

A quality management framework for emerging maize farmers in selected provinces in South Africa

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DECLARATION

I, ***Thabang Frans Ramogodi***, declare that the contents of this thesis represent my own unaided work, and that the thesis has not been submitted previously for academic examination towards any qualification.

Furthermore, it represents my opinions, ideas and not necessarily those of the North-West University of South Africa. I further declare that all the sources cited or quoted are indicated and acknowledged through a comprehensive list of references.



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ABSTRACT

Agriculture, especially emerging farming, is critical for South Africa's economic future. For various reasons, including the lack of an emerging-farmer-specific quality management framework, most emerging farmers do not survive and seldom advance to become sustainable commercial farmers. The general research problem for this study was that even when many researchers have shown the value of quality management to many big organizations, there is still not enough research showing how small businesses, particularly emerging farmers, could leverage quality management to improve their overall businesses and profitability. The specific research problem was that there is no quality management framework for emerging maize farmers to help them improve the quality and quantity of maize to increase their overall business performance for sustainability. Therefore, this study aimed to develop a quality management framework for the farming industry, particularly emerging maize farmers. The first objective was to determine the critical factors involved in developing a quality management framework; the second objective was to assess the competency of emerging farmers on the critical factors affecting maize quality and grain quality standards by emerging maize farmers. The third objective was to assess the competency of emerging farmers in maize quality standards (grading), and the last objective was to determine grain quality processes currently in place to meet product quality standards. This study was based on two prominent theories of total quality management: the Juran trilogy and the Deming cycle. This inductive phenomenological qualitative study followed an interpretivist paradigm. The primary data collection instrument for this study was non-standardized, face-to-face, and semi-structured interviews conducted one-on-one while observing all Covid-19 prevention protocols. Seventeen participants were interviewed, comprising five industry experts and twelve emerging maize farmers. These semi-structured interviews were supplemented by reviewing relevant documents and observations during farm inspections. Data from the semi-structured interviews were analysed using thematic analysis techniques. Four preconceived themes emerged from the research data: quality management framework, quality affecting factors, quality grade takers, and quality inspections. The data from the interviews were triangulated with the document analysis and observations. The study's major findings were as follows: firstly, there is no quality management framework currently tailor-made for emerging farmers. All participants agree that there is a need to develop a quality management framework for emerging maize farmers. The framework must focus on finance, soil quality, maize hybrids, training, pests, climate change, farming practices, farming resources, planting dates, and weeds. Secondly, most emerging farmers understood how critical factors such as planting dates, seed quality, soil quality, insects, weeds, improper application of chemicals (pesticides and herbicides), improper fertiliser application, poor hygiene, and inappropriate moisture content could affect the

quality of maize. However, the challenge was understanding fungi, mycotoxins, and pesticide residues, which have detrimental effects on humans and animals that consume contaminated maize. Thirdly, all emerging farmers who participated in this study are not competent in the grading process to determine the correct grade of maize. Even though most understood the importance of the grading process and how they could benefit from knowing how to grade maize, they were not knowledgeable on how to determine them. Fourthly, all twelve participants had inspection procedures to ensure that the maize quality was monitored regularly. They also had mitigation practices in the form of readily available individuals that they contacted for assistance if any anomalies were identified. This study contributes to the academic body of knowledge in developing a quality management framework for emerging maize farmers in the selected provinces of South Africa.

KEYWORDS: Deming's theory; emerging farmers; frameworks; Juran's theory; maize grading, maize quality; quality inspections; quality management

ACCREDITED JOURNAL PUBLICATIONS FROM THE THESIS

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DEDICATION

This study is dedicated to my late mother, **Annah Machuene Ramogodi** and my father, **Philemon Mobe Ramogodi**.

My appreciation also goes to my child:

Dakalo

ABBREVIATIONS

BEM	Business Excellence Models
Bt	Bacillus thuringiens
CA	Conservation agriculture
DMAIC	Define-Measure-Analyze-Improve-Control
EFQM	European Foundation for Quality Management
FAO	Food and Agriculture Organization
FMEA	Failure mode and effect analysis
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GM	Genetically Modified
GPS	Global Positioning System
HACCP	Hazard Analysis Critical Control Point
HT	herbicide-tolerant
IPCC	Intergovernmental Panel on Climate Change
ISO	international Organization for Standardization
IT	Information Technology
JIT	Just-in-time
MBNQA	Malcolm Baldrige National Quality Award
MRL	maximum residue limits
NDA	National Department of Agriculture
O₃	ozone gas
PDCA	Plan-Do-Check-Act
QMS	Quality Management System
SAEM	South African Excellence Model
SAP	Sustainable agricultural practices
SPS	Statistical process control
TQM	Total Quality Management
US	Ultrasound
UV	Ultraviolet
WM	White maize
YM	Yellow maize

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CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Agriculture, particularly emerging farming, is crucial for the future of the South African economy. However, most emerging farmers do not survive and rarely progress to become sustainable commercial farmers for many reasons, including the lack of an emerging farmer-specific quality management framework (Ramogodi & Pelsers, 2020:1).

Emerging farmers' successes have been on a downward trajectory for many years in South Africa (Sebola, 2018:3). Many researchers have attributed this trajectory to several factors such as lack of funding for the farmers, poor support from the government in terms of resources (production and mechanisation inputs), lack of research and development, non-existent extension services, and poor infrastructure (Khapayi & Celliers, 2016:25; Ramogodi & Pelsers, 2020:1; Sebola, 2018:2). According to Khapayi and Celliers, (2016:26), many small-scale farmers aspire to become commercial farmers but Manenzhe *et al.*, (2016:426) and Sebola, (2018:1) maintain that emerging farmers seldom progress to actualise the aspirations of becoming commercial farmers (Ramogodi & Pelsers, 2020:1).

Although Quality Management has proved to have the potential to improve the overall business performance in many organisations and industries (Siva *et al.*, 2016:149), emerging farmers still struggle to meet the minimum production requirements in terms of quality and quantity (Maponya *et al.*, 2018:421; Ramogodi & Pelsers, 2020:1). Moreover, the urgency for emerging farmers to succeed in South Africa has paved way for researchers to practically assist emerging farmers. Quality management promises to be only one aspect that could be used to improve emerging farmers' overall business.

Quality management is central to emerging farmers' well-being because their income depends solely on quality and quantity (Ramogodi & Pelsers, 2020:1). Grain quality and quantity are also crucial for marketing the produce, both nationally and internationally (Maponya *et al.*, 2018:421). Therefore, the purpose of this inductive phenomenological study is to add to the current knowledge of how emerging farmers, in particular, and small businesses in general, could use quality management practices to improve their overall businesses. That purpose is ultimately fulfilled by developing a quality management framework that emerging grain farmers could adopt.

1.2 PROBLEM STATEMENT

Some research has been conducted on emerging farmers in South Africa, but none focuses on how emerging farmers could use quality management to improve their profits and become sustainable. For example, Khapayi and Celliers, (2016:25-28) investigated the main factors inhibiting emerging farmers' progression from subsistence to commercial farming in the Eastern Cape Province. They concluded that poor physical and market infrastructure, lack of transportation to the markets, lack of marketing skills and information, high transaction costs, scarce land, lack of agricultural implements, poor production and farm management skills, and low education levels all cumulatively contribute to this status. Most of the above factors are also reiterated in a study by Maponya *et al.*, (2018:421-422), who investigated the socio-economic factors affecting emerging farmers in the Alfred Nzo District of South Africa. The study by Sebola (2018:1-7) focused on the financial aspect of the problems that emerging farmers encounter and concluded that government institutions' current funding models are ineffective.

According to Maponya *et al.*, (2018:421), the capacity of emerging farmers to meet the minimum production requirements in terms of quality and quantity determines their fate to participate in high-value markets. This capacity is also critical because the emerging farmers' income is directly proportional to their product's quality and quantity. Even when many researchers have shown the value of quality management to many big organisations (Ramogodi & Pelser, 2020:1; Siva *et al.*, 2016:149), there is still not enough research demonstrating how small businesses, particularly, emerging farmers, can leverage quality management to improve their overall businesses and profitability (Murphy & Leonard, 2016:1104). The specific management problem is that there is currently no quality management framework to help emerging grain farmers improve their product quality and quantity, thereby increasing their overall business performance for sustainability (Murphy & Leonard, 2016:1104; Ramogodi & Pelser, 2020:1).

There are many quality management frameworks available such as the most widely adopted TQM, ISO 9001, six sigma and lean manufacturing to name but a few (Laux *et al.*, 2015:313). However, according to Aldowaisan and Youssef (2006:231), all these frameworks are unsuitable for small businesses such as emerging farmers. This strengthens the case for the current study to develop a quality management framework that is suitable for emerging farmers.

1.3 RATIONALE AND SIGNIFICANCE OF THE STUDY

The study anticipates assisting emerging grain farmers improve their overall business performance and provide a sound basis for their sustainability. It also assists emerging farmers to unlock market opportunities, both national and international. Furthermore, this study emboldens emerging farmers with the product quality knowledge necessary for survival in the open market because there is a direct correlation between their product quality and income.

There is currently no emerging-farmer-specific quality management framework in the literature. Therefore, this study contributes to the body of knowledge by developing a quality management framework that is essentially a non-prescriptive guideline for quality planning, quality control and quality improvement for sustainability. The framework is suitable for the farmers and the extension officers who support farmers and training providers in the grain industry.

1.4 AIM AND OBJECTIVES

1.4.1 Aim

This study aimed to develop a quality management framework for the farming industry, particularly emerging maize farmers.

1.4.2 Objectives

- To determine the critical factors involved in the development of a quality management framework
- To assess the competency of emerging farmers on the critical factors affecting maize quality and grain quality standards by the emerging farmers
- To assess the competency of emerging farmers in maize quality standards (Maize grading)
- To determine what grain quality processes are currently in place to meet the product quality standards

1.5 RESEARCH QUESTIONS

1.5.1 Main research question

Can a quality management framework be developed for the farming industry, particularly emerging grain farmers?

1.5.2 Sub-questions

What are the critical factors involved in the development of a quality management framework for emerging maize farmers?

How competent are emerging maize farmers on factors affecting maize quality and maize quality standards?

How competent are emerging maize farmers in determining the maize quality standards (maize grading)?

What are maize quality processes currently in place to meet product quality standards?

1.6 PRELIMINARY LITERATURE REVIEW

1.6.1 Defining quality

Quality is a multifaceted, ambiguous, and complex concept to define, and there is no consensus across the board, even within disciplines (Hajjat & Hajjat, 2014:499). According to Golder *et al.*, (2012:1), quality has its roots in philosophy, marketing, operations management, management, strategy and economics. To give perspectives on quality, Garvin, (1984:25) developed a comprehensive framework for defining quality, including five different approaches: transcendent, product-based, user-based, manufacturing-based and value-based. Nonetheless, George and Kabir (2014:1-3) conclude that there is no universal, all-compassing or global definition for quality. George and Kabir, (2014:1), reiterate that all these definitions are correct depending on the context in which they are applied. The focus of this study is on the product-based approach and this is elaborated further in subsequent segments.

The product-based approach regards quality as a precise and measurable variable characterised by differences in the quantity of some desirable ingredients, traits, or attributes (George & Kabir, 2014:1-3). This approach contradicts that of Juran, who states that in this sense, high quality would be expensive because specific product features impact price. Juran further reiterates that

customers only see one product quality free from defects and possesses all necessary features (George & Kabir, 2014:1).

Garvin, (1987:104) proposed advanced systemic thinking regarding product quality by explaining product quality in eight dimensions: performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality. Furthermore, Hajjat and Hajjat, (2014:500) clarify the multidimensionality of product quality and the fact that each dimension can be used individually or in groups strategically for competitive advantage.

1.6.2 Defining emerging farmers

The definition of emerging farmer is equally ambiguous in the South African context. For instance, the National Department of Agriculture (NDA) defines emerging farmers in three different ways, namely: as farmers who are the beneficiaries of one of the government's land reform programmes; secondly, as farmers who are mainly dependent on state and semi-state organisations for support and finance; finally, as farmers who consume and sell some portion of their harvest (NDA, 2006:1). In support, Gelderblom (2003:1) defines an emerging farmer as a person who aspires to farm successfully within their given physical, mental and socio-economic constraints and needs the assistance of an external facilitator to realise this aspiration. Senyolo, (2007:3) further reiterates that emerging farmers intend to participate in formal markets but have limited access due to various challenges (Ramogodi & Pelsner, 2020:1). These emerging farmers would want to sell more of their products but they have been previously disadvantaged. Mabaya, (2011:11) views emerging farmers in the South African dualistic agriculture system as those that fit in-between small-scale farming and commercial agriculture.

1.6.3 Quality management frameworks

The development of quality management frameworks is not a new phenomenon (Laux *et al.*, 2015:313). This phenomenon dates back to the origin of quality management and its gurus. Crosby (1979) provided a 14-step framework described as a stepwise method for integrating TQM into an organisation. Deming (1986) developed a framework of 14 points to try and change business culture and persuade top management to adopt a quality improvement attitude for processes, product and services. Juran (1993) established 12 steps for quality improvement (Chauke *et al.*, 2019b:2918-2919).

There are many quality management frameworks available, but most are not suitable for small business environments, according to Murphy and Leonard (2016:1104-1107). They further reiterate that researchers have not addressed this paucity in frameworks by developing a more user-friendly, specific, and simpler 'fit for purpose' framework for small businesses. In support,

Laux *et al.*, (2015:313) emphasised that some frameworks such as the new quality award models MBNQA and EFQM, ISO 9000 QMS and Total Quality Management (TQM) are not suitable for small businesses because they are expensive to use and written in jargon that constitutes an incomprehensible language.

Quality management has the potential to improve the overall business performance in many organisations and industries (Siva *et al.*, 2016:149). In support, Shafiq *et al.* (2019:31-33), in their study, showed a positive and significant correlation between the implementation of quality management and overall firm performance. However, this is disputed by Zondo (2018:1-3) in his study about QMS accreditation and small training providers in KZN, who found no statistically significant correlation between QMS adaptation and the financial performance of the small training providers. However, this is attributed to the non-incorporation of financial measures during the implementation of QMS.

1.6.4 Quality management and emerging grain farmers

Quality management is crucial for emerging grain farmers because of the grain's quality and quantity which determine the marketing and the grain price in South Africa. Regardless, Khapayi and Celliers (2016:25-28) show in their study that 83% of emerging farmers involved in crop production did not have the grading skills required to determine the quality grade of their produce. The same study also showed that over 90% of the emerging farmers had low education levels, making it difficult to learn grading specifications and regulations independently (Khapayi & Celliers, 2016:25-28).

Grain quality refers to the attributes of grain, which makes it pleasant to the customer or consumer. The quality attributes include flavour, colour, and nutritional value and from the absence of harmful substances such as mycotoxins, chemical residues, noxious seeds, microorganisms, pests and insects (Van Aswegen, 2018:5). According to Sendin *et al.*, (2018:311), grain quality in South Africa is determined according to the following factors defined in the South African grain regulations, including defective kernels and foreign matter as the most common. Other quality factors determined include nutritional (fat, protein and starch), physical (Hectolitre mass, 100-kernel mass, kernel size, breakage susceptibility, stress cracks and milling index) and food safety (mycotoxins, chemical residues and GMO) (SAGL, 2019:1); (Sendin *et al.*, 2018:311).

Grain quality can be affected by many factors during and after production. Those factors can be internal, (those that the farmer has control over) or external (those the farmers do not have control over). The internal factors that affect grain quality include the choice of agricultural practices

(Karlsson *et al.*, 2017:53), the biological composition (Degani *et al.*, 2018:26) (Mendoza *et al.*, 2017:9), lack of technological adaptations (Tessema *et al.*, 2018:33) and technical incompetence (Maponya *et al.*, 2018:421). On the contrary, external factors that affect grain quality include mostly climatic and environmental conditions (Czembor *et al.*, 2015:11) and (Karlsson *et al.*, 2017:54), lack or poor farming resources and quality inputs (Ramogodi & Pelsler, 2020:1; Sebola, 2018:2).

1.6.5 Theoretical foundation

This study's theoretical foundation is based on the Total Quality Management (TQM) approach and guided by two prominent management theories: Deming's theory and Juran's theory. TQM is an approach to doing business that attempts to maximise an organisation's competitiveness through the continual improvement of the quality of its product, services, people, processes and environment (Hedao & Sangode, 2019:22). TQM is relevant to this study because it helped the researcher evaluate the findings by comparing how emerging farmers engage in continuous improvement of their products, processes, people and the environment.

The first theory adopted for this study was Deming's, founded by Edward Deming, who is referred to by many as the father of TQM. Deming's work is not purely about quality control and production but a broad vision into organisations' nature and how they should be changed. Deming's 14 points for management, 16 obstacles, the seven deadly diseases and the Plan-Do-Check-Act (PDCA) cycle outline his vision. The essence of Deming's theory is the observation that variability exists in everything everywhere. However, variability can only be understood well enough to manipulate and change it by studying and analysing statistics (Chauke *et al.*, 2019a:2918). The relevance of this theory to this study lies in comparing how emerging farmers engage in continuous improvement. It also helped develop the quality management framework by guiding the framework's structure using the PDCA cycle.

The second theory adopted for this study is Juran's, founded by Joseph M. Juran. Juran is known for his contribution to management theories by developing the Juran Quality Trilogy. The Juran Trilogy summarises the three managerial functions as quality planning, quality control and quality improvement. Quality planning involves developing the products, systems, and processes needed to meet or exceed customer expectations. Quality control involves access to actual quality performance, comparing performance with goals, and acting on differences between performance and goals. Quality improvement involves improving quality that is ongoing and continual (Chauke *et al.*, 2019a:2919). The Juran trilogy provides the structure for the development of the quality management framework anticipated in this current study.

1.7 DEFINITION OF KEY CONCEPTS

1.7.1 Emerging farmers

For this study, emerging farmers produce maize, they are black, planting between 150 and 500 hectares, are developing, participating in either formal or informal markets and are funded by Senwes.

1.7.2 Quality

Quality is defined as the “degree of excellence” in the Concise Oxford Dictionary. Juran defines quality as “fitness for purpose;” while Crosby defines it as “conformance to specifications” (Farner, 1996:89). It is also referred to by the International Organization for Standardization (ISO) as the degree to which the requirements are fulfilled by a set of inherent characteristics (Hoyle, 2009:24). The researcher views quality as meeting both the statutory and regulatory requirements and exceeding customer expectations.

1.7.3 Quality management

Quality management is an approach and a process of achieving quality (Knowles, 2011:11). According to Siva *et al.*, (2016:149), quality management is a philosophy comprising tools, principles, and practices focusing on the customer, fact-based decisions, and continuous improvement. Ferrón Vílchez and Darnall (2016:222) view quality management as a leading philosophy that encourages continuous improvement within all organisations' activities to achieve quality. The researcher defines quality management as a scientific approach for continuously improving organisational processes, people and the work environment in order to increase its overall performance.

1.7.4 Grain quality

Grain quality is defined as grain that meets both the statutory and regulatory specifications and is agreeable with the customer or consumer (Van Aswegen, 2018:5). Grain quality can also be defined as the range of physical and compositional threshold specifications set according to final use requirements (Nuttall *et al.*, 2017:136; Ramogodi & Pelser, 2021:1). The researcher views grain quality as grain that meets the grading regulations requirements and exceeds customer expectations.

1.7.5 Framework

The Merriam-Webster Dictionary (2019:1) defines a framework as a “basic conceptual structure” while the Oxford Dictionary (2019:1) defines framework as a “basic structure underlying a system, concept, or text.” According to Yusof and Aspinwall (2000:284), most researchers define a framework as a prescriptive set of things to do. The researcher views a framework as a basket of ideas or a structure that provides a guideline on how quality could be achieved.

1.7.6 Business performance

Business performance is defined as the pursuit of realising management goals by evaluating all organisational efforts (Cetindere *et al.*, 2015:1377). Zulkiffli and Perera (2011:1) view business performance as the operation’s ability to meet the expectations of the organisation’s shareholders. The researcher defines business performance as the company’s ability to maximise profits to satisfy all stakeholders consistently.

1.8 RESEARCH PARADIGM, PHILOSOPHY AND METHODS

1.8.1 Research paradigm

A research paradigm is described as the researcher’s ‘world-view’ (Shaw *et al.*, 2010:513). It is a lens through which the researcher views the world that they live or want to live in. It constitutes beliefs and principles that shape how the researcher sees the world (Davies & Fisher, 2018:21). Researchers have proposed several paradigms but Kivunja and Kuyini, (2017:30) suggest that these can be grouped into four main taxonomies: positivism, interpretivism, critical realism, and pragmatism. According to Saunders *et al.*, (2016:133), the distinctions in these paradigms matter because they influence the researcher’s view of the world and how they conduct their research. The following segment commits to an exploration of these facets.

Positivism is based on the ontological assumption that there is one single reality (Azzopardi & Nash, 2014:152). The positivist’s epistemological assumptions are that the study of a phenomenon must be undertaken with detached impartiality and objectivity to know a single reality. In a quest to discover that single reality, positivist methodology tests predetermined hypothesis or theories, and is experimental and mostly uses large sample sizes and quantitative methods (Davies & Fisher, 2018:22). It employs a deductive approach which concerns the development of theory evaluated through several propositions related to the theory (Ade Bilau *et al.*, 2018:601).

Interpretivism is associated often with qualitative research and dependent on constructivist ontology. Epistemology and ontology in the interpretivist paradigm are intertwined because knowledge is crucial in the ontological assumptions of the world's composition (Goldkuhl, 2012:135). According to Bilau *et al.*, (2018:600), interpretivism views knowledge as complex in nature, context-dependent and socially constructed. Furthermore, interpretivism recognises history and practice in knowledge development as significant constructs. Their philosophical view is that research participants play a vital role in the research process and that the researcher's experience and background influence the object under study (Bilau *et al.*, 2018:600).

Critical realism holds a middle ground between positivist direct realism and postmodernist nominalism and is often confused with an extreme form of realism supporting the philosophy of direct realism. It underscores explaining what we see and our experiences relating to the basic structures of reality that shape the events. Furthermore, they see reality as independent and external and cannot be reached through our understanding and observation of it (Saunders *et al.*, 2016:138-139).

Shaw *et al.*, (2010:514) as supported by Azzopardi and Nash (2014:156) assert that pragmatism concerns finding the truth in the solutions to problems and the consequences of actions and objects and attends to reality's practical nature. The only contention regarding the synonymy of truth with the solution to a problem provides a foundation for pragmatism as a paradigm unto itself. The statement above reproduces the fact that pragmatists distinguish epistemology, ontology and methodology very clearly from other common paradigms (Shaw *et al.*, 2010:514). Pragmatism supports the use of mixed research methods together with modes of analysis and a continuous cycle of adductive reasoning guided by the researcher's desire to yield socially useful knowledge (Feilzer, 2010:6).

1.8.2 Research philosophy

Research philosophy is a system of beliefs and assumptions about knowledge development (Saunders *et al.*, 2016:124). Ade Bilau *et al.*, (2018:599) reiterates that it is concerned with nature, source and knowledge development. The researchers need to understand their philosophical positions to choose a research paradigm related to their beliefs and principles and subsequently identify an effective research design and suitable methodology and method for the study (Ade Bilau *et al.*, 2018:599). Research philosophies are distinguished using three philosophical assumptions: ontology, epistemology, and axiology, and these are subsequently discussed.

Ontology is defined by Saunders *et al.*, (2016:127) as assumptions about the nature of reality. Ontology is also referred to as the study of being by Ade Bilau *et al.*, (2018:599). The researcher's

ontological assumptions determine how the researcher views and studies the research items. Those items normally include the organisation, management, work-life of individuals and work events in management and business studies. Thus, the ultimate basis upon which the researcher selects their research prospects are modulated by the researcher's ontology (Saunders *et al.*, 2016:127).

Epistemology is described as knowledge assumptions, legitimate, valid and acceptable knowledge, and how knowledge can be communicated to others (Saunders *et al.*, 2016:127). It could be both subjective and objective, according to Ade Bilau *et al.*, (2018:600). Subjective epistemology views the world "in the realm of clarifications from reflection," while objective epistemology reflects the outside world as being hypothetically independent (Ade Bilau *et al.*, 2018:600).

Axiology concerns the role played by values and ethics in the research process. It clarifies how researchers deal with their values and those of the research participants. For the credibility of the research, values play a vital role throughout the research stages. In essence, our value compass guides all our actions during the research process (Saunders *et al.*, 2016:128).

1.8.3 Approach in this study

The interpretivism paradigm was applied in this study. The researcher's ontological assumptions underpinned the selection of this paradigm. The researcher is convinced that multiple realities exist which are shaped by context. The researcher also is convinced that truth evolves and changes. The researcher undertook to talking and interacting with people in a bid to obtain an in-depth understanding of the context. The researcher's subjectivity guided the epistemological grounding in this study. The point is that interaction was necessary and consolidated an important part of the research.

1.8.4 Research method

There are various choices available on the type(s) of research methods to utilise during research, according to Saunders *et al.*, (2016:165). The choice can be the utilisation of qualitative, quantitative or both, referred to as a mixed-method approach. For this study, the researcher chose the qualitative method because he wanted to study the central phenomenon in-depth and in detail, create openness, stimulate the participants' individual experiences, uncover trends in thought and opinions, and delve into the problem. Haven and Van Grootel, (2019:232-233) defines a qualitative method as an inductive process of data organisation into categories and recognising patterns amongst categories. The qualitative method is distinguished through non-numeric data and uses interviews to collect data (Saunders *et al.*, 2016:165). In contrast, the quantitative

method is a deductive process distinguished through the use of numeric data characterised by numbers and relies on questionnaires as data collection techniques or statistics and graphs that utilise numeric data for analysing data (Saunders *et al.*, 2016:165).

1.8.5 Research design

According to Haven and Van Grootel, (2019:232-233), the qualitative research approach is possibly the most flexible compared to others. It encompasses various accepted methods and techniques. There are four major types of qualitative research designs: phenomenology, case study, grounded theory and ethnography. This study adopted a descriptive phenomenological research design because of its ability to provide rich and detailed human experiences. However, the researcher also acknowledged that he has to be objective and free from bias when interpreting the phenomenological study's data.

According to Qutoshi, (2018:215-216), phenomenology is a qualitative research design that strives to make the implied structure and meaning of human experience clear. It is the science of experience or essential structures of consciousness. Phenomenology searches for the “essences” that ordinary observation cannot divulge. It aims to directly access the imaginative and pure vision of what an experience means (Qutoshi, 2018:216). Van Manen, (2017:814-815) asserts that with phenomenology, a researcher can explore and understand daily experiences without prior knowledge of those experiences. Phenomenological research entails that the researcher is open to views presented during the investigation into a phenomenon (Van Manen, 2017:814-815).

As adopted for this study, descriptive phenomenology concerns finding the essence of a phenomenon by describing emerging farmers' experiences regarding quality management. On the contrary, interpretive phenomenology is about the interpretation of how subjects make sense of their experiences through exploring how emerging farmers would make sense of their quality management experiences (Gentles *et al.*, 2015:1773).

1.8.6 Demarcation of the study

The research was carried out in provinces where Senwes operates its business and has farmers funded by Senwes. Senwes ranks among the top agricultural firms in South Africa. The business is deeply rooted in agriculture and has a long and prosperous past spanning 111 years. Three pillars support Senwes: Input Supply, Financial and Technical Services and Market Access in the North West, Free State, Gauteng and Northern Cape. Senwes has an integrated business model

that facilitates its core objective of making a meaningful contribution to South Africa's food security sustainably.

1.8.7 Research process

1.8.7.1 Population

The study's target population was the emerging maize farmers in the selected provinces of South Africa, which are funded by Senwes. Senwes had only 15 emerging maize farmers in their database nationally, and all of them were sampled. This population provided study units from which purposeful sampling took place.

1.8.7.2 Sampling method and sample size

Sampling in qualitative research is defined by Gentles *et al.*, (2015:1775) as selecting particular data sources where data is collected to respond to the research objectives. There are two main categories of sampling, namely: probability sampling and non-probability sampling. Probability sampling is a strategy in which equal probability is afforded for each individual, and it includes random sampling, systematic, stratified and cluster sampling. On the other hand, in non-probability sampling, the researcher has no way of forecasting that each population element is ultimately represented in the sample and examples range from convenience, quota, snowball, maximum variation through to purposive or purposeful sampling (Schreuder *et al.*, 2001:281).

The purposeful sampling strategy was adopted for this study. According to Gentles *et al.*, (2015:1779), the term purposeful sampling is troubled with ambiguity and lack of clarity. Thus, the researcher needs to describe what it means in their specific context rather than just a purposeful sampling strategy was adopted. Otherwise, the information necessary to judge the study's rigour could be in jeopardy (Gentles *et al.*, 2015:1779). The researcher would have failed to distinguish their approach to convenience sampling, which is defined by Patton (cited by Gentles *et al.*, 2015:1779) as the practice of “doing what is fast and convenient”. This study defined purposeful sampling as selecting an information-rich group of emerging grain farmers who share common characteristics for an in-depth study of the phenomenon.

Typically small samples are required for qualitative research but should be substantive to gather enough data to adequately address the research objectives and describe the phenomenon (Gentles *et al.*, 2015:1782). According to Creswell, (2016:121), a sample size of 5-25 is sufficient for a phenomenological study and Morse, (1994:225) recommends at least six participants while Guetterman, (2015:14) purports that it could even be more. Thus, this study targeted all 15 participants (emerging maize farmers). The participants who met the selection criteria must have

received funding from Senwes, produced maize, were black, produced between 150 and 1000 tons, were developing and participated in either formal or informal markets. The reason for purposely selecting all participants was because the researcher strove to gather comprehensive information from different participants in terms of production volumes and different grain farming experiences. The researcher also targeted five (5) industry experts from different entities to give credibility to the study and also to solicit their expertise and suggestions on how a quality management framework could be created. The criteria for the expert's selection was based on their knowledge on grain quality management, emerging farming, grain pathology and agronomy.

1.8.7.3 Data collection instruments

Qualitative data were collected through semi-structured interviews, documents and observations as suggested by Saunders *et al.*, (2016:390). The researcher had a list of key questions and made use of an interview schedule to get answers from the questions covered during the interview derived from the literature review of this study and the questions posed in this study. The data from the interviews were captured by audio-recording the conversations. The choice of methods, particularly the interviews, was encouraged because some of the target participants had low education levels, and some did not understand English very well. Thus, this method was suitable for clarifying some questions and translating questions to the participants' language when there was a need.

1.8.7.4 Data collection

Data were collected through face-to-face, semi-structured, and in-depth interviews. The interviews took place on the farm or the home of the participants depending on their preference. The researcher himself conducted the interviews. The participants were contacted telephonically to set appointments on the date suitable for them and discussed a suitable location for the interview. The process of the interview was briefly discussed during the same telephone conversation. It was done to ensure that the participants understand what is expected of them and make them comfortable. Data was then collected after all parties agreed with the terms of the study, and a consent form was signed by all participants involved.

1.8.7.5 Data coding and analysis

Thematic analysis, a generic approach to analysing qualitative data, was followed for this study because it allowed the researcher to search for themes from the data as suggested by Saunders *et al.*, (2016:579). Raw data was captured using an audio recorder. It was then organised and prepared for analysis. It involved listening to the interviews, transcribing the interviews and field notes typing. The notes were then read through to write notes in margins and noting common

ideas. Data were then coded to categorise data with similar ideas and forming themes. The themes contain categories and sub-categories. According to Saunders *et al.*, (2016:581), coding is used to arrange data with similar meaning into categories. Linneberg and Korsgaard, (2019:259-260) reiterates that coding includes providing each unit of data within a data item with a code that summarises the extract's meaning. The aim was to make data of interest accessible for further analysis (Saunders *et al.*, 2016:581).

1.8.7.6 Reliability and Validity

According to Saunders *et al.*, (2016:396), using semi-structured interviews come with a burden of data quality issues that needs to be addressed. Those issues include reliability/dependability, forms of bias, cultural differences, generalisability/transferability and validity/credibility. Amaratunga *et al.*, (2002:12) define validity as “the ability to describe reality with a good fit” which means that the measure must measure what it purports to measure.

The researcher ensured that strategies were in place to guarantee that data quality issues were adequately addressed before data collecting began. Such strategies included recognising that all research methods have limitations and careful preparation before conducting interviews to avoid bias that would threaten the data's reliability and validity (Saunders *et al.*, 2016:426). A pilot study of five (5) participants was conducted to put the test strategies, and adjustments were made to collect data to validate its credibility. Furthermore, the researcher solicited comments from the pilot study participants concerning the interview themes and key questions to make sure the themes and the key questions were fully understood and if need be, amend the themes and the key questions. As such, the pilot test interviews' administration resulted in the final key questions being amended to include spelling corrections, grammatical corrections, and wording corrections.

1.8.7.7 Measures in ensuring the trustworthiness of the study

According to Morrow (2005:250), the term trustworthiness can be used to express validity in a qualitative study. Trustworthiness in a qualitative study can be achieved through the five aspects as proposed by Guba cited by Shenton (2004:64), namely: credibility, dependability, transferability, confirmability and reflexivity. The researcher applied Shenton's (2004:73) suggestions on how to ensure the trustworthiness of the study. A brief discussion outlining how the four aspects we ensured is given below.

Credibility can be ensured by understanding the participant's culture, peer-reviewing the study, reflective commentary usage, framing findings through examining previous findings, random sampling and using appropriate research methods. Dependability is ensured by describing the methodology in-depth, which allows study repetition and using overlying methods. Transferability

is ensured by detailing the phenomenon description and giving the background data to establish the study's context. Confirmability is achieved by recognising limitations by the researcher, admission of the researcher's ontology and epistemology, and triangulation (Shenton, 2004:73). Finally, reflexivity is an attempt to assist to minimize the effects of the researcher bias on the study. Reflexivity is achieved through the researcher continuously incorporating awareness of reflecting, exploring and examining his relationships throughout the research as suggested by Kolb (2012:85).

The researcher used an audio recorder and manually recoding data on a notebook to collect data with the participants' permission. The researcher was subjected to strict peer scrutiny and face validation before analysing data to ensure the study's trustworthiness. Furthermore, clarification of misunderstandings and the reduction of bias were ensured by triangulating the results of the interviews with those from document reviews and observations as suggested by Musikavanhu (2017:126-127).

Regarding the study's credibility, the researcher held meetings with Senwes management to understand participants' culture before starting the interviews. Furthermore, the study was peer-reviewed by colleagues in academia, and selected experts in the industry and the feedback was used to improve the questions. For transferability, background reading was essential to study the context, while the findings defined the study context. Finally, the researcher triangulated the interviews' findings and recognised the interviews' limitations, as suggested by Musikavanhu (2017:126-127).

1.9 ETHICAL CONSIDERATIONS

Research ethics refers to the standards of behaviour that guide the researcher's conduct concerning the rights of those who become the subject of the researchers work or are affected by it (Saunders *et al.*, 2016:264). According to Reybold (2008:279), when a study involves human subjects, the situation requires a high degree of professional ethics and integrity. Thus, the data collection process did not begin until the study received ethics clearance from North-West University. The study also did not commence until the study was discussed with the participants. The participants had signed the consent letter, also allowing the researcher to use a voice recording device.

The participants were informed of their rights and the benefits of participating in this study, such as those advocated by Alsmadi (2008:153-156) such as: the purpose of the study, anticipated

interview duration, and interview procedures; their right to withdraw from the research at any stage of the research process; the anticipated consequences of declining or withdrawing from the study; any potential risks or adverse effects related to this study; any prospective research benefits; the procedures for maintaining confidentiality; and the immediate person to contact for questions related to this research. Further considerations that were made as proposed by Saunders *et al.*, (2016) include guaranteeing zero harm to the participants; safeguarding of all participants' identity; privacy of information and anonymity of participants; prevention of possible emotional harm, risk of upset and reputational risk aversion.

All data was coded such that participant names were not associated with them to maintain the highest degree of data confidentiality. All materials relating to this study, such as digital voice recorder, notes, and documentation, were kept safe, including locked file cabinets and will be secured for three years. Security codes were assigned to all computerised records, and all information relating to this study remained confidential and was not shared with any unauthorised persons as proposed by Mganga (2013:73).

1.10 OUTLINE OF THE THESIS

1.10.1 Chapter One – Overview

In this chapter, the introduction and background of the study were given. The scope of the problem statement was also provided. The rationale and significance of the study were discussed. The main aim and objectives of the research were clearly defined, and the main research question and sub-questions clearly outlined. Some preliminary literature review was provided to link the study's central question to current and previous research. The key concepts significant to the study were defined. Also, research paradigm, method, design, demarcation of the study, sampling method and data collection method and techniques were outlined. The chapter concluded by discussing ethical considerations.

1.10.2 Chapter Two – Literature study on quality management frameworks

This chapter focuses on a literature study on quality management frameworks and quality processes that emerging farmers use for quality management.

1.10.3 Chapter Three – Theoretical framework

This chapter develops and interrogates a theoretical framework on significant theories regarding quality management, overall business performance and sustainability. Quality management principles, theories and TQM framework were discussed. Business performance was also conceptualised, linking it to factors affecting business performance. Finally, a link between quality management, overall business performance and sustainability was established.

1.10.4 Chapter Four - Methodology

This chapter provides a comprehensive methodology on how data was collected, analysed and interpreted for the following objectives: to assess emerging farmers' competency in product quality and management. The sole purpose is to investigate the awareness, perceptions and understanding of grain quality and grain quality standards by the emerging farmers.

1.10.5 Chapter Five – Empirical results/discussion of data collected

This chapter analysed, interpreted and discussed the empirical results of data collected in the previous chapter. The chapter sought to finalise the assessment of competency of emerging farmers on quality management. It also concluded by focusing on emerging farmers' awareness, perceptions and understanding of grain quality and grain quality standards.

1.10.6 Chapter Six – Conclusions and recommendations

This chapter deals with the study's conclusions and recommendations to the various role players and further studies. This section also presents the quality management framework for emerging farmers in South Africa.

1.11 LIMITATIONS OF THE RESEARCH

The study was limited to emerging farmers whom Senwes only funded, planted maize, were black, produced between 100 and 1000 tons, was developing, and participated in formal or informal markets. Furthermore, some participants had low educational levels and were illiterate. Lastly, the data used in the literature were from 1980 to date.

1.12 SUMMARY

This chapter discussed the introduction and background of the study. The problem statement was also specified. Next, the study's purpose and significance were examined. The research's main goal and objectives are clearly stated, as are the main research question and sub-questions. A preliminary literature review was provided to connect the study's central phenomenon to current and past research. Next, the study's most important concepts were defined. Also discussed were the research paradigm, method, design, study demarcation, sample method, and data collection method and procedures. The chapter came to a close with a discussion of ethical issues.

The next chapter deals with the study's literature review and address both the theoretical and conceptual frameworks.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter locates and critically appraises literature published by scholars and researchers regarding quality management and emerging farmers. This section of the study strengthens the research topic's argument and helps shape the study's purpose, goals, and objectives (Faryadi, 2018:2913). Therefore, the purpose of this section of the study is to assist the reader in understanding how the ideas of this study were informed, generated and refined through a comprehensive review of the related and recent literature. This literature review also helped identify gaps in previous research in developing the study's research questions in the first chapter.

This section of the study commences by discussing the emerging farming industry of South Africa to provide the context of the study. The maize value chain is also discussed because the study focuses on emerging farmers that only plant maize. The biggest problem faced by emerging farmers in South Africa is the inability to transform from subsistence farmers into commercial farmers (Khapayi & Celliers, 2016:25; Ramogodi & Pelsner, 2020:1). Therefore, the study identifies the challenges faced by emerging farmers leading to their inability to succeed and become commercial farmers. These challenges negatively affect the production, quantity and quality of the grains resulting in small profits; thus, the sustainability of emerging farmers is hampered.

The study follows this with a discussion on how maize quality is determined to lay a foundation for the factors affecting maize quality. According to Van Aswegen (2011:1-15), maize grain quality is affected by many factors such as insects, fungi, pesticides residues, mycotoxins, and other foreign matter found in the grain. All these factors and their effect on maize grain are discussed in this section. Lastly, various quality management frameworks are discussed to identify which frameworks are available and compare how they propose quality should be managed. According to Wiśniewska and Szczepańska (2014:352); Saad and Khamkham (2018:587), quality management frameworks are increasingly on demand by small businesses to improve their business performance. When used properly, quality management frameworks could improve the overall performance of small businesses and satisfy all stakeholders (Wiśniewska & Szczepańska, 2014:352).

2.2 THE EMERGING MAIZE FARMING INDUSTRY OF SOUTH AFRICA

2.2.1 Understanding the emerging farming industry

In South Africa, agriculture is critical for both job creation, economic growth and food security. According to Lotriet *et al.*, (2017:456), the agricultural sector absorbs about 5.2% of the country's workforce, which is 1.8% lower than what was reported (Mabaya, 2011:11; Ramogodi & Pelser, 2020:1), comprising mostly unskilled and semi-skilled workers with low education levels. Primary agriculture directly contributes 3% to the GDP while the entire sector contributes up to 12% (Lotriet *et al.*, 2017:456; Mabaya, 2011:11; Ramogodi & Pelser, 2020:1).

The South African grain industry is significant to the agricultural value chain as it accounts for 25-33% of the total gross value of agricultural production. The "Grain Industry" in South Africa comprises grains such as maize, wheat, sorghum, barley, and oilseeds such as sunflower, soybeans, canola and groundnuts. Maize is the most important grain crop in South Africa because it is a staple food for many people and a major feed grain (Lotriet *et al.*, 2017:456; Ramogodi & Pelser, 2020:1). South African agriculture is made up of both emerging farmers and commercial farmers. However, emerging farmers constitute a small number of less than 5% of the total marketed agricultural output. There are estimated to be about 1.3 to 3 million emerging farmers in South Africa, mostly situated in the former homelands and communal areas (Lotriet *et al.*, 2017:457; Ramogodi & Pelser, 2020:1). Sebola (2018:2) indicates that about 200,000 emerging farmers are commercially orientated and about 2.5 million households participating in primary agriculture, which is a good indication of South Africa's agricultural development. A clear definition of emerging farmers is crucial for policymakers and other related parties (researchers, training providers and financing institutions) to accurately develop programmes and solutions targeted at emerging farmers (Mabaya, 2011:3; Ramogodi & Pelser, 2020:1).

According to Mabaya (2011:3), the categorisation developed by Land Bank (Fig. 2.1) is useful in defining emerging farmers. It puts the farmers on a scale from subsistence to established commercial farmers. The target group for this study are the "emerging commercial" farmers who sit with one leg in the small scale and the other in the established commercial farming in the South African dualistic agriculture that is characterised by established commercial farmers at the upper end and subsistence farmers at the lower end (Mabaya, 2011:3; Ramogodi & Pelser, 2020:1). To further narrow down the definition, the researcher in this study defines emerging farmers as those who produce maize, are black, producing between 150 and 1000 tons, are developing, participate in either formal or informal markets and are funded by Senwes.

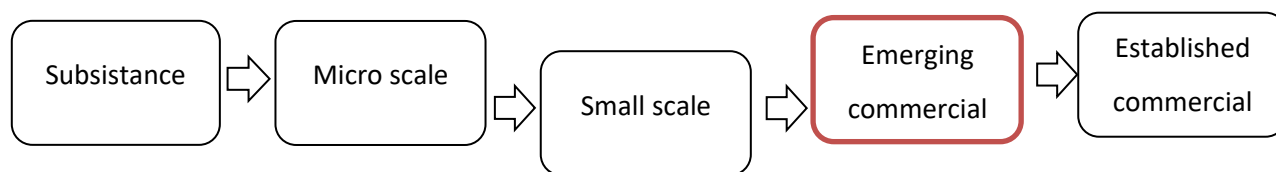


Figure 2.1: Classification of South Africa's farming sector

Source: Mabaya *et al.*, (2011:3)

2.2.2 The maize grain value chain

The maize grain value chain can be divided into different sectors, namely primary, secondary and tertiary sector. In addition, the grain market value chain can also be divided into levels which include: grain producers (emerging and commercial farmers), silo owners, grain traders (they market and sell grains), grain processors (transform raw grain into edible form), and consumers who are the end-users (DAFF, 2018:2).

The primary sector comprises input suppliers, grain producers and silo owners (DAFF, 2018:29). The input suppliers render input products for various farming practices such as seeds, fertilizer, irrigation equipment, fuel, tractors, harvesters and more. Primary producers are farmers and can be commercial or emerging farmers. Silo owners handle and store grains on behalf of others and account for safe short-term and long-term storage (Senwes, 2019:1). They also supply buyers continuously in between the harvesting seasons (DAFF, 2018:29).

The secondary sector comprises grain processors such as millers, brewers, oil crushers, refineries and expressers. They all process the grains into a consumable form for both humans and animals (DAFF, 2018:29).

The tertiary sector consists of transporters, traders and retailers. Transporters assist in moving grains within the grain value chain from farmers to the silo owners or directly to the processors. They also move grain from the silo owners to the processors and intermediaries to the final consumers. Traders market and sell grains to the domestic or export market. They also import grain into the domestic market during shortages of grains. There are three types of traders in the markets, namely: hedgers (use options and futures to mitigate against risks associated with the adverse market movement to protect existing portfolios), arbitrageurs (use price differentials of grain in different markets to make a profit) and speculators (target the short-term movements in

grain prices to make profits using option and futures). Finally, the retailers or wholesales offer services and infrastructure to distribute grain products to the consumer (DAFF, 2018:26).

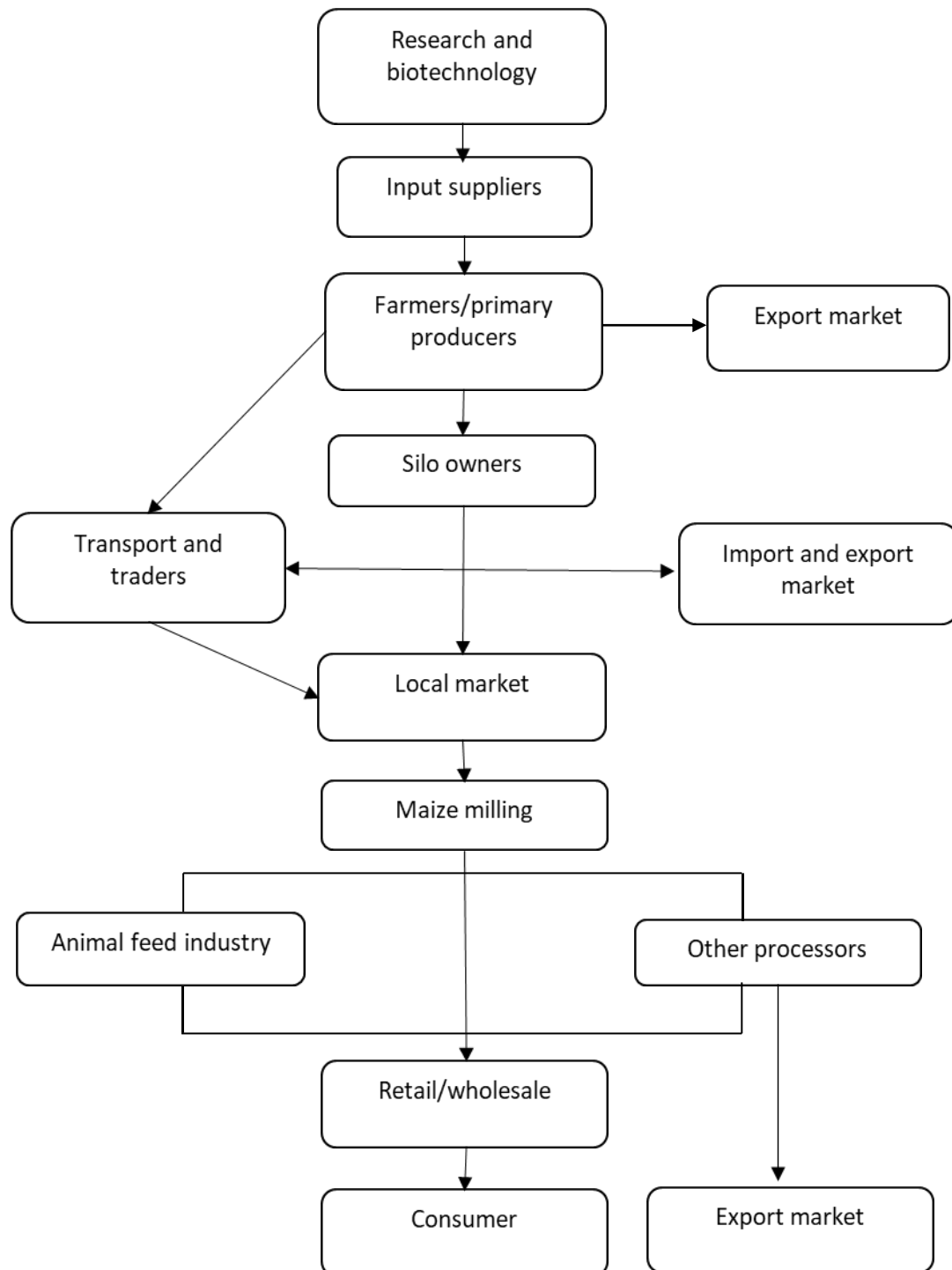


Figure 2.2: The grain value chain

Source: (DAFF, 2018:260)

2.3 CHALLENGES FACED BY EMERGING FARMERS

The biggest problem faced by emerging farmers in South Africa is the inability to transform from subsistence farmers into commercial farmers (Khapayi & Celliers, 2016:25; Ramogodi & Pelsner, 2020:1). Several research studies have been conducted over the years to assess the challenges faced by emerging farmers. These challenges directly or indirectly affect both the quality and quantity of the grain produced, leading to a lack of profitability and sustainability amongst emerging farmers. Thus, this section of the literature study explores some of those challenges that culminate in a lack of transformation to become commercial farmers by emerging farmers. The segment also evaluates the possible solutions proposed in the literature.

2.3.1 Finance

According to Aliber and Hall (2012:550), budgetary allocation by the government that is directed at emerging farmers has been increasing since the mid-1990s. However, the utilisation and dissemination of these financial resources only benefit the few farmers, and its impact is minimal (Ramogodi & Pelsner, 2020:1). In support, Sebola (2018:1) acknowledges that the South African government spends a great amount of money annually, trying to convert many emerging farmers into commercial farmers. However, Sebola (2018:1) argues that besides the government's visible spending, the investment ends up lost in failed projects because emerging farmers who qualify for the funding have little expertise and experience and are not interested in the farming business (Ramogodi & Pelsner, 2020:1). In contrast, Ncube (2018:89) states that lack of funding is still a major concern despite the improved budgetary allocation. Wilk *et al.*, (2013:281) purports that without proper financing, emerging farmers are unable to install irrigation systems, employ labour and buy costly inputs such as drought-resistant seeds, fertilizer and pesticides to generate high crop yields and produce good quality grains (Ramogodi & Pelsner, 2020:1).

Aliber and Hall (2012:550) suggest that a strategic decision should be taken to support many farmers in transforming them into commercial farmers through increased diversification of their produce. However, Sebola (2018:1) argues that the only way financing the emerging farmers could succeed is if financing is based on ability, experience, and interest in farming (Ramogodi & Pelsner, 2020:1). Also, funding should be extended to private and public employees who are motivated and have the ability and interest in farming (Sebola, 2018:1).

2.3.2 Access to land

Access to productive and sufficient land is crucial for the survival of emerging farmers because a small farm does not have economies of scale (Ramogodi & Pelsner, 2020:1; Wilk *et al.*, 2013:281). In support, Khapayi and Celliers (2016:39) state that the lack of access to productive land by

emerging farmers is one of the key influencers of emerging farmers' participation in the agricultural markets (Ramogodi & Pelsner, 2020:1). Commercial farmers have tracts of land sometimes in different areas and are less affected by climate change issues. Big farms make more profits and can be used as collateral to access finance from the banks (Ramogodi & Pelsner, 2020:1; Wilk *et al.*, 2013:281).

Agriculture, especially emerging farmers, is a vital driver of the economy; however, access to capital, land and markets are often being cited as entry barriers. Therefore, government needs to fast-track land reform targeted at emerging farmers so that they get farms or increase their farmland that could eventually be used as collateral to access finance from the banks (Ramogodi & Pelsner, 2020:1).

2.3.3 Infrastructure

Agriculture, particularly farming, depends heavily on the availability of infrastructure. However, research shows that government provision of infrastructure has been on a sharp decline in the past few decades. For instance, conservation work subsidies have declined from R6.4 billion per annum in the 1980s to about R176 million in the 2000s (Black *et al.*, 2014:3; Ramogodi & Pelsner, 2020:1). Moreover, Black *et al.*, (2014:3) argue that programmes such as the Poverty Relief and Infrastructure Investment Fund, Community-Based Public Works Programme (CWP) and the Consolidated Municipal Infrastructure Programme have not shown any positive effects. Moreover, irrigation schemes have also not been maintained over the past years (Black *et al.*, 2014:3; Ramogodi & Pelsner, 2020:1). In contrast, a study by Chaminuka *et al.*, (2008) demonstrates that service infrastructure characterised by the distance of the nearest town from the villages and the state of roads used by emerging farmers are more accessible to emerging farmers than before.

According to Senyolo *et al.*, (2009:208), lack of roads, poor road infrastructure and lack of transport services are contributory factors to why emerging farmers are struggling as these hinder access to high remunerating markets by emerging farmers (Ramogodi & Pelsner, 2020:1). In support, a study done by Khapayi and Celliers (2016:38) conducted in the Eastern Cape province found a need to upgrade infrastructure such as farming facilities, roads and communication lines as these impede the progress of emerging farmers (Ramogodi & Pelsner, 2020:1). Furthermore, Maponya *et al.*, (2018:426) purports that for emerging farmers to participate in high remunerating markets, resources such as road infrastructure and transport systems have to be improved (Ramogodi & Pelsner, 2020:1). In support, Chaminuka *et al.*, (2008:365) recommends that government policy should directly deal with emerging farmers' access to services to stimulate agricultural development.

2.3.4 Resources

Ncube (2018:89-96), in his study in the Western Cape, investigated the constraints affecting emerging farmers' success. He found access to water to be one of the important resources hindering emerging farmers' success. This lack of success was attributed to an uncoordinated institutional process to support emerging farmers resulting in them not participating in strategy and policy formulation (Ramogodi & Pelser, 2020:1). In support, a study by Kekana and Maponya (2017:136) in the Eastern Cape province showed that lack of access to sufficient and reliable water source results in emerging farmers having nothing or less to send to the markets due to production ceasing or producing less (Ramogodi & Pelser, 2020:1). To mitigate the problem, Ncube (2018:89) suggested collaboration between institutions and policymakers and improved relationships between emerging farmers and institutions (Ramogodi & Pelser, 2020:1). Furthermore, policymakers should put more effort into accurately identifying factors hindering emerging farmers' progress and directing more resources towards addressing this problem (Kekana & Maponya, 2017:136; Ramogodi & Pelser, 2020:1).

2.3.5 Access to markets

Markets play a crucial role in improving the profits of emerging farmers. However, South African markets are volatile and not well organised. They are also not easily accessible to emerging farmers (Ramogodi & Pelser, 2020:1, Senyolo *et al.*, 2009:212). In support, Jordaan and Grove, (2013:508) reiterate that one of the impediments to emerging farmers' success is their inability to consistently supply good quality products, hindering their chances of accessing the volatile markets. This is also perpetuated by the lack of information that emerging farmers need to negotiate good prices at the markets and small scale operations (Jordaan & Grove, 2013:508; Ramogodi & Pelser, 2020:1; Senyolo *et al.*, 2009:212). Similarly, Kekana and Maponya (2017:130) and Maponya *et al.*, (2018:421) echoed that market information access, transport availability, and the type of road to the markets significantly influence emerging farmer's market participation.

Jordaan and Grove (2013:508) suggest that this problem of non-access to markets due to small scale operations could be solved through collective action by specifically forming agricultural cooperatives. However, for those cooperatives to succeed, the role of social capital such as trust, social networks and shared norms in driving performance and farmer-to-farmer skills transfer cannot be overstated (Jordaan & Grove, 2013:508; Ramogodi & Pelser, 2020:1). In support, a study by Bitzer and Bijman (2014:167-183) in the citrus industry analysed the extent to which cooperatives succeed in commercialising emerging farmers and found that those partnerships were a step in the right direction in terms of addressing production issues related to assuring

product quality and improved market access (Ramogodi & Pelsner, 2020:1). However, the same study also cast doubt on these partnerships, suggesting that they do not address critical issues such as the overall management support, strategy, and marketing necessary for emerging farmers' success (Bitzer & Bijman, 2014:167-183; Ramogodi & Pelsner, 2020:1). Maponya *et al.*, (2018:421) conclude that both the private and the public sector should establish an emerging farmer-specific model that encompasses an efficient and effective transport system, road improvement to the farming sites, and reduced transport costs by developing more sales points in the farming areas.

2.3.6 Government support

The government's role in providing emerging farmers with financing, extension services, and research and development is currently weak. However, many contend that if emerging farmers are provided with adequate government support, they would likely succeed in becoming commercial farmers and contribute positively to the South African agricultural economy (Ramogodi & Pelsner, 2020:1; Sebola, 2018:2).

According to Wilk *et al.*, (2013:281); Kekana and Maponya (2017:136), the government's support through the extension officers' services has been very poor to almost being non-existent. This narrative is supported by Khapayi and Celliers (2016:37), who reiterated that poor support services, particularly the government's extension officers, contribute to emerging farmers' failures (Ramogodi & Pelsner, 2020:1). However, the same study (Khapayi & Celliers, 2016:36) does highlight the acknowledgement by some emerging farmers who have received some form of government support such as water during the drought seasons. Manenzhe *et al.*, (2016:36) suggests that extension offices should play an important role in transferring knowledge and training emerging farmers to improve their success rate.

2.3.7 Education and knowledge

Some level of education and knowledge on new techniques, crop varieties, pesticides, agricultural practices, equipment, climate, breeding and basic business management is essential for any farmers' survival (Ramogodi & Pelsner, 2020:1). Unfortunately, emerging farmers are often not privy to such information because they are exclusively reliant on the services of the extension officers from the Department of Agriculture (DoA), which are almost non-existent (Kekana & Maponya, 2017:136; Wilk *et al.*, 2013:281). The importance of education is further emphasised by Khapayi and Celliers, (2016:38), who stated that farming is a business, thus successfully acquiring knowledge and skills in banking, record keeping, labour management, and agricultural production methods are essential (Ramogodi & Pelsner, 2020:1).

According to Manenzhe *et al.*, (2016:36), training emerging farmers culminates in their success. It is proven in their study that the performance and sustainability of farming projects were improved through training. Khapayi and Celliers (2016:39) suggest that the government ought to take a leading role in educating and upskilling emerging farmers while also acknowledging that being uneducated does not automatically mean that one never succeeds in farming (Ramogodi & Pelser, 2020:1). The training should focus on technical and business competence, including training such as marketing strategies development necessary to access and secure markets channels (Khapayi & Celliers, 2016:38). Furthermore, Wilk *et al.*, (2013:285) suggest a need for improving access to knowledgeable advisors and training to improve communication across and within emerging farmer communities through knowledge sharing forums (Ramogodi & Pelser, 2020:1).

2.3.8 Agricultural practices

The choice of an agricultural practice affects the production, profitability and quality of the grains produced by emerging farmers. In most cases, emerging farmers can choose between two of the most prominent agricultural practices: conservation and conventional. Conventional agriculture involves a sequence of tillage practices such as disturbing and ploughing the soil resulting in a fine seedbed and removing crop residues from the previous season (Ramogodi & Pelser, 2020:1; Shahzad *et al.*, 2017:24634). On the other hand, conservation agriculture is characterised by its resource-saving principle, improving the soil's physical, biological and chemical properties through permanent soil cover maintenance, minimal soil disruption, and various crop rotation (Eskandari *et al.*, 2016:93; Ramogodi & Pelser, 2020:1). According to Lotter (2015:111-118), there is another agricultural practice called organic farming but not suitable for emerging farmers. It requires a certain skillset, more land to grow the same amount of tons, and high nitrogen needs required in the careful soil fertility management (Ramogodi & Pelser, 2020:1).

Conventional agriculture or non-organic agriculture is also characterised by farmers' use of artificial chemical inputs (Tal, 2018:1). According to Sithole and Magwaza (2019:2), conventional agricultural practices such as conventional tillage or reduced tillage tend to affect the distribution of nutrients, soil acidification and reduced bulk density due to mixing and overturning during tillage operations. On the other hand, the practices mentioned above may lead to quicker soil organic matter oxidation depending on the soil type, climate, and integration depth (Sithole & Magwaza, 2019:2).

Conservation agriculture is based on three principles, namely: minimum soil disturbance (no-till) to improve soil structure, penetration and water-holding capacity, permanent soil cover (mulch) for soil moisture conservation and soil surface temperature moderation, and advanced crop rotations to control pests, diseases and weeds and natural fertilisation. A cocktail of these three

principles makes crop production less sensitive to extreme weather, particularly drought and climate variability, which are collectively good for grain quality (Ramogodi & Pelser, 2020:1; Satterfield *et al.*, 2018:453). Moreover, Sithole and Magwaza (2019:1-2) agree that adopting conservation-agricultural practices, particularly no-till practices, has benefits such as reduced soil erosion and run-off, soil physical property improvement, soil organic matter (SOM) content enhancement and improved soil water retention. However, Sithole and Magwaza (2019:2) also warn that soil under constant non-tillage practices tends to cause stratification of nutrients and SOM, reduced upper soil surface PH and may improve the bulk density of the soil near the surface.

2.3.9 Technology

Under the current regime, agriculture prides itself on technological advancements such as utilising GPS and sensors for cloud farming (Jaiganesh *et al.*, 2017:256) and precision farming technology (D'Antoni *et al.*, 2012:121). According to Balamurugan *et al.*, (2016:713), these GPS and sensors allow for data analysis and exchange. Also, IT and the agricultural cloud deliver special skills services to farmers concerning crop planting, fertilizer and application, pricing, plant diseases, scientific research discoveries, weather patterns, modern planting techniques suggestions, and more (Balamurugan *et al.*, 2016:713; Ramogodi & Pelser, 2020:1). However, emerging farmers have not fully embraced these technologies due to a lack of knowledge and financial resources (Jaiganesh *et al.*, 2017:256; Ramogodi & Pelser, 2020:1).

Other technologies such as the Genetically Modified (GM) crops have been making great strides since 1996, when they were first introduced. These could be adopted easily by emerging farmers (Gouse *et al.*, 2016:27; Ramogodi & Pelser, 2020:1). For instance, Gouse *et al.*, (2016:27-38) conducted a study in the Free State province of South Africa where the effect and performance of insect-resistant (Bt) and herbicide-tolerant (HT) maize showed benefits such as high-yields, insect control, labour-saving, taste, quality, and the ease of farming herbicide-tolerant (HT) crops (Ramogodi & Pelser, 2020:1). This is supported by Tesfaye *et al.*, (2017:959). In addition, they reiterate the importance of heat-tolerant maize varieties to shield farmers from severe yield loss due to high temperatures caused by climate change (Ramogodi & Pelser, 2020:1). However, the adoption and spread of this technology has been limited by the lack of GM seed availability and access to markets (Gouse *et al.*, 2016:27).

Post-harvesting, grain storage management technologies and metal silos have also been a great development in solving grain storage problems endured by emerging farmers (Gitonga *et al.*, 2015:222). The absence of these storage management technologies and proper storage structures compels emerging farmers to sell their produce immediately after harvesting to avoid post-harvest losses from pests and pathogens even when the prices are unfavourable. This

results in emerging farmers receiving low market prices. Ultimately, because of such encumbrances, the emerging farmers are unable to use their grains as collateral to access credit, thus negatively affecting their profitability and sustainability (Tefera *et al.*, 2011:240).

2.3.10 Climate change

Climate change is currently one of the most talked-about subjects worldwide, as evidence suggests that this phenomenon has developed into a significant challenge (Ramogodi & Pelser, 2020:1). This scourge warrants a change in agricultural practices employed by farmers (Makuvaro *et al.*, 2018:75). According to Satterfield *et al.*, (2018:452), our relationship to the natural environment is being transformed by climate change, rendering previously stable climatic factors seem threatening and unpredictable. The agricultural sector is significantly affected by climate change, and thus, research has been conducted to gauge the effect of climate change on agriculture (Makuvaro *et al.*, 2018:75).

Climate change is characterised by changes in weather patterns, including reduced rainfall, increased temperature, and increased extreme weather events such as droughts and floods. Climate change is projected to increase climate variability in most areas and decrease mean rainfall; thus, exerting a negative impact upon rain-fed farming (Findlater *et al.*, 2019:47; Ramogodi & Pelser, 2020:1). This is a great concern because approximately 90% of the farming system in South Africa and Sub-Saharan Africa is rain-fed (Makuvaro *et al.*, 2018:75; Ramogodi & Pelser, 2020:1).

According to Manda *et al.*, (2016:2), sustainable agricultural practices (SAPs) have a great potential to solve agricultural production problems by sequestering carbon for climate change mitigation, soil fertility improvement, crop yield, and income increment. However, regardless of the benefits, there is still no significant empirical evidence on their adoption and impact on emerging farmers (Manda *et al.*, 2016:2). SAPs can generally be defined to include intercropping or crop rotation with legumes, residue preservation, conservation tillage, complimentary use of organic fertiliser, improved crop varieties, and soil and water conservation through stone and soil bunds (Manda *et al.*, 2016:2; Ramogodi & Pelser, 2020:1).

Conservation agriculture (CA) plays a vital role in sustainable agriculture. CA has potential as a climate adaptation strategy that grain farmers could adopt to counter the effects of climate change (Findlater *et al.*, 2019:47; Ramogodi & Pelser, 2020:1). Satterfield *et al.*, (2018:453) concur that to transition towards climate-resilient agriculture, farmers need to adopt conservation agriculture. According to Findlater *et al.*, (2019:47), conservation agricultural practices are recommended by the Food and Agriculture Organization (FAO) and affirmed by the Intergovernmental Panel on Climate Change (IPCC) as part of the Climate-Smart Agriculture and Sustainable Intensification

frameworks. These have the potential to increase climate resilience (Findlater *et al.*, 2019:47; Satterfield *et al.*, 2018:453).

Despite the advantages of conservation agriculture, particularly no-till farming, there are also some contrasting views by some researchers (Leplat *et al.*, 2013:105). Silvestro *et al.*, (2013:73) suggest that along with these benefits, you get the build-up of diseased debris, paired with limited crop rotation, and this generates a vicious cycle of infection and decreased control options which greatly affect grain quality. In such a complex scenario, the question remains on what the best option could be (Silvestro *et al.*, 2013:73). According to Leplat *et al.*, (2013:105), periodic tillage practices generally decrease the risk of mycotoxins producing fungal species such as *Fusarium* by allowing debris to be moved to deeper soil and limit germination of spores. This, along with the rotation with non-host, may contribute to controlling the fungi (Leplat *et al.*, 2013:105). In contrast, a study by Paulovska *et al.*, (2017:13-18) contends that there is no relationship between several soil tillage systems in reducing grain fungi.

2.4 DETERMINATION OF MAIZE QUALITY (MAIZE GRADING)

This section of the study discusses how the quality of maize is determined. According to Aswegen (2018:2), the objective of grain grading is to facilitate grain trade through the provision of the intrinsic value (Sendin *et al.*, 2018:311) of the grain and also by laying down a standard understanding of all national and international stakeholders. The grading essentially eliminates the necessity of contracts between seller and buyer and this equally reduces buying time per sample (Aswegen, 2018:2). In support, Sendin *et al.*, (2018:311) explained that the main objective of grading is to determine the health and the condition of grain. This is a key step that assesses whole-grain kernels fitness for human and animal consumption. The grading regulations focus on the commercial value of grain and how this conforms to specific requirements (Aswegen, 2018:2).

2.4.1 The importance of maize

Maize (*Zea mays* L.) is the most dispersed crop globally and the most consumed in South Africa (Ramogodi & Pelser, 2021:1; Sendin *et al.*, 2018:311). It is staple food for the majority of the South African population and major feed grain. White maize is the most produced in South Africa, accounting for 60% and yellow variety accounts for 40% of the production (DAFF 2018a:1). Its nutritional and economic value is mainly attributed to high starch content representing about 75% of matured grains' weight. Maize has various uses, such as human consumption and animal feed, biofuels, and biofilms (Table 2.1). It is also considered a source of energy and protein. Other uses of maize, particularly Zeins, represent 50% of the kernel's proteins, including raw material for

films, plastic application and coatings (Berta *et al.*, 2014:161; Ramogodi & Pelser, 2021:1). Maize is also used as a raw material for manufactured products such as paper, textile, medicine, paint and food (DAFF, 2018a:1; Ramogodi & Pelser, 2021:1).

Table 2.1: Description and purpose of various maize fraction

Source: ARC, 2017b and DAFF, 2018a:33

Milling fraction	Description	Characteristics	Maize-based products
Grits	A de-germed product consisting of large pieces of broken maize endoderm and free of husk and germ	Flaking	Ready to eat breakfast and samp
		Course	Cereal, snack food and maize rice
		Medium (Semolina)	Cereal and snack food
		Fine (Semolina)	Brewing and maize porridge
Maize meal	Milling of the homy and mealy endosperm	Predominantly course (Super maize meal)	Maize porridge, pancake and muffin mixes, corn snacks, cereal and bakery products
Maize flour		Granulated	pancake and muffin mixes, corn snacks, cereal and bakery products
		Fine (special maize meal)	Maize bread and bakery mixes, infant foods, biscuits, wafers, fillers and carriers in meat products and breakfast cereal
Chop/bran	A mixture of the outer layer of the maize kernel, the pericarp and the mealy endosperm	Hominy chop	Animal feed
Maize germ	Contain the embryo part	Rich in oil	Oil, margarine, animal feed, bio-diesel and industrial products (soap, paint, rustproofing for metal surface, inks, textiles, insecticides, pharmaceutical preparations)
Maize starch	Wet milling	Starch	Foodstuff (puddings, gravies and sauces), industrial products (corrugated boards, adhesives, textile sizing, paper coatings)

2.4.2 Understanding grain quality

Grain quality can be y defined generally as any features that distinguish or identify the grain or the grain's degree of excellence determined through grading. It can also be defined by the inherent physical-chemical qualities of the grains (Henry & Kettlewell, 2012:3-4). Nuttall *et al.*, (2017:136) defines grain quality through an array of compositional and physical properties where the end-use requirements set the threshold requirements. However, the ultimate definition of quality is determined by consumers' preferences or end-use and the grain market success (Henry & Kettlewell, 2012:3-4).

The suitability of grain for a specific purpose like milling or crushing for oil is determined by functional and nutritional quality, limiting the end product's quality, thus significantly influencing the grain's commercial value (Henry & Kettlewell, 2012:3-4). For example, wholegrain physical properties such as shape, size, mass per volume and hardness influence screening losses and milling yield, affecting the grain value and processing efficiency. In addition, other chemical properties of grains such as protein, starch and others are a central measure of quality that defines end-user and nutritional properties of the end product (Nuttall *et al.*, 2017:136).

2.4.3 Maize grading

South Africa follows a simple manual grading system argued by many as labour-intensive and subjective (Sendin *et al.*, 2018:311; Sendin *et al.*, 2019). However, maize grading is a vital process since the outcome of the process influences the final product's quality and determines its market value (Sendin *et al.*, 2019:1612). Regarding the grading process, a representative sample (150g minimum) is obtained from the consignment for visual inspection to identify and separate undesirable materials such as foreign I and defective material from the sound white maize. The detected undesirable materials separated within each category are weighed to determine percentages and referenced to stipulated maximum levels according to the grading regulations (Sendin *et al.*, 2018:311). However, Sendin *et al.*, (2019:1612) contends that it is very important to accurately determine the grade, thus developing an objective method to identify a wider range of foreign matter and defective kernels important to millers, farmers, and traders is imperative.

Defective maize kernels are defined in the maize grading regulation as pieces of maize kernels that are shrivelled, obviously immature, frost-damaged, mouldy or chalky; discoloured by external factors such as water and sun (provided that discolouration on both sides of the maize kernel is limited to less than a quarter from the bottom tip of the maize kernel shall not be considered as defective); have sprouted, including kernels of which the shoot (plumule) in the germ is visibly discoloured; have cavities in the germ or endosperm caused by insects or rodents; are visibly soiled (smeared) or contaminated by smut, fire, soil, smoke or coal-dust; can pass through the

6,35 mm round-hole sieve, and are of subspecies other than *Zea mays indentata* or *Zea mays indurata*. However, irregularity of shape and size of maize kernels shall not affect the grading thereof; and chipped or cracked maize kernels or pieces of maize kernels which are in a sound condition and which appear in a sample of maize, but which do not pass through a 6,35 mm round-hole sieve, shall not be regarded as defective maize kernels under these regulations (Department of Agriculture, 2009:4-5).

Foreign matter includes any other matter found in maize grains (Ramogodi & Pelsner, 2021:1), excluding stones above the sieve, dung, glass, coal or metals. Stones, glass, metals, dung and coal are excluded because there is a zero-tolerance for them. Thus, they are not allowed in any grain sample (Aswegen 2018:10; Department of Agriculture, 2009:5).

In terms of the Agricultural Product Standards Act (119 of 1990), regulations relating to the grading, packaging and marking of maize intended for sale in the Republic of South Africa (2009), allow for maize to be divided into three classes, namely class white maize, class yellow maize and class other maize. Class white maize (WM) is categorised into 3 grade of WM1, WM2 or WM3, while class yellow maize (YM) is categorised into YM1, YM2 or YM3. For the maize to qualify as such, they have to meet the following standards: shall be free from a musty sour or other undesired odour; shall be free from glass, metal, coal or dung; shall be free from a substance which renders it unfit for human consumption or processing into or the utilisation thereof as food or feed; shall be free from insects; shall be free from stones which cannot pass through the 6,35 mm round-hole sieve; shall contain no more than one gram of stones, which can pass through the 6,35 mm round-hole sieve, per 10 kg; shall contain no more poisonous seeds than permitted in terms of the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act No. 54 of 1972); shall have a moisture content of not more than 14%; and shall not exceed the maximum percentage of permissible deviation as determined in Table 2.2 for each grade (Department of Agriculture, 2009:8).

2.5 FACTORS AFFECTING MAIZE GRAIN QUALITY

Maize grain quality can be affected by many factors such as the presence of grains, insects and pathogens, foreign matter and hazardous substances such as pesticides, residues and mycotoxins, and moisture content (Van Aswegen, 2011:1-15).

Table 2.2: Standards for grades of class white maize and class yellow maize

Source: Department of Agriculture (2009:12)

	Maximum permissible deviation					
Deviation	White maize			Yellow maize		
	WM1	WM2	WM3	YM3	YM2	YM3
1	2	3	4	5	6	7
Foreign matter [regulation 15]	0.3%	0.5%	0.75 %	0.3%	0.5%	0.75%
Defective maize kernels, above and below the 6,35 mm round-hole sieve [regulations 16]	7%	13%	30%	*	*	*
Defective maize kernels that can pass through the 6.35 mm round hole sieve [regulations 16(c)]	*	*	*	4%	10%	30%
Defective maize kernels that cannot can pass through the 6.35 mm round hole sieve [regulations 16(e)]	*	*	*	9%	20%	30%
Other colour maize kernels [regulation 17]	3%	6%	10%	2%	5%	5%
Deviations referred to in items 1, 3, 4 and 5 collectively <i>individually within the specified limits</i>	8%	16%	30%	9%	20%	30%
Pinked maize kernels [regulation 18]	12%	12%	12%	*	*	*

2.5.1 Grain insects' infestation

2.5.1.1 Pre-harvest insects

Countless grain insects attack the maize crop while in the fields and they are a cause of major yield losses. Lepidoptera, the second largest order of insects after the order Coleoptera, is the most dreaded maize pre-harvest insect. In Africa, maize is attacked by various lepidopteran pests while still in the fields and the most prevalent are the stem borers and the armyworms. In addition, the production of maize is threatened by new invasive pests such as spotted stem borer, *Chilo partellus* (Swinhoe) (Lepidoptera: Crambidae) and the fall armyworms, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), which have the potential to spread throughout the continent. These pose a significant threat to the production of maize for small-holding farmers in South Africa (Botha *et al.*, 2019:1; Van den Berg, 2017:1).

Lepidopterans, predominantly the stem borers, are known for their disastrous attack on maize in the continent, particularly species such as the spotted stem borer *Chilo partellus* (Swinhoe) (Lepidoptera: Crambidae), African pink stem borer *Sesamia calamistis* Hampson (Lepidoptera: Noctuidae), African maize stem borer *Busseola fusca* (Fuller) (Lepidoptera: Noctuidae) and African sugarcane borer *Eldana saccharina* Walker (Lepidoptera: Pyralidae) (Van den Berg, 2017:1). In South Africa, the spotted stem borer and the African maize stem borer are the most significant stem borer insects (Kotey *et al.*, 2017:200). However, Van Rensburg and Flett (2010:74) maintains that the African stem borer is the most pervasive in South Africa. African maize stem borer is regarded as the most disruptive lepidopteran pest because its infestation may lead to at least 10% yield reduction to 100% yield loss in severe infestations. In contrast, spotted stem borer is a highly competitive coloniser (Van Rensburg & Flett, 2010:74). These two pests may occur in a mixed or single population (Kotey *et al.*, 2017:200).

The fall armyworms were first identified in Africa in 2016 (Sisay *et al.*, 2018:1), while the first outbreak reported in South Africa was in 2017 in Limpopo, North West and Mpumalanga. The damage caused by the fall armyworms is a result of its larvae that feed on the leaves and also causing injury to both ears and tassel. Furthermore, the larvae focus on maize plants that have not yet silked but can cause damage to all maize development stages. However, the most significant damage caused by the fall armyworms is partly or total destroying of young ears, and the damage usually happens in patches in the field (ARC, 2017:1; Early *et al.*, 2018:26; Sisay *et al.*, 2018:1).

According to Kotey *et al.*, (2017:200), the most effective tool in the management of *B.fusca* is the use of genetically modified (GM) maize expressing *Bacillus thuringiensis* (Bt) protein because it gives economic and appropriate alternatives for yield loss mitigation. Botha *et al.*, (2019) also revealed that Bt maize expressing Cry proteins have shown successful control of *Spodoptera frugiperda* but raised concerns regarding insects' resistance. Moreover, Togola *et al.*, (2018:1) suggested that insecticides and occasional use of several types of chemical formulation may effectively control the fall armyworms. However, when these chemicals are used improperly, they may cause harm to both the consumer, the produces and the environment (Togola *et al.*, 2018:1).

The fall armyworms are difficult insect pests to control in maize. Thus, an integrated pest management approach is recommended. The integrated pest management approach should consist of registers insecticides, biological control, Bt technology, and pheromone traps (Ramogodi & Pelser, 2021:1). Those effective controls should be applied when the larvae are still small, thus, signifying the importance of early detection and identification (ARC, 2017:1).

2.5.1.2 Post-harvest insects

Maize is the main staple food for many people in Africa and it is produced under rain-fed conditions seasonally. Thus, farmers need to store their maize to protect it from post-harvest pests until the next harvest and provide a cushion against price fluctuations. Nevertheless, postharvest storage off- and on-farm poses some serious risks in losses caused by poor storage conditions and storage pests (De Groote *et al.*, 2017:72). Grain insects are estimated to cause about 12-36% of the grain losses worldwide, affecting mostly small farmers in developing countries due to inappropriate grain storage conditions and infrastructure. Moreover, insects postharvest infestation results in significant damage to grains' quality (López-Castillo *et al.*, 2018:67).

According to Kamanula *et al.*, (2011:41), the large grain borer (LGB) (*Prostephanus truncates*) is the most damaging and invasive grain insect. Bruchids (*Callosobruchus maculatus*) and grain weevils (*Sitophilus* spp.) are widely reported as the major pests of maize in Africa (Kamanula *et al.*, 2011:41). López-Castillo *et al.*, (2018:67) concurs that the maize weevil (*Sitophilus zeamais*) and LGB in developing countries contributes to grain losses during storage of about 40% of the total production. In support, De Groote *et al.*, (2017:72) stated that LGB and maize weevil are the most serious pests in Africa, threatening food security. Van Aswegen (2018:15-16) classify South African insects into two groups: those that develop inside the grain kernel (granary weevil, maize weevil, larger grain borer, lesser grain borer and angoumois grain moth) and those that develop outside the grain kernel (rust-red flower beetle, saw-toothed grain beetle, flat grain beetle, khapra beetle, khapra beetle larva, indian meal moth, tropical warehouse moth and grain-lice).

According to López-Castillo *et al.*, (2018:67), management programmes can be employed to control postharvest grain losses due to grain insect. These include chemical crop protection, hermetical storage structure implementation protection against insects and moisture and planting of high yield insect-resistant maize varieties. In support, Kamanula *et al.*, (2011:41) suggests that synthetic pesticides should effectively control insects only when used properly. Furthermore, a study by Singano *et al.*, (2019:145) confirmed that the use of hermetic bags was also effective in controlling maize insects in maize stored at temperatures between 25 and 38°C. However, since we live in an era of climate change, which is characterized by warmer mean temperatures and more erratic rainfall patterns, a continuous assessment of the efficacy of hermetic bags for emerging farmers' grain storage should be done.

2.5.2 Presence of noxious seeds

There are nine commonly known noxious seeds in South Africa that render maize and other grains unfit for human and animal consumption, namely: *Datura* species (Thorn Apple), *Crotalaria*

species (Wild Lucene), *Ricinus Communis* (Caster Oil), *Argemone Mexicana* L. (Mexican Poppy), *Convolvulus* species (Field Bindweed), *Ipomoea Purpurea* (Morning Glory), *Lilium Temulentum* (Darnel), *Xanthium Strumarium* (Cockle Bur) and *Xanthium Spinosum* (Burweed) (Aswegen 2018:10; Department of Agriculture, 2009:1).

According to the Department of Agriculture (2009:1), only one seed of *Datura* species, *Crotalaria* species or *Ricinus Communis* is allowed in one kilogram of a representative sample while seven seeds are allowed for *Argemone Mexicana* L, *Convolvulus* species, *Ipomoea Purpurea*, *Lilium Temulentum*, *Xanthium Strumarium* and *Xanthium Spinosum* (Aswegen 2018:10; Department of Agriculture, 2009:1).

2.5.3 Improper use of pesticides

Pesticides are used extensively in grain production and storage to control nasty insect pests to protect the quality of the grain, and improve food security (Freitas *et al.*, 2017:1). According to Dabrowski *et al.*, (2014:31), South Africa is the largest user of pesticide in sub-Saharan African countries. However, their use, particularly when it is done improperly, inadvertently results in residues in the grains and the environment (Akoto *et al.*, 2013:67; Mahugija *et al.*, 2017:137; Ogah *et al.*, 2011:169). In their nature, pesticides are harmful; thus, human exposure to pesticide residues is detrimental to their health (Cunha & Fernandes, 2011:7748; Ogah *et al.*, 2011:169). In addition, pesticides are known to be neurotoxic and carcinogenic, among others (Ogah *et al.*, 2011:169). According to Kamanula *et al.*, (2011:41), synthetic pesticides provide effective control against pre-and post-harvest insects when used correctly (Ramogodi & Pelser, 2021:1). However, when not used properly according to the prescribed dosage of application, they create a problem of pesticide residues, which renders grain unsafe, affecting its quality (Akoto *et al.*, 2013:67; Kamanula *et al.*, 2011:41; Ramogodi & Pelser, 2021:1).

Pesticide residues are prevalent in the grain farming industry continent-wide. For example, a study by Ogah *et al.*, (2011:169-174) conducted in the Lagos state of Nigeria verified that 96% of the maize samples tested for pesticides contained more than one organophosphate, some with higher concentrations exceeding the maximum residue limits (MRLs). Another study by Akoto *et al.*, (2013:67-73) conducted in Ejura, Ghana, identified high levels of organophosphorus, organochlorines and pyrethroids pesticide residues in the maize samples tested. In support, Mahugija *et al.*, (2017:134-144) also confirmed high levels of pesticide residues in maize grains in Dar es Salaam and Ruvuma, Tanzania, showing that milling processes do not eliminate residues.

Due to the newer trends in food consumption and greater consumer awareness, the demand for pesticide-free products has significantly increased, warranting an invigorated need for their

management during production and storage (Freitas *et al.*, 2017:1). According to Mahugija *et al.*, (2017:137-138), the first line of control in the management of pesticides is awareness and the know-how of the proper application of pesticides complemented by good agricultural practices during production and storage. Freitas *et al.*, (2017:1) suggest that if all fails, then alternative methods such as degradation of pesticides residues could be adopted, which include ultrasound (US), ultraviolet (UV) radiation and ozone gas (O₃), all of which have shown great potential in recent years (Freitas *et al.*, 2017:1).

2.5.4 Moisture content

Moisture content is critical to maize's economic value as it affects quality, premiums, discounts, and storability (Ramogodi & Pelser, 2021:1). Maize moisture content is expressed as a moisture percentage based on a dry matter (dry basis) or wet weight (wet basis). Commercially wet basis moisture content is commonly used, while the dry basis is predominantly used in research (Hellevang, 1995:1). Moisture content is determined using the oven, which is the direct method but can also be determined using an indirect method such as moisture meters but must be calibrated according to the oven (Armstrong *et al.*, 2017:619);

In the market system, maize is often affected by biological agents such as insects, fungi, and rodents. Their proliferation is influenced by the grain's moisture content, amongst other factors (Manu *et al.*, 2019:11; Ramogodi & Pelser, 2021:1). According to Afzal *et al.*, (2017:49-50), maize grains are hygroscopic as their moisture content changes in response to the surrounding relative humidity. This moisture content affects and determines how they must be stored. Manu *et al.*, (2019:11) concur that moisture content is influenced by relative humidity and temperature. According to Dorsey-Redding *et al.*, (1990:292), other potentially important quality factors of maize affected by moisture content include breakage susceptibility, hardness and kernel density.

High moisture content in maize and other grains encourages fungi and insects' growth, consequently affecting grain quality (Afzal *et al.*, 2017:49-50). In support, Manu *et al.*, (2019:11) suggests that maize with high moisture content deteriorates fast due to fungal infestation perpetuated by insect infestation. Furthermore, high moisture maize negatively affects the grain quality, biochemical reaction, dry matter losses and permissible storage times of maize (Manu *et al.*, 2019:11). Other researchers concur that high moisture content and optimal temperature affect the quality, quantity, biochemical reaction and storability (Armstrong *et al.*, 2017:619). Similarly, high moisture coupled with high relative humidity creates optimal conditions for mycotoxigenic fungi to produce mycotoxins (Afzal *et al.*, 2017:49-50; Ramogodi & Pelser, 2021:1).

It is well known that minimizing the deterioration of grain during storage starts with harvesting grains with good moisture content or drying the grain to acceptable moisture content before

storage. Two-grain drying methods are available, namely solar and mechanical drying (Ali *et al.*, 2015:674). According to Armstrong *et al.*, (2017:619), the importance of proper storage cannot be overemphasized because exposure of maize to humid conditions during storage culminates in the absorption of water by maize from the surrounding environment. This absorption capacity leads to an increase in moisture content even when grain was dried before storage. Moreover, Lopes *et al.*, (2015:11) postulate that grain temperature should be reduced during storage through aeration systems to maintain quality and control moisture migration. Low temperatures also create unfavourable conditions for fungi and insects (Lopes *et al.*, 2015:11).

2.5.5 Fungal infection and mycotoxins

Due to the worldwide significance of the crop, maize's fungal diseases result in substantial nutritional, economic, and livelihood effects. The most problematic fungi affecting the maize grains are those causing ear rots since they directly affect maize grain quality and quantity (Ramogodi & Pelser, 2021:1). These are of specific importance as they produce mycotoxins detrimental to human health and animals consuming such maize grain. These mycotoxins can be present on the grain with or without fungal infection symptoms (Thompson & Raizada, 2018:1).

Mycotoxins are fungal species-specific as secondary metabolites are produced when conditions are optimal during production on the farms, during grain storage and transportation. Therefore, they negatively affect global food safety and security. The problem originates from fungal infections in the fields before harvest, improper storage increasing the contamination, and mycotoxins' accumulation in commercial feed and food products (Meyer *et al.*, 2019:2). According to Udomkun *et al.*, (2017:110), mycotoxins are very stable; thus, they are a cause for concern for the entire grain value chain from crop production through storage, transport, and final products processing. Furthermore, mycotoxins greatly affect the quality of grain, thus plummeting grain competitiveness on the markets (Udomkun *et al.*, 2017:110).

Various governments have set regulatory limits for mycotoxins in food and animal foodstuff presented for sale or imports, although not these are not globally harmonized (Meyer *et al.*, 2019:2). However, Alberts *et al.*, (2019:1) and Shephard *et al.*, (2019:78) contend that in most African countries, including South Africa, grains, particularly maize, are consumed in large quantities; thus, increasing the exposure to mycotoxins which exceeds safe levels even when they are below the regulated maximum level.

The most prominent mycotoxins-producing fungi associated with maize include *Fusarium* species (*Fusarium* Ear Rot) associated with Fumonisin, *Fusarium graminearum* Schw. (*Giberella* Ear Rot) associated with deoxynivalenol (DON) and zearalenone, *Aspergillus* species (*Aspergillus* Ear Rot) associated with aflatoxins, *Stenocarpella maydis* (Berk.) (*Diplodia* Ear Rot/*Stenocarpella*

Ear Rot) associated with *Diplodiatoxin* and *Ustilago maydis* (DC) Corda (Corn Smut) associated with no toxins (Thompson & Raizada, 2018:1); (Van Rensburg & Flett, 2010:76).

The fungi infect the maize crop in various ways (Thompson & Raizada, 2018:5-6). For example, *Aspergillus* and *Fusarium* species utilise various modes of infection to the plant, including water and wind transmission, the roots or contaminated seeds from the previous season, and insects' damage and other wounds. Also, *Aspergillus* and *Fusarium* species are soilborne and can survive between seasons on plant debris. During storage, *Aspergillus* is known to be problematic when the grain is not stored properly. The fungi access the maize kernel from the outside layers to move to the inside of the kernels, where mycotoxins are produced when optimal conditions allow (ARC, 2017b:1). On the other hand, *Stenocarpella Maydis* and *Ustilago Maydis* also infect the maize plant through various ways, which include silks (Thompson & Raizada, 2018:5-6).

Most areas in Southern Africa that are productive have a tropical or subtropical climate, characterised by humid and hot conditions, recurrent drought spells, and inconsistent rains that generate ideal conditions for the proliferation of toxigenic fungi (Misihairabgwi *et al.*, 2019:43-44). This is aggravated by practices such as insufficient grain drying, early harvesting of grains, long-term storage of grains without adequate insect and fungi control measures that prevent the production of mycotoxins (Misihairabgwi *et al.*, 2019:43-44). Alberts *et al.*, (2019:3) concur that the problem of mycotoxins also depletes the farmer's harvest, particularly emerging farmers who use untreated seeds from the previous season, planting late in the season because of changes in rain patterns, promotion of pests and diseases through crop monoculture and no-till agriculture, and lack of insect control such as stock bores which spreads fungal infections (Ramogodi & Pelser, 2021:1). Furthermore, during storage, the problem of mycotoxins is compounded by poor storage practices including poor aeration, poor temperature and moisture control, and inadequate pest control (Misihairabgwi *et al.*, 2019:43-44).

The control of mycotoxins requires a multifaceted approach (Shephard *et al.*, 2019:79), which involves an in-depth understanding of agricultural practices, weather patterns, climate change, and mycotoxins occurrence (Alberts *et al.*, 2019:1; Ramogodi & Pelser, 2021:1). According to Phokane *et al.*, (2019:86), mycotoxin contamination of crops can be reduced by employing good agricultural practices such as irrigation, crop rotation, transgenic hybrids, and early planting (Ramogodi & Pelser, 2021:1). Misihairabgwi *et al.*, (2019:52) purports that in cases where resources and sophisticated technologies are lacking in Southern African countries, simple, practical, culturally accepted, and cheaper methods of mycotoxins reduction can be used. For example, sorting and cleaning grains post-harvest effectively reduces mycotoxins, while improved varieties are useful during pre-harvest (Misihairabgwi *et al.*, 2019:52; Ramogodi & Pelser, 2021:1). Moreover, the use of biologically based products, insecticides, and pesticides to control

mycotoxigenic fungi coupled with the use of transgenic Bt hybrids to control stock borers should be promoted (Alberts *et al.*, 2019:1; Ramogodi & Pelsner, 2021:1). A study by Walker *et al.*, (2018:34) also confirmed that hermetic storage in plastic and metal silos or bags significantly reduced aflatoxins regardless of the grain's moisture.

2.5.6 Weeds and poisonous seeds

Due to poor weed management practices and insufficient resources, weeds can cause a devastating loss of maize crops. The consequence is poor maize quality, particularly for emerging farmers. The inefficient use of mineral fertilizers and herbicides and the lack of weeding also affect proper weed management by emerging farmers, which delays weeding to a point where economic harm cannot be prevented (Mhlanga *et al.*, 2016:24; Ramogodi & Pelsner, 2021:1). In addition, when harvested along with maize, some of these weeds generate poisonous seeds. Poisonous seeds refer to seeds or parts of seeds that, when eaten, are harmful to human or animal health (Ramogodi & Pelsner, 2021:1).

Adopting an integrated programme that incorporates the best expertise and cost-effective practices entails proper weed control by developing farmers. The solution must include competition for seeds, manual weeding, herbicides and adequate fertilization with nitrogen. One method of managing weeds is crop rivalry. Increased planting density, reduced row spacing, and competitive cultivars can suppress weeds and allow for crop competition. Crop competition practices can improve their effectiveness in controlling weeds in conjunction with other agricultural practices. For emerging farmers who often cannot afford herbicides, crop competition is economical and especially significant (Mhlanga *et al.*, 2016; Ramogodi & Pelsner, 2021:1). Besides, adequate nitrogen fertilizer encourages the maize crop's strong growth, and this leads to the crop outperforming the weeds (Khan *et al.*, 2012; Ramogodi & Pelsner, 2021:1).

2.6 QUALITY MANAGEMENT FRAMEWORKS

2.6.1 Introduction

This literature review section investigates prominent quality management frameworks such as the business excellence models, TQM, ISO 9001 and lean six-sigma. Quality management frameworks are becoming important for small businesses due to expectations and demands to satisfy all stakeholders and improve business performance. When used properly, these frameworks provide a structured way of assessing products' quality and improving organizational performance through consistent identification of areas that require upgrading (Wiśniewska & Szczepańska, 2014:352; Saad & Khamkham, 2018:587).

2.6.2 Business excellence models

Business Excellence Models (BEM) are frameworks for evaluating a business to qualify for awards and acknowledging businesses that strive for excellence and high-performance levels (Asgher *et al.*, 2015:1758). Business Excellence Models are used for an extensive adaptation of the methods and principles of business excellence and TQM. In most cases, these models are developed and supported by national bodies upon which quality award programmes are founded (Escrig & de Menezes, 2015:3).

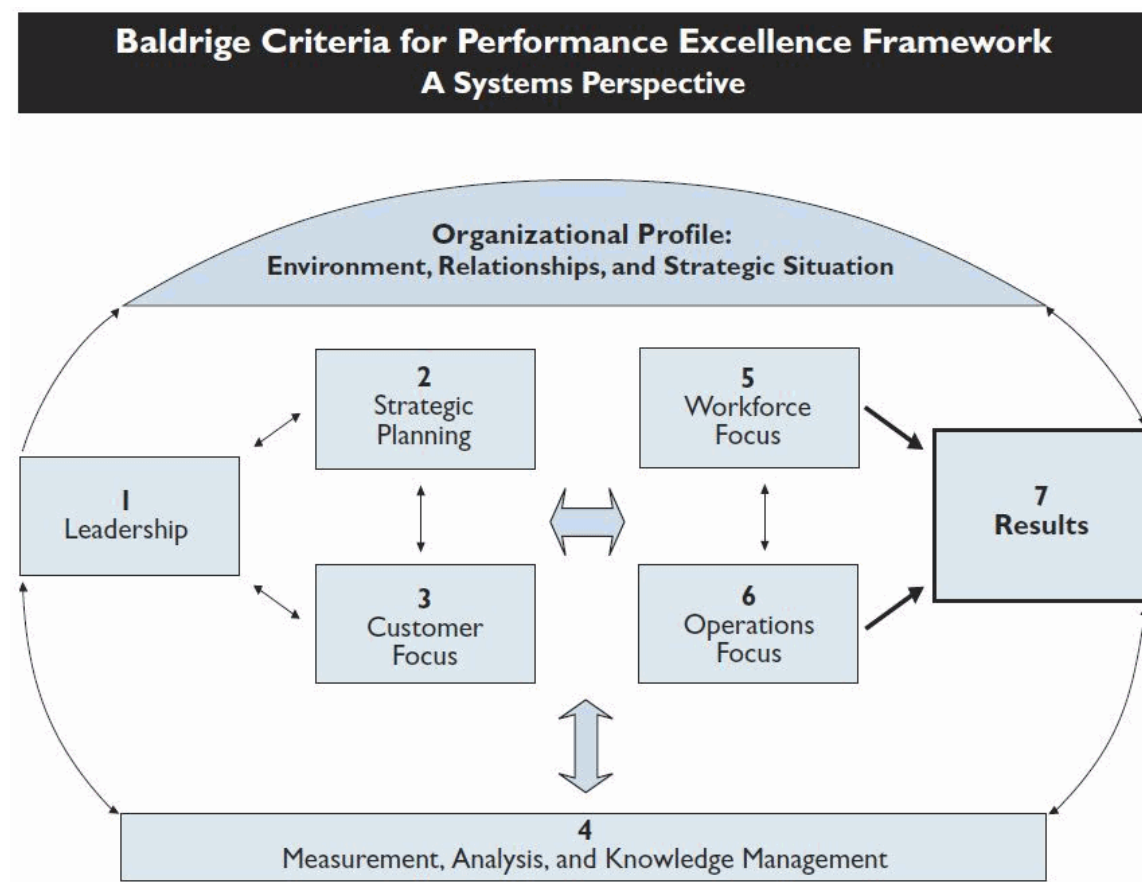


Figure 2.3: Malcolm Baldrige National Quality Award

Source: http://www.baldrige21.com/Baldrige_Framework.html

Most national quality awards frameworks are based on the three most prominent models, namely: Deming model, Malcolm Baldrige National Quality Award (MBNQA) (Figure 2.3) and the European Foundation for Quality Management (EFQM) (Figure 2.4) (Dahlgaard *et al.*, 2013:2;

Flevy Lasrado, 2019:182;(Ghicajanu *et al.*, 2015:449; Toma & Marinescu, 2018:967). In addition, South Africa also have their model called the South African Excellence Model (SAEM) (Figure 2.5) , which is based on both the MBNQA and the EFQM (Ladzani, 2016:11). Although variations exist in these models, they are quite similar and based on the MBNQA (Ladzani, 2016:9); (Toma & Marinescu, 2018:972), and their comparison is reflected in Table 2.3. According to Flevy Lasrado, (2019:182), these frameworks aim to promote TQM awareness, enhance competitive spirit, and help organisations benchmark themselves against the best and contribute much more than recognition. Moreover, they enhance performance and provide valuable feedback for continuous improvement (Flevy Lasrado, 2019:182).

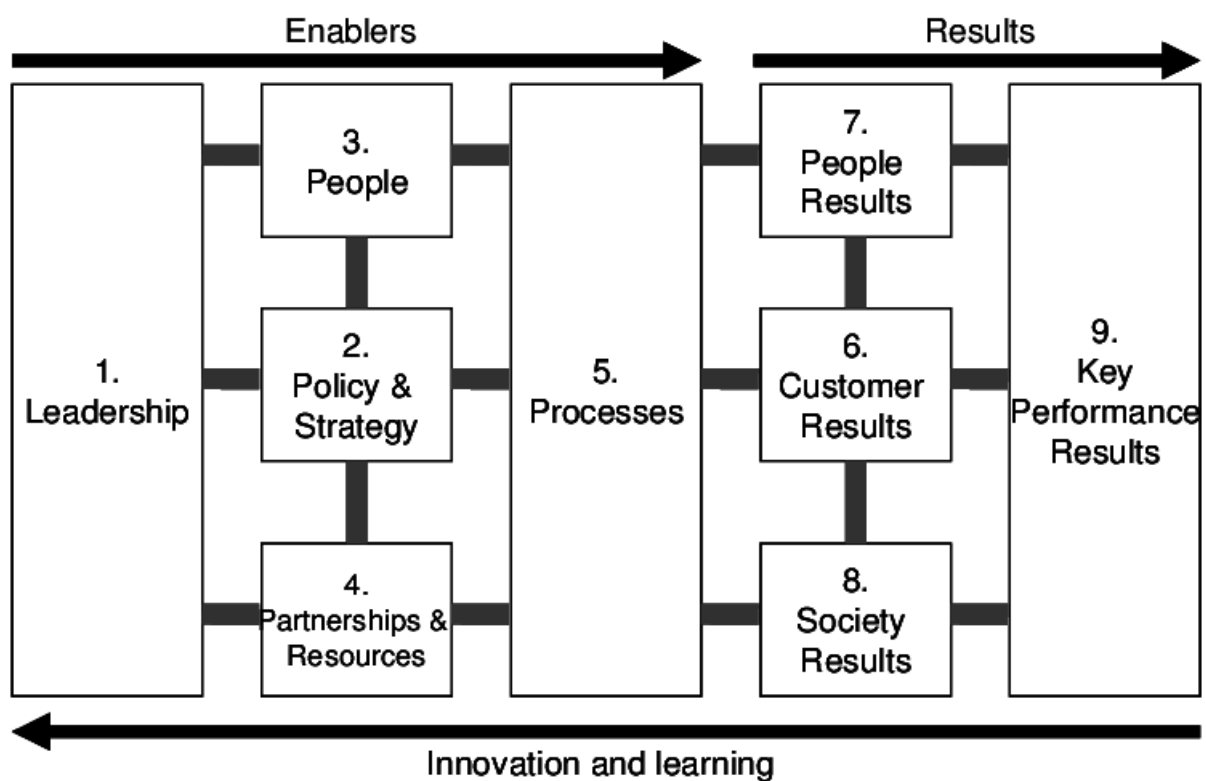


Figure 2.4: European Foundation for Quality Management

Source: (Janeš & Dolinšek, 2010:258)

Some research indicates that organisations implementing BEM significantly enjoy benefits such as increased financial performance and non-financial outcomes (Dahlggaard *et al.*, 2013:2). A study by Miller and Parast (2019:377), also confirmed an improvement in the quality performance of companies that implemented the MBNQA. However, despite several positive influences of BEM on business, some authors still have reservations regarding the positive correlation between their

use and business performance (Escrig & de Menezes, 2015:3). For instance, Tickle *et al.*, (2016:1) argues that business performance improvement through BME adoption is not automatic but depends on an organisation's business excellence maturity. Jankalová and Jankal (2018:1) contends that not all business excellence models have a central approach that considers economic, social and environmental aspects of sustainability. Thus, caution is necessary in the goal of increasing overall business performance.



South African Excellence Model (SAEMXIII)

Figure 2.5: The South African Excellence Model (SAEM)

Source: Ed van den Heever (2018)

According to Kalpande *et al.*, (2012:9), research has shown that new quality awards models such as the European Foundation for Quality Management (EFQM), Malcolm Baldrige National Quality Award (MBNQA) and the South African Excellence model are not suitable for small businesses. Some of the limitations with these quality models include the following: the models do not cater for the needs of small businesses and only provide a TQM framework for large businesses, the language used is difficult to understand by small businesses, and these models are too expensive for small businesses (Kalpande *et al.*, 2012:9); (Dahlgaard *et al.*, 2013:1). There is a recognition

that business excellence models have extensive paperwork, have cumbersome procedures, lack focus on what is required in practice, and use sophisticated assessment criteria.

Table 2.3: Criteria comparison of prominent business excellence models

Sources: (Ladzani, 2016:11); (Ghicajanu *et al.*, 2015:449); (Toma & Marinescu, 2018:971)

	The Deming model-Japan	MBNQA- America	EFQM- Europe	SAEM- South Africa
1	Policies	Leadership	Leadership	Leadership
2	Organization	Strategic focus	Strategy	Strategy and Planning
3	Information	Customer focus	People	Customer focus
4	Standardization	Management, analysis and knowledge	Partnership and resources	Employee management
5	Human resources	Workforce focus	Processes, products and services	Resource management
6	Quality assurance	Operational focus	People results	Core processes
7	Maintenance	Results	Customer results	Organisational results
8	Improvement		Society results	
9	Effects		Business results	
10	Future plans			

2.6.3 TQM

2.6.3.1 Introduction

Ajayi and Osunsanmi (2018:1753), define TQM as the management of business processes and people to achieve far-reaching customer satisfaction at all stages. In contrast, Hedao and Sangode (2019:21) define TQM as a process of achieving customer satisfaction through all stakeholder involvement in the continual improvement of quality. Furthermore Hedao and Sangode (2019:22) reiterate that TQM is based on three principles: customer satisfaction, stakeholder involvement, and continuous improvement. Antonis *et al.*, (2012:17) views TQM as representing a company's organizational structure, organizational processes, application methods and tools, the maintenance and improvement activities towards performance improvement. According to Cetindere *et al.*, (2015:1376), TQM entails strategic planning, benchmarking with successful organisations, employee satisfaction, having the best quality

employees, motivating and empowering employees, performance evaluation, and rewarding performance errors. This entails the elimination of mistakes

According to Chauke *et al.*, (2019a:2917-2918), TQM is prominent today due to contributions made by quality management gurus such as Deming, Juran, Crosby, Shewhart and Ishikawa. The work of these gurus is briefly illustrated in Table 2.4 as follows:

Table 2.4: Contributions made by quality management gurus towards TQM

Sources: Chauke *et al.*, (2019a:2918); Steenkamp, (2011:16-20)

Name	Year	Contribution
W. Edwards Deming	1986	• The Deming Cycle (PDCA cycle) • Deming's 14 points • Deming's 7 deadly diseases • Deming's 16 obstacles
Joseph M. Juran	1993	• Juran's 3 basic steps to progress • Juran's 10 steps to quality improvement • The Pareto principle • The Juran trilogy • Developed the concept of cost of quality
Philip B. Crosby	1979	• Advocacy for zero-defects management • Introduced the concept of quality is free • Crosby's Quality vaccine • Crosby's 14 steps of quality improvement
Armand V. Feigenbaum	1991	• Introduced the concept of total quality control
Walter A. Shewhart	1924	• Introduced the concept of statistical control charts and understanding process variability
Kaoru Ishikawa	1985	• Cause and effect diagrams • Introduces the concept of internal customer
Genichi Taguchi	1960	• Developed the loss function • Focused on Product design quality

A study by Cetindere *et al.*, (2015:1376-1382) establishes a strong positive correlation between TQM and organisational performance. This is supported by Yuni *et al.*, (2019:1397) and Jelena (2016:70). They indicate that a TQM framework comprising critical elements such as total employee involvement, customer focus and continuous improvement and a significant and positive effect on organisational performance. On the contrary, Ratna Purwita and Achmad (2018:77) contends that the implementation of TQM improves competitive advantage but not performance. On the other hand, Nallusamy (2016:189) argues that TQM implementation depends on TQM practices relating to human aspects being flexible and those relating to the technical aspects being inflexible.

There are not many studies conducted on the effect of TQM specifically in agriculture, particularly primary agriculture. However, a study in the agriculture-value chain by Chauke *et al.*, (2019b:2896-2907) conducted in a Bakery Firm in the City of Tshwane, Pretoria, South Africa, confirmed a positive relationship between TQM (employee involvement, leadership, supplier management, process management and knowledge management) and operational performance. Another study by Al Shehhi and Azam (2019:30-42) developed a TQM framework for Saudi agriculture and fisheries. However, its success depended on the availability of good TQM policies, leading any organisation to success. In the farming sector, a study by Juli Nuryani *et al.*, (2016:203-217) confirmed that TQM improved financial performance in farming cooperatives in Bali. Also, a study by Walley, (2000:46-61) in the UK farming sector showed that adopting a formal TQM framework or similar management practices exerted a positive impact on the successful operation of farms.

According to Hadzi Naumova-Mihajlovska (2017:195), when citing Krieger and Schiffer (2013), good hygienic practices (GHP), good agricultural practice (GAP) and good manufacturing practice (GMP) are necessary for a good foundation for TQM when combined with HACCP (Hazard Analysis Critical Control Point) for agribusinesses. They create a conducive environment that enables the quality of work and continuous improvement. Hence, TQM implementation is a complex but systematic process in agribusinesses. Primarily, it entails utilising standardised procedures and applying the practices mentioned above in all processes, implementing techniques and methods for improved performance, and having a proper information system for the process optimisation (Hadzi Naumova-Mihajlovska, 2017:195).

According to Ajayi and Osunsanmi (2018:1753), TQM implementation is not free from challenges. Its implementation in small businesses is not as smooth as in large companies (Ratna Purwita & Achmad, 2018:67). TQM challenges include high cost of implementation, not understanding the process requirements and lack of quality management systems documentation which often hinders the success in the implementation for small companies (Ajayi & Osunsanmi, 2018:1753). In support, Kalpande *et al.*, (2012:12) reiterates that despite many successes of TQM in larger companies, the framework is still not well adopted by small businesses, citing a lack of resources, cost constraints, lack of information on TQM about small businesses, and low awareness and understanding (Kalpande *et al.*, 2012:12). On the contrary, Israr and Gangele, (2014:43) argues that small companies should design and implement their own cheap and easy-to-follow TQM framework, which could ultimately improve organizational performance. The researcher agrees with Israr and Gangele (2014:43), which is why this study strives to bridge that gap by developing a quality management framework suitable for small businesses, particularly emerging farmers.

2.6.3.2 Critical elements of TQM

There is no one unique TQM model that could be adopted because TQM is a network of co-dependent elements, which include practices, critical factors and tools and techniques. Nevertheless, for a TQM programme to yield real benefits, most of these elements must be factored into the specific model. Regardless of the different views about what constitutes TQM, various common elements exist under different definitions (Fotopoulos & Psomas, 2009:152). The critical elements of TQM can be divided into two broad categories, namely, “soft” and hard” components (Chen, 2013:1072). Most of these components form part of the TQM framework (see picture 6), which is essential for the organisation to achieve improved quality management and adjust the overall business performance (Hedao & Sangode, 2019:24). These components are discussed in the subsequent segment of this study.

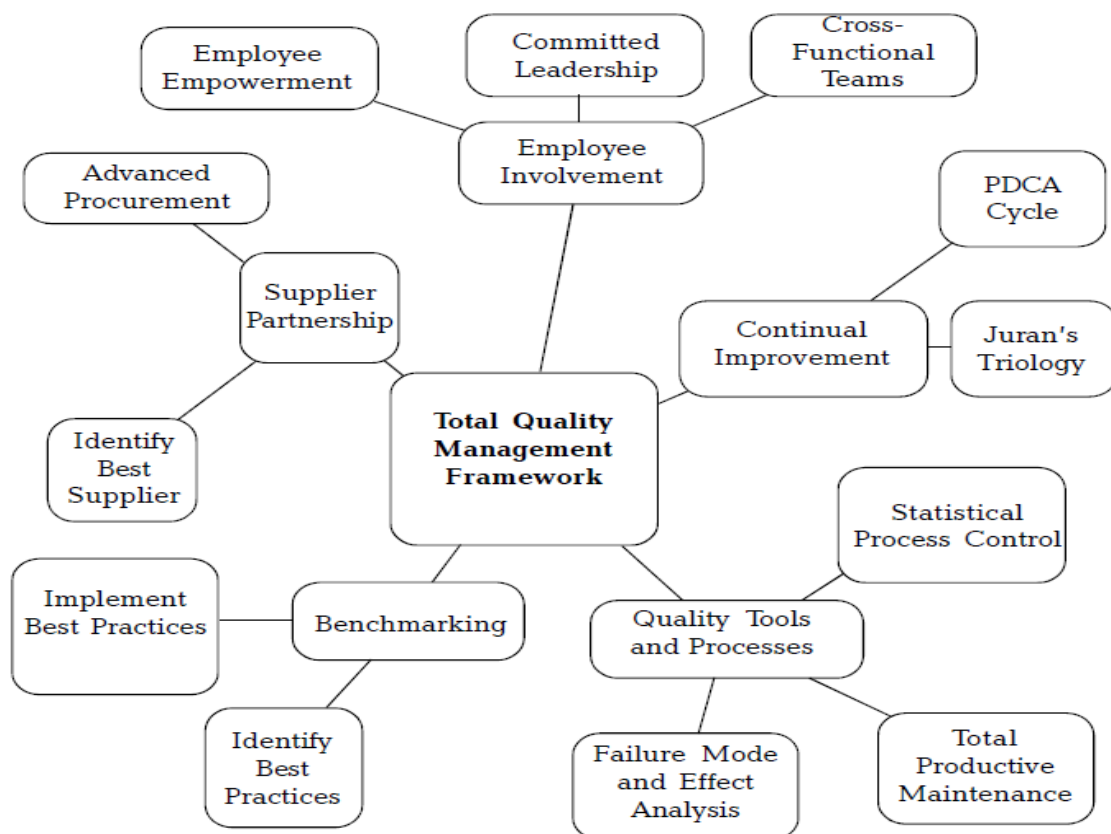


Figure 2.6: The critical elements of TQM

Source: Hedao & Sangode, (2019:24)

2.6.3.2.1 “Soft components”

The soft components of TQM include: strategically based, customer focus, obsession with quality, scientific approach, long-term commitment, teamwork, continual process improvement, education and training, freedom through control, unity of purpose, employee engagement and empowerment, peak performance, leadership, process approach, evidence-based decision making, and relationship management (Steenkamp, 2011:14).

Leadership

Leadership is crucial in directing the organisation in the right direction and establishing unity of purpose. Leadership should generate and maintain an internal environment conducive to full employee involvement in achieving the organisational objectives (Hoyle, 2009:10). Leadership is vital to successfully implementing quality through strategic planning, considering stakeholders' and customers' needs and expectations (Nihal, 2010:126; Zanqar *et al.*, 2019:102).

Strategically-based components

Organisations that subscribe to total quality management have an all-inclusive strategic plan comprising a vision, mission, extensive objectives, and organisational activities that must be completed. The strategic plan provides a sustainable competitive advantage for the total quality organisation in the marketplace. Moreover, the competitive advantage is geared towards achieving high levels of quality and continuously improving on it (Steenkamp, 2011:14)

Customer focus

The organisation should always strive to understand both the current and future needs of customer requirements and exceed customer expectations (Hoyle, 2009:10). Moreover, those customer needs and expectations should be adopted to the organisation's strategic planning, service/product design, and all customer activities. Also, information relating to customer satisfaction and dissatisfaction must be considered when deriving strategies linked to customer satisfaction (Nihal, 2010:126; Zanqar *et al.*, 2019:102).

Obsession with quality

With organisations subscribing to TQM, internal and external customers define quality. After quality is defined, the organisation becomes obsessed with meeting and exceeding the defined quality. The focus of employees at all levels approach all job aspects from the “how can we do this better?” perspective. That means ‘good enough’ is never good enough with organisations that are steeped in TQM (Steenkamp, 2011:14).

Teamwork

The success of an organisation is dependent on the skills, knowledge and motivation of its workforce. The success of employees is dependent on opportunities provided to learn and practice new skills. All this can be fostered through teamwork. Teamwork can be classified into three categories, namely, vertical (teamwork between low-levels employees and management which is evidence of empowerment), horizontal (teamwork between cross-functional lines and within workgroups), and inter-organisational partnerships (with customers and suppliers) (Evans, 2000:19).

Continual improvement

Continual improvement forms part of management's bid to achieve peak organisational performance (Nihal, 2010:126). Organisations must strive to improve their overall performance, making this endeavour a perpetual objective (Hoyle, 2009:12). Moreover, innovation is enhanced through continual improvement, ensuring sustainable development (Ajayi & Osunsanmi, 2018:1753; Zangar *et al.*, 2019:103). Continual improvement can be achieved through adopting philosophies of Deming (PDCA cycle) and Juran trilogy of quality planning, quality control and quality improvement (Diamandescu, 2016:676; Hedao & Sangode, 2019:23). The four phases of the PDCA cycle are as follows: Plan (planning of activities of improvement such as determining the necessary processes and goals to attain results according to organisational policies and customer requirements), Do (Improvement plan implementation), Check (checking the executed work through monitoring and measuring processes and product against objectives, policies, product requirements, results reporting), and Act (process correction through implementing continuous improvement process actions based on the previous stage's results).

Education and training

Education and training must be ongoing undertakings because change and improvement are continuous. Continuous education and training eventually become permanent enterprises. There is a direct correlation between investing in people and the results in terms of productivity. Moreover, an inclusive human resource programme that aims to develop staff positives affects an organisation's quality and overall performance (Scott & Palmer, 1994:141).

Relationship management

The relationship management principle shows that an organisation and its stakeholders (including suppliers) are interdependent and provide value for the organisation. The stakeholders are enhanced by a mutually beneficial relationship (Hoyle, 2009:13). Suppliers are crucial for

organisations; thus, partnerships with them must be formed by identifying and selecting the best, building a mutually beneficial relationship to procure high-quality materials (Hedao & Sangode, 2019:23). Quality products are intertwined with the quality of suppliers; thus, high-quality levels should be demanded from the supplier at all times (Nihal, 2010:126; Zangar *et al.*, 2019:103).

Employee engagement and empowerment

People at all levels are at the heart of an organization, and they must be fully involved for the organisation to benefit from their abilities (Hoyle, 2009:11). According to Hedao and Sangode (2019:23), people's engagement means empowering them, developing leaders from them, and creating teams across functions to deliver quality output. Taking care of the employees and improving them can lead to improved overall organisational performance. Managing employees can effectively produce valuable information to improve organisational performance and financial performance (Al Shehhi & Azam, 2019:33); (Zangar *et al.*, 2019:102). Based on the above discussion, the key elements of TQM relating to people are summarised in Table 2.5.

Table 2.5: The key elements needed to achieve TQM

Source: (Al Shehhi & Azam, 2019:33)

Key element	Description
TQM strategy	Appointing the right and adequate number of people who are placed in the right position at the right time
Employee Retention	Retaining the right people with the right mind-set and add value to the company
Employee Assessment	Appropriate compensation, incentive and benefits must be ensured through a correct assessment of the employee's performance
Employee Management	Organisational goals are achieved through efficient management of employees to ensure that they complete all key tasks
TQM Developments	The whole organisation is developed and improved through the management of the entire quality management and other important organisational activities

Process approach

The process approach is concerned with the sequence of activities envisioned to achieve desirable results (Nihal, 2010:126). Therefore, ideal results can be more efficiently achieved when related activities and resources are managed as a process (Hoyle, 2009:11). The process approach helps organisations identify, understand, and manage related processes contributing to their efficiency. This is important in achieving the quality performance reflected in the principal objectives (Zanqar *et al.*, 2019:103).

Systems approach

The systems approach is primarily concerned with setting a procedure for doing organisational activities and documenting them (Nihal, 2010:126). It also involves understanding and implementing a quality management system in an organisation to ensure organisational efficiency and continuous improvement, given that the organisational activities are embodied in interconnected processes. The quality management system processes are managed as a system by generating, appreciating and conducting network processes that depict dynamic interactions (Diamandescu, 2016:676).

Evidence-based decision making

The information and analysis of data must be the sole foundation for decision making (Hoyle, 2009:13). This means that data are collected and analysed in real-time before decisions based on the analysed data are taken (Nihal, 2010:126). Decision-makers rely on accurate data and information about the organisation's functioning in general, staff performance, and overall performance (Zanqar *et al.*, 2019:103).

2.6.3.2.2 “Hard” components of TQM

The “hard” components of total quality management include the tools and techniques of quality (Steenkamp, 2011:14). There are various tools and techniques that organisations frequently utilise. This means that these companies are responsible for choosing the correct tools and using them at the appropriate time to avoid errors which might diminish the expected improvement of performance. Therefore, an organisation needs to select the correct tools and techniques at the right time and implement them properly to use them effectively. However, it is not easy to give a definitive list of the various tools and techniques for implementing TQM (Chen, 2013:1072). Some of the generally accepted tools and techniques of TQM are shown in Table 2.6.

Table 2.6: Generally accepted tools and techniques of TQM

Source: Steenkamp, (2011:169 & 199)

Tools and techniques	Description
Statistical process control (SPS)	The primary principles of SPC are to establish (and maintain) process consistency and enable process improvement. SPC contributes to better overall productivity, means to control for consistency, better process prediction and process improvement, conformity to specification without statistical control means tighter process capability and positive effect on the cost of quality (COQ)-process control means lower assembly costs and few inspections
Just-in-time (JIT)	Emphasizes the idea of producing items only when they are required. It concerns planning and control that aims to meet demand promptly with seamless quality without any waste.
PARETO charts	Are convenient for unravelling the important from the unimportant. They can assist the organisation to decide where the limited resources should be focused on. Data are arranged along an x-axis and a y-axis.
Cause-and-effect diagrams	Focuses on identifying and segregating the cause of the problem. They are not based on statistics.
Check sheets	It simplifies the gathering of relevant data, presenting it in a graphic form that is simply comprehended by the brain. They also facilitate the collection of specific purpose data to convert into valuable information.
Histogram	Their focus is on data variability. Variable data and attributes data are two kinds of data that are ordinarily allied with processes. Histograms are a measurement scale across one axis and a frequency of like measurements of the other.
Scatter diagrams	They are the simplest total quality tools and are used to determine the correlation between two variables. It can reveal negative correlation, positive correlation or no correlation.
Run charts and Control charts	They are thought of as being one too combined. The control chart the sophisticated version of the run chart. The run chart records over time the output results of a process. Its disadvantage is that it does not reveal if the variation is due to common or special causes. That gave rise to the control chart where data is plotted as they are on the chart, but the upper control limit (UCL), the lower control limit (LCL), and the average are included.
Stratification	Groups data into categories to investigate the cause of the problem. Data are grouped by common characteristics or elements to facilitates data understanding and to draw insights from them.
Five -S	It is used to remove waste and reduce defects, errors, and injuries.
Flowcharts	They are used to chat the inputs, steps, functions, and overflow of the process to understand how the process works comprehensively. It also helps understand the resources needed, the people involved and what inputs go into the process, and their influence on outputs and timing.
Failure mode and effect analysis (FMEA)	Attempt to recognize all probable process or product failures and prioritise them for exclusion depending on their risk level.

2.6.4 ISO 9001

ISO 9001 quality management system (QMS) was first issued by ISO in 1787 and has since then become a crucial management framework for all organizational types internationally and a major element of the quality movement (Fonseca & Domingues, 2017:149; Franceschini *et al.*, 2018:1). ISO 9001 is a model for systematically growing businesses while guaranteeing quality of the products and services (Aldowaisan & Youssef, 2006:231). It is an important tool for attaining a

set of benefits measured in economic, financial and operations performance, a subject that has been extensively debated in the literature (Dias & Saizarbitoria, 2016:137; Psomas & Antony, 2015:2089).

ISO 9001 is the most comprehensive international standard for establishing and maintaining a quality management system. Its focus is mainly on customer focus, leadership for quality, process approach, teamwork, systems approach to management, fact-based decision-making, and continuous improvement (Ruamchat *et al.*, 2017:52). In addition, it is based on the Plan-Do-Check-Act (PDCA) cycle (Figure 2.7) (ISO 9001:2015). The latest version, ISO 9001:2015, requires companies to adopt a risk-based approach and the principles mentioned above that compel companies to plan and put in place measures to control risks (Rybski *et al.*, 2017:1076).

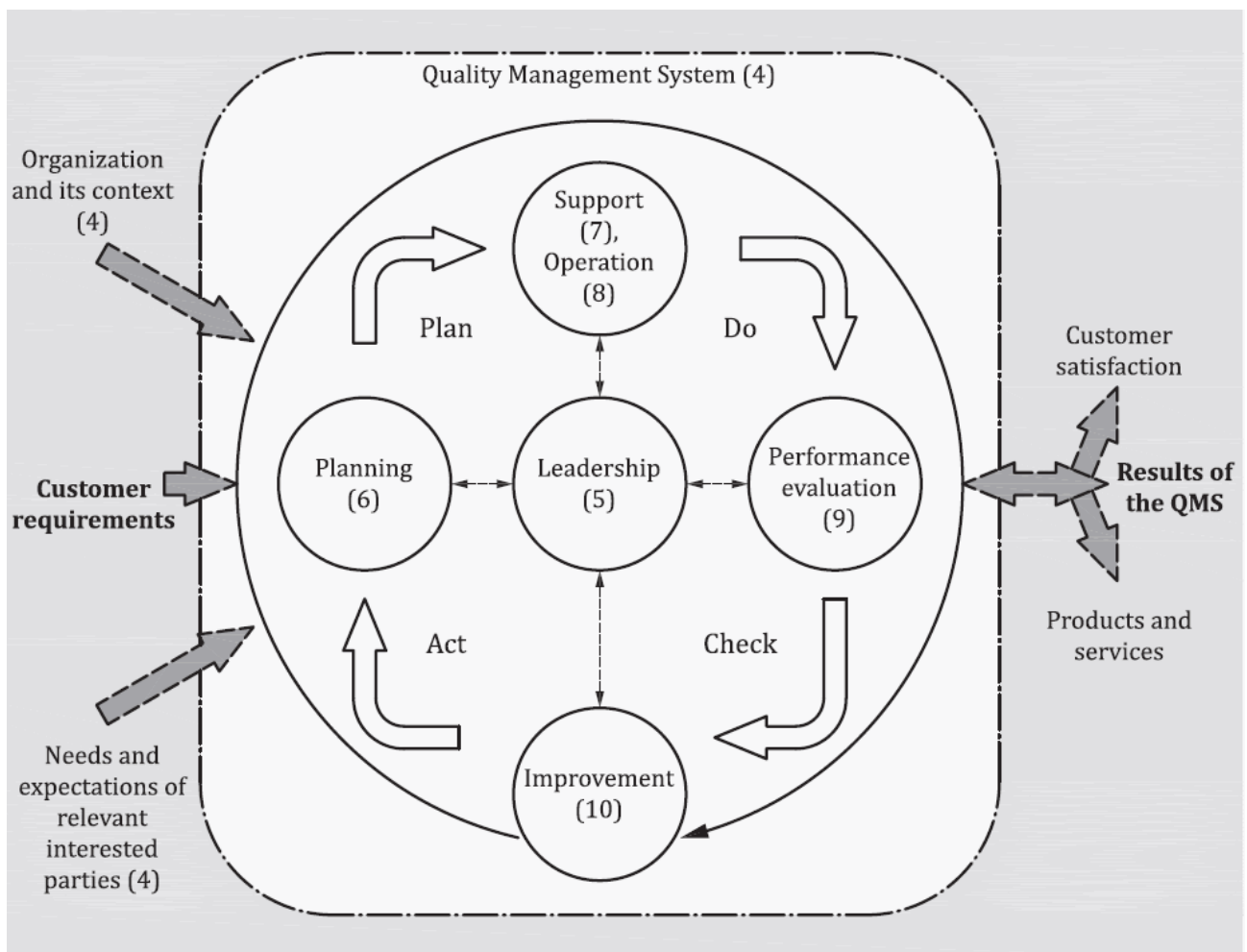


Figure 2.7: Representation of the structure ISO 9001:2015 in the PDCA cycle

Source: (ISO 9001:2015: viii)

Kakouris and Sfakianaki (2018:1003) argue that organizations implementing ISO 9001 are bound to enjoy both internal and external benefits such as increased productivity, increased efficiency, employee participation, new markets and improved company image but financial benefits are not guaranteed. Dias and Saizarbitoria (2016:157) urges that adopting ISO 901 is most important for giving organization comparative advantage and market entrance and its benefits on organizational and financial performance should be interpreted with caution. In contrast, a study by Ionaşcu *et al.*, (2017:166-180) conducted in Romania, showed that companies that implemented ISO 9001 and other systems performed better financially and that performance was directly linked to the implementation of the systems. Furthermore, a study performed by Novokmet and Rogošić (2017:1003-1016) showed that companies with matured quality management systems enjoyed long-term financial performance.

There is not much literature on the impact of implementing the ISO 9001 system in agriculture. However, a study by Laux *et al.*, (2015:313-321) conducted in the United States of America (USA) on a large, multisite grain elevator company showed that implementing a quality management system contributed significantly to the overall business performance. For instance, errors in grain grading damage and foreign matter were significantly reduced. In addition, significant monetary value was added to low-value grains through inventory management optimization using quality metrics. This is in addition to blending strategies and internal efficiencies that were realized in situ (Laux *et al.*, 2015:313-321).

Although many large organizations have shown great success from adopting and implementing ISO 9001, the same cannot be said for small organizations (Bravi *et al.*, 2019:76; Aldowaisan & Youssef, 2006:231). Numerous small businesses have not survived due to a lack of a tailor-made system for quality management. As a result, they cannot implement the ISO 9001, citing a lack of resources and the time it takes to implement the system (Aldowaisan & Youssef, 2006:231). According to del Castillo-Peces *et al.*, (2018:34); Dominik (2015:551), the implementation of ISO 9001 comes with the burden of both the initial capital outlay and maintenance costs expected from the monetary benefits recouped in implementing the system. However, these investments are not always recouped by the positive results achieved, which can be detrimental to small businesses (del Castillo-Peces *et al.*, 2018:34). In support, Kakouris and Sfakianaki (2018:1003) argues that the financial benefits are indirect and intangible.

2.6.5 Lean and Six sigma

Lean production or manufacturing was invented by the car manufacturing industry in Japan and is prevalent due to its philosophy and tools. Lean is predominantly known for its characteristics such as work-process standardization, just-in-time (JIT), waste elimination, visualization, mapping of the value stream, 5S, people improvement and continuous improvement (Andersson & Eklund,

2014:661). On the other hand, six sigma is a methodological approach for improving processes, products and services for customer value (Grover *et al.*, 2015:285) and comprises of six sigma toolbox, reduction of variation, decision-based on facts, six sigma organization, Define-Measure-Analyze-Improve-Control (DMAIC) approaches, customer focus and Bottom-line focus (Assarlind *et al.*, 2013:2;(Khiste & Maske, 2018:90).

Lean and six sigma are modern and prevalent methodologies for process improvement envisioned for organizations that strive to garner operational excellence (Assarlind *et al.*, 2013:2). Although these two concepts evolved in different directions, they can be combined into a concept known as Lean six sigma or Lean sigma (Figure 2.8), which enhances process improvement (Assarlind *et al.*, 2013:2; Grover *et al.*, 2015:285; Laux & Sabharwal, 2018:138; Zhang *et al.*, 2012:599). Together, six sigma and lean manufacturing are powerful enough to eliminate each approach's limitation (Zhang *et al.*, 2012:599). Lean Six Sigma is a combination of techniques and tools for reducing waste generation and forming a continuous improvement plan to achieve process consistency. Lean six sigma comprises principles such as data-based decision-making to improve performance, effective root cause analysis and implementing continuous improvement plans (Laux & Sabharwal, 2018:138). Like six sigma, it is often implemented through champions, black belts, master black belts, and green belts (Zhang *et al.*, 2012:599).



Figure 2.8: Lean six sigma

Source: (Rastogi, 2021:1)

Lean six sigma has been applied to some extent in the agriculture and food sector compared to the other frameworks. For example, a study by Andersson and Eklund (2014:661-666) showed that lean processes in the agricultural farms and nurseries positively influenced the psychological work environment due to the structure given by lean and such contributes to the sustainability of the farms. Another study by Kandananond (2018:337-348) suggests that six sigma can be used to achieve sustainable water consumption in the agricultural sector and be effective in agricultural management. Moreover, Laux and Sabharwal (2018:143) proposes that lean Six Sigma tools should be applied in the emerging farmer context to improve food security and safety and ensure consistent farming production in line with market demand and minimal wastage of food production and storage. In support, Costa *et al.*, (2018:122) also suggests that Lean and six sigma are effective, and their implementation can increase productivity and reduce costs in the food industry.

Researchers have identified several challenges that hinder the successful implementation of Lean six sigma (Costa *et al.*, 2018:122). For instance, a study by Melin and Barth (2018:845-855) in Swedish agriculture purports that despite the popularity of Lean increasing, many companies and organisations face many challenges and often fail. Some of the challenges include management, commitment, lack of leadership, employee and management training, the role of change agents, employee resistance, lack of employee participation, nature of processes, human factors and characteristics of the industry (Costa *et al.*, 2018:122; Melin & Barth, 2018:853).

2.6.6 ISO 22000

The ISO 22000 framework for food safety management was first developed in 2005. The framework (Figure 2.9) could be extended to all food value chain organizations, regardless of scale, maintaining the chain's credibility (Fernández-Segovia *et al.*, 2014:3). According to Allata *et al.*, (2017:239), it aids food manufacturers in producing food that is healthy for human and animal consumption. This is accomplished by incorporating a well-designed, reliable, and constantly updated food safety system into the company's management system.

Psomas and Antony (2015:2089) found that companies certified for ISO 22000 outperformed those not certified in achieving the HACCP goal of producing healthy food in a study conducted in the dairy industry. Escanciano and Santos-Vijande (2014:50) agreed, stating that ISO 22000 certification could improve production, productivity, and quality of food products produced. Furthermore, according to Neacsu (2015:105), implementing ISO 22000 can be a powerful tool for increasing business performance and improving customer satisfaction.

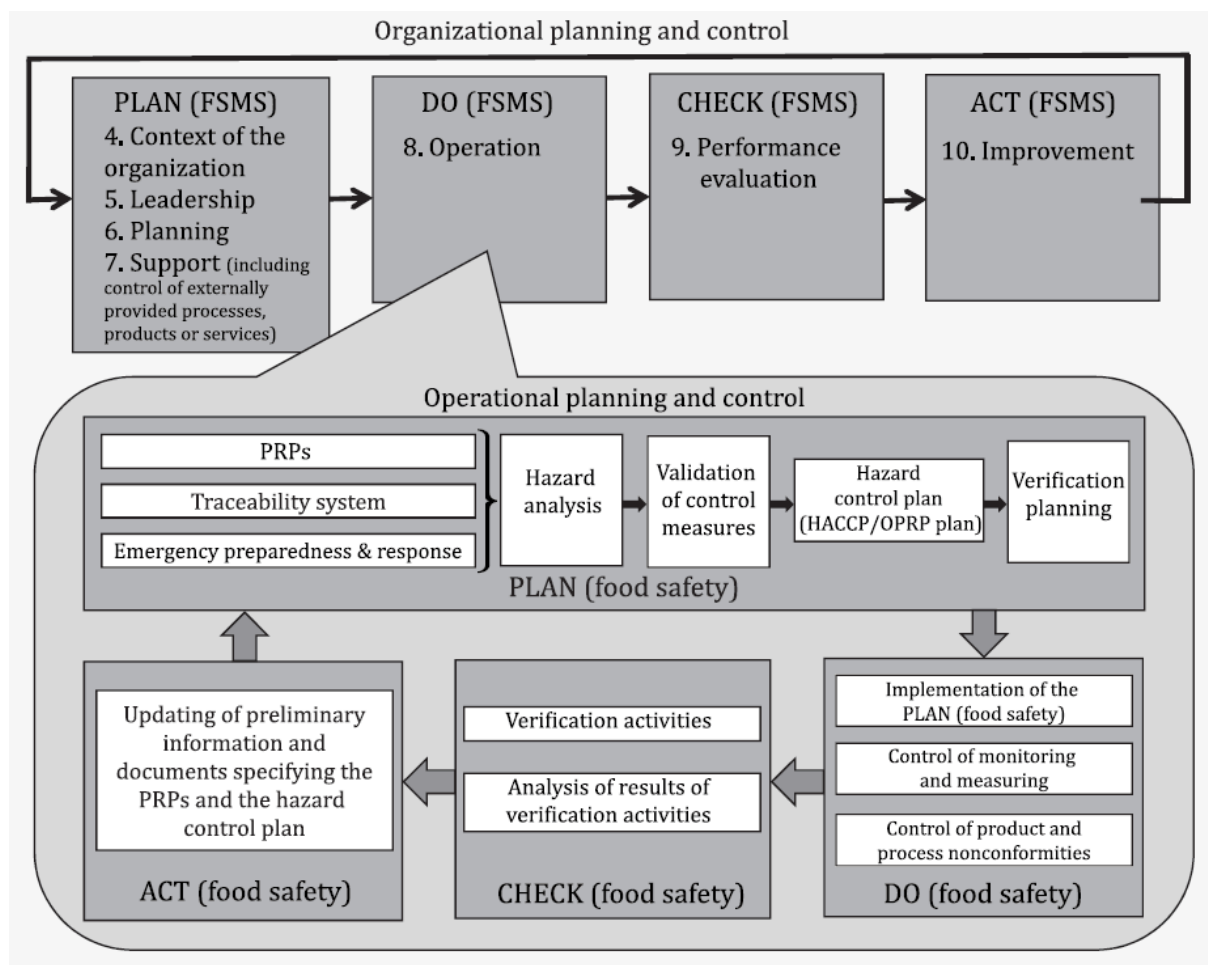


Figure 2.9: ISO 2200 framework and the PDCA cycle

Source: SANS, (2018:76)

The latest edition of ISO 22000:2005 underwent a revision phase that was completed in June 2018. The main improvements made to the new edition, now known as ISO 22000: 2018, include structural changes as well as clarification of key concepts, such as the introduction of a new high-level structure (Annex SL) (Figure 2.10), to ease use by companies. The new high-level framework would make it easier for organizations to incorporate integrated management systems to implement multiple management systems simultaneously. Furthermore, a risk-based strategy was implemented to handle risks in a formal, systematic, and rigorous manner. Furthermore, the Plan-Do-Check-Act (PDCA) cycle was made clearer by combining two different cycles in the standard, covering the management framework and covering the HACCP principles. A detailed overview of the operation process was provided, together with explanations of keywords like

Critical Control Points (CCPs), Operational Prerequisite Programs (OPRPs), and Prerequisite Programmes (PRPs) (ISO, 2018:27).



Figure 2.10: The ten clauses of Annex SL

Source: Cooper (2015:55)

2.7 TQM AND OVERALL BUSINESS PERFORMANCE

A study by Cetindere *et al.*, (2015:1382) demonstrated that TQM and business characteristics such as leadership, training, internal customer, external customer and continuous improvement affect business performance. However, they highlighted that TQM's leadership and training had a greater positive correlation with business performance. In another study, Juli Nuryani *et al.*, (2016:203) demonstrated that TQM had a significant impact on organisations' financial performance. Furthermore, a study by Ratna Purwita and Achmad (2018:77) concluded that implementing TQM parameters such as continuous improvement, long-term commitment, teamwork, education and training, scientific approach and unity of purpose can improve an organisation's performance leading to competitive advantage and sustainability. Another study by Yuni *et al.*, (2019:1397), signified that the implementation of TQM, particularly its four critical elements, namely, customer focus, total employee involvement, strategically based, and continuous improvement have a positive and significant influence on organisational performance.

2.8 THE THEORETICAL FRAMEWORK OF THE STUDY

2.8.1 Introduction

This chapter focuses on the study's theoretical framework. A theoretical framework is the logical construction of a related collection of premises and concepts from one or more theories to scaffold a thesis. It is about the researcher's use of a theory to draw on their work (Varpio *et al.*, 2020). This study is based on two prominent theories of total quality management: the Juran trilogy and the Deming cycle.

2.8.2 Philosophical theories of TQM

Several philosophical theories driving the total quality management processes exist, namely, the Shewhart Philosophy (introduced process variability and statistical control charts concept), the Deming philosophy (developed the Deming cycle and encouraged management responsibility and developed 14 points of quality improvement guide), the Juran philosophy (developed the Juran trilogy, defined quality as fitness for use and developed the cost of quality concept), Feigenbaum philosophy (Introduced the total quality control concept), Crosby philosophy (Introduced the zero defects and quality is free concepts), Ishikawa philosophy (introduced the internal customer concept and developed the cause and effect diagrams) and Taguchi philosophy (developed the loss control function and focused on the quality of product design) (Chauke *et al.*, 2019a:2918; Steenkamp, 2011:16-21). All these philosophies played a crucial part in developing the TQM philosophy, but this study only focuses on The Deming Cycle and The Juran Trilogy, subsequently discussed.

2.8.3 The Juran Trilogy

The Juran philosophy premise on the notion called the quality trilogy. The quality trilogy comprises three processes: quality planning, quality control and quality improvement (Table 2.7). Quality planning articulates quality goals, whereas both internal and external environments are being understood. Quality control is a process of meeting those set quality goals throughout the operations. Moreover, it involves resolving what needs to be controlled; thus, understanding units of measurements for objective evaluation of data. Lastly, the quality improvement concept refers to the organisational ability to achieve optimal performance through the employment of the right employees, diagnose the cause of poor performance correctly and develop remedies against it (Chauke *et al.*, 2019a:2919).

Table 2.7: The Juran's trilogy

Source: (Neyestani, 2017:7)

Quality planning	Quality control	Quality improvement
Establish quality goals	Evaluate actual performance.	Prove the need.
Identify who the customers are.	Compare actual performance with quality goals.	Establish the infrastructure
Determine the needs of the customers.	Act on the difference.	Identify the improvement projects.
Develop product features that respond to customers' needs.		Establish project teams
Develop processes able to produce the product features.		Provide the teams with resources, training, and motivation to: Diagnose the causes, and stimulate remedies.
Establish a process controls; transfer the plans to the process		Establish controls to hold the gains.

The three processes of the Juran trilogy are interconnected, and that is articulated in the Juran trilogy diagram (Figure 2.11). The diagram shows a graph with the vertical axis representing the cost of poor quality and the horizontal axis representing the time. Quality planning is the initial activity where planners define the customers and their needs. The planners then develop the product and process designs to respond to the identified needs. Lastly, the planners convert the plans into operating forces: The process runs, produces the product features, and meets the customers' needs" (Juran, 1999:26).

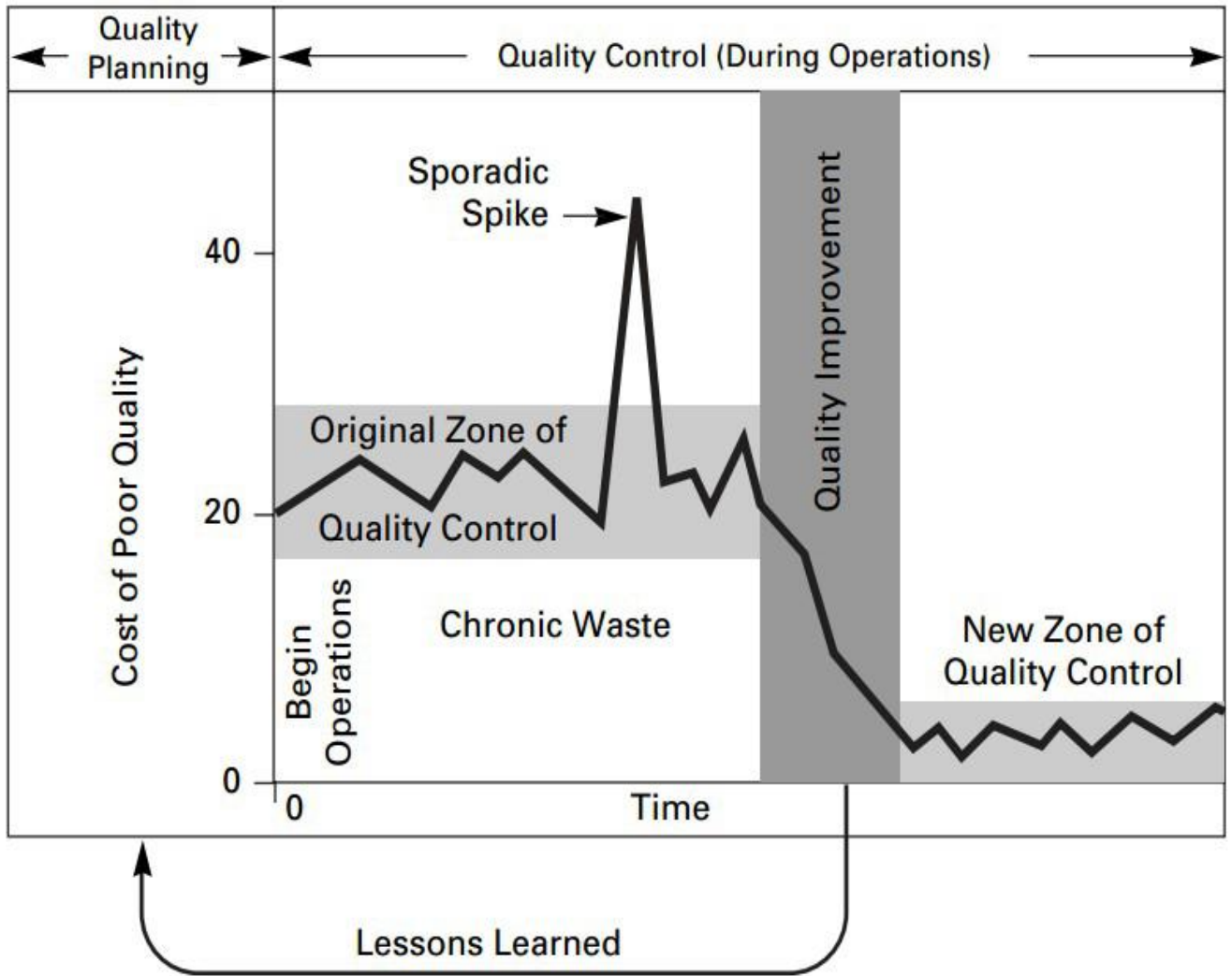


Figure 2.11: The Juran trilogy diagram

Source: (Neyestani, 2017:7)

2.8.4 The Deming cycle

W. Edeard Deming is regarded by many as the founder of the quality movement. His contributions to the movement would be difficult to overstate. One of the things that made Deming prominent in the quality movement was the Deming Cycle's (Figure 2.12) development. The purpose of the Deming cycle is to combine production with consumer needs by focusing on all departmental resources (design, research, production, marketing) in a supportive manner to meet those needs (Steenkamp, 2011:17). The Deming cycle is regarded as the most sensible concept for application within the agricultural sector in terms of quality management and control (Dudin *et al.*, 2017:287).

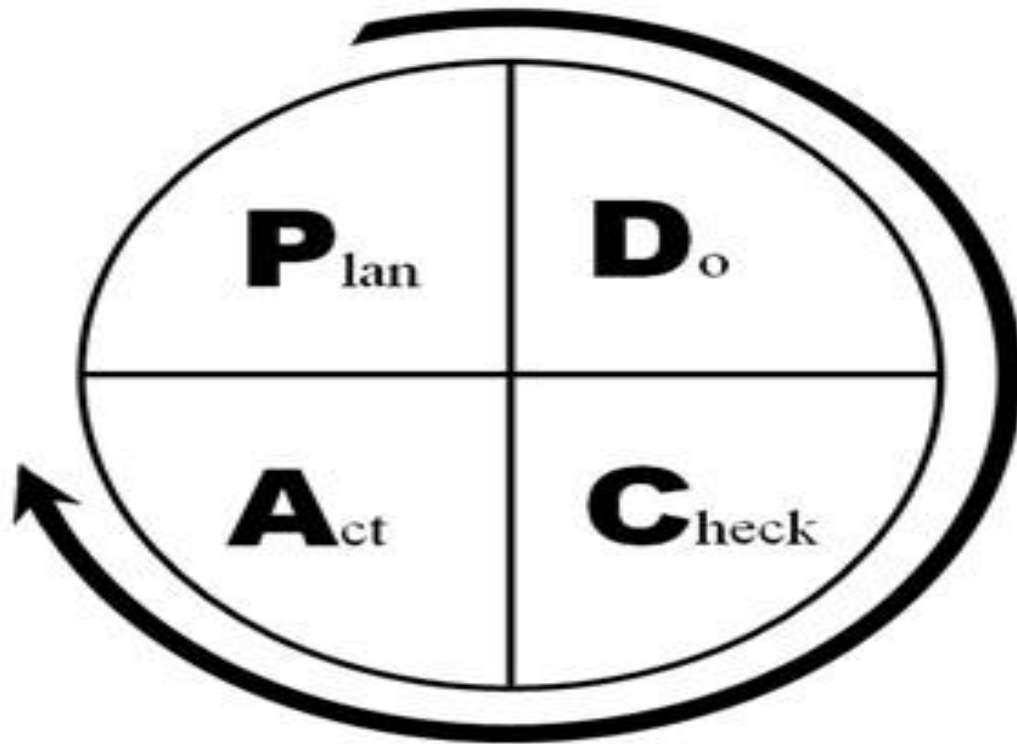


Figure 2.12: The Deming Cycle (PDCA cycle)

Sources: Nasution, (2016:56) and Jagusiak-Kocik, (2017:20)

According to Steenkamp (2011:17), the Deming cycle operates as follows: Product planning that is based on the conducted consumer research (Plan), Product production (do), Product checking to ensure that the production was carried out according to the plan (Check), Marketing of the product (ACT), and Analysis of how the marketplace is receiving the product in terms of cost, quality and other criteria (Analyse). However, Dudin *et al.*, (2015:245) suggests that the Deming cycle can be applied in agribusinesses based on four key management categories: the organisation's planning activities (Plan), production and sale of products (Do), quality assurance of the products (Check), and monitoring of the products including addressing company complains (Act). According to Nasution (2016:56), the PDCA cycle can be used generally for continuous improvement as follows: Improvement planning (Plan), Improving (Do), Analyse any influence by the improvement (Check), and taking new improvement action (Act).

2.9 THE CONCEPTUAL FRAMEWORK OF THE STUDY

This segment introduces the study's conceptual framework. A conceptual structure connects ideas, scientific research and applies theories to advance and systematize information regarding similar concepts or issues (Rocco & Plakhotnik, 2009:126). A conceptual framework is a justification for why a study should be carried out (Varpio *et al.*, 2020:7). The conceptual framework may be in the form of a graphic or written business model that describes the main issues investigated in the study such as concepts, variables, or key factors. In narrative or graphical form, the framework also defines the presumptions of relationships between those issues (Modiba & Kekwaletswe, 2020:113).

The conceptual framework of this research (Figure 2.13) suggests that as a starting point, one need to identify the factors that affect emerging farmers' success. This subsequently leads to the identification of quality management as the prominent factor affecting the success of emerging farmers. This is an aspect that is of significant interest in this study. The conceptual framework then emphasizes the relationship between the four areas of interest required to develop a quality management framework for emerging farmers, namely, quality management frameworks, key factors affecting maize quality, competency or merging farmers in grading, and quality processes. The framework then suggests the development of quality management for emerging maize farmers in South Africa.

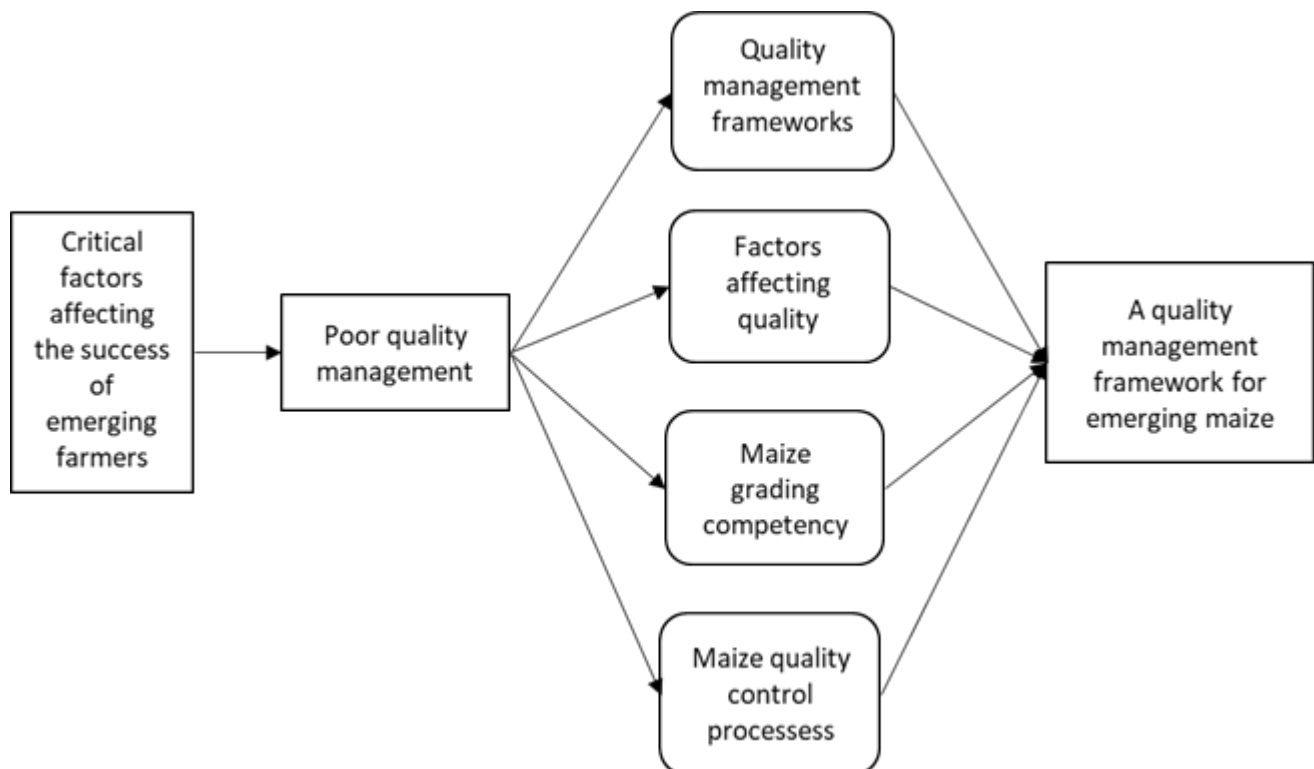


Figure 2.13: The conceptual framework of the study

2.10 CHAPTER SUMMARY

The background theory underpinning this study was described in this chapter. The chapter commenced by providing the study's context and discussing the emerging farming industry of South Africa. The chapter also outlined the maize value chain to understand the importance of maize grain and different stakeholders. It is clear from the literature that South African agriculture comprises of both emerging farmers and commercially developed farmers known as commercial farmers. However, emerging farmers constitute a small number of the total marketed agricultural output. Regardless of their small numbers, emerging farmers are important in agricultural development, job creation and boosting the economy. Therefore, efforts must be made by policymakers to help them improve their businesses.

The chapter also scrutinized the challenges faced by emerging farmers, contributing to their lack of transformation to become commercial farmers. The challenges faced by emerging farmers identified in this study include lack of finance, access to land, infrastructure, resources, access to markets, government support, poor education and knowledge, choice agricultural practices, not embracing Technology and the effect of climate change. Therefore, all these challenges must be addressed as they directly or indirectly affect both the quality and quantity of the grain produced, leading to a lack of profitability and sustainability of emerging farmers. They also form a foundation on which the quality management framework developed by this study will become successful.

In order to describe and appreciate the factors affecting maize quality, it is imperative to understand maize quality and its determination. Grain quality is defined as any features that distinguish or identify the grain or the grain's degree of excellence determined through grading. Maize quality is determined using visual inspection to identify and separate undesirable materials such as foreign material and defective material from the sound white maize. The factors affecting maize quality include infestation by grain insects (pre-and post-harvest during storage), infection by fungi, mycotoxins, pesticide residues, noxious seeds in grains and high moisture content.

This study aims to develop a quality management framework for maize grain emerging farmers in South Africa. Thus, there was a need to compare quality management frameworks available to benchmark the new framework. Therefore, this chapter discussed the four prominent quality management frameworks: Business excellence models, TQM, ISO 9001 and Lean and Six sigma. Although research has revealed that companies that implement one or more quality management frameworks are likely to enjoy benefits such as increased financial performance and non-financial outcomes, some argue that for organisations to enjoy the benefits of these frameworks, which provides a structure by assessing quality and improving overall business performance through continuous improvement, these frameworks must be properly implemented, maintained and improved continuously.

Lastly, the conceptual and the theoretical frameworks of the study were discussed. Two prominent theories of total quality management: The Juran trilogy and the Deming cycle, underpinned the study, providing the theoretical framework. The conceptual framework was in the form of a graphic that describes the main issues to be investigated by the study given in Figure 2.13.

The next chapter discusses the methodology of the study.

CHAPTER THREE

METHODOLOGY

3.1 RESEARCH PHILOSOPHY

A research philosophy is seminal in any research, whether in the social or natural sciences. It is also important for the researchers to think about philosophical issues in their research, affecting the research quality. Research philosophy is fundamental to the concept of research design, and that is why, before conducting any research, the researcher has to think about the underlying philosophy as stated by Bahari (2010:18).

Research philosophy is a system of beliefs and assumptions about knowledge and epistemological development (Saunders *et al.*, 2016:124). It can also be referred to as 'the school of thought that underpins the development of knowledge and the nature of that knowledge concerning research' (Winit-Watjana, 2016:249). According to Ade Bilau *et al.*, (2018:599), research philosophy concerns the nature, source, and development of knowledge. Research philosophy relates to knowledge development and the nature of that knowledge in social science. It includes crucial assumptions about how the researcher views the social world (Bahari, 2010:18).

An astute and dependable set of assumptions will craft a trustworthy research philosophy, which supports the choice of methodology, research strategy, techniques for data collection and data analysis procedures (Ade Bilau *et al.*, 2018:600; Saunders *et al.*, 2016:156). The long-reaching effect of this is that the researcher will design an intelligible research project with intertwined research elements (Saunders *et al.*, 2016:156). In support, Bahari (2010:18) suggests three reasons why the researcher should understand philosophy in research: assist in clarifying the research design, assist in knowing which designs work for your research, and recognize and produce designs which may even be outside the researcher's experience.

According to Saunders *et al.*, (2016:156), at every research stage, the researcher makes different types of assumptions or manners of thinking about research philosophy. These assumptions include those about human knowledge (epistemological assumptions), the realities you encounter during the research (ontological assumptions) and how one's values influence the research process (axiological assumptions). These assumptions each carry substantial differences that exert an impact on how we consider research procedures (Bahari, 2010:18; Saunders *et al.*, 2016:156). These three philosophical realms or assumptions directly involved in research, namely, ontology, epistemology, and axiology, are subsequently discussed.

3.1.1 Ontology

Ontology is about studying the nature of reality, existence or being (Winit-Watjana, 2016:429) or simply described as the study of being (Ade Bilau *et al.*, 2018:600). It defines the researcher's outlook on nature and beliefs about reality (Winit-Watjana, 2016:429). Ontology is also concerned with the nature of the truth of the assumptions we make about reality (Ade Bilau *et al.*, 2018:600). Briefly, ontological assumptions concerning the nature of the phenomenon being investigated and different ontologies make different assumptions (Bahari, 2010:23).

Ontology makes two most commonly used assumptions, namely, realism and relativism, which associate with questions like "whether social entities need to be perceived as objective or subjective", "how things are", and "how things work" (Ade Bilau *et al.*, 2018:600). These ontological assumptions about the nature of reality can be described using a subjective-objective dimension (Bahari, 2010:23).

In qualitative research, the researcher is subjective and accepts the notion of multiple realities (Bahari, 2010:23). According to Ponterotto (2005:130), this view is normally held by the constructivists-interpretivists who believe in multiple constructed realities, a position known as relativism. According to relativists' position, reality is not only subjective. However, it is influenced by the situation's context, such as the individual's perceptions and experiences, the interaction between the researcher and individual, and the social environment (Ponterotto, 2005:130).

In quantitative research, the researcher accepts that reality is objective and that only one truth exists (Bahari, 2010:23). This notion is normally held by positivists who contend that only one true reality is recognizable, apprehendable and measurable, a position referred to as realism (Ponterotto, 2005:130). Realism is based on the premise that reality is predetermined by nature and is independent of consciousness and human cognition. On the contrary, relativism suggests that reality is created by the human mind and identifies that as a result an observer may have opposing views about reality (Ade Bilau *et al.*, 2018:600).

The ontological position adopted in this study is relativism. This is because the researcher accepts that multiple realities exist which are shaped by the context. The research also accepts that truth evolves, changes and can be created and be used in similar contexts. Moreover, the researcher strongly believes in understanding the context by talking to people to dig deep into the phenomenon.

3.1.2 Epistemology

Epistemology is concerned with justified beliefs and knowledge of reality (Winit-Watjana, 2016:429). Bahari (2010:21), describes epistemology as a theory of knowledge and worries about what is deliberated in a specific discipline. It is the study of knowledge that talks to the questions of what can be known and who can know it (Converse, 2012:29). It assists in clarifying the researcher's position on the nature of the knowledge of reality (Winit-Watjana, 2016:429). It also addresses the type of relationship the researcher has with the research and provide guidance on how the researcher gets the knowledge and discover new things (Converse, 2012:29).

The fundamental issue of epistemology is whether the same procedures and principles can be used to study social sciences and natural sciences. The acceptability of the developed knowledge from the research process provides the answer to the question above. Thus, the epistemological assumption can be viewed as being associated with the method used to acquire that knowledge's knowledge and nature (Bahari, 2010:22).

According to Ade Bilau *et al.*, (2018:600), epistemology can be either objective or subjective and is concerned with approaching research to produce valid and acceptable knowledge in a field of study. Objective epistemology purports that knowledge is discovered through objective measures where the researcher stays far away from the research. In contrast, subjective epistemology suggests a subjective researcher to reality, and the researcher forms part of the research as they believe that interaction is necessary (Ade Bilau *et al.*, 2018:600).

The epistemological position adopted by this study is subjective. This is because the researcher is convinced that knowledge should be discovered using subjective measures. Furthermore, the researcher believes that interaction is necessary during research, so the researcher wants to be part of the research.

3.1.3 Axiology

Axiology focuses on personal values such as aesthetics and ethics and their association with knowledge, while the research reasoning is revealed by the logic of inquiry (Winit-Watjana, 2016:429). It concerns researchers' foundation for value judgment and the nature of values. In the course of research, researchers can express their values, experiences and beliefs and can also be positioned as unbiased about the value concept (Saunders *et al.*, 2016:128). Two most common value axiological positions exist, namely, the one relating to positivism which is value-neutral and the one relating to interpretivism, which is value-laden. The research that applies both the value positions depending on the research objectives relates to pragmatism (Ade Bilau *et al.*, 2018:600).

The positivists' position contends that values have no place in the research process. Positivists further argue that the researcher should remain emotionally disconnected from the inquiry being investigated. Furthermore, they suggest that values, expectations, hopes, and feelings should not have a place in a research process (Ponterotto, 2005:131). Therefore, the positivists advocate for systematic, standardized investigative methods to control or eliminate any influence the researcher might have on the research process or participants (Saunders *et al.*, 2016:136). Although the positivists' researchers can contain the biases of their values during the research process, naturally, values are reflected in selecting their research topic (Ade Bilau *et al.*, 2018:600; Ponterotto, 2005:131).

On the other hand, the interpretivists position maintains that there is no way of divorcing the researcher's values and lived experiences from the research process. They suggest that the researchers should not eliminate their values, but rather, they should acknowledge, pronounce, and "bracket" them (Ponterotto, 2005:131). Moreover, the interpretivists strongly suggest that it is a fallacy even to think that the researcher can divorce his or her value biases in an interdependent interaction between the researcher and participants, keeping in mind that the epistemology underlying this position requires intimate and lengthy interactive contact with the research participants to ease their building and the manifestation of the "lived experience" under research (Ade Bilau *et al.*, 2018:600; Ponterotto, 2005:131; Saunders *et al.*, 2016:128).

The axiological position chosen for this study is that relating to interpretivism, which is value-laden. This is because the researcher believes that his values form an integral part of the research process, and thus, they cannot be divorced. Furthermore, this research deals with theory building; thus, the research needs to conduct an in-depth study to have a clear understanding of the phenomenon. As a result, a close and prolonged interdependent interaction between the researcher and the participants is necessary.

3.2 RESEARCH PARADIGM

A prerequisite to an informed understanding of research methodology is the research paradigms. Research paradigms can be defined as various ways of looking at the world and these paradigms form a foundation for undertaking research (Davies & Fisher, 2018:21). They can further be described as a set of beliefs or philosophical frameworks that guide action on research. They portray diverse philosophical perspectives and usually reflect the researcher's assumptions (Winit-Watjana, 2016:429).

Research paradigms help determine the researcher's position on the three realms of philosophy: ontology, epistemology, and axiology (Winit-Watjana, 2016:429). In understanding these paradigms and their impact on the research process, the researcher is better positioned to apprehend the nature of research questions, the best methodologies to answer those questions and analyse and interpret the collected data. Subsequently, the researcher gains knowledge on how to critique and conduct the research properly (Davies & Fisher, 2018:21).

There are various classifications of paradigms (Table 3.1); however, there is still controversy and confusion among students, academics, and researchers regarding this classification of the research paradigms. This might be caused by the number of different paradigms, some of which are very similar (Winit-Watjana, 2016:429). In support, Davies and Fisher (2018:21) clarify the importance of noting the overlap between paradigms and that they are not always exclusive. Furthermore, there are also contradictory arguments in the literature that differ between publications, resulting in great confusion for a rookie researcher. Nonetheless, they are frequently a point of departure for a researcher. They allow them to intellectualize and express the research approach and provide a foundation for designing their research study (Davies & Fisher, 2018:21). This study will discuss the four most common paradigms, namely, positivism, interpretivism (or constructivism), post positivism (or realism), and pragmatism as mentioned by Davies and Fisher (2018:21) and Winit-Watjana (2016:429).

Positivism

Positivism's knowledge development premise on the physiological perspective that says reality exists in the outside world (Ade Bilau *et al.*, 2018:600). In support, Davies and Fisher (2018:22) postulates that positivism is founded on the ontological assumption that only one single reality exists and an epistemological assumption that suggests that for the reality to be studied. Moreover, objectivity and impartiality should be exercised during the study of the phenomenon to eliminate bias. Moreover, to learn that single reality objectively, positivists normally employ experimental methodology in nature, test prearranged theories or hypotheses, and typically utilise quantitative research methods based on large sample sizes. For positivist research, verification of knowledge is vital through hypothesis formulation (Ade Bilau *et al.*, 2018:600; Davies & Fisher, 2018:22).

Positivist research aims to generate data that relies upon the concept of probability, extrapolative and generalizable to a situation or a population. The reasoning employed is deductive, which follows a thought process whereby hypotheses are general and predetermined, then applied to what is being tested (Davies & Fisher, 2018:22). According to Ade Bilau *et al.*, (2018:600), positivists are convinced that the researcher is detached from the subject under research. Thus,

quantitative methods are used when researching simulations, experiments, and surveys that can be analysed statistically and replicated. Moreover, the manner of reporting often follows the conversion of data into numerical indices. However, they are often criticized for not considering the subjectivity of human experience and individuality (Ade Bilau *et al.*, 2018:600; Davies & Fisher, 2018:22).

Interpretivism

Interpretivist research takes an opposing stance to positivists as they subscribe to an ontological assumption that believes in multiple realities and the epistemological assumption that suggests that the researcher needs to use subjective measures (Davies & Fisher, 2018:23-24). Their physiological view is that the researcher's experiences and background influences the object under research, and those research participants play a fundamental role in the research process. Interpretivists observe knowledge as being context-dependent, socially constructed and complex. Furthermore, they acknowledge the significant role of practice and history in knowledge development (Ade Bilau *et al.*, 2018:600).

Interpretivist research aims to explore, describe and have an in-depth understanding of the context of the events occurring naturally. With Interpretivists research, theories are developed from particular observations rather than tested, employing inductive reasoning. They usually utilize qualitative research methods with smaller sample sizes to collect and generate in-depth and rich data, describing the participants' lived experiences. Qualitative researchers are neither detached nor impartial from the research process; thus, and they are inseparable from the research or the participants. Moreover, finding are generated through intimate interaction between the researcher and the subject. This research is often criticized for lacking generalisability and transferability (Davies & Fisher, 2018:24).

Pragmatism

Pragmatists take a different approach by avoiding any philosophical arguments that cause tension between the positivists and interpretivists. Pragmatists argue that positivism and interpretivism paradigms limit intellectual curiosity since they are prescriptive to their approach to undertaking research (Davies & Fisher, 2018:23-24). Therefore, pragmatists' researchers never commit to any research philosophy and reality during knowledge development. They do not see the world as an absolute unity, and they believe that research happens in a variable context, be it social, historical or political. They also believe that the world can be autonomous or dependent on the mind (Ade Bilau *et al.*, 2018:600).

Any pragmatist aims to solve “real world” problems rather than focusing on philosophical positions. However, they concede that both single and multiple realities exist (Davies & Fisher, 2018:23-24). Thus, pragmatists focus on using an available research approach to comprehend and solve the research problem. Pragmatists are concerned about finding a solution to the problem. As a result, they focus on the research problem and the application of practical research approaches. The research method's suitability towards achieving the research goal is considered when selecting research methods and techniques (Ade Bilau *et al.*, 2018:600).

Pragmatist prefers mixed methods research in a methodology and may collect data using both qualitative and quantitative methods. In recent years, this paradigm has grown in popularity amongst researchers as they try to address the shortcoming of other approaches. However, a researcher needs to have both qualitative and quantitative skills before embarking on a mixed-method approach. This paradigm is often criticized for its flexibility and the potential to confuse the design and analysis of mixed-method research findings (Ade Bilau *et al.*, 2018:600; Davies & Fisher, 2018:23-24).

Postpositivism

Postpositivism is an approach to research that acknowledges that human behaviour is multifaceted while doubting the possible positivist objective of unbiased, impartial research reporting. Postpositivist research is premised on critical realist ontology, which accepts that there is a single reality that we cannot certainly know about it. Moreover, it is based on an objectivist epistemology that has been modified, believing that pure objectivity is impossible (Davies & Fisher, 2018:22; Saunders *et al.*, 2016:138-140).

Postpositivism focuses on clarifying what we experience and understand in terms of the fundamental structures of reality that shape the apparent events. This paradigm holds a middle ground between postmodernist nominalism and direct positivist realism (Saunders *et al.*, 2016:138-140). Postpositivism acknowledges the intrinsic biases emanating from the research process or social interaction while accepting the ‘imperfect reality’. Furthermore, postpositivist research is partly value-bound, but the researcher can control the pertinent biases. This means that the researcher may affect the study since they are part of what is being researched. Their thinking logic follows deductive reasoning, and they use scientific methods (Winit-Watjana, 2016:430).

Postpositivist researchers normally use the triangulation of approaches to research due to their prevalent belief that there is no single perfect way of determining the truth. Therefore, the use of diverse approaches allows them to complement one another, with the weaker one supported by

the stronger one. Triangulation can happen within methodologies, methods, and analysis of data. Postpositivism often employs both quantitative and qualitative methods of research. However, they are often criticized for not producing clear answers to research questions (Davies & Fisher, 2018:22)

Paradigm adopted in the study

This study's research paradigm is interpretivism because it deals with theory building. The researcher needed to dig deep and talk to people to have an in-depth understanding of the context. Moreover, the researcher subscribed to the ontological beliefs that multiple realities exist which are shaped by context. The researcher considered that besides the fact that truth can be created, it evolves and changes and may be used in similar contexts. Epistemologically, the researcher is subjective to reality and forms part of the research process because they truly believe that interaction with the research participants is necessary. The researcher's axiological stance is that value cannot be separated from research and that the experiences and background influence the object under investigation.

3.3 LOGICS OF INQUIRY

Researchers globally are faced with the predicament of choosing a suitable approach to establish a link between theory and research (Awuzie & McDermott, 2017:356). Most textbooks on research methods seldom mention these approaches, and if they do, only induction and deduction are mentioned. Most researchers assume that the deductive approach is the logic used in 'quantitative' research and the inductive approach in 'qualitative' (Blaikie, 2018:638). The task of establishing the definite connection between theory and research remains burdensome for most qualitative researchers. This is due to the perceived inadequacy of the two most used approaches, inductive and deductive approach (Awuzie & McDermott, 2017:356).

Research involves using theory, which may or may not be obvious in the research design (Saunders *et al.*, 2016:152). That theory is crucial as it forms the bedrock of a social enquiry and affords a rationale for the research in question. It also gives a framework for studying the social phenomenon and interpreting findings (Awuzie & McDermott, 2017:356). However, that theory is usually made obvious during the presentation of the findings and conclusions. Therefore, the researcher needs to be clear about the theory at the inception of their research to guide the research study's design. There are three major approaches to theory development: deductive, inductive, and abductive (Awuzie & McDermott, 2017:356; Saunders *et al.*, 2016:144 & 152). These three major approaches will now be discussed.

Table 3.1: Summary major paradigms and their characteristics

Source: Davies & Fisher, (2018:22); Saunders *et al.*, (2016:135-137); Winit-Watjana, (2016:431-432)

	Positivist	Interpretivism	Pragmatism	Postpositivism
Synonym	Empiricism or reductionism	constructivist or Naturalistic	None	Realism, critical realism
Purpose	Generate probable, generalizable and predictive data	Explore, describe and have an in-depth understanding of lived experiences within a particular context	To solve “real world” Problems, Attention is given to the research problem	Unearth significance of reality as agreed by individuals or groups
Ontology	Naive realism, One single reality, believes in one single truth	Relativism. Multiple realities exist, shaped by the context	Practicality. Single and multiple realities	Critical or transcendental realism. Believes in one probable truth, truth autonomous of belief or human thoughts, Truth is known only probabilistically and poorly
Epistemology	The researcher is objective and detached. Objective measures used to discover knowledge	The researcher is subjective and forms part of the research, interaction necessary	The researcher's point of view is both subjective and objective and. Knowledge is subjectively and objectively observed for the research question	Numerical data or facts are used to observe or measure data, researcher influence that research, Knowledge is not perfect and dependable
Axiology	Value-neutral or value-free, researchers values detached	Value-laden, researcher forms part of the research	Partly value-laden, values are critical for results interpretation	Partly value-laden, researcher controls biases

Research orientation (the logic of inquiry)	Deductive	Inductive	Both deductive and inductive	Mainly deductive reasoning
Research Methods	Quantitative	Qualitative	Both quantitative and qualitative	Predominantly quantitative but includes some qualitative analysis
Common research designs/strategies	Experimental, randomized control trials, descriptive	Phenomenology, ethnography, grounded theory biographical, narrative	Mixed methods research	Ideological review, Critical analysis, participation in programs of action
Research Techniques	Surveys, questionnaire, highly structured, large samples	Interviews, in-depth investigation, focus groups, small samples	Mixed research techniques used	Range of techniques and data types to fit the subject matter
Research rhetoric (the language of research)	Scientific, formal or informal style	Formal or informal style,	Formal or informal	Scientific, formal or informal style
Criticisms	Disconsider subjectivity of human experience and individuality	Lacking generalisability and transferability	Can lead to confusion due to its flexibility	Well defined answers are not always produced

Deductive

This approach is normally associated with quantitative research (Bahari, 2010:20-21) and is more inclined towards a positivist paradigm (Ade Bilau *et al.*, 2018:601) where a theory and hypothesis (or hypotheses) are established followed by a research strategy designed to test the hypothesis (Saunders *et al.*, 2016:152). According to (Bahari, 2010:20), the deductive approach is described as the tactic to the relationship between research and theory. The research is conducted by referring to the hypothesis and ideas inferred from the theory (Bahari, 2010:20-21).

With the deductive approach, the researcher put theory forward at the beginning of the study and uses it deductively. As a result, the study's theory forms a framework for the rest of the study,

establishing a model for the research hypotheses or questions and process for collecting data. The process followed by the deductive approach is as follows: researcher tests or verifies an existing theory, from the theory, the researcher tests the hypothesis or research question, and then the researcher describes and put into operation the variables extracted from the theory, and uses an instrument to measure the variables to obtain a score (Bahari, 2010:20-21).

Induction

In contrast, an inductive approach is associated with qualitative research where the theory is developed due to the observation of empirical data collected (Bahari, 2010:19; Saunders *et al.*, 2016:152). This means theory follows data compared to a deduction approach where data follows theory (Saunders *et al.*, 2016:147). According to Ade Bilau *et al.*, (2018:601), an inductive approach is more inclined towards interpretivism, starting with the conceptual framework.

With the inductive approach, the goal is to understand a certain phenomenon of relevance within its social context. Consequently, it can be concluded that the inductive approach in qualitative research strategies concerns the generation of theory. The procedure for inductive logic is as follows: the researcher starts by gathering information from participants, information is collected through asking open-ended questions and recording field notes, information is analysed to form categories or themes, these themes are then advanced into theories, broad patterns or generalizations, and lastly, the information is compared with existing relevant literature or personal experiences (Bahari, 2010:20).

Abduction

Unlike induction, which moves from data to theory or deduction, this approach moves back and forth in effect, combining induction and deduction. Abduction starts by observing the 'surprising fact' followed by working out a reasonable theory of how this could have happened. With this approach, data is utilized to explore a phenomenon, explain patterns and identify themes to generate new or modify an existing theory subsequently tested through collecting additional data (Saunders *et al.*, 2016:148 & 152).

The abductive approach involves observation of the surprising fact, guessing a pre-position that, if correct, would explain this fact as a natural, and conditional recognition of the preposition as true, resulting in the propulsion regarded as grounds for the consequent deduction which will further be observed through induction. The surprises from induction can trigger new abductive conclusion and so forth (Baker, 2019:1).

The logic of inquiry adopted in this study

The orientation adopted in this research study is inductive because the study aims to develop theory emanating from the analysis of data (example is moving from data to theory). The study's main objective is to develop a quality management framework; thus, the researcher first needs to archive certain objectives, which include determining what critical factors are involved in the development of a quality management framework, assess the competency of emerging farmers in product quality and its management, investigate the awareness, perceptions, and understanding of grain quality and grain quality standards by the emerging farmers, and determine what grain quality processes are currently in place to meet the product quality standards. Therefore, the data generated from determining the objectives mentioned above was used to generate the theory necessary to develop a quality management framework.

3.4 RESEARCH METHOD

There are several research methodologies available; therefore, one can argue that there is more than one way of acquiring research knowledge. However, there have been passionate debates for many years between the camps advocating for different research approaches. There are two different approaches to research, namely, qualitative and quantitative (Szyjka, 2012:110). In response to the long-lasting and unproductive debates, researchers advanced what is now known as a mixed-method approach, a dualistic approach based on the pragmatism paradigm (Feilzer, 2010:6; Szyjka, 2012:111). Therefore, the principle of the research question or that of context determines the researcher's choice of method (Szyjka, 2012:111).

Qualitative and quantitative research can be distinguished by the use of numerical data (numbers) and non-numerical data (video clips, images, words, and other related materials). Therefore, qualitative research is associated with any data collection techniques or data analysis procedure that utilizes or produces non-numeric data. In contract, quantitative research is associated with any data collection techniques or data analysis procedure that utilizes or produces numeric data. However, this way of distinguishing between qualitative and quantitative methods is narrow and problematic because many research designs are likely to combine the elements of qualitative and quantitative approaches. Thus, the broader way of distinguishing this qualitative from quantitative is by comparing their association to philosophical assumptions and research paradigm and strategies (Saunders *et al.*, 2016:165). Table 3.2 summarizes the comparisons between the different approaches.

Table 3.2: The comparisons between the different methodological approachesSource: (Saunders *et al.*, 2016:165-171)

	Qualitative	Quantitative	Mixed
Philosophy	Interpretivism	Positivism	Pragmatism
Research orientation	Inductive, focus is on developing knowledge	Deductive, when the focus is on testing theory	Inductive, deductive or abductive approach to theory development
Characteristics	Data collection is non-standardized, the research process is interactive and naturalistic, uses non-probability sampling techniques, may use a single data collection techniques (Mono method qualitative study) or multiple data collection techniques (multi-method qualitative study)	Data collection is standardized, the researcher is independent of the research, research questions are expressed clearly, uses probability sampling techniques, may use of a single data collection techniques (Mono method quantitative study) or multiple data collection techniques (multi-method quantitative study)	Qualitative and quantitative techniques are combined, various research designs are used: Concurrent mixed method research (separate use of qualitative and quantitative methods within a single phase of data collection and analysis), Sequential mixed method research (more than one phase of data collection and analysis), Sequential exploratory method research (qualitative followed by quantitative), Sequential explanatory method research (Quantitative followed by qualitative), and Sequential multi-phase method research (e.g. Qualitative followed by quantitative followed by another qualitative)

Qualitative

Qualitative research attempts to comprehend some kind of social phenomena through the perceptions of involved individuals (Szyjka, 2012:111). In support, Haven and Van Grootel (2019:232) purports that qualitative research tries to expose individuals' perceptions under investigation regarding the research questions. Its purpose is to conceptualize, comprehend and

interpret a situation (Szyjka, 2012:111). Moreover, Haven and Van Grootel (2019:232) and Grafton *et al.*, (2011:61) confirm and verify that qualitative research aims to answer the questions “how,” “why,” and “what” regarding the phenomenon. Qualitative research makes two major assumptions that reality is socially created and that the variables in a situation are intertwined, extremely intricate and challenging to measure (Szyjka, 2012:111).

Normally, an inductive enquiry forms the beginning of qualitative research, which results in a hypothesis or theory generated by participants. In this case, the researcher is the key instrument in a realistic setting and is involved with the research personally. Moreover, this method requires attention to detail and a decent level of descriptive writing, and enough time to collect and process data (Saunders *et al.*, 2016:168; Szyjka, 2012:111).

In qualitative research, language is used as data, be it oral or written. This kind of research may also make use of videos, photos or other kinds of behavioural recordings. Qualitative research normally uses interviews, observations or focus groups to collect data. Furthermore, it utilizes an evolving design, a frequentative process of linking data collection, preliminary data inspection, and data analysis. The major benefit of using this evolving design is that it reinforces and extends the qualitative study's validity and rigour Haven and Van Grootel (2019:232).

Quantitative

In social science, quantitative methods can be defined as a method to attain knowledge grounded on a wide-ranging generalization through the larger population. The advocates of this approach concern the predictions or generalization of outcomes to clarify particular events. Quantitative research assumes that social facts possess an objective reality away from the individual researcher's subjective perspective. Consequently, the researcher is detached from the research process and does not influence or interfere with the research findings. Particular variables are only just identified, focused and put into categories for their relationship to become obvious through some kind of correlational analysis or experimentation (Szyjka, 2012:111).

Qualitative research orientation is deductive, meaning that the investigation progresses from being general to specific (Szyjka, 2012:111). According to Saunders *et al.*, (2016:166), quantitative research focuses on using data to test the theory. However, in certain instances, research may also incorporate an inductive approach where theory is developed from data (Saunders *et al.*, 2016:166).

With quantitative research, collected data is normally collected abridged through numbers, statistics, and indices concerning the research design (Szyjka, 2012:111). In support, Saunders

et al., (2016:166) reveals that quantitative research scrutinizes relationships between variables, which are numerically measured. Those variables are analyzed using a range of graphical and statistical techniques. As with experimental designs, controls are often incorporated to ensure the validity of data. Moreover, data is collected in a standard manner; therefore, the questions must be clear so that they are understood in the same way by the participants (Saunders *et al.*, 2016:166).

Mixed-methods

This method does not comfortably follow any one of the approaches but strives to combine both qualitative and quantitative research strategies (Feilzer, 2010; Shannon-Baker, 2016:321; Sligo *et al.*, 2018:66). The purpose of combining these research methods is to give a multifaceted understanding of the phenomenon that would not be reachable if one method was used (Shannon-Baker, 2016:321; Sligo *et al.*, 2018:66). According to Saunders *et al.*, (2016:170), combining these methods can range from simple, concurrent, sequential forms to more complex forms. The proponents of mixed methods suggest that with this method, one can expect to arrive at knowledge that is complete as the flaws of one method will be compensated by the other's strength (Szyjka, 2012:111). In support, Grafton *et al.*, (2011:61) concludes that combining both qualitative and quantitative methods facilitates exploring more intricate relations and features of the social and human world.

According to McKim (2017:202), when conducting a mixed methods research, one always asks the question, “does choosing a mixed-methods add more value than using a single method?”. The answer to that question is evident in the increased usage of the mixed methods approach by researchers due to the possibilities of overcoming the flaws associated with using a single method (Grafton *et al.*, 2011:61). Furthermore, the mixed-method approach provides a richer approach for collecting, analyzing and interpreting data (McKim, 2017:202; Saunders *et al.*, 2016:169).

However, McKim (2017:202) cautions that given the added time, resources and expertise needed, it is crucial to understand the alleged value of merging the two different methods. This method requires more time to collect and analyze two different sets of data from the two methods. This research is also more expensive to conduct due to the need to get assistants to assist in data collection and analysis. Moreover, a mixed-methods researcher will need to have the expertise of both qualitative and quantitative research; otherwise, the use of additional researchers with expertise in one or another method should be sourced (McKim, 2017:202).

The method adopted in this study

The research method adopted in this study is qualitative. This is because the researcher is attempting to have an in-depth understanding of the phenomenon (quality management) through the perceptions of involved participants (emerging maize farmers). Furthermore, the research believes that he needs to be involved with the research process personally to understand the phenomenon to generate knowledge.

3.5 PURPOSE OF THE INQUIRY

Before developing the design of a study, the purpose of the study should be articulated. However, some researchers and authors view the study's purpose as part of the design (Strydom, 2013:149). The research design should reflect the purpose of the inquiry, which are grouped into four different categories, namely, exploratory, descriptive, explanatory, and evaluative, which are subsequently discussed (Biereenu-Nnabugwu, 2018:7; Saunders *et al.*, 2016:174; Strydom, 2013:149).

Exploratory

Explorative research aims to discover what is happening and gain insights into a particular phenomenon of interest by asking open-ended questions (Saunders *et al.*, 2016:174). It is associated with research designs predominantly used to gain thoughts and perceptions about research problems and the issues and variables relating to those problems. Explorative research assists the researcher to identify and understand variables and their relations. Explorative research designs are often used as “pilot” studies of extensive or in multipart research but can also be important research on its right (Biereenu-Nnabugwu, 2018:9; Strydom, 2013:151).

Research questions asked during data collection to explore a phenomenon during an explorative study are likely, to begin with, “How’ or ‘What”. This kind of study is useful for clarifying a researcher’s understanding of a phenomenon, issues or problem when he or she is unsure of its nature. Explorative research can be conducted through interviewing subject matter experts, literature search, conducting a focus group or in-depth interviews of individuals. Moreover, this research type is can easily adapt to change and is flexible. It follows an unstructured research process, often employs non-probability sampling and does not have a pre-planned statistical design for analysis (Saunders *et al.*, 2016:174; Strydom, 2013:151).

Descriptive

Descriptive studies are concerned with gaining an in-depth profile of persons, events or situations (Saunders *et al.*, 2016:175). According to Strydom (2013:153), a descriptive study can be referred to as a process of recording and reporting phenomena without being concerned with causes. Descriptive studies aim to gain a more compact description of the phenomenon and its deeper meaning by describing the setting. This research type tries to discover facts or accurately describe reality as it naturally exists to comprehend the situation's current status. With descriptive studies, additional knowledge is produced to add to the already existing body of knowledge, perhaps at a high significance level (Strydom, 2013:154).

The research questions asked during data collected to understand persons, events, or situations are likely, to begin with, 'What', 'Who', 'When', 'Where' or 'How' (Saunders *et al.*, 2016:175). Moreover, those questions involve the gathering of fact and are overarching (Strydom, 2013:153). Descriptive research can foreshadow a portion of an explanatory study or maybe an extension for a portion of an exploratory study. Therefore, the researchers need to know the phenomenon in question before they begin with data collection. Descriptive research should be regarded as a means to an end rather than an end. Moreover, this research type is rigid, often follows a structured research process and has a pre-planned statistical design for analysis (Saunders *et al.*, 2016:175; Strydom, 2013:153).

Explanatory

Explanatory studies are common in most conventional researchers. They aim to explain why the phenomenon occurs and are conducted to predict future similar events or behaviour as they occur and build theory (Biereenu-Nnabugwu, 2018:7). Explanatory research concerns identifying the cause to establish causation between factors and discover effects on a phenomenon's behaviour. Explanatory research also concerns the prediction of how one phenomenon transforms relative to another variable. Explanatory researches are usually naturally experimental where experimental groups are used, and hypothesis can be tested (Strydom, 2013:154).

Explanatory research usually establishes relationships between variables. Research questions that the researcher may ask during data collection in explanatory research mostly begin with or include 'How', 'What' or 'Why'. The main purpose of this kind of research is to explain the relationship between variables by studying a problem or a situation (Birtrnu-Nnabugwu, 2018:7; Saunders *et al.*, 2016:176; Strydom, 2013:154).

Evaluative

Evaluative research strives to establish how well something works (Saunders *et al.*, 2016:176). It evaluates a certain practice or intervention in realistic situations in the social world. Evaluative research focuses on accountability, proper allocation of scarce resources, and upgrading an existing service or programme. Evaluative research also incorporates the components of descriptive, exploratory, and explanatory research purposes (Strydom, 2013:156).

Research questions seeking to evaluate something are likely to start with 'What' or 'How' during data collection. In business research, evaluative research may evaluate the effectiveness of an organizational strategy, program, initiative or policy. This study may also yield a theoretical influence where the emphasis is on the efficiency of something and comparing the descriptions to existing theory as proposed by Saunders *et al.*, (2016:176) and Strydom (2013:156).

Combined

A research study may include more than one purpose in its design. This is normally achieved in mixed methods research design to simplify some amalgamation of explorative, descriptive, explanatory and evaluative research. Alternatively, a single method research design may be used in a manner that simplifies the use of multiple purposes (Saunders *et al.*, 2016:176).

The purpose adopted in this study

The purpose of this study is explorative. The choice is motivated by the fact that the researcher wants to understand in-depths the phenomenon and discover thoughts and ideas of how to develop a quality management framework. The researcher strives to determine the critical factors involved in developing a quality management framework and understand how emerging farmers manage quality management to develop a quality management framework.

3.6 RESEARCH STRATEGY

A research strategy can generally be defined as a plan of action to achieve a goal. In essence, a research strategy outlines how a researcher will answer his or her research question. Furthermore, a research strategy provides a methodological connection between the researcher's philosophy and the choice of data collection and analysis methods (Saunders *et al.*, 2016:177). There are many possible different research strategies due to different research traditions, and the most relevant strategies include phenomenology, case study, grounded theory and ethnography (Saunders *et al.*, 2016:177; Williams, 2007:68). All these strategies meet different needs; for

example, phenomenology and case studies can be used to study individuals, while grounded theory and case studies can be used to explore activities, processes, and events. Ethnography studies broad culture sharing behaviours of groups or individuals (Williams, 2007:68). The differences between these strategies are discussed in detail below.

Phenomenology

Qutoshi (2018:215) suggests that it is difficult to get one fixed and universal answer on what constitutes phenomenology because there are multiple styles. Converse (2012:28) defines phenomenology as a philosophical perspective that helps researchers explore and comprehend the everyday experiences without prior knowledge of those experiences (Converse, 2012:28). As a result, the researcher is open to what the research presents during the phenomenon (Converse, 2012:28). Qutoshi (2018:215) views phenomenology as a philosophy that affords a researchers theoretical guidelines to understand a particular phenomenon at the subjective reality level. Moreover, this philosophical framework helps the research subject about a particular event or a phenomenon concerning his or her life (Qutoshi, 2018:215).

Errasti-Ibarrondo *et al.*, (2018:1724) establishes that phenomenology is a complex research methodology for understanding in-depth the phenomenon of interest. This inherent complexity relates to the fact that phenomenology is associated with qualitative methods (Errasti-Ibarrondo *et al.*, 2018:1724; Law & Shafey, 2019:657-658) and because it is a fragment of interpretive/constructivist paradigm (Qutoshi, 2018:218). Phenomenology has methodological and philosophical positions; that is why the researcher can opt for data collection strategies within a phenomenological investigation method such as observations, interviews, and discussions (Qutoshi, 2018:215). With phenomenological research, data collection and sense-making take place concurrently. The aim is to illuminate specific experiences to recognize the phenomena in a certain situation as perceived by actors. The emphasis is on personal knowledge and subjectivity in distinguishing and deducing the phenomena from the participants (Converse, 2012:32)

Phenomenology has seven unique perspectives: descriptive (transcendental constitutive), naturalistic constitutive, existential phenomenology, generative historicist, genetic, hermeneutic (interpretive) phenomenology, and realistic phenomenology. However, this study will only focus on two perspectives that guide most phenomenological research: descriptive and hermeneutic phenomenology and are subsequently discussed below as emphasised by Caroline *et al.*, (2018:3310) and Wojnar and Swanson (2007:173).

Descriptive phenomenology is concerned with how objects are constituted in pure consciousness, suspending any relationship questions of the phenomenon to the world wherein one exists. Descriptive phenomenology is a philosophical practice and a method of investigation that is complex. The emphasis is on discovering the phenomena through direct interaction between the object of study and the researcher. It requires the researcher to suspend the prejudices through the process elaborated in bracketing (Caroline *et al.*, 2018:3309-3310; Wojnar & Swanson, 2007:173).

To define the phenomenon, phenomenologists use various frames of reference, which include: the live-world plane of interaction where the participants and the researcher need to interact, the transcendental subjectivity where the researcher needs to be open and neutral to the realities of other, and eidetic essences which is the worldwide truth. The lived experiences are utilized to give a worldwide explanation of the phenomenon. The ultimate test of quality for the descriptive phenomenological study can only be attained from the participants' testimonies confirming whether the researcher's explanation of the phenomenon did capture their lived personal experiences (Law & Shafey, 2019:659; Wojnar & Swanson, 2007:173).

On the other hand, hermeneutic phenomenology focuses upon interpreting the structures of the experience, how people who live through those experiences, and those who study them understand things (Caroline *et al.*, 2018:3311; Wojnar & Swanson, 2007:173). The foundation of hermeneutic phenomenology is based on the belief that the participants and the researcher come to the inquiry with fore-structures of understanding moulded by their upbringings where they together generate an understanding of the phenomenon under investigation in the process of interaction and analysis (Wojnar & Swanson, 2007:174).

According to Converse (2012:31), phenomenological methodologies are time-consuming and require personal involvement in the research, particularly during the not so well-defined process of interpretation. Therefore, the researcher must generate results that reflect the experiences of the participants and those of his or her own (Converse, 2012:31). Moreover, Errasti-Ibarrondo *et al.*, (2018:1732) emphasizes that conducting phenomenological research is a challenge due to the difficulty in understanding the variety of methodologies available or the complex philosophy, as well as the lack of clarity in phenomenological literature on how to apply lucid methods associated with this type of strategy. However, the researcher must always bear in mind that phenomenology is not a prescribed step-by-step investigation but a strategy in which the methods engaged need to correspond with the phenomena of interest and trailed with gratefulness for the original literature (Errasti-Ibarrondo *et al.*, 2018:1732).

Grounded theory

Grounded theory can be used to integrate methodology and method (Saunders *et al.*, 2016:195), permitting key concepts and theory to arise out of data (Kolb, 2012:86; Williams, 2007:68). The grounded theory emphasizes theory development, and that is how it differs mostly from other strategies (Kolb, 2012:86; Williams, 2007:68). The grounded theory refers to the theory that is grounded in or inductively developed from a data set. It is used to develop processes in an extensive range of context, including management and business. Also, it is used to develop theoretical explanations of social interaction. Moreover, grounded theory is developed to analyse, interpret, and explain the significances that social actors create to make sense of their everyday experiences in particular situations (Saunders *et al.*, 2016:195).

According to Barney Glaser and Anselm Strauss (2016) , the creators of grounded theory, a theory could be developed through qualitative scrutiny of the data collected from the field rather than in the literature (Saunders *et al.*, 2016:195; Williams, 2007:69). With this strategy, numerous stages of gathering, sanitizing and sorting the data are used. Grounded theory is developed through essential strategies, including making constant comparisons and applying theoretical sampling (Kolb, 2012:86; Saunders *et al.*, 2016:195). In support, Williams, (2007:69) notes that grounded theory follows a format called the constant comparative method where data is collected, analysed, and the process is repeated. Data can be collected from multiple sources, which include participants' interviews, onsite observations and reviewing archived videotapes. Data is analysed using a standardized format which includes axial coding, open coding, selective coding, and theory development. A grounded theory's outcomes combine five facets: research question description, review of literature, methodology description, analysis of data explaining the theory, and implications discussion (Williams, 2007:69).

Based on the research problem or question, the grounded theory, which is one of many qualitative research methodologies, may or may not be the most appropriate method. For the researcher to choose the most suitable method for achieving greater knowledge and understanding of the research problem, greater caution must be taken. Consequently, concerns are raised with regards to issues such as data management and credibility. Moreover, data analysis must begin instantly after data collection and data are interpreted continuously until the study is completed (Kolb, 2012:86).

The grounded theory strategy is associated with qualitative research, which uses purposive theoretical and theoretical sampling strategies. The sampling mentioned above strategies have an inherent potential for bias; therefore, the researcher needs to be aware of the study's potential shortcomings and always be honest when sharing them with the readers. Furthermore, with

grounded theory study, the researcher's worldview and biases may influence the study's process; therefore, the researcher must acknowledge those factors and put measures in place to minimize their effect on the study (Kolb, 2012:86).

Case study

Case study research is a qualitative research approach that explores a real-life case (bounded, intergraded system) or cases (multiple bound systems) over some time (Alpi & Evans, 2019:2; Merriam, 2002:8). That is achieved over comprehensive and in-depth data collection comprising numerous sources of facts, reports, case themes and case descriptions (Alpi & Evans, 2019:2; Saunders *et al.*, 2016:184) and Williams (2007:68) defines a case study as a research study whereby a researcher explores in-depth an event, a program or activity on one individual or more where a time frame is clear. In support, Merriam (2002:8) views the case study as a rigorous depiction and exploration of a social unit or a phenomenon such as an individual, group, community or institution.

The case study's objective is to learn more about a poorly understood or little known situation (Williams, 2007:68). As a result, the unit of analysis might be a single case taking place within a single site or multiple cases taking place in multiple sites (Alpi & Evans, 2019:2; Merriam, 2002:8). The unit of study determines whether a study is a case study or not, making this type of qualitative study stand apart amongst other strategies discussed. Also, since the unit of analysis defines the case study, other strategies can be used in combination with the case study (Merriam, 2002:8).

According to Williams (2007:68), case study structure should be the research problem, the issues, the context, and lessons learned. When using a case study, data collection should be far-reaching. It must be obtained from multiple sources, including interviews, participant observations, physical artefacts, archived documents, and audio-visual materials. A case study research does site visits and spend time with participants under investigation. The outcome of a case study research should be patterns identified relating to theory and lessons learned (Williams, 2007:68).

The fact that a researcher chooses between a single case or multiple cases makes this strategy tricky. For instance, a rookie researcher may find that a single case study strategy is more manageable than multiple cases. Also, a researcher may opt for a research design founded on two or three cases where the interest is on achieving lateral replication. On the other side, choosing a multiple case study strategy may produce more evidence than a single case study strategy. However, the choice of a strategy is not driven by the need to gather more evidence but by the purpose of research. A single case study approach is selected based on the study's nature,

while the multiple case approach is selected to allow replication. Therefore, a researcher interested in using this approach must ensure that they understand the objectives and the nature of their study (Saunders *et al.*, 2016:187).

Ethnography

Ethnography studies the social world or the group's culture, unlike the case study strategy that studies person, event or program (Williams, 2007:68). It means a written account of an ethnic group of people. Ethnographers' objective is to study a group of people who share the same space and interact with one another within a particular context. Disagreements regarding how best to achieve ethnography's objective led to the manifestation of several ethnographic strategies that include realist, interpretive or impressionist and critical ethnography, briefly discussed below (Saunders *et al.*, 2016:187-188; Williams, 2007:68).

A realistic ethnographer believes in identifying 'true' meanings, objectivity and factual reporting. The ethnographic researcher will report observed situations through data or facts about processes and structures, procedures and standards, customs and practices, and symbols and objects. Such reporting is likely to generate quantitative data from observation by using standardized categories. The ethnographic researcher tends to represent their role as an objective reporter of truths by writing their explanation in the third person. This explanation will deliver a comprehensive background and nature of the observed cultural relations and classify social process and behaviour (Saunders *et al.*, 2016:188).

In comparison, interpretive ethnography puts more emphasis on subjectivity rather than objectivity. The interpretive ethnographic researchers believe in multiples meanings rather than one true meaning like realistic ethnographers. Those multiple meanings will be positioned in the interpretation of the diverse participants that are socially constructed. Therefore, a more pluralistic approach is suggested where those being investigated are treated as participants rather than objects, and the ethnographic researcher focuses on understanding meaning. This requires an ethnographic researcher to ensure their research's validity and reliability through the continuous engagement of reflexivity (Saunders *et al.*, 2016:188).

On the other hand, critical ethnography is radically designed to explain and explore the impact of privilege, power and authority on the research subjects to these influences. Critical ethnographers try and bring about change by adopting an advocacy role in their research. A self-conscious form of critical ethnography may be assumed to discover the impact of a challenging issue within a workgroup or an organization to encourage internal or external change. That challenging issue

may relate to strategy, regulation, procedures, communication, and others (Saunders *et al.*, 2016:188-189).

Opting for an ethnographic study is not free from challenges; therefore, the researcher must be cognitive of a few things to have successful research. The researcher needs to make sure that the scope of the proposed ethnographic research is realizable. This is concerning the objectives and the research question. When undertaking data collection in the field, comprehensive notes of all the observations should be made, and the researcher must spend more time reflecting on the observations made. Moreover, more notes should be taken through informal interviews and discussions to supplement the process of observation. Also, any documentation that supports the data collection should be collected to have sufficient data to analyse to meet the research objective and answer the research questions (Saunders *et al.*, 2016:188-189; Williams, 2007:68).

Research strategy adopted in this study

The research strategy adopted in this study is phenomenology and descriptive phenomenology in particular. The researcher believes that to discover and understand the phenomenon; there is a need for direct interaction with the participants. The researcher is also convinced that he needs to be open and neutral to the realities of others. This selection is appropriated because it assists the researcher explore and understand quality management processes in the emerging maize farms without any prior knowledge. Thus, the research is open to what the findings of the research present to him.

3.7 RESEARCH DESIGN AND PROCESSES

3.7.1 Unit of analysis

The unit of analysis is the most important part of any research because the entire search is based upon it. It is crucial to determine the unit of analysis at the beginning of research as the conceptual framework, sample size, and data collection techniques are dependent on it. The unit of analysis can be referred to as the units, parts, or social life cases under deliberation. The units of analysis are also important to developing concepts, observing or practically evaluating concepts and utilizing data analysis. They can be classified as individuals, groups or organizations (Baxter & Jack, 2008:545; Khan, 2014:304).

According to Baxter and Jack (2008:545), determining the unit of analysis is challenging for both seasoned and rookie researchers. To effectively determine the appropriate unit of analysis, researchers must decide if they want to 'analyse' the individual, a programme, a process, or the

differences between organizations. That decision can be reinforced by discussing with a colleague as a strategy to delineate further the unit of analysis (Baxter & Jack, 2008:545).

The unit of analysis selected for this study is individuals, particularly the individual emerging maize farmers from selected provinces of South Africa. This study investigated individual farmers to understand their perceptions, behaviours, attitudes, and opinions regarding maize quality management to develop a quality management framework for emerging farmers.

3.7.2 Population

A population comprises the full sets of elements or cases from which a sample is taken (Saunders *et al.*, 2016:274-275). Rahi (2017:3) defines a population as all items or people that the researcher wishes to study and understand. However, for the researchers to define the population as manageable, they might redefine the population. This often referred to as a subset of the population called a target population. A target population is a population that is the actual target or focus of the research investigation (Saunders *et al.*, 2016:274-275).

The population for this study was the emerging farmers that were affiliated and funded by Senwes. After redefining the population, the target population was identified as the black emerging maize farmers from Gauteng, Free State and Northern Cape Province of South Africa, affiliated and funded by Senwes. Senwes had about 50 emerging maize farmers in its national database. However, only 15 were black. Therefore, our target population was the 15 emerging maize farmers, whereby the study sample was obtained.

3.7.3 Sampling method

Sampling is a process of choosing a section of the population for research (Rahi, 2017:3). Research is about answering the research question, which involves selecting several items or people as participants referred to as a study sample (Wilson, 2016:69). According to Saunders *et al.*, (2016:274), it is possible to collect data from the entire population in some research, such as this one, due to a small target population size. However, in most instances, it is impracticable to collect data from the entire population. Thus, a sample must be taken (Saunders *et al.*, 2016:274). According to Rahi (2017:3), the benefits of taking a sample include reduced cost and work burden, efficient data collection, and accuracy.

The taking of that sample and the sampling method depends on the research method selected to conduct the research and the results the researcher is hoping for (Wilson, 2016:69). In support, Rahi (2017) purports that selecting a sampling method depends on the study's nature, including theoretical and practical issues. The method influencing the sampling and the sampling method

of research can either be qualitative, quantitative or both (Wilson, 2016:69). Sampling methods include probability or representative and non-probability sampling (Saunders *et al.*, 2016:275; Wilson, 2016:69).

Probability sampling

Probability sampling comes close to the objective of sampling, which is to draw a sample that is representative of the entire population (Wilson, 2016:70). With probability sampling, the probability of all cases selected from a target population is equal and is known for each case. Therefore, it is possible to statistically estimate the target population's features from a sample to achieve the objectives and answer the research questions (Rahi, 2017:3; Saunders *et al.*, 2016:275). According to Wilson (2016:70), the most important part of probability sampling is every element in the population could form part of the sample. This probability is known and can be confirmed.

Probability sampling can be divided into five categories: simple random sampling (a sampling process where each population unit has an equal chance of being included in the sample. Random samples are generated through a computer program), stratified random sampling (a sampling process where a stratum or each subgroup has an equal probability of being randomly selected. Equivalent balanced representation is afforded to each stratum), systematic random sampling (a primary sampling point is haphazardly selected followed by the selection of the cases at periodic intervals), cluster sampling (a combination of populations that are distributed geographically are used to develop a sample and are mostly inaccessible simultaneously), and multi-stage sampling (a sequence of stages are involved). Firstly, a random sample of the whole region in a cluster is selected. Secondly, a particular region is selected, and finally, the appropriate objects for the sample size are selected (Rahi, 2017:3; Saunders *et al.*, 2016:284; Wilson, 2016:70).

Non-Probability Sampling

On the contrary, with non-probability sampling, each case's probability is unknown (Rahi, 2017:3; Saunders *et al.*, 2016:275). In support, Wilson (2016:70) argues that with non-probability sampling, the researcher cannot be sure of a particular constituent's population incorporated in the sample. Wilson (2016:70) further purports that this method does not allow generalization from the sample to the population because the research cannot be certain about the sample's representativeness. However, according to Saunders *et al.*, (2016:275) the researcher can still generalize from non-probability samples about the target population. Saunders *et al.*, (2016:275) suggest that it is impossible to use statistics to estimate a target population's features to achieve

the objectives and answer the research questions. Still, Wilson (2016:70) believes that these methods can be sufficient subject to the research question, cost-effective and easier to use.

Non-probability sampling can also be divided into five categories, namely, convenience sampling (a cost-effective method where data collected from the immediate population that is easily accessible; this method is often criticized for being bias), quota sampling (strata of the population are defined and a quota set for sample element from each stratum). Findings of this method cannot be generalized due to the lack of using probability sampling to select the element), snowball sampling (the researcher begins by contacting a small group of relevant people and used them as referrals to make contact with other relevant people), and purposive or judgment sampling (a cost-effective and convenient method which relies on the researcher's judgment to select the sample of interest. The sample is selected for a particular purpose) (Rahi, 2017:3; Saunders *et al.*, 2016:284; Wilson, 2016:70).

Sampling method selected for this study

This study's sampling method is total population sampling, a non-probability purposive sampling method commonly used to study the entire population with a particular set of characteristics. In this case, the study aims to investigate emerging maize farmers characterised by the following unique set of characteristics: produce maize, are black, planting between 150 and 500 hectares, are developing, participate in either formal or informal markets and are funded by Senwes. This method was selected based on the researcher's knowledge of the population and the objectives of the study. The decision was based on the researcher's judgment as he believed that the selected method would allow the research question of the study to be answered, and the objectives met. The decision was also supported by Converse, (2012:31), who revealed that the sampling strategy normally employed for phenomenological studies is purposeful and snowball sampling that concerns understanding the participants' lived experiences.

3.7.4 Sampling size

There have been many extensive discussions in the literature regarding the sample size. The selection of a suitable sample size is still a major challenge for many researchers. Thus, the sample size needs to get great consideration as it may strongly affect the analysis of results (Rahi, 2017:3). For instance, Saunders *et al.*, (2016:297) suggest that sample size issues for all non-probability sampling techniques excluding quota samples are ambiguous, unlike rule-less probability sampling. The selection of sample size is dependent on the research question and the objectives of the study. Moreover, the researcher needs to understand what he or she needs to find out, what will have credibility, what is useful and the availability of resources. Such is crucial,

particularly when the qualitative researcher intends to collect data through a semi-structured or unstructured interview like was the case with this study and as was proposed by Saunders *et al.*, (2016:297).

According to Wilson (2016:70) when quoting Connaway and Powell, four criteria help a researcher to select an appropriate sample size: the degree of accuracy required (there more accuracy needed, the bigger the sample size required), the population's variability (bigger population variability required bigger sample size), the sampling method (sampling sizes for non-probability sampling is confusing unlike probability sampling), and method of analysis (bigger samples are suitable for statistical analysis as opposed to smaller samples).

Qualitative studies generally make use of smaller samples, unlike quantitative studies. However, when conducting qualitative studies, care should be taken to ensure that the sample size is sufficient to collect enough data to adequately describe the phenomenon and achieve the research objectives (Gentles *et al.*, 2015:1782; (*et al.*, 2016:297). According to Saunders *et al.*, (2016:297) and Guetterman (2015:14), several researchers suggest that one must continue to do so until data saturation is reached when collecting qualitative data. Data saturation means the continuous collection of data until the additional data does not propose new themes or offer any new information. While this is helpful but it does not answer the question, how many participants must be selected in a qualitative study. Table 3.3 summarises the sample sizes according to some study types (Saunders *et al.*, 2016:297).

Table 3.3: Summary of sample sizes according to study types

Source: (Clive Roland, 2016:429; Creswell, 2007:121) and Saunders *et al.*, (2016:297)

Nature of the study	Sample size
Phenomenology	5-25
Ethnography	35-36
Grounded theory	20-35
Case study	15-30

According to Converse (2012:31), sample sizes employed in phenomenological studies are relatively small. Creswell and Poth (2016:126) points out that sample sizes may vary for different studies. Moreover, Saunders *et al.*, (2016:297) suggest a sample size of 5-25 participants is sufficient in the phenomenological study. In support, a study by Guetterman, (2015:14) that analyzed 11 phenomenological studies found a mean sample size to be 21 participants. Gentles *et al.*, (2015:1782), further purports that a descriptive phenomenological study may have a sample size of around 12 participants, while for hermeneutic phenomenology, less than 10 participants are enough if intense and greater than 30 participants if it is less intense.

The sample size selected for this study was 15 participants, the total population. However, three participants rejected the invitation to participate. The sample is divided into 15 emerging maize farmers (entire target population) in the selected provinces, which are the actual objects of interest and five industry specialists who have the expertise and knowledge in grain quality management, emerging farming, grain pathology, and agronomy.

3.7.5 Participants

A participant can be defined as a person who answers questions in a research study through an interview or group interview (Saunders *et al.*, 2016:723). This study's participants were purposely selected from the entire population of 15 emerging maize farmers affiliated and funded by Senwes. They were based in the Free State, Gauteng and Northern Cape provinces of South Africa. The criteria used to select the participants purposely include the following: they must have received funding from Senwes, produced maize, were black, produced between 150 and 500 tons, were developing and participated in either formal or informal markets. These participants were selected because the researcher wanted to understand the phenomenon from emerging farmers of different sizes in terms of production volume and maize farming experience.

To give credibility to the study and also elicit expert knowledge of how best to develop the quality management framework for the emerging maize farmers, the researcher targeted five industry experts to add to the participant's list. The criteria for the expert's selection were based on their knowledge of grain quality management, emerging farming, grain pathology, and agronomy.

3.7.6 Data Collection Methods/ Instruments

Three major types of data collection instruments can be used in a qualitative study: interviews, observation, and documents (Creswell, 2007:129). The data collection strategy is guided by the research questions and the determination of which instrument will produce the best information that answers the research questions. Frequently, two methods are used for collecting primary data, one which is the primary method, the other supporting the primary method. For instance,

data can be collected using interviews supported by studying the documents relating to the phenomenon (Creswell, 2007:129; Merriam, 2002:12).

Interviews can range from being highly structured to being completely unstructured. Structured interviews, also referred to as interviewer-completed questionnaire, are questionnaire where standardized questions and the order they are asked are predetermined before the interview (Saunders *et al.*, 2016:390). On the contrary, unstructured interviews also referred to as non-directive interviews, are interviews where the questions and their order are not pre-determined. However, the research has topic areas to explore. Unstructured interviews are informal and can be used to explore in-depth the phenomenon of interest. Moreover, the interviewees can freely express themselves about behaviour, events, and beliefs concerning the phenomenon. Many interviews fall anywhere in between structured and unstructured. Interviews can also be semi-structured where a researcher has a list of possible key questions and themes, but how they are used may differ between interviews (Creswell, 2007:132; Merriam, 2002:12; Saunders *et al.*, 2016:392; Stake, 1995:64).

When conducting phenomenological research, in-depth interviews or semi-structured interviews are recommended for gathering data. The focus of the researcher is on the phenomenon as experienced by the participants. One researcher normally conducts the interviews to develop a proper understanding of the phenomenon, and an interview schedule is used. The questions that ask the participant to describe the phenomenon and its context are crucial. The participants must have first-hand experienced the phenomenon under investigation. However, it should be noted that a phenomenon is complicated and could be experienced differently by different participants; therefore, immediacy to a phenomenon is not afforded any epistemological priority. The researcher should acknowledge the fact that each participant has a unique meaning of the lived experience. Thus, phenomenology aims to understand the meaning of the phenomenon rather than creating generalized results (Converse, 2012:31).

Semi-structured and in-depth interviews can be worthwhile in helping explore and understand the context in an exploratory study like this one. Both these interview types may deliver crucial contextual material of the study. They allow the researcher to review answers where interviewees need to explain or add to their responses. Moreover, this kind of data collection method is very important for interpretivism research concerned about understanding the meanings participants attribute to various phenomena. Also, semi-structured and in-depth interviews may lead to discussing topics that were not previously considered but valuable to the study resulting in the collection of a rich and detailed data set.

The second major form of collecting data is through observations. According to (Creswell, 2007:132), observing is a special skill the researcher needs to deal with issues such as the possible trickery from participants, managing impression, and the possible researcher's weirdness in an unfamiliar setting. With observations, the researcher receives data from a direct encounter with the phenomenon of interest, unlike the interviews where data is received indirectly. The research can be either active or inactive (or complete) during the observations. An inactive observer is not known by those under observation, while the active observer is known and participates while observing maybe as a member of an organisation or a group. Observations can be used in combination with interviews, and such case is referred to as field study or fieldwork. This method is suitable for inquiry for observing firsthand an event, activity or situation. It is also suitable for studies where participants are unwilling or unable to participate (Creswell, 2007:132; Merriam, 2002:13).

The third major form of data collection is a document review. The document reviewed can be written, visual photographs, oral or cultural artefacts. Moreover, the researcher can analyze available public records, newspapers, annual reports, physical material, correspondence, minute of meetings, personal documents and more. What makes the review of documents appealing is that they already exist in the situation, they do not change the setting in any way, and they do not intrude as a researcher would. Furthermore, they are not dependent on human beings who may not be cooperative when collecting data through interviews and observations. An entire study can be built solely on reviewing documents (Merriam, 2002:13; Stake, 1995:68).

The primary data collection instrument opted for this study was non-standardized, face-to-face, and semi-structured interviews conducted on a one-on-one basis while observing all Covid-19 prevention protocols. The protocols included wearing masks, sanitization of hands and keeping a two-meter social distance during the interviews. These semi-structured interviews were supplemented by reviewing relevant documents and observations during farm inspections. Documents that were reviewed included policies, public records, newspapers, annual reports, and others. Participant observations were done to enable the researcher to develop mutual trust with the participants and observe the context-specific quality management process investigated by research question four.

3.7.7 Data Collection Procedure

The key to a successful interview is thorough preparation, particularly when the researcher uses in-depth or semi-structured interviews. The researchers must obtain confidence from their participants, which can be demonstrated through the researcher's competence and credibility. The preparation process must cover issues such as the researcher's level of knowledge,

development of interview themes and interview protocol, supplying information to the participants before the interview, and selecting the interview's best location (Saunders *et al.*, 2016:401).

Data were collected using non-standardized, face-to-face, semi-structured interviews following a customized step-by-step procedure as proposed by Creswell (2007:132-133). Observations were also made the same day when the interviews were held. The procedure was as follows: Participants were identified using a purposeful sampling method under the following criteria: emerging maize farmer must have received funding from Senwes, produced maize, were black, produced between 150 and 500 tons, were developing and participated in either formal or informal markets. A meeting was held with the general manager of Senwes to get consent allowing the researcher to use their emerging farmers as participants of the study. The consent was granted; consent forms were sent to individual emerging farmers as well as the industry experts to study and sign them committing their interest in participating in the study. After the North-West University granted the ethics clearance, five participants were telephonically contacted to negotiate an interview date and the location of the interview as a pilot study. A pilot study was conducted to refine the research questions and the research procedure. Once the pilot study was completed, all participants were telephonically contacted to confirm the interview date, and the location of the interview for the actual study. After arriving at the interview site, the purpose of the study, objectives and the time needed to complete the interview were discussed in preparation for the interview. The interviews were then conducted using a designed interview protocol (see Appendix 1) and a voice-recording device. Data were then transcribed, organised and prepared for analysis using a thematic analysis technique. The processes of data analysis coded, explored, interrogated, analysed data to generate categories and themes. During the interviews, the researcher remained true to the questions, was polite and respectful throughout the interview. The participants were thanked for participating in the study. The confidentiality of their responses were guaranteed.

3.7.8 Data Analysis

Qualitative data, in its pure form, may be difficult to comprehend for most people. Thus, it needs to be processed and analyzed to make it meaningful (Saunders *et al.*, 2016:566). Data analysis is a systematic process of scrutinizing and organizing all data gathered from interview field notes, transcripts and other materials to improve the researcher's understanding of the data and the subsequent presentation of the discoveries (Kolb, 2012:84). To successfully analyse qualitative data, the researchers must understand whether they approach the analysis from an inductive or a deductive perspective. This study analysed data following an inductive perspective, where the theory grounded in the data is developed. Moreover, the researcher understood the interactive

nature of analysis and qualitative data collection. This was important so that the researcher can plan to analyse the data while data collection was underway (Saunders *et al.*, 2016:566).

According to Saunders *et al.*, (2016:566), qualitative data can be analysed using many analytical techniques, including thematic analysis, content analysis, template analysis, data display and analysis, explanation building and testing, narrative analysis, discourse analysis, and grounded theory method. Also, there is a range of qualitative data analysis software, which are sometimes referred to as computer-aided qualitative data analysis software (CAQDAS) or qualitative data analysis software (QDAS) (Flick, 2006:343; Saunders *et al.*, 2016:615). The data were analyzed using the thematic analysis technique. According to Braun and Clarke (2012:60), Kiger and Varpio (2020:3) and Nowell *et al.*, (2017:4), thematic analysis can be performed in several ways. However, it typically follows a six-step process namely: Familiarization, Data coding, Theme Generation, Theme Review, Theme Definition and Naming, and Writing-up. Each step is subsequently discussed.

Familiarization

Familiarizing oneself with the entire data set is essential for all subsequent steps and will give one a good sense of where to start with the raw data (Kiger & Varpio, 2020:5). According to Nowell *et al.*, (2017:5), the researcher must actively read the data repeatedly to search for patterns and meaning to be immersed in it. This is especially important when dealing with various complex qualitative data formats, such as the ones used in this study, such as audio recordings, transcriptions, and documents that lack a consistent structure but are necessary for conducting a thorough analysis (Nowell *et al.*, 2017:5). Before examining individual data items, the researcher needed to get a detailed overview of all the data gathered. The researcher's process for becoming immersed in the data included the transcription of audio, reading through the text and taking initial notes, and simply searching through the data to become familiar with it. Moreover, transcribing the data and comparing the transcripts against the original audio recording for accuracy was time-consuming. However, it was an excellent way of becoming familiar with data.

Data coding

Data coding is defined as a process of analysing data according to Kolb (2012:84). Saunders *et al.*, (2016:712) defines coding as a process of giving labels to data using a code that summarises the data's significance. Coding aims to collect a comprehensive picture of the information obtained through the data collection process and make data of interest accessible for further analysis (Saunders *et al.*, 2016:194 & 581). Three levels of coding were applied: open coding,

axial coding and selective coding, which are subsequently discussed as proposed by Flick (2006:296-302), Kolb (2012:84) and Saunders *et al.*, (2016:194).

During open coding, the first step in coding, the researcher constantly matched data and asked questions regarding what is understood or not. Various techniques were utilised to identify different categories, dimensions, and properties within the data. During axial coding, the second step in coding allowed connections between categories by patching data together in new ways. The main highlight of axial coding was to relay subcategories to a category through the deductive and inductive thinking process by asking questions and making evaluations. In the last stage of coding, selective coding, the core category was identified, selected, and systematically linked to other categories. The parallels and connections were then validated to complete the categories that needed more modification and improvement. The theory only materialized after the process of incorporating the intertwining and decontaminating of all the key categories into the selection of a core category (Flick, 2006:296-302; Kolb, 2012:84; Saunders *et al.*, 2016:194).

Theme Generation

This step involves analysing the coded and collated data extracts to look for potential themes of broader significance. The researcher constructs themes through analysing, combining, comparing, and even graphically mapping how codes relate to one another. A theme is defined as a sequential response or sense extracted from the data to answer the research question. In contrast to a category that describes and organizes the 'manifest material' of a data set, a theme is a more abstract object requiring a greater degree of data analysis and integration (Kiger & Varpio, 2020:3-5; Nowell *et al.*, 2017:8). The themes for this study were derived using a deductive approach to thematic analysis. Instead of allowing the data to decide the study themes as in an inductive approach, the selected deductive approach meant approaching the data with certain preconceived themes the researcher expects to find represented there, based on theory or prior knowledge. The themes generated were latent themes generated by reading into the subtext and assumptions underlying the data, which contrasts semantic themes generated by examining its explicit content.

Theme Review

After the themes have been devised, this phase is about refining those themes. The researcher checks to see if the coded data extracts from individual themes form a logical pattern. Furthermore, the researcher considers each theme's validity to see if it correctly reflects the entire data collection context (Nowell *et al.*, 2017:9). This step involved ensuring that the generated themes were useful and accurately represented the data. The researcher compared the themes

to the data set to see if they covered everything, provided a good representation of the data, and needed to make any changes to make them work better. When the researcher ran into issues with the themes, they were split up, combined, discarded, or even created new ones to make them more accurate and valuable.

Theme Definition and Naming

Defining the themes requires the researcher to state each theme's uniqueness clearly, and specificity - a good test to achieve is, to sum up, each theme's essence in a few sentences. A good thematic analysis will generate themes that have the following characteristics: simple with a singular focus, are related but do not overlap, nor they are repetitive and addresses the research question directly (Braun & Clarke, 2012:66). From the final list of themes, this step entailed naming and defining each one. Themes were defined by formulating what each theme meant and determining how each theme aids in data comprehension. The process of naming themes involved creating an easily comprehensible and concise name for each theme.

Writing-up

The final step included presenting the final analysis and findings in writing. The writing-up process began with notes taking, themes description, and representative data extracts selection in previous stages. In other words, the writing-up was a "continuation" of data collection and interpretation. A presentation of the results and a discussion of the results were included in the writing up segment. The section included a narrative that described the data's analysis and interpretation in a succinct, simple and logical manner. It also explained why the researcher's theme selection and data analysis were correct and meaningful. The study offered a justification for why the researcher's interpretation comprehensively addressed the research question using representative data extracts such as direct quotes from participants and narrative accounts. All direct data extracts were given sufficient context to understand their meaning, and an interconnected explanation of text was used to emphasize their significance as proposed by (Kiger & Varpio, 2020:7-8).

3.7.9 Trustworthiness

According to Leung (2015:326), trustworthiness or validity means "appropriateness" of the processes, tools and data in qualitative research. Trustworthiness can also be expressed using validity, rigour or credibility (Morrow, 2005:250). Validity is a great area of concern in methodology. Thus, researchers must account for the study's given information and recognize both internal and external validity. Internal validity deals with data accuracy by integrating triangulation procedures, participant's involvement, and member checks.

On the other hand, external validity deals with the areas of generalization and reliability. The researcher's responsibility lies in ensuring that precautionary measures are taken to confirm their study's validity (Kolb, 2012:85). According to Kolb (2012:85), it is not easy to prove the study's validity, but several strategies have been identified in the literature. Measures that were taken for this study to ensure validity include triangulation, transferability, reflexivity, and negative case analysis as suggested by Kolb (2012:85).

According to Kolb (2012:85), triangulation is a technique used to improve data interpretation's validity and trustworthiness using several data collection methods. It is dependent on merging data collected using different methods or the same method over time (Kolb, 2012:85). In this study, triangulation was achieved by collecting data using the audio-recording device, the data collection protocol (see appendix 8), and documents relevant to the study, converging all the data during interpretation.

The researcher self can be a threat to validity in a qualitative study by being biased and reactive, which was overcome in this study using reflexivity. Reflexivity is an attempt to assist minimize the effects of the researcher bias on the study. Reflexivity was achieved through the researcher continuously incorporating awareness of reflecting, exploring and examining his relationships throughout research as suggested by (Kolb, 2012:85).

Transferability or generalisability was ensured by detailing the phenomenon description and giving the background data to establish the study's context as suggested by (Shenton, 2004:73). Moreover, a practical approach used to assess this study's generalizability was to adopt similar validity criteria, including triangulation, proper audit, consistent comparison, and documentation as referred to by (Leung, 2015:326).

Furthermore, this study's validity was ensured by understanding the participant's culture, peer-reviewing the study, reflective commentary usage, framing findings through examining previous findings and using appropriate research methods as proposed by (Shenton, 2004:73). More specifically, before starting with the interviews, the researcher held meetings with Senwes management to understand the participants' culture. Furthermore, the study was peer-reviewed by colleagues in academia, and selected experts in the industry and the feedback was used to improve the questions.

3.7.10 Reliability

Reliability, also termed dependability, refers to the exact replicability of the results and the processes used to obtain them in quantitative research. However, the same definition of reliability is puzzling and epistemologically illogical in qualitative research with its various paradigms. Therefore the principle of reliability in qualitative research is based on consistency (Leung, 2015:326). In support, Saunders *et al.*, (2016:398) reveals that the intention of qualitative research is not replicability since they reflect reality at the time of data collection, which is dynamic. This is true, particularly when using in-depth or semi-structured interviews that are flexible in exploring the topic's complexity. Therefore, trying to ensure the replicability of non-standardized qualitative research is neither feasible nor realistic without undermining the strength of qualitative research (Saunders *et al.*, 2016:398). Therefore, a fair margin of variability for results is accepted for qualitative studies subject to the epistemological logistics and methodology, generating ontologically comparable data, which may vary in character and richness within similar dimensions (Leung, 2015:326).

For this study, the reliability of process and results was enhanced by following five strategies proposed by Silverman as cited by Leung (2015:326). Those strategies include refutational analysis, comprehensive data use, continuous data analysis, table usage and deviant case inclusion. Moreover, reliability was enhanced through triangulation, where the accuracy of the original data in terms of context and form was verified through continuous comparison, either with peers or alone as suggested by Leung (2015:326). Lastly, reliability was accessed by adopting the Popperian dictum of falsifiability as the crux of science and truth and refuting the qualitative data and analytes as orioised by Leung (2015:326).

3.7.11 Ethical considerations

Research ethics refers to the standards of behaviour that guide the researcher's conduct concerning the rights of those who become the subject of the researchers work or are affected by it (Saunders, *et al.*, 2016:264). According to Reybold (2008:279), when a study involves human subjects, the situation requires a high degree of professional ethics and the study's integrity. Thus, the data collection process did not begin until the study received ethics clearance from the North-West University. The study did not begin until the study was discussed with the participants, and they signed the consent letter, which included allowing the researcher to use a voice recording device.

The participants were informed of their rights and the benefits of participating in this study, such as those advocated by Alsmadi (2008:153-156): the purpose of the study, anticipated interview

duration, and interview procedures; their right to withdraw from the research at any stage of the research process; the anticipated consequences of declining or withdrawing from the study; any potential risks or adverse effects related to this study; any prospective research benefits; the procedures for maintaining confidentiality; and the immediate person to contact for questions related to this research. Further considerations that will be made as proposed by Saunders *et al.*, (2016) include: guaranteeing zero harm to the participants; safeguarding of all participants' identity; privacy of information and anonymity of participants; prevention of possible emotional harm, risk of upset and reputational risk aversion.

To maintain the highest degree of data confidentiality, all data was coded such that participant names were not associated with them. All materials relating to this study, such as digital voice recorder, notes, and documentation, were kept safe, including locked file cabinets and secured for three years. Security codes were assigned to all computerized records, and all information relating to this study remained confidential and was not shared with any unauthorized persons as proposed by Mganga (2013:73).

CHAPTER FOUR

PRESENTATION OF RESULTS

4.1 INTRODUCTION

The comprehensive methodology was discussed in Chapter Four, which explained how data were collected using semi-structured interviews and documents. Data analysis and collection were conducted using the theories (outlined in chapter three) as the lenses. This chapter used thematic analysis and content analysis to analyse data. Content analysis was used to analyse documents, including articles, policy documents, manuals, and communication documents. Thematic analysis was used to analyse the transcribed semi-structured interviews. Four distinct themes emerged from the research data. A deductive approach to thematic analysis was used to produce these themes. The data was approached from the point of preconceived themes that the researcher expected to reflect on theory or prior knowledge following a deductive method. The latent themes were discovered by delving into the subtext and assumptions that underpin the data. The four themes generated are synonymous with the four research questions.

4.1.1 Research Questions

4.1.1.1 Main research question:

Can a quality management framework be developed for the farming industry, particularly emerging grain farmers?

4.1.1.2 Sub-questions:

What are the critical factors involved in the development of a quality management framework?

How competent are emerging maize farmers on factors affecting maize quality and grain quality standards?

How competent are emerging maize farmers in determining the maize quality standards (maize grading)?

What are maize quality processes currently in place to meet product quality standards?

4.1.2 Theories as analytical lenses:

-  The Juran Trilogy
-  The Deming cycle

4.1.3 Study themes:

The study themes generated are synonymous with the research objective and questions. The themes and categories are detailed in Table 4.1:

Table 4.1: Data coding into themes

Research questions	Themes	Categories
Can a quality management framework be developed for the farming industry? What are the critical factors involved in developing a quality management framework?	Theme 1: Quality management framework	1.1 Availability of a framework 1.2 Framework development 1.3 The focus of the framework
How competent are emerging maize farmers on factors affecting maize quality and grain quality standards?	Theme 2: Quality affecting factors	2.1 Planting dates 2.2 Seed quality and fertilization 2.3 Soil quality 2.4 Fungi and mycotoxins 2.5 Insects 2.6 Weeds 2.7 Chemicals 2.8 Hygiene 2.9 Moisture
How competent are emerging farmers in quality management?	Theme 3: Quality grade takers	3.1 The importance of maize grading 3.2 Grades of maize 3.3 The Grading process 3.4 Grading parameters
What maize quality processes currently exist to meet product quality standards?	Theme 4: Quality inspections	4.1 Field inspections

4.2 INDUSTRY EXPERTS FINDINGS

4.2.1 Demographics of the participants

This qualitative study interviewed five industry experts, and all participated voluntarily (Table 4.2). All these industry experts work to provide technical support to emerging farmers as part of their job descriptions. Industry expert 1 is an agricultural service manager with over twenty years of experience in the North West province. Industry expert 2 is an agronomist with fourteen years of experience and is based in the Free State province. Industry experts 3, 4 and 5 are all extension officers. Industry expert 3 has twelve years of experience and is based in Gauteng. Industry expert 4 has seven years of experience and is based in the Northern Cape. Industry expert 5 has three years of experience and is based in the Free State province. For anonymity and ease of reference, the participants are each given a unique code (see Table 4.2).

Table 4.2: The demographics of the industry experts

Participants	Code	Province	Gender	Position	Experience
Industry expert 1	IE1	North West	Male	Agricultural service manager	20 years
Industry expert 2	IE2	Free state	Male	Agronomist	14 years
Industry expert 3	IE3	Gauteng	Male	Extension officers	12 years
Industry expert 4	IE4	Northern Cape	Male	Extension officers	4 years
Industry expert 5	IE5	Free State	Female	Extension officers	3 years

4.2.2 Interview findings of industry experts

This qualitative study interviewed five industry experts to render credibility to the study and solicit expert knowledge of how best to develop the quality management framework for emerging maize farmers. The outcomes of these interviews were also used to develop the questionnaire for the emerging farmers who are the target population for the study.

4.2.2.1 Theme 1: Quality management framework

Quality management frameworks are becoming increasingly relevant for small businesses because of the expectations and demands to satisfy all stakeholders and improve business performance. When applied effectively, these frameworks provide a methodical technique to review product quality and improve organizational performance by consistently identifying improvement areas (Winiewska & Szczepaska, 2014:352; Saad & Khamkham, 2018:587). Their evolution is not a new phenomenon, according to Laux *et al.* (2015:313). However, most of them are unsuitable for small businesses, such as emerging farming ventures (Murphy and Leonard

2016:1104-1107). As a result, the need for a more user-friendly, particular, and simpler fit-for-purpose quality management framework for emerging farmers is reiterated.

Since they provide technical support to the emerging farmers, these industry experts were asked what they thought about a quality management framework and its availability for emerging farmers? Is there a need to create one, and how best can one be created? The responses showed that all participants agreed that there is currently no quality management framework tailor-made for emerging farmers. They all agree that there is a great need to develop such a framework. The framework must focus on funding, mentoring pests, diseases, maize storage, seed quality, water, soil, insects control, harvesting, maize handling, grading, agricultural practices, temperature, moisture and environment.

For instance, participant IE3 alluded: *“Emerging farmers do not have a formal quality management system, but they have a document control system to keep records for all farming activities.”* Furthermore, participant IE3 emphasised that *“developing an emerging farmer-specific quality management framework is crucial. It must be based on the basic agricultural principle, and it must not be difficult to understand and must address temperature, moisture and environment.”*

In support, participant IE1 reported:

“There is currently no formal framework for quality, but emerging farmers do follow the readily available agricultural guidelines which guide them about planting dates, GMO seeds, control of diseases and more. I think the development of a quality management framework that is specific for emerging farmers will be very helpful, especially if it can bring all those different agricultural guidelines together into one framework.”

In concurrence participant IE2 also stated:

“There is no quality management framework, and emerging farmers rely on agricultural experts and consultants for guidelines on producing quality maize. The development of a framework is very important because quality is everything in maize production. The most important aspect of this new framework must focus on funding and mentoring.”

The response from all the participants on this theme provided enough insight to conclude that there is a need to develop a quality management framework for emerging maize farmers. This is because there is currently no framework for emerging maize farmers. The responses corroborate

the observations by Murphy and Leonard (2016:1104-1107) that there is no specific framework for emerging maize farmers, that most of the quality management frameworks available are unsuitable for small businesses such as emerging farming.

4.2.2.2 Theme 2: Maize quality affecting factors

The necessity for emerging maize farmers to understand the factors that influence the quality of their crops is critical. However, there are still knowledge gaps to be overcome, as many emerging farmers are unfamiliar with maize quality and its factors (Maponya *et al.*, 2018:421). Numerous factors can influence maize quality, but not all of them are relevant. Significant factors have a detrimental impact on the grading process during maize delivery to the silos (Ramogodi & Pelsler, 2021:1). Many factors influence maize grain quality, including the presence of grains, insects and viruses, foreign matter and harmful compounds including pesticide residues and mycotoxins, and moisture content (Van Aswegen, 2011:1-15).

These participants were asked if they thought emerging farmers are competent about maize quality and maize grading factors. There was also a general agreement that there is a gap in knowledge from the emerging farmers regarding understanding the factors that affect the quality of maize. Most of these participants indicated that most emerging farmers know some of these factors that affect quality. However, they lack a broader understanding of how those factors affect the quality of their maize. For instance, some of these participants we quoted as follows:

Participant IE 1 said:

“This depends greatly on the kind of emerging farmer you are dealing with. Some farmers have more experience and will know more than emerging farmers with one year of maize farming experience. However, in general, I can say that not all emerging farmers are clued up with the factors that affect the maize quality, so there is a gap to fill there in terms of educating them.”

In tandem, participant IE2 said:

“There is a good proportion of emerging farmers who have the requisite knowledge regarding the factors that can affect the quality of maize, but there are those who are clueless and those who require great assistance.”

Furthermore, participant IE4 noted:

“I think some of them know the factors that affect the quality of maize, but I do not think they understand those factors fully.”

The responses on this theme suggest that some emerging farmers understand the factors that affect quality, but some work is still needed since there is still a lack of a broader understanding of these factors. The responses agree with the sentiments of Maponya *et al.* (2018:421), who purports that there are still knowledge gaps to be overcome, as many emerging farmers are unfamiliar with maize quality and its factors

4.2.2.3 Theme 3: Quality grade takers

Many actors in the field claim that South Africa's simple manual grading system is labour-intensive and subjective (Sendin *et al.*, 2018:311; Sendin *et al.*, 2019). However, maize grading is an important step since the outcome impacts the final product's quality and market value (Sendin *et al.*, 2019:1612). The literature is silent on whether or not the emerging maize farmers are competent or not. However, it is common knowledge in the maize sector that silo operators obtain maize grading training as a pre-requisite to receiving grain at the silo, and their companies cover the cost. As a result, emerging maize farmers are frequently excluded from such training due to the high expense of attendance.

The participants were also asked if they believed that emerging farmers are competent in maize grading. The response suggests that all industry experts agree that emerging farmers do not understand the grading process and are not competent in maize grading. Some of those industry experts responded to the question as stated below:

Participant IE2 emphasised that:

“All emerging farmers that are under my control do not know how to grade maize. I am often faced with a situation where I need to solve maize grading disputes at the silos because emerging farmers are sometimes not treated fairly because of their lack of understanding on maize grading.”

Participant IE4 noted that:

“I am disappointed that our emerging farmers do not know how to grade because if they knew, it would benefit them greatly in terms of understanding the quality of the maize they produce and even get better pricing for it.”

Also, Participant IE 5 concurred by saying:

“I do not know of any emerging farmer who can grade maize. Even myself, I do not know how to grade maize, and I think I would like to learn about it one day.”

The participants' responses on this theme settled that emerging farmers do not understand the grading processes and are not competent in maize grading. Literature is silent on this matter, so between and the responses and literature corroborations was not made.

4.2.2.4 Theme 4: Quality inspection

One of the most important tools emerging farmers have for managing maize quality is grain quality inspection. Emerging farmers can spot problems early before irreversible damage when applied properly as a quality management process. Early insect infestation, fungal diseases, and fertilizer deficiency are just a few of the primary challenges that this tool identified. Farmers, including emerging maize farmers, visit their fields frequently (du Plessis, 2003:31-33).

Participants were asked if the emerging farmers had quality management processes to meet product quality standards. The participants reported that most emerging farmers have quality management processes, including quality inspections of the maize field. They also confirmed that most emerging farmers understand the importance of conducting these quality inspections regularly. Some of those participants responded to the question as follow:

Participant IE 1 alluded that:

“Maize emerging farmers understand the need to visit their farms every day or every second day to inspect the field for diseases and anything that can affect the quality of maize. Furthermore, this is what differentiate grain farmers and livestock farmers in that grain farmers must be full time at the farm.”

In support, participant IE2 mentioned that:

“Any farmer who does not inspect his farm regularly is inviting big problems. All emerging farmers know about the importance of farms inspection in order to check for any irregularities and call for help early.”

Also in concurrence is participant IE4, who said:

“The only mechanism that emerging farmers use to identify problems early to preserve the maize quality is field scouting which they do three times a week to scout for diseases and insects.”

The participants' responses conclusively suggest that most emerging farmers understand the importance of regularly visiting their maize fields to inspect them for any irregularities. Also, they do visit their fields regularly. This is in line with the sentiments of du Plessis (2003:31-33), who emphasised the importance of visiting the fields by any grain farmer, including emerging farmers.

4.3 FINDINGS FROM EMERGING MAIZE FARMERS

4.3.1 Demographics of the participants

This phenomenological study is based on semi-structured, face-to-face interviews of twelve emerging maize farmers from three South African provinces. All these emerging farmers participated voluntarily, and all Covid-19 prevention protocols were observed. The list of participating emerging farmers was solicited from Senwes, the funders of these emerging farmers (Table 4.3). Farmer 1, 2, 3 and 4 were based in Gauteng province, Farmer 5,6,7,8, 9, and 10 in Free State province, and farmers 11 and 12 were based in the Northern Cape province. Farmer 6 was the only female. The average age of the farmers was fifty years, with the youngest being thirty-four years old and the oldest being sixty-nine. The average farming experience was years, and the minimum was six years, while the maximum was twenty years. The average number of hectares planted by these emerging farmers was 230 hectares, and the least hectares was 100, while the most hectares were 600. All farms are rain-irrigated excepts for farmers 11 and 12, which are irrigation farms.

Table 4.3: The demographics of emerging farmers

Farmer Code	Code	Gender	Province	Farming experience (years)	Average hectors	Irrigation type
Farmer 1	F1	Male	Gauteng	9	120	Rain
Farmer 2	F2	Male	Gauteng	7	250	Rain
Farmer 3	F3	Male	Gauteng	8	200	Rain
Farmer 4	F4	Male	Gauteng	15	300	Rain
Farmer 5	F5	Male	Free state	11	200	Rain
Farmer 6	F6	Female	Free state	12	200	Rain
Farmer 7	F7	Male	Free state	12	250	Rain
Farmer 8	F8	Male	Free state	6	300	Rain
Farmer 9	F9	Male	Free state	6	150	Rain
Farmer 10	F10	Male	Free state	20	600	Rain
Farmer 11	F11	Male	Northern cape	6	100	Irrigation
Farmer 12	F12	Male	Northern cape	12	100	Irrigation

4.3.2 Theme 1: Quality management framework

A quality management framework is crucial for the success of emerging maize farmers. The notion was emphasised by the industry experts who were interviewed in this study. They confirmed the absence of a quality management framework tailor-made for emerging farmers and also called for its development in section 4.2.2.1 discussed above. This section of the study discusses the findings from emerging farmers and give a brief conclusion relative to the finding by the industry experts. This section is broken into three categories: availability of a framework, framework development, and the framework's focus.

4.3.2.1 Category 1.1: Availability of a framework

All participants confirmed that no quality management framework provides a structure of how maize quality can be produced. For instance, Participant F1, when asked about the availability of a maize quality framework, said:

“There is no framework; I rely on experience I acquired through working with agronomists and neighbouring farmers”.

In support, participant F5 stated that:

“We do not have any framework. We rely on the agronomist who tells us exactly what to do. We also rely on our own farming experience.”

Also in agreement was participant 7, who alluded:

The is no formal framework that is available, but we do have an informal one that we acquired through the indigenous knowledge that we have.”.

4.3.2.2 Category 1.2: Framework development

Most participants mentioned that creating a maize quality management framework would immediately contribute to their success when asked about creating a quality framework specific to emerging farmers. For instance, participant 1 responded by saying:

“It is a very good idea to develop such a framework for us. I have previously suggested that Senwes offer us one-week training, and I think such a framework will help with training”.

Participant F5 concurred by stating that:

“The development of that framework will be very important for us small farmers. It will be even better if it is also written in our own languages.”

Also, this was backed by participant F1, who reported that:

“Especially for emerging farmers, it is very important to develop a quality framework because they say with us if you want to hide information, you must hide it in a book.”.

4.3.2.3 Category 1.3: The focus of the framework

Most participants provided their proposals on what the framework should focus, including examples of those critical factors. When these participants asked what the framework should focus on, participant F1 said,

“For me knowing how to work the land is the most important. Working the land include tilling and testing the soil. I need to know the needs of my land for fertilizing purposes. Training of emerging farmers is also very important and must be included in the framework”.

Participant F5 stated that:

“It must include the farming practices, how to prepare the soil and application of pesticides. It must also include training regarding technology in farming as it is continuously changing.”

Also, participant 7 said:

“The framework must start with the soil. Soil preparation is key because everything starts with the soil. It must also focus on the application of pesticides and herbicides, seed quality, and quality monitoring. We must not forget planting times as well because if you plant too early, you run a risk of damage with rain, and if you plant late, you run the risk of frost, so you need balance.”.

However, Participant F11 provided a different perspective when asked about the critical factors that the framework should focus upon when he said,

“The critical factors that the framework must focus on maize marketing, maize trading and fixing contracts, maize grading, seed selection for specific areas, and planting equipment.”.

The responses from the participants on this theme conclude that there is no quality management available for emerging maize farmers. Moreover, the responses provided guidelines on what the focus of the framework should be. These findings align with the industry experts and literature findings discussed in section 4.2.2.1, which cements the notion advocated that there is a need to develop the framework.

4.3.3 Theme 2: Maize quality affecting factors

All emerging farmers must know and understand the factors that affect maize quality to manage production effectively. However, the interview with the industry experts suggested that even though some emerging farmers know those factors, there is still a knowledge gap that needs to be filled to ensure competency of these factors by emerging factors. This section of the study presents the emerging farmers' findings and summarises these findings to those of industry experts and literature discussed in section 4.2.2.2. This section develops ten categories: planting dates, seed quality, soil quality, fungi and mycotoxins, insects, weeds, chemicals, fertilizer, hygiene, and moisture. All these factors are critical because they directly affect the quality of maize.

4.3.3.1 Category 2.1: Planting dates

Participants were asked how the planting dates affect the quality of maize and were requested to substantiate their answer. The results indicate that most participants understand how planting dates can affect the quality of maize. Moreover, the participants understand the effect that early or late planting may have on maize quality. For instance, Participant F1 reported that *“The weather controls the timing of planting. It is desired to plant in October or November, but sometimes we even overlap into January due to lack of rain. If you plant after the cut-off date of 15 December, you run a risk of having your maize being underdeveloped or damaged by the frost due to the April cold leading to poor quality and quantity.”*

Participant F2 emphasised the importance of rain and their struggles with good weather forecasting when he said, *“Due to the changes in the weather, the rain patterns change a lot; sometimes, we get rain late, forcing us to plant late. We need enough moisture to put the seed down. We need sufficient rain within the planting dates for the maize to grow. We get the rain data on the app and TV, which are unreliable. We need a month worth of data about rain.”*

Participant F7 substantiated by reporting that *“Planting times are critical because if you plant too early you run a risk of damage with rain, and if you plant late you run the risk of frost, so you need balance. We rely on the weather stations and data from the previous seasons to make correct planting decisions.”*

4.3.3.2 Category 2.2: Seed quality and fertilization

Participants were asked to elaborate on how the seed quality affects maize quality, including the seed cultivar. The different perspective was expressed in responses, but 11 out of 12 Participants understood the importance of seed quality and how they affect maize quality. However, only one participant, F1, suggested that seed quality is not important and does not affect the quality of maize when he said, *“Honestly, I do not think that seed affects the quality of maize that much. I have planted different seeds before and I have not seen any differences. A seed just need fertilizer, and it will grow.”*.

On the contrary, participant F4 emphasised the importance of seed quality, including certification and treatment of seeds, reported that:

“You need to get good quality seeds to produce good quality maize. If you plant ungraded seed from a registered company will affect quality. Seeds must be certified or registered with the department of agriculture. Otherwise, you stand a risk of producing inferior quality maize. The seeds need to be treated for insects and pests.”

Participant F7 concurred by saying:

“Before we plant, we shop around for the best seeds, that is, the ones that can perform best for our area. We do that because we understand the poor planting of seeds will lead you to produce bad quality. If I take any seeds that are not best for my area, the seeds might not perform satisfactorily and also affect the quality of maize.”

Regarding fertilisation, participants were asked how the improper application of fertilizer affects the quality of maize. Most participants' responses showed that they understand how the improper application of fertilizer affects the maize quality. Some even qualified their responses by explaining how under and over-application will affect the maize.

To illustrate this point, participant F3 reported that *“Overapply of fertilizer will burn your plant while under applying will affect the tonnage of your maize. If you use them as advised by the supplier will not affect quality.”*

In support, participant F5 noted that *“Improper use of fertilizer is very dangerous. If you apply less, then your plants will not grow and if you apply more, the plant will burn”*.

Participant F4, on the other hand, raised an interesting point when he linked fertilizer application and soil analysis when he mentioned that *“Fertilizer is a stimulant which stimulates the soil. You must apply the fertilizer properly during planting, and the soil analysis must inform it.”*

This notion was echoed by participant F1, who reported that *“It starts with testing the soil, and that will tell you exactly what your soil need. We receive fertilizer from the government, and they normally give us the one that does not meet the needs of our soil. We must use the correct fertilizer to get good quality maize.”*

Participant F8 summed up this theme nicely when he stated that *“If you do not apply fertilizer properly, you must just forget about the yield and quality you want”*.

4.3.3.3 Category 2.3: Soil quality

Participants were asked to detail how soil quality affects maize quality. All 12 participants seem to understand the impact of soil quality on maize quality. Most even explained the importance of soil analysis to determine the fertilizer needs of the soil.

For instance, participant F3 noted that *“Soil analysis in farming is crucial. You need to know your soil. You need to know if your soil is loamy or sandy. This is important for water retention, which can cause crop loss at a later stage. Soil analysis is also important for fertilizer application because you will know exactly which fertilizer to order.”*

In agreement was participant F8, who said, *“I always perform soil analysis just to check the need for fertilizer because if you do not do that, you will not get good quality maize”*. However, there were discrepancies as to how often should a soil analysis be conducted.

For instance, participant F 9 suggested that he conducts soil analysis every two years when he reported that *“Every two years I analyse my soil to know the PH of the soil.”*

Participant F10 reported that he conducts soil analysis every three years when he said, *“Soil quality affects the quality of maize. You need high potential soil to get quality maize. I do soil analysis every three years to identify the soil potential of the soil.”*

Participant F12 reported that he tests his soil every year when he stated that *“Before you start doing anything, you need to do a soil analysis to know the status of your soil. It will also help you understand the fertilizer you need. I do the soil analysis every season before planting.”*

4.3.3.4 Category 2.4: Fungi and mycotoxins

When asked about the effect of fungi on maize quality, few participants were able to show their understanding of the subjects. Some even went on to explain how they should be controlled.

For instance, participant F2 showed some understanding of the damage caused by fungi on maize when he stated that *“Fungi cause severe damage on maize. It can cause maize to rot. It can be stem or corb fungus.”*

On the control part, participant F1 reported: *“We defeat fungi by using GMO cultivars. Since using this cultivar I have never had any problems with fungi. We also rely on fungicides. I have never been bothered by fungi.”*

Participant F4 added that *“If you do not control the fungi they will adversely affect the quality. Ask those who know to advise on which pesticides to use. The experts must give you advice on which pesticides to use. I have had the fungi on my farm because I do prevention. Controlling the fungi is important because infected maize shrink, they change colour, and they stink.”*

Some participants, such as F10, F11 and F12, did not have a slight idea about fungi.

Participant F11 reported that *“Fungi is like worms; heat eat the roots of the plants.”* While participant F12 noted that *“Fungi such as armyworms will affect the quality very much. That is why you have to visit your field every day and contact the chemicals rap si you see anything.”*

Participant F9 stated that *“I do not know how they affect quality because I have never had a problem of fungi in my farm. In the past two years, I have been working with the ARC to conduct research, and their research showed that my farm does not have any fungi”.*

All 12 participants seem not to know about mycotoxins when asked how mycotoxins affect the quality of maize. Participants F3, F6, F7, F8, F9, F10, and F11 responded by saying they do not know mycotoxins.

Participant F1 indicated that mycotoxins are not important when he said, *“What are mycotoxins? I do not worry about those things. 99% of black people eat pap every day, some more than three times per day and have no problems.”*

Participant F3 added that *“I only know that they cause maize to be toxic”*, while participant F4 claimed that he had some idea about mycotoxins when he reported that *“Yes, I have heard about them, but I cannot explain what they are. I just know that they are bad.”*

4.3.3.5 Category 2.5: Insects

The participants were asked during the interviews how do insects affect the quality of maize. The responses suggest that most emerging farmers understand the damage the insects can inflict on the maize and how that affects the quality of the maize.

Participant F4 showed his understanding when he reported that:

“Insects such as stock borers waken the stem, and they eat the stem and the crop itself, resulting in poor quality. So it is very important to control the insects to preserve the quality.”

Participant F7 added that:

“Insects are crucial in quality management. They can be disastrous if you do not control them properly. For instance, last year we had a great loss due to bollworms. By the time we realised their presence in the maize, the damage was already big.”

Moreover, some participants, such as participant F1, explained the importance of the insects on maize quality and how insects are controlled when he reported that:

“We do not have insects. We kill them with pesticides. But I know locusts are dangerous and can eat your entire maize crop.”

In support, participant F9 explained that:

“Insects like worms damage your maize and eat them if you do not control them. I apply to pesticides seeds to make sure that I do not have problems with the insects.”

4.3.3.6 Category 2.6: Weeds

When asked about the effect of weeds on the quality of maize, most participants elaborated on the effect they have on the maize and maize quality. They showed an understanding of how the

weeds affect the physiological process of the maize in the field, which leads to the production of poor quality maize.

Participant F 6 explained this vividly and also shared a practical experience when she said:

“You will never have a beautiful maize crop if you do not deal with the weeds because they compete for food with your maize. For example, look at the field that we are facing; we planted maize, and it is not growing because of the weeds.”

Participant F12 concurred by saying:

“The weeds affect the maize by overgrowing it, and it drinks water and eat the food for the maize and gives you poor maize performance. You need to treat them with chemicals to kill them.”

Nonetheless, most participants could not establish a link between weeds and poisonous seeds, even though some understand that the grading process rejects poisonous seeds at the silo. However, only participants F2 and F12 showed an informed understanding.

Participant F2 reported that:

“I have problems with the poisonous seeds, especially the apple thorn. They grow with maize as weeds, and when you harvest, they mix with the maize, and the market rejects your maize because of that.”

In the same vein, participant F12 noted that:

“Some weeds are poisonous like oliboom. It's also time-consuming for the silos to sieve them; that is why they penalize us. They also compete for nutrients with the maize affecting their growth.”

4.3.3.7 Category 2.7: Chemicals

When asked how improper use of pesticides and herbicides affect maize quality, most participants understood that improper application of these chemicals to control pests and weeds could affect the maize quality.

For instance, participant F5 emphasised applying pesticides according to the manufacturers' instructions to avoid affecting the maize quality when he said, *“If you don't follow the instruction*

when applying pesticides, it will affect the maize quality. You must apply them according to the instruction. If you apply less, it will not be effecting in killing the pests, and if you apply more, it will kill the maize.”

The previous sentiments were echoed by participant F7, who reported that *“We have a very supportive guy who advises un on this application of this chemicals. For example, when we had problems with bollworms, he advised us on which pesticides we must apply and how much we must apply. You do not just put the pesticides because if you apply more of these chemicals, they can infiltrate the maize as well and cause problems.”*

Also, participant F6 concurred when she noted that *“Pesticides needs to be applied properly to avoid affecting the quality of maize. Luckily, the supplier does give us the guidelines to follow and the measurements to apply.”*

However, only one participant, F10, mentioned that over application could lead to the creation of pesticide residues that are dangerous to the health of humans and animals consuming the maize when he reported that *“If you overspray you might kill the plants or affect the quality of maize. Over application can also get into the maize and becomes dangerous to the people eating the maize.”*

Most participants, such F2, seemed not to believe that pesticide residues existed when they said, *“Overspraying will affect the quality of the maize. Pesticides residues do not exist. We should have had complaints by now.”*

Participant F9 suggested that over-spraying could only affect the farmer's pockets as they would be wasting money when he noted that *“If you apply more, I think you will be wasting your money. I do not think that applying more will cause any damage to the maize quality.”*

4.3.3.8 Category 2.8: Hygiene

Participants were asked how hygiene affects the quality of maize during the harvesting and maize delivery in particular. The responses to the interview questions suggest that most participants understood the effect that hygiene might have on the maize quality.

When asked to explain the effect of hygiene on maize quality, participant F2 said, *“Soil and foreign matter will get into the maize if you are not hygienic”.*

Similarly, participant F4 reported that *“Transportation and delivery of your maize to the silo is very important. The truck must be clean and always cover the grain if possible because too much dust can lead to the silo downgrading the maize quality.”*

Also in agreement was participant F7, who reported that *“The quicker you get the maize to the silo, the better.. You need to plan properly and check that you do not harvest when it’s raining. Before we start harvesting, we clean the harvester and the trucks, check for rust and clean all the trailers. We also check if there are no insects in the truck. All those will affect the quality of the maize.”*

Participant F5 concisely summarised the importance of hygiene on maize quality when he said, *“Hygiene is very important. If you do not practice hygiene, things that are not supposed to be in the maize will get into the maize, affecting the grade at the silo. So it would be best to clean the harvesting implements and the delivery trucks when you transport the maize.”*

4.3.3.9 Category 2.9: Moisture

Participants were asked during the interviews why is the correct moisture content important after harvesting maize. The response to the interviews indicated a good understanding of the subject. Moreover, different perspectives were presented by the participants to qualify their understanding of the subject.

One participant, F5, focused on the silo moisture requirements and the need to consult with the silo before delivering when he reported that *“Moisture is the requirement at the silo, so you need always to make sure you meet the requirements of the silo. You must harvest the maize when it is dry because when it is wet, it will rot at the silo, and the silos do not want that. So before harvesting, you must take a sample to the silos, and they will tell you if it is ready for delivery.”*

Another participant, F4, emphasised the financial repercussions of delivering maize to the silo outside the requirements when he noted that *“You must harvest on time and secure the correct moisture. The moisture must not be too dry because you will lose money on the weight. If it is too wet, they will charge drying costs.”*

In support, participant F9 reported that *“When the maize is harvested drier you lose the weight and if it is wet then the silo will charge you the drying costs.”*

Another perspective was given by participant F7, who focused on the damage caused by harvesting maize at the wrong moisture when he said, *“You harvest when the maize is still wet you run the risk of mould developing on your maize. I have seen the mould in action in our small silo that we have here on the farm. Last year we stored maize with higher moisture, and it was affected by mould.”*

In support, participant F11 reiterated that *“Moisture must be 10 to 14%. When the maize is dry, less than 10%, the harvester will break the maize and affect its quality. When the maize is over 14%, it will get rotten at the silo, so they reject it”.*

The responses from the participants about this theme conclude that most emerging farmers know the factors affecting the quality of maize. However, their full comprehension still needs more to be desired. These findings corroborate with those by the industry experts and literature discussed in section 4.2.2.2.

4.3.4 Theme 3: Quality grade takers

Grain grading is very important as it is the only process used to decide the price of maize the emerging farmer's farmer receives when delivering grain at the silo. The study sought to present the findings from the merging farmers about their competency in the maize quality grade determination. This presentation of results complements the findings from the industry experts discussed in section 4.2.2.3, who unanimously agreed that emerging farmers do not understand the grading processes and are not competent in maize grading. The link between the findings from the emerging farmers, literature and emerging farmers is also summarised.

The participants were asked through the interviews why it is important to determine the grades of maize and how many grades of maize are available. Moreover, to evaluate their competency in grade grading, the participants were asked how knowledgeable they thought they were regarding the maize grading process, and were asked about some parameters used to determine the grade, such as the sample size, accepted moisture, defective maize, foreign matter, and other colour maize. This section is broken into three categories: the importance of maize grading, grades of maize, the grading process, and grading parameters.

4.3.4.1 Category 3.1: The importance of maize grading

The participant's responses to why it is important to determine the grades of maize suggested that the participants understand why it is important to grade maize. Participants F3 and F5 emphasised the relationship between grading and maize price.

Participant F3 reported that *"It is important for the quality of foods. It is actually to determine quality. Not meeting the grade will affect your selling price, and you will get less money."*

In support, participant F5 noted that *"Grading is done to tell you the grade and the price. The high the grade, the more money you get. Grade 2 and grade 3 decrease the price."*

On the other hand, participant F8 focused on the safety of the maize when he said, *"They do it to determine if the maize can be used for human consumption or animal feed."*

Similarly, participant F11 reiterated the point about the safety of maize while also dealing with the leanings that comes out of the grading process when he said, *"Grading help me to go back and identify where I went wrong, particularly when we are given lower grade at the silo. Grading is important*

to determine the quality of maize. They need to know if the maize is good for human consumption or feed the animals.”

Participant F10 concluded by raising a very pertinent point about the challenges faced by emerging farmers due to the lack of competence in maize grading when he reported that, *“It is very important that we must know the grading process because sometimes at the silo they will tell you that you maize is grade 2 when it is not. At that time, it is a grade1, but you cannot argue with them. Last year at the silo, they said my maize is grade 3, but I did not argue with them even though I did not agree with them.”*

4.3.4.2 Category 3.2: Grades of maize

The question about the number of grades available on maize showed that most participants know the number of different grades available and named the three grades correctly.

On the contrary, only participants F4, F7, F8, F10, and F12 incorrectly reported four grades of maize.

When asked to name them, participant F4 said, *“I know four grades, 1 to 3 and disqualified grade”*

Participant F7 said, *“We have four grades, grade 1 to grade 4”*

Participant F 8 reported that *“There four grades but I do not know them”*, farmer 10 reported that *“There are four grades of maize. There is grade 1 to grade 3 and the dead grade.”*

Lastly, participant F 12 reported that *“There are four grades. Grade 1 to grade 3. There is also a super grade that is above grade 1.”*

4.3.4.3 Category 3.3: Grading process

The interview questions about how knowledgeable they are about the grading process suggest that all participants do not understand the maize grading process. The responses also suggest that all the participants are grade takers at the silos as they accept whatever outcome comes out of the grading process from the silo. Participants F3, F4, F6, F8, 10, and F11 reported knowing the grading process, but they cannot grade themselves.

Participant F1 reported that:

“I do not know the process, but I always watch them when they grade. I do not understand how the silo machines determine the percentages. However, I think It will help very much if I knew the process. I have taken the maize to different silos and gotten different grades.”

Participant F7 noted that:

“I have been exposed to the grading process before. I had a friend who was a silo manager, so he took me through a step by step on how to grade, but it was too quick for me. But, if you give me maize to grade, I won't be able to grade it myself.”

Participant F12 reiterated that:

“I do not know how to grade, so we rely on the silo for the grade. But I can tell with my eyes if the maize is bad or not because I do not have the machines.”

4.3.4.4 Category 3.4: Grading parameters

The participant's responses to the questions about the parameters used to determine the grade, such as the sample size, accepted moisture, defective maize, foreign matter and other colour maize, vividly showed a lack of knowledge in the grading of maize by all participants. The responses here correlate with the previous question about how knowledgeable the participants think they are regarding the maize grading process. All the 12 participants did not know the sample size used for grading, how much foreign matter is acceptable, the percentage of other colour and pinked kernels are accepted.

About the foreign matter, most had a slight idea of what foreign matter is but all did not know how much is accepted at the silo.

For example, participant F2 reported that:

“Foreign matter is the pieces of the crop that has been crushed. I do not know how much is permissible.”

Similarly, participant F3 stated that:

“Foreign matter are the stuff that are sieved at the silo. They are not maize. I do not know how much is allowed.”

Also, participant F5 concurred when he stated that:

“Foreign matter refers to grass, part of the cob and another thing that is not maize. Those things are not allowing in large quantity. I do not know the exact percentage that is allowed.”

Also, varying responses were submitted when the participants were asked about the moisture level accepted at the silo.

For instance, participants F1, F4, F7 and F10 reported that the silos accept up to 14% moisture on maize. On the other hand, participant F2 noted that the silo receives the maize at 13% moisture, participant F5 reported 12% as the accepted moisture at the silo. In contrast, participant F8 noted that 10% is the accepted moisture.

Participant F3 stated differently, *“We deliver on 11, 11.5 to 12%. Sometimes they accept from 16%. However, 11 is the cut-off.”*

Lastly, participants F6 and F9 said they do not know what the accepted moisture is. The silo decided if the moisture is correct.

The responses also showed a lack of proper understanding of what constitutes defective kernels on maize. For instance, participants F1, F5, F6, F8, F9 and F11 responded by saying they do not know what constitutes defective maize when asked. However, few participants, such as F2, F3, F7 and F12, mentioned some of the factors that constitute defective kernels, but that was insufficient to prove competency.

In support, participant F2 reported that *“I know frost damage and different coloured maize.”*

Participant F3 noted that *“I think maize is defective if it cannot be classified to any grade. They look for water damage, frost damage and when the maize is rotten.”* also, participant F12 stated that *“They look for rotten and brown maize. They also look for mixed colour maize due to crossing over. They also check for maize with insects.”*

Lastly, participant F7 displayed a better understanding from all other participants when he reported that *“Defective maize is the Maize eaten by insects, frost-damaged, immature maize, maize with spots.”*

The responses from the participants about this theme conclude that emerging maize farmers are not competent in maize grading. These findings align with the industry experts' findings, who came to the same conclusion in section 4.2.2.3.

4.3.5 Theme 4: Quality inspections

Quality field inspections are a great tool for emerging farmers to check their fields to identify irregularities regularly. These findings from the interviews of industry experts suggested that emerging farmers have a quality management process in the form of field inspection, which they conduct regularly. Therefore, this part of the study presents the findings from emerging farmers and summarises findings related to those of the industry experts discussed in section 4.2.2.4.

In order to evaluate the participants' understanding of quality management processes and quality inspections, the participants were asked through the interviews what processes were in place from planting to harvest to ensure that maize produced meets the quality standards. Participants were also observed while inspecting the field on the interview day to ascertain the validity of the responses (discussed in section 4.5).

4.3.5.1 Category 4.1: Field inspections

The responses showed that all twelve participants had inspection processes to ensure that the quality of the maize is checked regularly. They also had mitigating practices, mostly in the form of readily available people to call for help after identifying any irregularities. Those people include agronomists, suppliers for chemicals and fertilizer, extension officers, other farmers and mentors. The only discrepancy was on how regular each participant visited the farm.

Participant F1 reported that:

“I go to the farm every two days to inspect the maize for any regularities, and If I see something fishy, I contact the agronomist immediately. On my last visit to the field, I discovered part of the maize turning yellow, and I immediately called the agronomist to come to check.”

Also, participant F4 noted that:

“A farmer must go into the land to check what is foreign in his eyes. Check if the weeds are thoroughly controlled. Open up the maize to check for worms and other pests. The farmer needs to be observant from planting to harvest. I visit my farm about four times a week if I am available. If I pick up any problems, i alert the farmers around me, the department of agriculture, the pesticides company or any knowledgeable person who can give advice.”

Participant F7 stated that:

“I do inspections of the field once a week. First, I check the general cleanliness of the field. I inspect the maize in different stages, I check the uniformity of the plants. I also look for the general health of the plants. The other day I found aphids, and I was scared only to find that its nothing that important. We also inspect the roots as to how deep they go.”

Lastly, participant F9 stated that:

To visit the land is very important. Many things can happen, so you need to visit the farm every time. You must inspect maize at a close range, check if there is nothing on leaves like spots, check for insects on the leaves. I go to the farm two times a week. If I see anything funny, I consult my mentor for help.

The responses from the participants about this theme unanimously conclude that emerging farmers inspect their fields regularly to identify problems early and seek help when needed. This finding aligns with the findings from the industry experts and literature discussed in section 4.2.2.4.

4.4 FINDINGS FROM DOCUMENTS REVIEW

This study section involved reviewing relevant documents as part of triangulation, including the interviews and observations. The document review was done specifically to supplement the interviews for the first three research questions, namely, to determine the critical factors involved in the development of a quality management framework, to assess the competency of emerging farmers on factors affecting maize quality and grain quality standards by the emerging farmers, and to assess the competency of emerging farmers in maize quality standards (Maize grading).

The results from the document reviews corroborate with the results of the interviews as they suggest a lack of a quality management framework for emerging farmers. The documents used include published articles, farming magazines, Senwes newsletters, integrated reports, internal documents, and articles. Still, on the first objective, the documents suggest the critical factors involved in developing a quality management framework for emerging farmers include finance, soil quality, maize hybrids, training, pests, climate change, farming practices, farming resources, planting dates, weeds, and others. However, regarding the second and third objectives, there was no information in the documents suggesting the competence of emerging farmers on grade grading and the factors that affect the quality of maize.

4.5 FINDINGS FROM OBSERVATIONS

This section of the study involved conducting observations while the emerging farmers were busy doing their routine field inspections for quality. This was done to complement and triangulate the interviews to fulfil the last research objective, which was set to determine what grain quality processes meet the product quality standards.

The findings of this section corroborate with the finding of the participant's interviews regarding inspections. While doing the inspections, the participants explained the research of what they were checking on the field. The participants inspected the field for impurities and contaminants, the presence of weeds, the general cleanliness of the maize field, diseased plants, insect and worms damage, general condition of the maize crop, and uniformity of the plants.

4.6 SUMMARY OF FINDINGS

This chapter focused on the data analysis and the presentation of findings. The semi-structured interviews were analysed using thematic analysis techniques, and four preconceived themes emerged from the research data. The data from the interviews were triangulated with the document analysis and observations. Seventeen participants were interviewed, made up of five industry experts and twelve emerging maize farmers. The major findings of the study are summarised below.

There is currently no quality management framework that is tailor-made for emerging farmers. All participants agree that there is a great need to develop such a quality management framework for emerging maize farmers. The framework must focus on finance, soil quality, maize hybrids, training, pests, climate change, farming practices, farming resources, planting dates, weeds, and other related.

Most emerging farmers understood how critical factors such as planting dates, seed quality, soil quality, insects, weeds, improper application of chemicals (pesticides and herbicides), improper fertiliser application, poor hygiene, and inappropriate moisture content could affect the maize quality. However, the challenge was understanding fungi, mycotoxins, and pesticide residues, which can have detrimental effects on humans and animals that consume contaminated maize.

All emerging farmers who participated in this study are not competent in the grading process to determine the correct grade of maize. However, most understand why is the grading process important and how they will benefit if they know how to grade maize. Most were aware of the number of grades available even though they do not know how to determine them.

All twelve participants had inspection procedures in place to ensure that the maize quality was monitored regularly. They also had mitigation practices, mostly in the form of readily available individuals contacted for assistance if any anomalies were discovered.

The next chapter interprets the study findings and subsequently provide the quality management framework for emerging maize farmers.

CHAPTER FIVE

INTERPRETATION OF FINDINGS AND THE FRAMEWORK

5.1 INTRODUCTION

In qualitative research, interpretation of findings entails summarizing overall results, comparing findings to the literature, discussing emic perspectives on the findings, stating limitations and recommending future research (Creswell & Creswell, 2017:198). Care must be taken with regards interpreting the results and giving them context. Rather than simply presenting the data, the interpretation of findings entails making judgments. The interpretation should explain how the results relate to the study's research objectives and the attendant questions. Furthermore, the research consequences for the related theories upon which the study is based in the literature review should be discussed (Saunders *et al.*, 2016:640).

This study aimed to investigate if a quality management framework could be developed for the farming industry, specifically for emerging maize farmers. The fact that emerging farmers still struggle to meet minimum production requirements in terms of quality and quantity inspired the conception of this study (Ramogodi & Pelsner, 2020:1). Furthermore, the need for emerging farmers to succeed in South Africa has enabled researchers to proffer solutions to assist them. Thus, quality management has been identified as one of the solutions that could increase the overall performance of emerging farmers, hence the need to develop a quality management framework specifically designed for emerging maize farmers. An inductive approach was used to establish four objectives to address and effectively respond to the overall aim of this research study.

This chapter presents the interpretation of the results, followed by the recommendations, which include the proposed quality management framework for emerging farmers. The findings are based on a phenomenological qualitative study - hose findings emanate from face-to-face, semi-structured interviews obtained from five industry experts and 13 emerging maize farmers. Moreover, the interpretation of the study's results based on thematic analysis of data from semi-structured interviews, document reviews, and observations are discussed. The results are interpreted according to the objectives listed below, which are synonymous with study themes. The interpretation involves summarising the study findings, comparing the findings to existing literature, and providing the researcher's viewpoints with regards the findings.

Aim

This study aimed to develop a quality management framework for the farming industry, particularly emerging maize farmers.

Objectives

- To determine the critical factors involved in the development of a quality management framework
- To assess the competency of emerging farmers on the critical factors affecting maize quality and grain quality standards by the emerging farmers
- To assess the competency of emerging farmers in maize quality standards (maize grading)
- To determine what grain quality processes are currently in place to meet the product quality standards

5.2 INTERPRETATION OF FINDINGS

5.2.1 Objective 1: To determine the critical factors involved in the development of a quality management framework (Synonymous to Theme 1: Quality management framework)

This objective is synonymous with the first theme, which is concerned with determining the possibility of a quality management framework and the critical factors involved in developing such a quality management framework. The findings show that there is currently no quality management framework that is tailor-made for emerging farmers. Also, there is a need to develop such a quality management framework for emerging maize farmers. These findings are supported by the literature search, which proved that there is currently no quality management framework for emerging farmers. Furthermore, Murphy and Leonard (2016:1104-1107) purport that many quality management frameworks are available, but most are not applicable for small business environments. Also, they argue that researchers have not addressed this paucity by developing a more user-friendly, specific, and simpler 'fit-for-purpose' framework for small businesses. Therefore, this supports the need to develop a quality management framework specific to emerging maize farmers.

The importance of developing this framework is supported by Maponya *et al.*, (2018:421), who emphasise that quality management is central to emerging farmers' well-being because their income depends solely on quality and quantity (Ramogodi & Pelser, 2020:1). However, Laux *et*

al., (2015) warn that issues such as cost of implementation and the use of an accessible and comprehensible language must be considered when developing the quality management framework. This is very important because most of the available frameworks, such as the new quality award models (MBNQA and EFQM), ISO 9000 QMS and Total Quality Management (TQM), are expensive to implement. Furthermore, the language utilised in these frameworks is difficult for emerging farmers to comprehend. This is a clear indication that this framework was developed for big business, which further strengthens the need to develop a quality management framework for emerging maize farmers.

The finding further shows that the framework must focus on finance, soil quality, maize hybrids, training, pests, climate change, farming practices, farming resources, planting dates, and weed eradication through proper management. Focusing on these factors in the development of this framework is crucial because these factors directly affect the quality of maize. In support, Van Aswegen, (2011:1-15) emphasises that maize quality could be affected by many factors such as grains, insects and pathogens, foreign matter, and hazardous substances such as pesticide residues, mycotoxins, and moisture content.

5.2.2 Objective 2: To assess the competency of emerging farmers on the critical factors affecting maize quality and grain quality standards by the emerging farmers (Synonymous to Theme 2: Maize quality affecting factors)

The second objective strove to assess the competency of emerging farmers on factors that directly affect maize quality. The findings are divided into ten subsections and are subsequently discussed.

Planting dates

The results established that most emerging farmers in this study understand how planting dates affect maize quality. Farmers are also conscious of the effect of early or late planting on maize quality. They understand that early planting can result in immature maize plants, while late planting can damage the maize through frost damage. Planting maize at the wrong time in the growing cycle can result in catastrophic losses (Aswegen, 2018; Ramogodi & Pelsner, 2021:1). Wrong planting dates will result in severe heat and mid-summer drought during the most vulnerable growth stage (flowering stage), putting the maize crop's survival at risk. On the other hand, late maize planting often results in frost-damaged maize, with wrinkles on both sides of the crown kernel and a pear-like appearance (Aswegen, 2018; Ramogodi & Pelsner, 2021:1). Considering all the challenges stated above, it is important to plant maize only when the planting conditions are ideal (Ramogodi & Pelsner, 2021:1).

South Africa's maize planting season lasts from October to mid-December. This period provides the ideal conditions for the maize crop to survive the harsh month of January when the crop's survival and fruition is checked by extreme heat and low rainfall. The maize crop does not then grow to full size until winter frosts begin in late April. In essence, adequate soil temperature and groundwater are needed for planting to begin. Germination is normally only possible if a minimum air temperature of 10 to 15 °C is sustained for seven days in a row. There is essentially no germination that occurs below 10 °C (du Plessis, 2003:13; Ramogodi & Pelser, 2021:1).

Seed quality and fertilisation

The findings show that most emerging farmers in this study understand the importance of seed quality, including seed cultivar and how they affect maize quality. Mostly advised by the suppliers of seeds, emerging farmers comprehend that they need the best seeds suitable for their area. The best planting seeds are made up of high-quality seeds and cultivars (Aveling, 2012). Seeds that are pure, stable, viable, and vigorous are considered high-quality seeds. Seed quality characteristics and insect resistance, heat tolerance, drought tolerance, and other traits are all present in good cultivars. The use of farmer-saved maize seeds by emerging farmers should be discouraged because they are often of low quality. The use of low-quality maize seeds for planting generally results in low yields that eventually cascade into significant financial losses. Seed-borne diseases, poor germination, and the presence of weed seeds may all contribute to low yields (Barnard & Calitz, 2011; Ramogodi & Pelser, 2021:1).

Soil quality

The results show that all 12 new farmers are aware of how soil quality affects maize value and quality. Furthermore, most new farmers are aware of the value of soil analysis in determining the soil's fertilizer requirements. Soil quality is described as the soil's ability to work within an ecosystem in maintaining maize crop health and a clean environment (Bünemann *et al.*, 2018); Maddonni *et al.*, 1999; Ramogodi & Pelser, 2021:1). Poor soil quality results in poor maize crops and a significant financial loss for emerging farmers. As a consequence, it is important to understand the soil's consistency and contents to supplement what is lacking. For example, improper fertilization due to a lack of awareness of the soil content may result in poor quality maize crop. Another factor contributing to poor maize crop production is the soil's ability to retain moisture, as South Africa is an arid country. The maize is often grown in this dry land, presenting severe challenges for emerging farmers. As a result, the soil must be evaluated for functionality factors such as soil potential, soil type, and soil nutrients before beginning maize production. Emerging farmers must understand the types of fertilizers needed to produce a good maize crop, but this could be impossible if the soil's functionality is unknown. Based on this scientific

observation, it is important to collect a soil sample and have it assessed by an approved laboratory before planting (Ramogodi & Pelser, 2021:1).

Fungi and mycotoxins

The findings show that the minority of emerging farmers understand the effect that fungi have on maize quality. They also acknowledge the importance of controlling those fungi. However, all emerging farmers in this study evinced a lack in understanding of their effect on maize quality regarding mycotoxins. Maize fungal diseases have a big impact on maize quality and quantity. The fungi that cause ear rots are particularly critical because they directly impact the quality and quantity of maize grains. Some of the fungi that cause ear rot produce mycotoxins harmful to humans and animals that consume maize products (Ramogodi & Pelser, 2021:1; Thompson & Raizada, 2018). Mycotoxins are secondary metabolites formed by specific fungal species when conditions are ideal during processing, storage, and transportation of maize (Meyer *et al.*, 2019:2; Ramogodi & Pelser, 2021:1). Farmers, especially some emerging farmers, exacerbate the problem of fungi-infected maize and mycotoxin by using untreated seeds from the previous season, planting late in the season due to changes in rainfall patterns, encouraging pests and diseases through crop monoculture and zero-tillage agriculture, and failing to control insects such as stock borers that spread fungal infections (Alberts *et al.*, 2019:1; Ramogodi & Pelser, 2021:1).

Insects

The findings show that most emerging farmers understand the damage that insects can inflict and how that affects the quality of the maize. Emerging farmers are usually hit hard by insect outbreaks because they lack the financial resources to replant if their entire crop is lost, forcing them to abandon farming altogether. Numerous grain insects attack maize crops, causing significant yield and quality losses. Insects can wipe out a large portion of the harvest or cause cavities in the germ or endosperm of maize kernels, thereby downgrading the maize quality. The biggest threat to emerging farmers is new invasive pests like stem borer and fall armyworms, which can spread quickly and damage maize production (Botha *et al.*, 2019; Ramogodi & Pelser, 2021:1; Van den Berg, 2017). The most recent threat is an outbreak of cutworm infestation, which has developed resistance to chemical treatments and has the potential to cause significant damage to maize crops (Dempsey, 2020; Ramogodi & Pelser, 2021:1).

Weeds

The findings show that most emerging farmers understand the effect of weeds on the maize and how that affects the quality of the maize. Weeds, particularly for emerging farmers, can result in a devastating loss of maize crop and poor maize quality due to poor weed management practices and a lack of resources. Weed management by emerging farmers is often hampered by

inadequate use of mineral fertilizers and herbicides and a lack of weeding labour, which causes weeding to be delayed to a point where economic harm cannot be prevented (Mhlanga *et al.*, 2016; Ramogodi & Pelser, 2021:1). When harvested with maize, some of these weeds produce poisonous seeds. Poisonous seeds are seeds or parts of seeds that, when eaten, are harmful to human or animal health.

Chemicals

The findings indicate that most emerging farmers are aware that using pesticides and herbicides incorrectly to control pests and weeds does affect maize quality. This awareness is based on the fact that these emerging farmers commonly use chemicals in maize production as advised by suppliers of the chemicals. According to Freitas *et al.*, (2017:1), pesticides and herbicides are widely used in grain production and storage to combat nasty insect pests and weeds to protect grain quality and increase food protection. On the other hand, these emerging farmers do not assume that overuse of pesticides would result in pesticide residues harmful to human and animal health. According to Akoto *et al.*, (2013:67), the misconception that over application has no impact on maize quality concerns because improper pesticide use, in particular, inadvertently results in residues in grains and the environment (Akoto *et al.*, 2013:67; Mahugija *et al.*, 2017:137). These residues can be harmful to the health of people and animals that eat maize. These pesticides are neurotoxic and carcinogenic, among other things (Ogah *et al.*, 2011:169).

Hygiene

The findings show that most emerging farmers understand the effect that hygiene might have on maize quality, particularly during harvesting and transportation of maize to the silos. It is impossible to overstate the importance of hygiene during maize harvesting and transportation to silos. The foreign matter will become part of the harvest if better hygiene practices are not followed during processing, reducing the maize quality. Foreign matter, which includes any other matter contained in maize grains, is permitted in maize consignments to a limited extent, as long as it does not exceed the admissible levels. Stones, glass, coal, and metals, on the other hand, have a zero-tolerance policy and are thus prohibited in any maize sample. Zero-tolerance contaminants like animal dung and gasoline can also contaminate maize during transportation (Ramogodi & Pelser, 2021:1; Van Aswegen, 2018:1).

Moisture

The findings show that most emerging farmers understand the importance of harvesting maize when the moisture is correct. Moisture content is important for the economic value of maize because it influences efficiency, premiums, discounts, and storability (Hellevang, 1995:1; Ramogodi & Pelser, 2021:1). Due to internal fermentation or external heat, harvesting maize with

too much moisture can cause heat damage to the grain. Excess moisture may also cause sprouted maize to grow roots or sprouts, as well as the shoot or plumules in the germ being visibly discoloured (Ramogodi & Pelser, 2021:1; Van Aswegen, 2018:1). Moisture may also affect important quality characteristics like breakage susceptibility, hardness, and kernel density (Dorsey-Redding *et al.*, 1990:292; Ramogodi & Pelser, 2021:1). Maize is often harmed by biological agents such as insects, fungi, and rodents in the market system. Their growth is affected by various factors, including the moisture content of the grain (Manu *et al.*, 2019:10; Ramogodi & Pelser, 2021:1). Similarly, mycotoxigenic fungi thrive in environments where there is a lot of moisture and relative humidity (Afzal *et al.*, 2017:49).

5.2.3 Objective 3: To assess the competency of emerging farmers in maize quality standards (maize grading) (Synonymous to Theme 3: Quality grade takers)

The third objective strove to assess the competency of emerging farmers in maize quality standards, that is, maize grading. The findings show that all emerging farmers who participated in this study are not competent in the grading process and correctly determining the correct grade of maize. These findings are corroborated by a study conducted by Khapayi and Celliers, (2016:25-28) that showed that 83% of emerging farmers involved in crop production did not have the grading skills required to determine the quality grade of their produce.

The competence of these emerging farmers on maize grading is very important due to the benefits that these emerging farmers can derive from knowing this process. When an emerging farmer is competent about maize grading, they can grade the maize while still at the farm and take maize to the silo with confidence. That confidence is critical because some of these receiving graders at the silo are dishonest while others are incompetent. Therefore, emerging farmers can use the knowledge and confidence to challenge some of those injustices caused by these incompetent and dishonest graders at the silos. In that way, they would stop being grade takers. The importance of not being grade takers should be emphasised because maize quality and quantity are crucial for the marketing of grain, both nationally and internationally (Maponya *et al.*, 2018:421). Besides, the outcome of the grading process is the only thing that determines how much these emerging farmers get paid because the emerging farmer's income is directly proportional to their quality (Maponya *et al.*, 2018:421; Ramogodi & Pelser, 2021:1).

Moreover, when these farmers are competent in maize grading, they can use that knowledge to work backwards to determine where they went wrong. They can also use the same knowledge for continuous improvement purposes. Continuous improvement is key in quality management, as highlighted by Ferrón Vélchez and Darnall (2016:222), who view quality management as a

leading philosophy that encourages continuous improvement within all the activities of the organisation to achieve quality. Additionally, this is crucial because the journey to quality begins with identifying and understanding customer needs and the statutory requirements, which are, in this case, encompassed in the maize grading regulations. Therefore, these emerging farmers do not find it easy to reach the quality journey if they are not competent in grading.

5.2.4 Objective 4: To determine what grain quality processes are currently in place to meet the product quality standards (Synonymous to Theme 4: Quality inspections)

The fourth objective was to determine what quality processes are in place to reach maize quality standards. According to the findings, the twelve emerging farmers who took part in this study had inspection processes to ensure that maize quality was monitored regularly. They also had mitigation processes in place, consisting of contacting readily available individuals for assistance if any irregularities were found. The understanding of quality inspections is crucial for emerging farmers, and they understand that. Literature suggests that farmers should inspect the field within the first 15-20 days after sowing to see if any issues have arisen. This is suitable for doing some initial fieldwork such as weeding, thinning, transplanting, and top dressing. Following that, maize fields should be inspected regularly, and these farmers are well aware of the need (du Plessis, 2003:31-33).

Moreover, they must check the maize and count the plant population once the field is planted and the maize is growing. Understanding what they have helps emerging farmers deal with issues that arise during the growing season. Compacted root systems can cause lodging in strong winds, and a sparse stand is vulnerable to weed competition. As a result, emerging farmers must walk the field, assess their efforts, prepare how to handle their maize harvest, and make changes for the following year (du Plessis, 2003:31-33).

5.3 THE QUALITY MANAGEMENT FRAMEWORK

This section conceptualizes a quality management framework for emerging maize farmers in South Africa (Figure 5.1). This study recommends that this framework be adopted and implemented by emerging maize farmers in South Africa to produce quality maize that consistently meets or exceeds both the customer and statutory requirements. This framework assumes that the financial aspect of farming would have been covered. The conceptualization is informed by interpreting findings, literature and it is specifically underpinned by the Deming cycle, also known as the PDCA cycle. The Deming cycle is regarded as the most sensible concept for

the application agricultural sector in quality management and control (Dudin *et al.*, 2017:287, Ramogodi & Pelser, 2021:1). For this framework, the PDCA cycle is applied according to the suggestions made by Dudin *et al.*, (2015:245) adjusted to the farming context based on four key management categories as follows: the farm's planning activities (Plan), production, harvesting, and transportation maize (Do), quality assurance of the maize (Check), and monitoring of the maize fields including addressing complains, and lessons learned (Act). These four management categories are discussed in detail together with their elements in the following segments.

Plan (P)

This phase includes planning activities that each emerging farmer should engage in before the planting of maize. This is the most important part of the framework because this is where the roadmap to the achievement of quality maize is drawn. Each emerging farmer must be knowledgeable in maize grading by attending training courses that are either formal or informal. Emerging farmers must understand both customer and statutory requirements because the journey to quality begins right there. Also, this is the stage where the emerging farmers must consult to determine which seeds are best for their area. They must plan their planting dates with assistance from available forecasting tools at their disposal. Soil samples should be taken and sent to an accredited laboratory for analysis to verify the potential of their soils and determine the fertilizer needs of their soils. The soils can be analysed every two years.

Do (D)

This phase occurs after the planning phase immediately after planting the maize, and it involves the production, harvesting, and transportation of maize. Fertilizer should be applied as guided by soil analysis results and the supplier instructions, following the soil analysis to determine the soil needs. Fertilizers provide nourishment to maize plants. They replenish the nutrients lost by crops in the soil. Thus, if fertilizers are not applied correctly, maize yields and quality would be drastically decreased. Pesticides should also be applied according to the supplier instructions to control pests such as fungi and insects, which can affect the quality of maize drastically. Eliminating weeds is also important at this stage because these unwanted plants compete for space, nutrients, and water with the maize crop. Weeding should start as soon as possible, typically in an early cultivation phase when the maize is still small.

Check (C)

This is the quality assurance phase in the production process, from planting to maize distribution to the silo. Checks should be in effect during this period to ensure that the whole production process adheres to best practices and complies with legislative regulations. Good hygiene practices should be followed to avoid contamination of the maize by foreign matter that can affect the quality. Good agricultural practices should also be practised because they may reduce the risk of maize contamination. Following best practices for minimizing microbial contamination ensures that the maize produced causes no harm or disease to maize consumers. To ensure that the maize produced is safe for consumption, Good Agricultural Practices should be implemented in tandem with a food safety management system. If food safety standards are not met, consumers can become seriously ill from food poisoning and foodborne illnesses. HACCP is the preferred framework for new farmers to use.

Act (A)

This last phase involves monitoring the maize fields for any irregularities that might affect the quality and quantity of maize. This phase includes addressing those irregularities and taking lessons from resolving them, sharing them with neighbouring farmers and other farming peers. The emerging farmer must inspect their fields regularly or at least three times a week. They must walk the maize fields to look for weeds, the general cleanliness of the maize field, diseased plants, insect and worms damage, general condition of the maize crop, and uniformity of the plants. Each emerging farmer must also compile a database of readily available people to call when they identify any irregularities. The database of those people must comprise agronomists, suppliers of chemicals, suppliers of seeds, extension officers, and other relevant people.

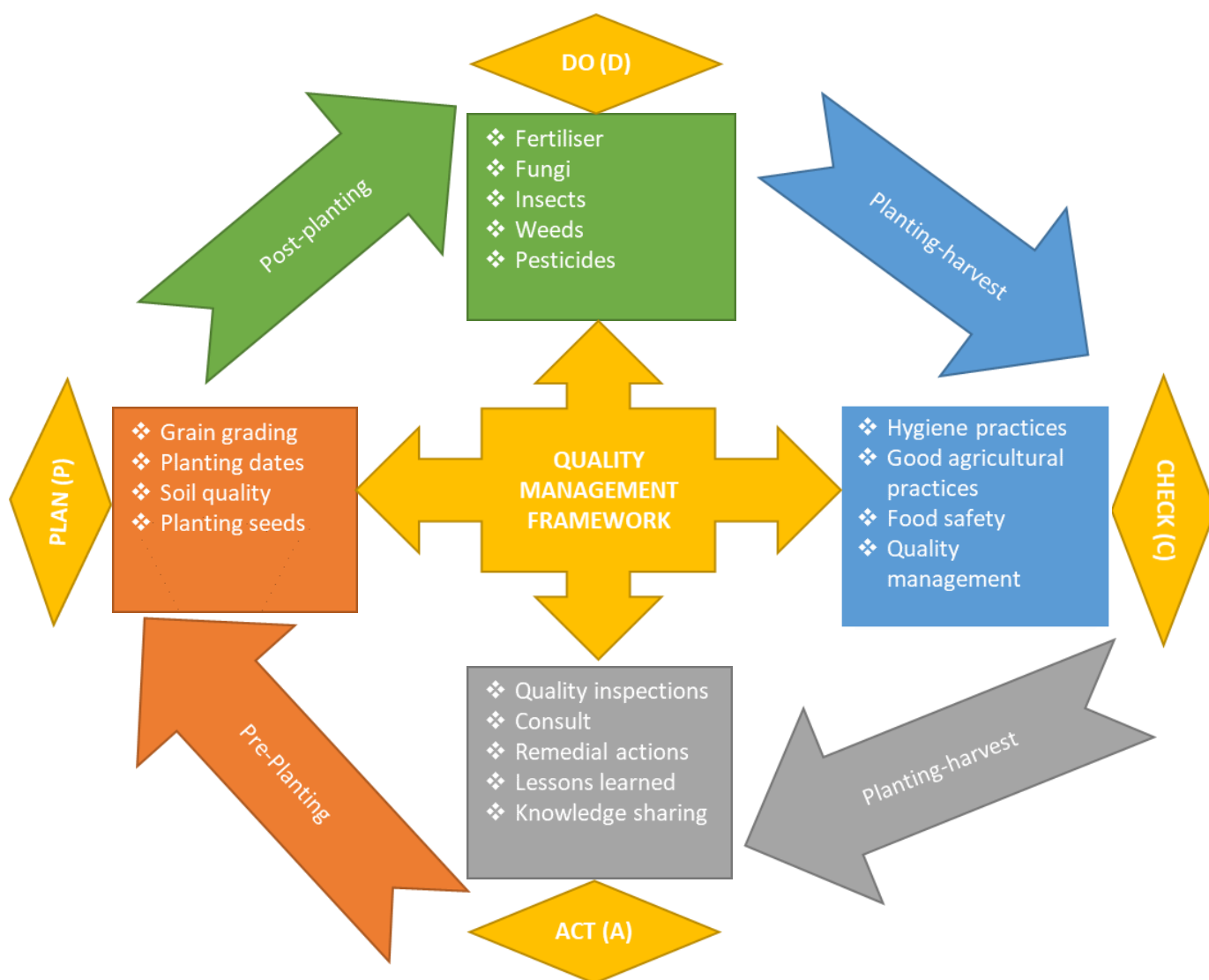


Figure 5.1: A quality management framework for emerging maize farmers in South Africa

5.4 SUMMARY

The interpretation of the results was addressed in this chapter. The recommendations, which included the proposed quality management framework for emerging maize farmers in South Africa, were made after the findings were interpreted. The interpretation process summarised the study results, compares them to established literature, and presents the researcher's perspectives on the findings. The interpretation of the study's findings was discussed arising from the thematic analysis of data from semi-structured interviews, document reviews, and observations. The themes, which are associated with research goals, were used to discuss the interpretation of the findings.

The next chapter concludes the study and reflects on the research journey.

CHAPTER SIX

EVALUATION OF THE RESEARCH, THESIS CONTRIBUTIONS, AND CONCLUSION

6.1 INTRODUCTION

This chapter reflects upon the research study's conclusion. This section of the report, according to Saunders *et al.*, (2016:641), should not present any new material but rather include a succinct conclusion of the entire research study, not just the study findings. The main goal of this section is to address the research question(s), revisit the study's goals, and, if applicable, support or refute the research hypothesis or propositions. The results are also taken into account. The researcher goes back to the literature review and clarifies if these conclusions contribute to interpreting the subject presented in the literature and the practical implications of the findings (Saunders *et al.*, 2016:641-642).

The chapter reflects on the research journey and concludes the study. This reflection includes responding to the research problems that motivated the conception of this study. Moreover, the aim and objectives are evaluated to determine the extent to which they were met. Also, this chapter provides the limitations of the study. The recommendations for future research are given as well as the contributions made by this study.

6.2 RESPONDING TO THE RESEARCH PROBLEM

The general research problem for this study was that even when many researchers have shown the value of quality management to many big organisations, there is still not enough research showing how small businesses, particularly emerging farmers, can leverage quality management to improve their overall businesses and profitability. There are many quality management frameworks available such as the most widely adopted TQM, ISO 9001, six sigma and lean manufacturing, to name but a few. However, all those frameworks are not suitable for small businesses such as emerging farmers.

The specific research problem was that there is no quality management framework for emerging maize farmers to help them improve their maize quality and quantity to increase their overall business performance for sustainability. Thus, this study responded to the research problem by developing a quality management framework specific to emerging maize farmers. However, before developing the framework, a few research objectives were fulfilled, and their outcomes

used as inputs in the ultimate development of the quality management framework. Those objectives are discussed below.

6.2.1 The primary aim

This study aimed to develop a quality management framework for the farming industry, particularly emerging maize farmers. The research aim was achieved by developing a quality management framework for emerging maize farmers presented in the previous chapter.

6.2.2 The primary research question

In line with the aim of the study, the primary question of the study was, can a quality management framework be developed for the farming industry, particularly emerging grain farmers? This research question was answered by the findings of this study that suggested that the development is necessary, and a quality management framework for emerging maize farmers was developed and presented in the previous chapter.

6.2.3 Study objectives

The first objective was to determine the critical factors involved in developing a quality management framework. This objective was achieved, and the critical factors were determined as follows: planting dates, seed quality, soil quality, insects, weeds, improper application of chemicals (pesticides and herbicides), improper application of fertilizer, poor hygiene, and inappropriate moisture.

The second objective was to assess the competency of emerging farmers on the critical factors affecting maize quality and grain quality standards by emerging maize farmers. This objective was achieved. The assessment suggested that most emerging farmers understood how critical factors such as planting dates, seed quality, soil quality, insects, weeds, improper application of chemicals (pesticides and herbicides), improper fertiliser application, poor hygiene, and inappropriate moisture content could affect the quality of maize. However, the challenge was in understanding fungi, mycotoxins, and pesticide residues, which could have detrimental effects on humans and animals that consume contaminated maize.

The third objective was to assess the competency of emerging farmers in maize quality standards (Maize grading). This objective was achieved. The assessment suggested that all emerging farmers who participated in this study are not competent in the grading process to determine the correct grade of maize.

The fourth and last objective was to determine grain quality processes currently in place to meet the product quality standards. This objective was achieved. The determination suggested that all twelve participants had inspection procedures to ensure that the maize quality was monitored regularly. They also had mitigation practices, mostly in the form of readily available individuals contacted for assistance if any anomalies were discovered.

6.3 LIMITATIONS

This study aimed to develop a quality management framework for emerging maize farmers in the selected provinces of South Africa, namely, Free State, Gauteng, and Northern Cape. That was the case in the final analysis.

The researcher would have preferred to interview more farmers. However, Senwes only had only 15 emerging maize farmers in their database, and only twelve accepted the request to participate in the study. Nonetheless, the population and the sampled size provided adequate data to respond sufficiently to the research questions and meet the study's objectives.

Another limitation was the demarcation of the study. The researcher would have been able to open new frontiers for the study to represent all the provinces of South Africa. However, due to Senwes only doing business in three provinces, the study demarcation was restricted. The study only took place in the Free State, Gauteng and the Northern Cape provinces of South Africa.

Access to policy and technical support documents from the organisation funding the emerging farmers was difficult to obtain. Moreover, quality management documents from the emerging farmers that would have helped support the finding of the interviews were not available. However, the available documents, interviews and observations did provide the necessary insight in any case.

Although it did not affect the study's finding, this study was a cross-sectional study of emerging maize farmers funded by Senwes, meaning that data was collected from a population at a specific time. A longitudinal study would have given a perfect picture in that data would have been collected repeatedly from the same population over an extended period.

6.4 RECOMMENDATIONS

6.4.1 Recommendations for future research

- Future research could engage in a study to investigate the effect of implementing the newly developed quality management framework on emerging maize farmers to determine the effectiveness of the framework on improving quality management and the overall performance of emerging maize farmers.
- Future studies may look at a quantitative study with many participants covering all of South Africa's provinces, using a different approach. The research could quantitatively validate the framework to reinforce the study's conclusions, demonstrate its generalizability, and make it appealing to a broad audience.
- Future research could be more succinct through a longitudinal study with the same objectives as this study compared to the current longitudinal study.
- Future research should examine each component of the framework's impact and role in emerging maize farmers' quality management and sustainability journeys.

6.4.2 Recommendations for emerging maize farmers

- Officials and professionals trusted with providing technical support and extension services to the emerging maize farmers should be trained on the implementation of the developed quality management framework.
- In turn, the officials and professionals should induct emerging maize farmers on the quality management framework. The induction must include the benefits of implementing the framework, the contents of the framework, and the implementation process.
- Emerging maize farmers must adopt and implement the framework with assistance from officials and professionals
- Emerging maize farmers should be trained about maize grading processes and the maize quality standards.
- Emerging farmers must be trained on factors affecting the quality of maize.

6.5 THESIS CONTRIBUTIONS

According to McKee (2004:3), there are at least three types of research, namely: research which has validity within the academic environment which contributes to the knowledge base; research which has value within the practitioner environment which contributes to service innovation and service development; and research to inform policy which contributes to policy formulation and development. The current study contributions resonate with all the above-mentioned research foci and their contributions. The contributions made by this study are briefly under four categories: emerging farmers, practical, body of knowledge, and methodological.

Emerging farmers

Emerging farmers could benefit from this study by objecting to valuable quality management information that they can use to improve their overall business performance and providing a sound basis for their sustainability. They could possibly unlock market opportunities, both national and international. They would be emboldened with the maize quality knowledge necessary for survival in the open markets.

Practical

The researcher gained expert knowledge of quality management in primary agriculture. The extension officers now have a framework to guide them when advising emerging farmers. The industry's training bodies have a framework to use while training farmers in general. The policymakers could use the outcomes of this study to develop policies that incorporate proper quality management as essential for emerging farmers' success. The funders of emerging farmers can use the developed quality management framework to adjust their finding criteria. They could also use the framework to train and provide technical support to their emerging farmers.

Body of knowledge

There is currently no quality management framework for emerging maize farmers within the management discipline. This study will add to the discipline's body of knowledge by developing a new quality management framework for emerging maize farmers in South Africa. Articles published from these studies are certainly going to contribute meaningfully to the academic body of knowledge by helping the academic community of interest understand the factors affecting emerging farmers and maize quality and the competency of emerging farmers in maize quality standards and grade grading.

Methodological

Regarding the research philosophy, this study contributes to the beliefs about how data regarding emerging farmer's quality management should be gathered, analysed, and used. Regarding research methodology contribution, this study adds new horizons to how future research could be conceived and designed, data handled and managed, data analysed, interpreted, and reported in agri-business related research.

6.6 CONCLUSION

This chapter concludes a journey taken to develop a quality management framework for emerging maize farmers in South Africa, which is the main aim of this research study. The management problem that this study strove to solve was that there is no quality management framework for emerging maize farmers to help them improve their maize quality and quantity to increase their overall business performance for sustainability. Four objectives were developed to fulfil the study's main aim, with their outcomes expected to be used to develop the framework. The first objective was to determine the critical factors involved in developing a quality management framework, the second objective was to assess the competency of emerging farmers on the critical factors affecting maize quality and grain quality standards by emerging maize farmers, and the third objective was to assess the competency of emerging farmers in maize quality standards (Maize grading). The fourth and last objective was to determine grain quality processes currently in place to meet the product quality standards. All those objectives were achieved following the phenomenological qualitative research method, where data were collected mainly using semi-structured interviews supplemented by documents review and observations. Data analysis was conducted following thematic data analysis techniques where pre-conceived themes were generated. This study contributed immensely to the academic body of knowledge. The biggest contribution was developing the quality management framework for emerging maize farmers in the selected provinces of South Africa.

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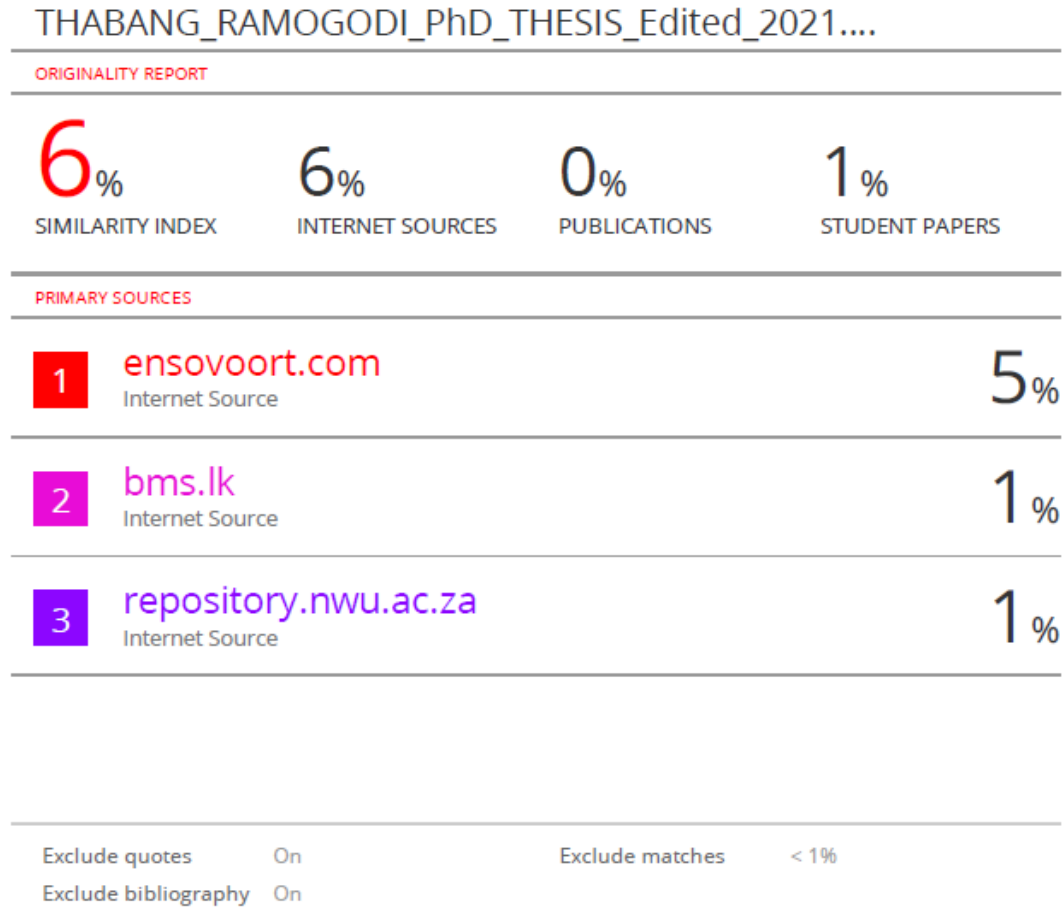
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APPENDIX 1: TURNITIN REPORT



APPENDIX 2: LANGUAGE EDITING CERTIFICATE



Office: 0183892451

FACULTY OF EDUCATION

Cell: 0729116600

Date: 1st September, 2021

TO WHOM IT MAY CONCERN

CERTIFICATE OF EDITING

I, **Muchativugwa Liberty Hove**, confirm and certify that I have read and edited the entire thesis, **A QUALITY MANAGEMENT FRAMEWORK FOR EMERGING MAIZE FARMERS IN SELECTED PROVINCES IN SOUTH AFRICA**, submitted by **Thabang F Ramogodi**, orcid.org/0000-0002-8245-2566, student number **33475172**, submitted for the degree **Doctor of Philosophy in Business Management** at the North-West University

Thabang F. Ramogodi was supervised by **Professor AMF Pelser** of the North-West University.

I hold a PhD in English Language and Literature in English and am qualified to edit such a thesis for cohesion and coherence. The views expressed herein, however, remain those of the researcher/s.

Yours sincerely

Professor M.L. Hove (PhD, MA, PGDE, PGCE, BA Honours – English)



APPENDIX 3: TECHNICAL EDITING CERTIFICATE



Faculty of Education
North-West University
Mafikeng Campus
P. Bag X2046
Mmabatho
2735

23 September 2021

I, **Andrew Mutsvangwa**, confirm and certify that I have technically edited the thesis, **A QUALITY MANAGEMENT FRAMEWORK FOR EMERGING MAIZE FARMERS IN SELECTED PROVINCES IN SOUTH AFRICA**, submitted by student **Thabang Frans Ramogodi**, in fulfilment of the requirements for the degree **Doctor of Philosophy in Business Management at the North-West University**.

Professor AMF Pelser was **Thabang Frans Ramogodi**'s promoter.

I hold a Doctor of Engineering (DEng) in Electrical Engineering degree with a specialization in Computer and Optical Telecommunications Networks and am qualified to technically edit such a thesis. The views expressed herein, however, remain those of the researcher/s.

Yours sincerely

A handwritten signature in black ink, appearing to read 'A. Mutsvangwa', is written over a horizontal line.

Dr Andrew Mutsvangwa (DEng)

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Cell: +27 785980956

APPENDIX 4: FINAL ETHICS CLEARANCE



Private Bag X6001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
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Economic and Management Sciences Research
Ethics Committee (EMS-REC)

31 July 2020

Prof AMF Pelser
Per e-mail
Dear Prof Pelser,

EMS-REC FEEDBACK: 31072020

Student: Ramogodi, TF (33475172)(NWU-00610-20-A4)

Applicant: Prof AMF Pelser – PhD in Business Management

Your ethics application on, *A quality management framework for emerging maize farmers in the Free State province of South Africa*, which served on the EMS-REC meeting of 31 July 2020, refers.

Outcome:

The application for amendments to the study served at the EMS-REC of 31 July 2020. The data collection method and the demarcation was approved. However, kindly consider amending the title to *A quality management framework for emerging maize farmers in selected provinces in South Africa*. The new demarcation is not representative of South Africa. It rather represents only selected provinces where maize is grown.

Due to the Covid-19 lock down ethics clearance for applications that involve data collection or any form of contact with participants are subject to the restrictions imposed by the South African government.

Kind regards,

Mark

Rathbone

digitally signed by Mark Rathbone
DN: cn=Mark Rathbone, o=North-West
University, ou=Economic Management
Research Ethics Committee, email=mark.rathbone@nwu.ac.za,
c=ZA

Prof Mark Rathbone

Chairperson: Economic and Management Sciences Research Ethics Committee (EMS-REC)

APPENDIX 5: ORGANISATIONAL CONSENT FORM



Private Bag X8001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Web: <http://www.nwu.ac.za>

Faculty of Economics and management sciences

Researchers: Thabang Ramogodi

Tel: 082 658 3851
Email: ramogodi@gmail.com

Date: 21 April 2020

TO THE AGRICULTURAL SERVICES MANAGER

PERMISSION TO CONDUCT ACADEMIC RESEARCH USING SENWES FINANCED FARMERS

Mr Thabang Ramogodi (student number 33475172) is currently enrolled as a PhD student in Economics and management sciences with business administration at the North-West University. Your permission is herewith requested to allow Mr Ramogodi to conduct his academic research using emerging farmers that are affiliated to your organisation.

The main aim of this study is to develop a quality management framework for the farming industry particularly emerging maize farmers. The document attached provides an overview of the research project, as well as the interview protocol that will be followed when conducting the interviews.

Your time in considering this request is greatly appreciated. Please sign below to indicate your willingness to participate in this study and return to me at your earliest convenience.

Yours sincerely

Mr Thabang Ramogodi
PhD candidate
North-West university

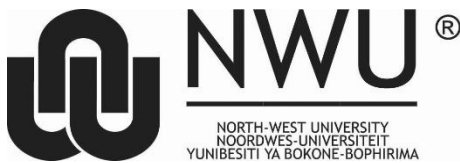
I, Julias Ramohlabi (Manager Agricultural Services), herewith give permission for the to be conducted using emerging farmers that are financed by Senwes

Signature

21 April 2020

Date

APPENDIX 6: INDUSTRY EXPERT INFORMATION AND CONSENT FORM



Private Bag X6001, Potchefstroom
South Africa 2520
Tel: 018 299-1111/2222
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Faculty of Economics and management sciences

Researchers: Thabang Ramogodi

Tel: 082 659 3851
Email: ramogodit@gmail.com

Supervisor: Dr AMF Pelser

Tel: 082 375 6636
Email: ampelser@hotmail.com

Date: 22 January 2020

DEAR INDUSTRY SPECIALIST

PARTICIPANT INFORMATION AND CONSENT FORM

I herewith request your consent to participate in this research, which involves answering a few questions about grain quality management and emerging farming through an interview. The interview will not be more than an hour. Before you give consent, please acquaint yourself with the information below.

The details of the research are as follows:

TITLE OF THE RESEARCH PROJECT

A quality management framework for emerging maize grain farmers in selected provinces of South Africa

WHAT IS THIS RESEARCH ABOUT?

Aim

The main aim of this study is to develop a quality management framework for the farming industry particularly emerging grain farmers.

Objectives

- To determine what the critical factors involved are in the development of a quality management framework
- To assess the competency of emerging farmers in product quality and its management
- To investigate the awareness, perceptions and understanding of grain quality and grain quality standards by the emerging farmers
- To determine what grain quality processes are currently in place to meet the product quality standards.

Participants

The industry experts who are knowledgeable about emerging farmers and/or maize grain quality.

What is expected of you as a participant?

You have been selected to participate in this research due to your outstanding knowledge of emerging farmers and/or grain quality in order to give credibility to the study and also to solicit your expertise and suggestions on how a quality management framework can be created. The study will entail you answering a few questions about grain quality management throughout the entire production process from planting to harvest. The questions will be answered through a structured interview which should not last for more than an hour at a location of your preference.

Benefits to you as a participant

The benefits of this study will include assisting emerging grain farmers to improve their overall business performance and provide a sound basis for the sustainability of their businesses. It will also assist emerging farmers to unlock market opportunities both national and international. Furthermore, this study will embolden emerging farmers with the product quality knowledge necessary for survival in the open markets because there is a direct correlation between the quality of their product and their income.

Risks involved for participants

There are no risks associated with participating in this study. You reserve the right to withdraw at any stage of the research process without any consequence and there are no anticipated consequences of declining or withdrawing from the study at any time during the process. The study has been endorsed by the grain industry and supported by GFADA.

Confidentiality and protection of identity

Information obtained during the study will be kept confidential and will only be used for research. Safeguarding of all participants' identity will receive high priority and the privacy of information and anonymity of participants will be kept protected at all times.

Dissemination of findings

Feedback procedure will entail meetings to discuss the findings of the research and distribution of research findings to all participants.

If you have any further questions or enquiries regarding your participation in this research, please contact the researcher for more information.

Yours sincerely

Thabang Ramogodi

0826593851

DECLARATION BY PARTICIPANT:

By signing below, I agree to take part in a research study entitled:

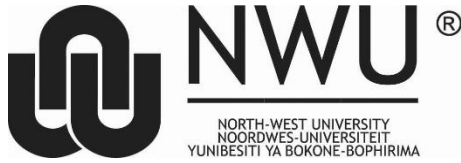
A quality management framework for emerging maize grain farmers in the Free State province of South Africa

I declare that:

- I have read this information and consent form and understand what is expected of me in the research.
- I have had a chance to ask questions to the researcher and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the research process before it has finished if the researcher feels it is in my best interests, or if I do not follow the research procedures, as agreed to.

Signed at (place) _____ on (date) ____/____/20____

APPENDIX 7: EMERGING FARMER INFORMATION AND CONSENT FORM



Private Bag X6001, Potchefstroom
South Africa 2520
Tel: 018 299-1111/2222
Web: <http://www.nwu.ac.za>

Faculty of Economics and management sciences

Researchers: Thabang Ramogodi

Tel: 082 659 3851
Email: ramogodit@gmail.com

Supervisor: Dr AMF Pelser

Tel: 082 375 6636
Email: ampelser@hotmail.com

Date: 22 January 2021

DEAR EMERGING MAIZE FARMER

PARTICIPANT INFORMATION AND CONSENT FORM

I herewith request your consent to participate in this research, which involves answering a few questions about grain quality management and emerging farming through an interview. The interview will not be more than an hour. Before you give consent, please acquaint yourself with the information below.

The details of the research are as follows:

TITLE OF THE RESEARCH PROJECT

A quality management framework for emerging maize grain farmers in selected provinces of South Africa

WHAT IS THIS RESEARCH ABOUT?

Aim

The main aim of this study is to develop a quality management framework for the farming industry particularly emerging grain farmers.

Objectives

- To determine what the critical factors involved are in the development of a quality management framework

- To assess the competency of emerging farmers in product quality and its management
- To investigate the awareness, perceptions and understanding of grain quality and grain quality standards by the emerging farmers
- To determine what grain quality processes are currently in place to meet the product quality standards

Participants

Emerging maize farmers who are affiliated with Senwes.

What is expected of you as a participant?

You have been selected to participate in this research due to your affiliation with Senwes as an emerging maize farmer that is developing. The study will entail you answering a few questions about grain quality management throughout the entire production process from planting to harvest. The questions will be answered through a structured interview which should not last for more than an hour. An audio recorder will be used to record the interview.

Benefits to you as a participant

The benefits of this study will include assisting emerging grain farmers to improve their overall business performance and provide a sound basis for the sustainability of their businesses. It will also assist emerging farmers to unlock market opportunities both national and international. Furthermore, this study will embolden emerging farmers with the product quality knowledge necessary for survival in the open markets because there is a direct correlation between the quality of their product and their income.

Risks involved for participants

There are no risks associated with participating in this study. You reserve the right to withdraw at any stage of the research process without any consequence. There are no anticipated consequences of declining or withdrawing from the study at any time during the process. The study has been endorsed by the grain industry and supported by Senwes.

Confidentiality and protection of identity

Information obtained during the study will be kept confidential and will only be used for research. Safeguarding of all participants' identity will receive high priority, and the privacy of information and anonymity of participants will be kept protected at all times.

Dissemination of findings

Feedback procedure will entail meetings to discuss the research findings and distribution of research findings to all participants.

If you have any further questions or enquiries regarding your participation in this research, please contact the researcher for more information.

Yours sincerely

Thabang Ramogodi

0826593851

DECLARATION BY PARTICIPANT:

By signing below, I agree to take part in a research study entitled:

A quality management framework for emerging maize grain farmers in the Free State province of South Africa

I declare that:

- I have read this information and consent form and understand what is expected of me in the research.
- I have had a chance to ask questions to the researcher and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the research process before it has finished if the researcher feels it is in my best interests, or if I do not follow the research procedures, as agreed to.

Signed at (place) _____ on (date) ____/____/20____

Signature of participant (emerging)

Researcher

APPENDIX 8: INTERVIEW QUESTIONNAIRE FOR INDUSTRY EXPERTS

Date of interview:

Place:

Interviewer:

Interviewee:

Code:

Position of interviewee:

Age of interviewee:

About the project: This study aims to develop a quality management framework for the farming industry, particularly emerging maize farmers in selected provinces of South Africa.

Definitions:

- **framework** - Is a basket of ideas or a structure aimed at providing a guideline on how quality maize can be produced
- **emerging farmers**- are those that fit in between small-scale farming and commercial agriculture in the South African dualistic agriculture system

Themes/interview topics:

Theme A: Quality management framework (s) for the farming industry and emerging maize farmers

1. Tell me about the types of quality management frameworks or systems used by emerging maize farmers?
2. Do you think it is a good idea to develop a specific quality management framework for emerging farmers? Please explain your answer
3. What should the focus areas of that specific quality management framework be?

Theme B: The critical factors involved in the development of a quality management framework

1. Explain the critical factors that are important for the development of a quality management framework?

Theme C: The awareness, perceptions and understanding of factors affecting maize quality and grain quality standards by the emerging farmers

1. Do you think the emerging farmers know and understand the factors that affect the quality of maize before planting? Explain those factors.
2. Do you think the emerging farmers know and understand the factors that affect the quality of maize from planting to harvest? Explain those factors.
3. Do you think the emerging farmers know and understand the factors that affect the quality of maize post-harvesting? Explain those factors.

Theme D: The competency of emerging farmers in maize quality standards (Maize grading)

1. Do you believe that emerging farmers know and understand the grading regulations? Explain
2. Do you think it will be beneficial for emerging farmers to know and understand this regulation? Explain

Theme E: Maize quality processes that are currently in place to meet the maize quality standards

1. What processes are in place to ensure that maize produced meets the quality standards?
 - During the planning phase before planting?
 - From planting to harvest?
 - After harvest?
2. Which preventative actions are taken by the emerging farmer to prevent the quality of maize from deteriorating pre-harvesting?
3. Which preventative actions are taken by the emerging farmer to prevent the quality of maize from deteriorating post-harvesting?
4. What measures are taken by the emerging farmer to identify quality problems early?
5. What are the corrective actions taken to remedy the identified quality problems?

APPENDIX 9: INTERVIEW QUESTIONNAIRE FOR EMERGING FARMERS

About the project: This study aims to develop a quality management framework for the farming industry, particularly emerging maize farmers in selected provinces of South Africa.

Date of interview:

Place:

Interviewer:

Interviewee:

Position of interviewee:

Important definitions:

- **Quality maize** – maize that is classified as grade 1 after the grading process at a silo or processing plant according to the South African maize grading regulations
- **framework** - Is a basket of ideas or a structure aimed at providing a guideline on how quality maize can be produced
- **emerging farmers**- are those that fit in between small-scale farming and commercial agriculture in the South African dualistic agriculture system

General questions

1. Did you sign the consent form?
2. Do you allow us to record this interview using an audio-recorder?
3. How many years of experience do you have in farming?
4. How old are you?

Interview Questions:

Main Research question: How can a quality management framework be developed for the farming industry, particularly emerging grain farmers?

Research question 1: What are the critical factors involved in the development of a quality management framework?

4. Tell me about the types of quality management frameworks or systems used by emerging maize farmers?
5. Do you think it is a good idea to develop a specific quality management framework for emerging farmers? Please explain your answer
6. Explain the critical factors that are important for the development of a quality management framework?

Research question 2: What are the emerging farmer's perceptions and understanding of factors affecting maize quality and grain quality standards?

1. How does the planting date affect the quality of maize?
2. How does seed quality affect the quality of maize?
3. How important is the cultivar of maize being planted?
4. How does soil quality affect the quality of maize?
5. How does fungal infection affect the quality of maize?
6. How do mycotoxins affect the quality of maize?
7. How do weeds affect the quality of maize?
8. How do insects affect the quality of maize?
9. How does the presence of noxious/ poisonous seeds affect the quality of maize?
10. How does the improper use of pesticides and fungicides affect maize quality?
11. How does improper fertilization affect the quality of maize?
12. How does hygiene affect the quality of maize?
13. Why is the correct moisture content important after harvesting of maize?

Research question 3: How competent are emerging farmers in quality management?

1. How many grades of quality do we have for maize?
2. Why is it important to determine the grades of maize?
3. What is the recommended grading sample size?
4. What is the acceptable moisture content during receiving?
5. What constitutes defective maize kernel?
6. How much of defective maize kernels are permissible?
7. How much of foreign matter is permissible?
8. How much of other colour maize kernels are permissible?
9. What do you know about pinked kernels?

Research question 4: What are maize quality processes currently in place to meet product quality standards?

1. What processes and preventative actions are in place from planting to harvest to ensure that maize produced meets the quality standards?