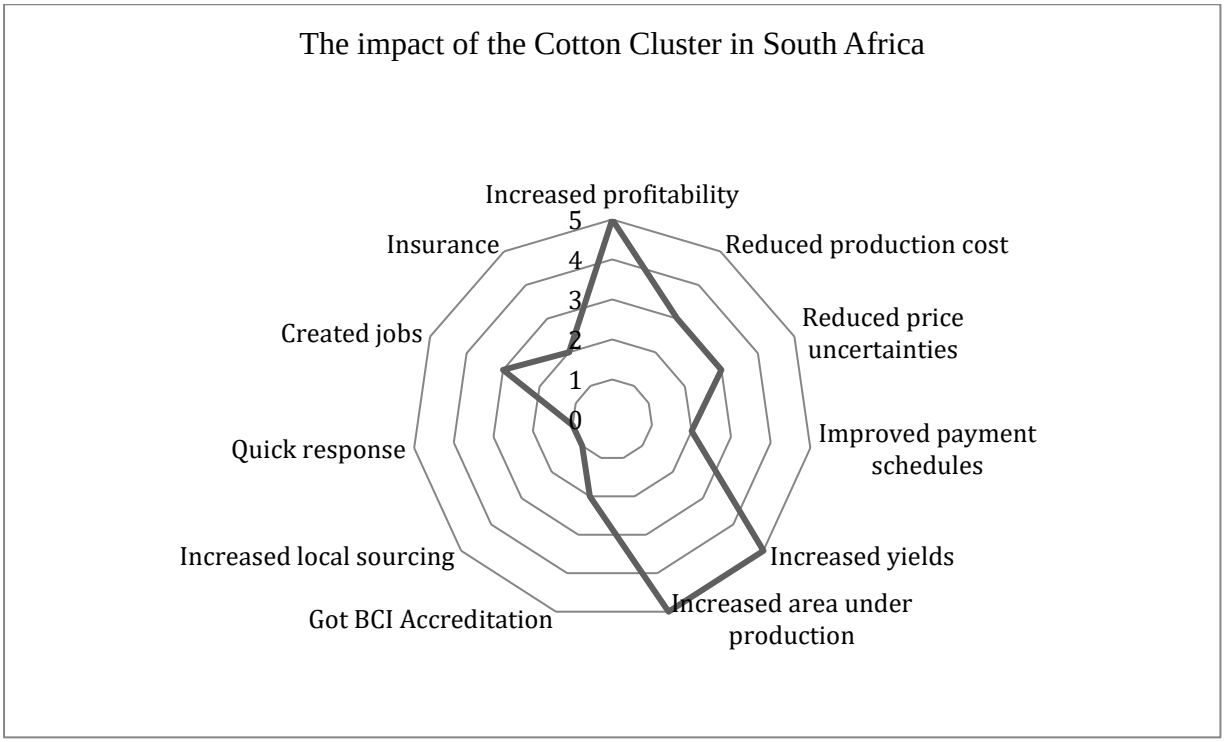

Figure 9: Impact of the cotton cluster in South Africa

From Figure 4.3 It can be concluded that the SCC has had a significant impact on the South African cotton industry since it has been able to increase the profitability, increase the yields and the area under production as noted by five respondents.

4.4 The functioning of the cluster: Unpacking the business model

This section discusses how the cluster works from the planning phase to the delivery phase. In establishing the ideology of the functioning of the cotton cluster, information on the integrated supply chain programme (ISCP) operation was sought from all the respondents in personal communication. It was observed that all respondents possessed a common knowledge and understanding of how the cluster works, which is depicted in Figure 4.4.

Figure 10: The cluster's business model

From Figure 10 it is evident that the cluster's business model is divided into four phases which are product identification, supply chain mapping, sustainable costing and finally the implementation. The interviewees stated that the cluster has adopted a virtually vertically integrated governance mechanism and a demand-led business model which means that the model works backwards from retailer to the farmer.

4.4.1 Product identification

Product identification is the first phase in the business model. It is at this phase that the retailer communicates the product according to their demand and this includes the volumes demanded, the technical specification and the standards that the product should meet. The IT platform at this stage captures data that it will use to monitor the product when it is under production.

4.4.2 Supply chain mapping

During the mapping of the supply chain the team of stakeholders together evaluates the manufactures to determine if they will be able to meet the requirements of the identified product. Their competence and performance are put under scrutiny to make sure that all risks are minimised to ensure success. The geographic location of the selected participants is also considered to minimise the transportation costs to the next tier.

4.4.3 Supply chain costing

Sustainable costing takes place at this phase. In this process, the stakeholders jointly cost the product to ensure that at all stages the triple bottom line sustainability (3 Ps) is achieved. The triple bottom line sustainability ensures that all supply chain stakeholders make a profit and employees get well compensated, and the environment is safe. This means that all people working along the product get fairly compensated, the environment is protected and that everyone realises some profit in the venture. The product price agreed upon should be competitive relative to the market price. Legal commitments are made at this stage and promissory note to purchase for twelve months are issued.

4.4.4 Implementation

The implementation phase is divided into two sub-phases, preparation for implementation and implementation. During the preparation sub-phase the selected stakeholders sign contracts among themselves. It is also at this stage that the product is virtually sampled on the IT platform. Finally, in the implementation sub-phase, contacts are double-checked to make sure everything is in place then the program starts. The implementation stage has a cycle of 18 months from the time of harvesting to the conveyance of the end product to the retailer. Figure 11shows how the cluster stakeholders are linked through the contracts, the flow of demand from the retailer to the farmer and the flow of the supply from farmer to retailer. The programme represents the SCC system which saves all information in cloud storage. The row marked VC represents the value chain output from the farm to the retailer.

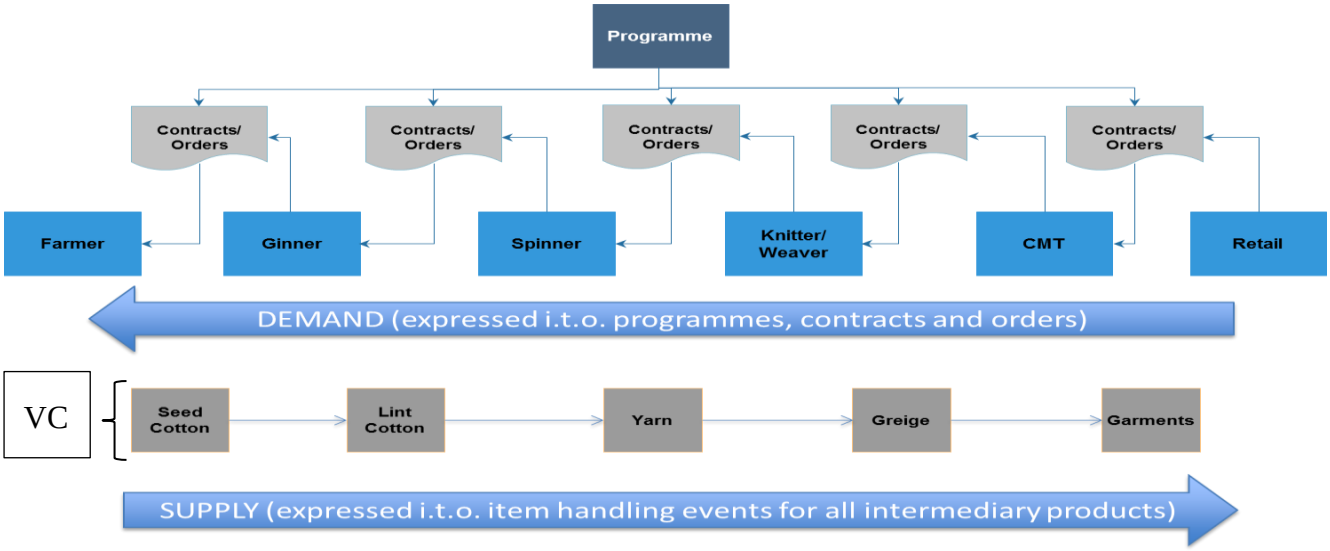

Figure 11: Stakeholder linkages in the SCC

4.4.5 The role of Information technology on the business model

Information technology plays a very important role in the functioning of the cluster's business model. The interviewees knew about the cluster but not all of them had detailed knowledge of the platform known as the Integrated Supply Chain Platform (ISCP) or the SCC system. The following quotes were gathered from the interviews regarding the IT platform;

- *"The IT helps in the planning and forecasting of future demand,"*
- *"The IT helps in the collection of Better Cotton Initiative (BCI) data"*
- *"The IT has helped in reducing risks along the chain since it tracks item handling events"*
- *"The system makes sharing information easy"*
- *"IT helps in monitoring and evaluation of the products since the information is uploaded during the planning phase"*
- *"We as farmers do not know much about the system, the extension officers help us in capturing the field data"*

Additional information about the IT system was sourced from the consultants responsible for developing the IT system. They reported that, on a high level, the system consists of a

demand planning module, a traceability module and governance of compliance to standards module. Each of these modules is discussed separately below:

4.4.5.1 Demand planning

In line with the supply chain approaches used in the SCC, the SCC system provides functionality to retailers to use their aggregated sales forecasts as a basis for a demand plan per product line, or per group of product lines. For a specific arbitrary planning horizon, retailers formalize their demand via a memorandum of agreement into committed volumes and the base price of the product. For each product line, the demand is expressed both as several units of product items, as well as its total net weight of cotton content. The total net weight of cotton-based products is decomposed into their fabric constituents, i.e. body fabric, rib fabric, etc. For each decomposed constituent, the net weight is translated into its concomitant weight requirement for greige. The total net weight requirement of greige is likewise translated into its concomitant requirement for yarn. In this manner, the retailers' demand is cascaded into the concomitant demand for intermediary products down to the requirement for seed cotton from farmers.

The SCC system also provides for retailers to schedule their upliftment requirements for products from manufacturers. The system provides a cascaded view on upliftment schedules across the entire value chain for each supply chain for the planning period in focus while considering delay times linked with the production and provision of intermediate products.

Although the SCC system provides for demand planning and transparency, it also makes primary production visible to the coordinators of supply and demand in the overall value chain. It should be kept in mind that industrial production is a continual process throughout the year whilst primary production at farmers' and ginneries' is a seasonal event. Hence, to ensure adequate continuous supply to the intermediate industries, supply and demand coordination needs to be supported from both the supply and demand sides simultaneously. Consequently, whilst local production needs to be protected and stimulated, import and export planning can also be supported by the SCC system.

4.4.5.2 Traceability

The traceability module maintains a single audit trail throughout the cotton value chain from farmers to retailers, both within organisations and between organisations. Being a real-time system, it records every item-handling event in each of the organisations that participate in the SCC. The data capture of item handling events is done primarily on the existing production and inventory management systems used within organisations, which the SCC system then interfaces to via the GS1 EDI standard. The interface replicates a defined minimum traceability data set for each item handling event, as well as certain agreed organisation specific operations data, to a private hosted space for the specific organisation on the secure web-based SCC system. The logic associated with the minimum traceability data set regulates the integrity of the centralised traceability audit trail across the full extent of the value chain and all its supply chains.

However, there are cases where an organisation does not have a complete audit trail of item handling events within itself. In such cases, specific functionality is developed and exposed from the SCC system cloud to compensate for functions lacking in in-house systems and workflow procedures. Organisations that fall into this category may alternatively opt to invest in their in-house systems and process capabilities to achieve a complete item-handling audit trail within themselves.

The traceability logic links dispatch and receive events with internal work orders to trade orders, supply contracts with retailer programmes. This structure provides an elegant way of accessing information with a high level of precision per organisation, per programme and person role. Information sharing is a sensitive matter in a supply chain context; therefore, the system is designed to protect the privacy and confidentiality of information. Information sharing happens through an agreement between parties. The SCC system records the flow of items into and out of facilities or locations. Although it is not an inventory management system it provides accurate information about the expected inventory levels of locations.

The traceability information on the SCC system, together with the compliance to standards information, provides a valuable source of evidence to retailers to substantiate their claims on product labels and swing tags, or to provide additional product information to consumers.

4.4.5.3 Governance of compliance to standards

This module provides a generic environment in which to load source documents of applicable standards. From these source documents, the applicable obligations are listed per role player in the value chain. For each obligation, the required actions which respondent organisations need to adhere to are listed. The SCC system provides the ability to design applicable questionnaires and/or scorecards that are then exposed to the relevant organisations to capture their responses to obligations and actions in terms of a specifically agreed standard, depending on the nature of the required actions.

Responses to questionnaires and scorecards, as well as other actions, can be scheduled per organisation and person role under the terms of the obligations per agreed standard. Respondents' responses can be downloaded for offline processing and business intelligence analysis. This functionality enables the first line of auditing of compliance to agreed standards to be conducted directly on the SCC system, rather than having to send auditors to site visits. Areas for closer investigation can be identified from the first line auditing and hence site visits can be limited to the absolute few. The BCI standards information is preloaded in the system and this enables the system to easily capture the compliance of different levels as soon as they upload their information.

4.5 Challenges faced by the Cotton Cluster

This section discusses the challenges that are faced by the cluster as identified by the key informants and the farmers in their focus group. To be in a position to make recommendations to improve the cluster's business model the researcher also interviewed the key informants and the focus group on the challenges that are faced by the cluster. The problems that were identified were narrowed down to three main themes as shown in Figure 4.7.

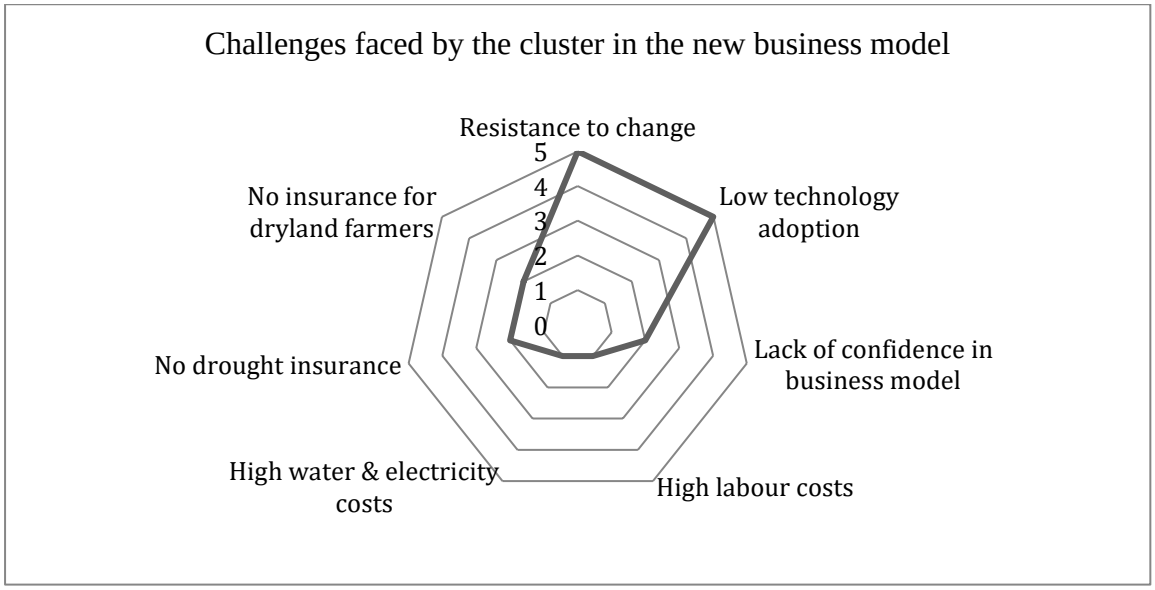

Figure 12: Challenges faced by the cluster in the new business model

Of the six respondents, five of them mentioned resistance to change as the main problem that was faced by the initiative. The fear of the unknown and lack of proper knowledge are the core causes of the resistance to change. Low adoption of the technology was also cited as the main challenge especially on the primary production side by two respondents. Some respondent was quoted saying "some farmers have low education levels" this made it difficult for the farmers to capture the BCI data in the field. An alternative that was used to try to counter this challenge without affecting the quality of information was to train the farmers' children on how to capture the data into the system, sometimes the extension officers are forced to go and capture the information from the farmers' fields. Of the six respondents, two respondents mentioned the lack of drought insurance and lack of insurance for dryland farmers as other challenges that the cluster was faced with. The high costs of water and electricity and labour were all brought up by only one respondent. Lastly, two of the respondents stated that some of the stakeholders lack confidence in the cluster and the new business model.

4.6 Conclusion

This chapter presented and discussed the findings of the study. The study aimed to investigate the origins, functioning and impact of the Sustainable Cotton Cluster in South

Africa. With regards to the origins, among other factors, the main driver for the formation of the cluster was to make the industry competitive since it was no longer competitive. Its competitiveness resulted mainly from the price uncertainty that surrounded the cotton industry especially at primary production. These uncertainties forced farmers out of cotton production because they were no longer making sufficient profits. This was also worsened by the cheap imports that came from other countries where cotton farming was highly subsidized, thus further forcing down the prices. Under the cluster initiative, significant impacts have been realised in the industry. Through the cluster and their business model, the cotton industry has successfully increased the yields, the area under production and made cotton production a profitable venture again attracting old and new farmers back to the sector. The business model implemented by the cluster relies on information technology. This technology supports the cluster throughout the process from planning to retail, since the supply chain is demand-led. The technology makes backwards planning easy, and also improves information sharing amongst members. Information includes item handling events and helps track the progress of the product from farm to fabric. It also provides traceability and visibility along the value chain. The cluster through all this faced several challenges. The most sensitive challenges were the low adoption of technology and the resistance from the stakeholders which are discussed in closing towards the closing of the chapter. The next chapter, chapter 5 concludes, summarises and makes recommendations using the results presented in this chapter.

CHAPTER 5

CONCLUSION, SUMMARY AND RECOMMENDATIONS

5.1 Introduction

The dissertation took a qualitative approach to study the Sustainable Cotton Cluster (SCC) in South Africa which was a programme of Cotton SA. The cluster is a supply chain collaboration where actors are vertically virtually integrated. Literature posits that collaborations in supply chains have several positive impacts on the overall performance of the chain such as increased productivity, increased profitability, sustainability to mention a few. The cotton cluster was formed in 2014 and developed and implemented a business model for piloting purposes along the cotton value chain in South Africa. Soon after the SCC business model was initiated, changes in the performance of the cotton industry were realized and the actors of the chain and the entire cotton industry had their hopes renewed.

The objective of this study was to investigate the SCC with close reference to their business model, through this business model the SCC that has made effective improvements in the industry that was already considered a moribund industry. In the quest to achieve this objective, the study further looked into the origins of the cluster to understand why the cluster was formed, the functioning of the cluster and the impact that the cluster initiative has had in the industry at the time of conducting the research. A case study design method was employed to accomplish these objectives of the study and the results were presented and discussed in the previous chapter (chapter 4).

5.2 Discussion of research propositions

This dissertation studied the SCC within the South African cotton industry with the premise to have a better understanding of the entire initiative from the perspective of the different actors and supply participants. The objectives of the study were to (1) identify the justification and factors that led to the birth of the cluster, (2) describe the functioning of the cluster through their business model, (3) assess whether profitability and uncertainty in the industry have improved, and (4) assess the impact that the cluster initiative has had on the cotton industry of South Africa.

5.2.1 Unprofitability and uncertainty versus virtual integration

Based on literature and previous and similar studies, the researcher made two propositions, firstly the study proposed that unprofitability and uncertainty in the South African cotton supply chain can be addressed by adopting a virtual integration model in supply chains and secondly the researcher proposed that virtual integration in the SCC supply chains is an effective tool for reducing supply chain-related risks.

The results of this study discussed in chapter four demonstrated that this proposition is indeed true. The SCC with its virtual integration model was able to reduce uncertainties and unprofitability that were faced by the cotton industry as were highlighted on figure 4.6 where 5 and 3 respondents mentioned that the SCC has increased profitability and reduced uncertainties respectively. The two main uncertainties that were identified to affect the cotton was supply chain are price uncertainties and payments uncertainty. Prices were deemed uncertain because they changed too often between the planting and marketing season. The local cotton prices were dependent on the international cotton price which was largely affected by the exchange rate. Through the virtually integrated SCC model, this was reduced through the sustainable costing that was discussed in chapter 4. However, the collected data cannot be used to claim the exact monetary value it was reduced with, but it was significant enough to attract old farmers back to producing cotton and on top of that attract new farmers. The delay in payments made farmers frustrated about whether they will get paid, when they will get their payments, are they going to get paid after all? The fluctuating and constantly low prices made the industry less profitable and drove farmers away.

It can therefore be concluded that proposition 1 is correct and that unprofitability and uncertainty can be addressed by virtual integration, as was manifested in the SCC.

5.2.2 Virtual integration versus Supply chain risks

The second proposition made in this study is that vertical integration is an effective tool for addressing supply chain-related risks. Examples of risks in agricultural supply chains are for instance natural disasters like hailstorms and fires, which pose specific threats to the value chains. These are also relevant to the cotton value chains. When probed about

risks, some respondents contended that the SCC initiative through their virtually integrated supply chain has reduced risks, even the mere risk of making a loss was now minimal. Amongst other means to curb risks, the SCC introduced the insurance pool for chain participants which gives them some degree of confidence in the industry. The insurance covers agricultural risks with regards to hailstorms and fires but does not cover risks that are posed by drought.

It can subsequently be concluded that the second proposition is also valid because the findings of the study found that among other factors, risks forced out farmers but ever since the formation of the SCC, the price risk was reduced, quick response was made possible thus addressing the bullwhip effect which ends up creating a risk of loss.

The findings presented by these studies all confirm that supply chain collaboration practices have a positive impact on supply chain performance. These findings agree with the findings of this study based on the sustainable cotton cluster. The sustainable cotton cluster through collaboration practices successfully improved the performance of the supply chain and in turn brought back the cotton industry in South Africa. The virtually integrated SCC supply chain contributes to the evidence supporting the influence of collaboration on operational performance.

5.3 Overall conclusion

The investigation showed that cotton production in South Africa is mainly practised by large scale farmers including a few small-scale farmers. Small-scale farmer's production has improved significantly since the introduction of the SCC. The origination of the SCC was informed mainly by the lack of competitiveness of the South African cotton industry, the requirement to serve the local market with sustainable and locally produced cotton, the need to overcome high production costs, the desire to contribute to the local economy, closing of gaps on information flow, and occupying a specific or niche market within the country. Based on the findings of this study discussed on chapter 4 on the origins and functioning of the SCC, the cluster eliminated information asymmetries across the cotton

production value chain and aided in creating a profitable business venture for small-scale and large-scale cotton producers.

5.3.1 Other conclusions

After the investigation of the sustainable cotton cluster, it can also be concluded that governments play a very important role in development. This is supported by the fact that the government of South Africa through the department of trade and industry (dti) funded the cluster initiative and through that initiative the cotton industry have since improved its performance and on a better striving environment. It is indeed true that governments are capable of creating enabling environments for the private sectors to strive.

Moreover, it can also be concluded that through clusters it is possible to attain goals that one cannot achieve individually. The sustainability in terms of profit was successfully achieved under the SCC. This was made possible through the joint decision making which also helps to align the goals of different participants. The sustainable costing helps to ensure that all the members of the supply chain benefits.

5.4 Recommendations

The study recommends the following to be considered for the SCC in the country:

The study recommends that a detailed review of the cotton industry must be done to inform the development of a financing model for financiers to eliminate uncertainties or doubts on the profitability and potential of the sector. This is on the premise that small-scale producers and largescale producers will produce in full capacity upon access to a tailored cotton production financing model;

The study recommends that the concept of clusters should provide more resources for information sharing through stakeholder engagement, print media, digital media, extension services or any other means deemed appropriate for farmers to have access to the latest technologies approaches to improving and increasing production. The clusters can also develop user friendly digital apps for use by less educated farmers which may also use native languages. This recommendation is informed by the findings of this study that information has played a crucial part in the effectiveness of the Sustainable Cotton

Cluster in engaging small-scale producers into integrated cotton value chains. The recommendation is also informed by the challenges faced by the cluster with regards to the use of technology especially at the farm level. Furthermore, to enhance information sharing, it is recommended that the cotton industry translate its publications and applications into more languages to add on the Afrikaans and English. This is informed by the low literacy level for some farmers which may pose as an information barrier between stakeholders.

It is recommended that the cotton industry should promote and grow specific markets for the different cotton and cotton by-products to absorb all output from the production of cotton. The markets may not be limited to cotton ginners, oil-seed millers, cotton-straws processors, handicrafts and weaving. This recommendation emanates from the challenge cited by the respondents regarding the shortage of spinning capacity, this means that the locally produced cotton has to be sent to neighbouring countries such as Eswatini for spinning.

Lastly, since the study was based on a pilot study, it is recommended that the cotton industry must adopt the SCC's business model. This will help the industry to increase the number of farmers, attract new markets, increase output and the number of people employed in the value chain. Consequently, successfully implementing the new business model is highly likely to improve the gross domestic product of South Africa.

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ANNEXURES

Annexure 1: Consent form

An Investigation into the origins, functioning and price impact of the Sustainable Cotton Cluster in South Africa: Mkhanyisi Dlamini: MSc (Agricultural Economics)

As a participant in this study the information that will be collected through the interview will be used to help improve the cotton cluster initiative, and the South African cotton industry as a whole, recommendations will be made that will further enhance the growth of the industry. Furthermore, the findings can help other sectors that may want to form clusters on how to make them work.

The recorded interview should not take more than ninety minutes to complete.

There are no known risks if you decide to participate in this research study. Participation is also free, with no costs to participate. No personal or commercial harm has been foreseen as a result of participating in this study. Even though the information may benefit you as an individual, it will be useful for the cotton sector, agricultural sector and other sectors in general.

Information collected from this interview will remain confidential and will be kept in password-protected devices, although anonymity cannot be guaranteed over the internet. No one will be able to identify you, or will know your responses. Should the data be collected be published, no individual information will be disclosed.

Your participation in this study is completely voluntary. By signing this form you are voluntarily agreeing to participate. Please be advised that you are free to decline to participate for any reason, to ask questions about the study and to access your data.

Participant's signature: _____ Date: _____

Annexure 2: Interview agenda

Interview agenda for non-participant stakeholder

1. Background of the SCC
    - Factors that led to the idea
    - Funding
    - Core objectives of the SCC
2. Functioning of the SCC
    - Planning
    - Governance (Supply chain collaboration)
    - IT platform (traceability, visibility, BCI)
    - Monitoring
    - Evaluation (measurement, KPIs)
3. Anticipated impact on the cotton industry
    - Profitability
    - Uncertainty / Risk
    - Competitiveness
4. Achievements to date
    - Number of Integrated Supply Chain Programs (ISCP)
    - Value of product sales under ISCPs (local and export)
    - Employment creation under ISCPs
    - SMEs incubation under ISCPs
    - Skills transfer
    - Cluster brand awareness
    - Local cotton production
    - Local beneficiation
5. Challenges
    - Resistance
6. Other

Annexure 3: Non-disclosure Agreement (NDA)

CONFIDENTIALITY AND NON-DISCLOSURE AGREEMENT

entered into between

Mkhanyisi Erick Dlamini

("Erick")

(Passport Number: 40710024)

and

iQ Logistica

("iQL")

(1998/000820/08)