

**AN EVALUATION OF THE ROLE OF PUBLIC AGRICULTURAL EXTENSION  
SERVICES TOWARDS PROMOTING SUSTAINABLE AGRICULTURE IN  
MPUMALANGA PROVINCE, SOUTH AFRICA**

By

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A thesis submitted in fulfilment of the academic requirements for the degree of

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## **ABSTRACT**

South Africa lacks an inclusive policy on sustainable agricultural practices. This has resulted - in the continued over-exploitation of the natural resources by farmers. This study evaluates the role played by public agricultural extension services in promoting sustainable agricultural practices in Mpumalanga province. The framework of this study was adopted from a Framework for Evaluation of Sustainable Land Management (FESLM) which was developed through collaboration among international and national institutions as a practical approach to assess whether farming systems are trending towards or away from sustainability.

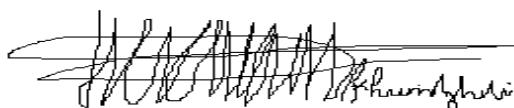
The framework of this study was based on the five-pillared framework: maintaining and increasing biological productivity, decreasing the level of risk to ensure larger security, protecting the quality of natural resources, and ensuring agricultural production is socially acceptable. Most literature refers to sustainability and to sustainable agriculture, citing the common three pillared framework of economic, environmental and social sustainability which falls short of key elements found within the five-pillared framework.

This study argues that the promotion of sustainable agricultural practices remains the domain of public agricultural extension services. The study proposes a need for the establishment of an inclusive policy that deals specifically with sustainable agricultural practices. In order to bring closer the context of the study, the definition of agricultural extension and the role it plays in agriculture is thoroughly discussed. The study also defines sustainable agriculture and why it became imperative in the last decade to expand the focus to the five pillars as a method for measuring outcomes in the future. The study evaluates the role of agricultural extension practitioners in Mpumalanga province in promoting sustainable agricultural practices. It further evaluates the role of extension managers in supporting extension practitioners. In conclusion, the study seeks to provide guidance to policy makers in considering the five pillars of sustainable agriculture when establishing agricultural policy on sustainable agriculture in South Africa. The study supports the need for training of extension managers, extension practitioners and farmers in the discipline of sustainable agricultural practices.

## PREFACE

I, Rendani Humphrey Khwidzhili, affirm that:

- I. The research reported in this thesis, except where otherwise indicated, is my original research.
- II. This thesis has not been submitted in any form to another institution of learning for the purpose of any degree award.
- III. This thesis does not contain any other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from those persons.
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Khwidzhili R.H. (Candidate) August 2019



sworth

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Prof Worth S.H. (Supervisor) August 2019

## **DEDICATION**

This thesis is dedicated to the

**Trinity:**

**God the Father (ALMIGHTY), God the Son (JESUS) and**

**God the Holy Spirit (COMFORTER)**

for giving me the strength during my studies.

The Lord is my shepherd; I shall not be in want...

**Psalm 23 vs. 1-6**

## DECLARATION

I, Rendani Humphrey Khwidzhili declare that the following articles were published and others are still under review in accredited journals as part of this thesis.

**Publication 1- Chapter 2 of the thesis:**

KHWIDZHILI, RH. & WORTH, SH. 2016. *The sustainable agriculture imperative: implications for South African agricultural extension*. S. Afr. J. Agric. Ext. Vol.44. No.2. 19-29.

**Publication 2- Chapter 3 of the thesis:**

KHWIDZHILI, RH. & WORTH, SH. 2017. *Evaluation of policies promoting sustainable agriculture in South Africa*. S. Afr. J. Agric. Ext. Vol.45. No.2. 73-85.

**Publication 3- Chapter 4 of the thesis:**

KHWIDZHILI, RH. & WORTH, SH. 2019. *Evaluation of South Africa's public agricultural extension in the context of Sustainable Agriculture*. S. Afr. J. Agric. Ext. Vol.47. No.1. 20-35.

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My deepest gratitude goes to my wife Fellicia, my daughter Tshilidzi and my son Tshifhiwa for your endurance and support as I had to lock myself in study rooms or be away from home for the purpose of my studies. On several occasions I had to visit my supervisor in Pietermaritzburg, present papers nationally and internationally, collect data throughout Mpumalanga province and other provinces. I acknowledge it's not easy to have a husband or dad who is always travelling, but you kept on supporting me emotionally. My son Tshifhiwa was only six months when I registered for my PhD. May the Almighty continues to bless my family, Amen.

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# CHAPTER 1

## GENERAL INTRODUCTION

### Background of the study

The study was conducted in Mpumalanga province, South Africa. This dissertation is presented in the form of published and publishable journal articles resulting in an overlap of information amongst chapters in this study. Each chapter consist of its own introduction, discussion and conclusion. Chapter 2-4 presents a detailed literature review of the study and also a theoretical framework. The review chapters were published in peer review journals.

The study presents an argument that agricultural extension in South Africa is best positioned to promote sustainable agricultural practices. The study defines the concept of sustainable agriculture and why it became imperative in South Africa to focus on five pillars of sustainable agriculture. The study further insists on the establishment of a sustainable agriculture policy which emphasises the five-pillared framework. The study presents the evolution of agricultural extension from its inception in South Africa. The study draws on existing literature in defining agricultural extension and its role in promoting agricultural practices in general.

The study was conducted in the seventeen municipalities in Mpumalanga province. In each municipality, four extension practitioners were interviewed through a structured questionnaire. The extension practitioners were evaluated on whether or not they promote sustainable agricultural practices amongst the farmers they serve. The study also evaluated the extension managers as to whether or not they support extension practitioners in their promotion of sustainable agriculture.

In conclusion, the study reveals that there is a marginal line of understanding between extension practitioners and their managers with regards to the concept of sustainable agriculture. The study suggests that extension practitioners and extension managers need training and practice in the application of the five pillars of sustainable agriculture. The promotion of sustainable agriculture in Mpumalanga province currently rests on individual expertise and is not formally

coordinated. This is due to a lack of engagement by the governmental institutions responsible for the development of sustainable agriculture on a municipal, provincial and national level.

### **Problem statement**

Promotion of sustainable agricultural practices by Mpumalanga public agricultural extension remain a challenge and therefore need to be addressed. The challenges will require intervention by policy makers, extension managers, extension practitioners and other relevant stakeholders on sustainable agriculture. The interventions should be given a priority to avoid further degradation of the natural resources. The challenges for poor promotion of sustainable agriculture might be as a result of the following:

- Lack of inclusive policy on sustainable agriculture in South Africa
- Lack coordination on sustainable agricultural practices in Mpumalanga province
- Scattered policies for protection of natural resources
- Lack of framework and guidelines to promote sustainable agriculture in Mpumalanga province
- Poor knowledge of extension managers and extension practitioners towards the five-pillared framework

### **Research Question**

This research is driven by the following central question: How can South African government's agricultural extension programme effectively promote sustainable agriculture in the context of the five-pillared framework.

*The above research question gives rise to the following sub-questions:*

- a) What is sustainable agriculture?
- b) What is the role of agricultural extension practitioners?
- c) How can agricultural extension practitioners promote sustainable agriculture?
- d) What are the factors limiting agricultural extension practitioners in promoting sustainable agriculture?
- e) What can the managers of public agricultural extension do to encourage the agricultural extension practitioners to promote sustainable agriculture?

### **Research Objectives**

The success of sustainable agricultural practices in South Africa is largely dependent on the effectiveness of existing extension policies, as well as the establishment of an inclusive policy

on sustainable agricultural practices. It is therefore, imperative to establish sub-divisions dealing with sustainable agriculture in provincial departments of agriculture.

The objectives of the study are:

- To draw on literature available on how public extension can expedite the realization of sustainable agricultural practices using the five-pillared framework
- To highlight why it became imperative to focus of five pillars of sustainable agriculture
- To identify and develop responses to challenges and barriers limiting agricultural extension practitioners in promoting sustainable agriculture
- To evaluate the role of public agricultural extension practitioners in promoting sustainable agricultural practices
- To evaluate the extent to which policy-makers considered the five-pillared framework when developing sustainable agricultural policies
- To establish a need for review of policies related to sustainable agriculture
- To define agricultural extension and the role it might play in promoting sustainable agriculture using the five-pillared framework
- To evaluate on whether extension services are aligned to five pillars of sustainable agriculture
- To suggest some relevant legislation that can be used to compile an inclusive policy on sustainable agricultural practices
- To highlight and make recommendations to the Mpumalanga Department of Agriculture, Rural Development and Land and Environmental Affairs (DARDLEA) on the imperative for sustainable agriculture.

### **Aim of the study**

The main aim of this study is to evaluate the role of public extension towards promoting sustainable agriculture through the five-pillared framework in Mpumalanga province. The study, by design, does not seek to understand or otherwise factor in the perceptions of farmers. The reason to interview farmers was solely for the purpose of data validation.

### **Theoretical framework**

Most literature focuses on the traditional three-pillared framework of economic, environmental and social sustainability. (Botha & Ikerd, 1995). The study will argue that there is a need to

further subdivide the traditional three pillars into five pillars. Most studies, while referring to sustainability and sustainable agriculture, do so using the traditional three-pillared framework thereby falling short of key elements essential to sustainable agriculture – namely maintaining and increasing biological productivity, decreasing the level of risk to ensure larger security, protecting the quality of natural resources, ensuring agricultural production is economically viable and ensuring agricultural production is socially acceptable.

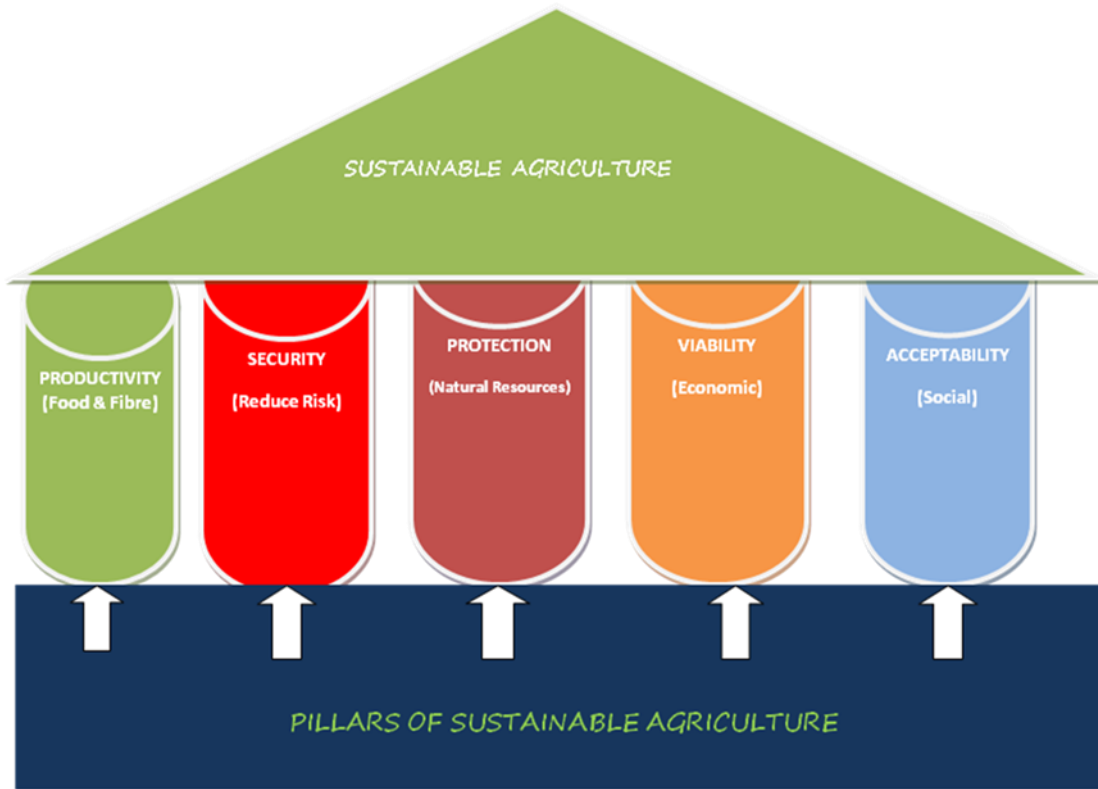
This study draws its theoretical framework from Dumanski, Terry, Byerlee and Piery (1998) in their publication, “Performance Indicators for Sustainable Agriculture” and can be used nationally and internationally to evaluate sustainability. “A Framework for Evaluation of Sustainable Land Management” (FESLM) was developed through collaboration among international and national institutions as a practical approach to assess whether farming systems are trending towards or away from sustainability (Dumanski, 1997; Dumanski *et al*, 1998).

The premise of the study is that the five pillars of sustainable agriculture, while being distinct from one another, must, be viewed in their totality to be effective. Attempts to analyse them individually will distract from the value of the holistic approach. A distinction is made on that the environmental pillar be subdivided into two: first, *productivity (food and fibre)* which emphasizes that most agricultural production takes place using soil as a natural resource, and secondly, *protection (natural resources)*, which focuses on other natural resources. The economic pillar is also subdivided into two; economic viability and reducing the level of risk.

Figure 1 is a graphical representation of the five-pillared framework for sustainable agriculture. These pillars frame the space in which farmers and extension practitioners must operate in order for farmers are to be successful at engaging in sustainable agriculture and in order for extension practitioners to be successful in their support of farmers. The five pillars are:

- Maintaining and increasing biological productivity;
- Decreasing the level of risk to ensure larger security;
- Protecting the quality of natural resources;
- Ensuring agricultural production is economically viable; and
- Ensuring agricultural production is socially acceptable and acceptance





**Figure 1: A framework for sustainable agriculture**

The definition of each pillar presents the principles relevant for each pillar and gives examples of the practical application to illustrate the point in each case. The first challenge is to engage farmers in honest conversations about each pillar as it applies to their farming operation, and to assist them in developing appropriate responses that not only meet the conditions of sustainable agriculture, but serve as a good fit for their unique circumstances. As will also be discussed, these pillars should be addressed in an integrated fashion, not as individual concepts seen in isolation. Therefore, the second challenge will be to resolve the inevitable tension created through the integration of the application of principles and requirements relative to the individual pillars.

At the ecological level, land scarcity is causing food scarcity for the ever-increasing population. Brown, Abramovitz and Starke (2000) pointed that resources are becoming scarce, natural species and forests are destroyed which also leads to destruction of wildlife and fisheries. Extension should play a pivotal role in discouraging further exploitation of the natural environment.

## **Methodology**

The study adopted a basic qualitative approach. In qualitative research, researchers bring their own world view, paradigms or sets of beliefs to the research project. There have been several efforts to define qualitative research in social sciences to determine whether it should or should not be differentiated from quantitative research (Bryman, 1998; Silverman, 2001).

Plumber (2001) argues that qualitative research is most commonly associated with interpretive sociological tradition, particularly phenomenology. Shank (2002) describes qualitative research as an outline of systemic empirical inquiry into the meaning of concepts. According to Denzin and Lincoln (2000), quantitative research involves an interpretive and naturalistic setting, attempting to make sense of, or to interpret phenomena in terms of the meaning people bring to them (Drath, 2001; Pearse & Conger, 2002). This study used a case study research design which emphasized that the data analysis focused on one phenomenon which the researcher selected to understand in depth, regardless of sites or participants in the study (Schumacher & MacMillan, 2001:398; Yin, 2003).

The researcher used interpretive and theoretical framework to remain relevant to the purpose of the study (Nieuwenhuis, 2007; Merriam & Associates, 2002; Creswell, 2007). The philosophical assumption of this study is based on reality of the concept of sustainable agriculture (Schwandt, 2001; Creswell, 2003). The study is also based on how the researcher conceptualized the epistemology and the language or rhetoric of sustainability using appropriate methodologies (Angen, 2000; Clandinin & Connelly, 2000; Greckhamer & Koro-Ljungberg, 2005). This research has discovered reality within a certain realm of probability towards promoting sustainable agriculture in Mpumalanga province (Ponterotto, 2005). The responses were based on means of valuing knowledge systems and their philosophies (Smith, 1999; Chilisa & Preece, 2005; Chilisa, 2011). The research design was governed by the notion of fitness of purpose. The purpose of the research determined the methodology and design of the research (Cohen, Manion & Morrison, 2007).

## **Research area and sampling**

The study was conducted in Mpumalanga province, South Africa. The province is divided into three district municipalities Ehlanzeni, Nkangala and Gert Sibande. The three district municipalities divided into seventeen local municipalities which are Albert Luthuli,

Depaliseng, Goven Mbeki, Lekwa, Mkhondo, Msukalikwa, Pixley ka Seme, Delmas, Dr. JS Moroka, Emalahleni, Highlands, Steve Tshwete, Thembisile Hani, Bushbuckridge, Nkomazi, Thaba Chweu and Mbombela.

The study used purposeful sampling, which denotes samples that have the characteristics relevant to the research (Dey, 1999). The study selected 68 public agricultural extension practitioners and 17 extension managers in Mpumalanga province. The selection was based on extension practitioners who are working directly with farmers within the province. The extension managers were selected to evaluate their level of support to the extension practitioners in promoting the five pillars of sustainable agriculture in the province. Four extension practitioners were interviewed using a structured questionnaire in each of the seventeen local municipalities, for a total of 68 extension practitioners. In each municipality one extension manager was given a questionnaire to complete. A number of farmers were also interviewed using convenient sampling. Convenient sampling allows the researcher the opportunity to select cases that are accessible during the research period (Saunders, Lewis & Thornhill, 2007). Convenient sampling is suitable when choosing cases that are readily available and willing to participate at the time of data gathering (Onwuegbuizie & Leech, 2007).

Chapter 5 of this study presents the findings from the public extension practitioners in the service of DARDLEA. Sixty-eight (68) extension practitioners were selected using purposive sampling to participate. Data were gathered using a structured questionnaire. The researcher selected four extension practitioners from each of the 17 municipalities in Mpumalanga Province. Permission to interview the participants was obtained in advance from the DARDLEA. On the day of collecting data, the respondents were briefed about the purpose of the study and about completing the questionnaire. They were given and signed consent forms to indicate their willingness of participating to the study. After the briefing session, questionnaires were distributed to individual extension practitioners. Each of the four extension practitioners completed the questionnaires independently without any influence from the researcher or other extension practitioners. The researcher was able to check with each extension practitioner if there were any difficulties in completing the questionnaire. In cases where an extension practitioner did not understand some questions, the researcher was available to provide clarity. After all the questionnaires were completed the researcher collected them on the same day. This exercise was repeated in all 17 municipalities. The

researcher was able to collect all the 68 questionnaires - giving a 100% response rate. Data collection process took place between June 2017 and August 2018.

Chapter 6, presents the findings from the 17 extension managers of DRDLEA. Selection was purposive noting that there was only one extension manager in each municipality. A similar procedure of collecting data was followed as with the extension practitioners. On the same day when collecting data from extension practitioners, a questionnaire was also administered to the one extension manager in each of the 17 municipalities. Permission to interview these officials was also obtained in advance and each manager signed a consent form. All 17 managers completed the questionnaires – giving a 100% return rate. The questionnaires for extension managers were separated from those of extension practitioners for the purpose of data analyses.

### **Data gathering methods**

A number of data collecting techniques were used in the study. The data collecting techniques included structured questionnaires, presentations, discussions, audio recorded group discussion, and literature review and documents analysis. Sampling refers to the selection of individuals, units or settings to be studied. The goal of qualitative approach can be stated as empirical generalisation of many (Patton, 2002; Camic, Rhodes & Yardly, 2003).

Each technique will be discussed as follows:

**Literature review:** A literature review is a critical analysis of a segment of a published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles (Alavi & Leidner, 2001). A review of prior relevant literature is an essential feature of any academic project. An effective review creates a firm foundation for advancing knowledge. It facilitates theory development, closes areas where a plethora of research exists, and uncovers areas where research is needed. The literature review was used to develop the theoretical framework of this study.

**Structured questionnaire:** The term structured questionnaire is used here to refer to qualitative approaches in data gathering, typically involving asking similar questions and observations that have some explicit structure to them in terms of theory or method, and they completely structured. The method is constructivist method where information is actively constructed by the researcher and the research participants based on their perceptions of a situation (Ertmer & Newby, 1993). This technique was core of this study.

**Document analysis:** Document analysis is a systematic procedure for reviewing or evaluating documents, both printed and electronic material. Like other analytical methods in qualitative research, document analysis requires that data be examined and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge (Rapley, 2007; Corbin & Strauss, 2008). Documents contain text and images that have been recorded without a researcher's intervention. For the purposes of this study, other mute or trace evidence, such as cultural artefacts, are not included. Atkinson and Coffey (1997) refer to documents as social facts which are produced, shared, and used in socially organized ways. In this study a number of related documents were analyzed to extract information on sustainable agriculture in line with the five-pillared framework.

**Presentations and group discussion:** A discussion group is a group of individuals with similar interests who gather either formally or informally to purposefully share ideas, solve problems or give comments. Group discussion is an important activity in academic, business and administrative spheres (Zander, Stolz & Hamm, 2013). While adjudicating for the agricultural extension awards in Mpumalanga province, the researcher captured the data arising from the presentations of extension practitioners and farmers, and subsequent questioning by other adjudicators thus adding value to the validity of the study. Extension practitioners were asked questions that are related to the purpose of the study. After presenting on sustainable agricultural practices, extension practitioners were further asked questions by a panel of eight adjudicators. The presentations by extension practitioners has added value towards the validity of this study. Finally, a group of farmers were also interviewed by adjudicators to validate the responses from extension practitioners.

### **Research validity and trustworthiness**

Triangulation was used to determine similarities and differences of the data collected. The main purpose of the study was to evaluate extension practitioners on whether they promote sustainable agriculture to the farmers that they serve in Mpumalanga Province. The data collected from farmers and extension managers were used to validate the primary data from extension practitioners. Triangulation is a powerful technique that facilitates validation of data through cross verification from two or more sources. In particular, it refers to the application and combination of several research methods in the study of the same phenomenon. This study used a number of data collection methods such as literature review, structured questionnaire,

oral presentations, group discussions and document analysis. The researcher was invited to be part of Mpumalanga provincial agricultural extension adjudications as per appendix 4 in this dissertation. Extension practitioners and their managers were invited by the department to do presentation. There was a question that was asked on their understanding of sustainable agriculture and how do they assist farmers towards sustainable agricultural practices. This information was recorded and used to validate data that was collected through questionnaires. The researcher was also able to get presentations from both extension practitioners and managers for the purpose of validation of this study, finally we had to visit all the farmers who are serviced by the extension practitioners who were presenting to check if the information presented was correct. This also assisted in validating data for this study. The national policy on extension and advisory services was only used to enhance the validity of the study, since the main focus was on extension practitioners and managers.

### **Data analyses**

This study used a qualitative approach to research. This method assisted the researcher in determining the relationship between emerging themes through qualitative inferences which were identified as well as allowing a discussion on similarities and differences that corroborate or contradict the finding of this study. The contents of the literature review, interviews, documents analysis, presentations, and group discussion were reviewed to identify emerging concepts, constructs and themes. Finally, the information was analysed according to their themes and recurring patterns of meaning and relationships (Cohen *et al*, 2007).

Chapter 5 and 6 are the core of the study and these chapters adopted a thematic analysis. Thematic analysis is one of the most common form of analysis within quantitative research (Braun & Clarke, 2006). After collecting data for both chapter 5 and 6, the researcher had to analyse the information gathered. On each questionnaire there were a set of structured questions. The researcher will pick the first question and read all the responses in relation to that question until the last respondents. The researcher followed the same procedure until the last question. When the researcher discovers similarities with responses, it was recorded as one set of response. It was only when there was new or different themes that will be recorded as new set of response. This procedure was repeated until the last question. Notes were written during this process and this assisted to interpreting of data for both chapter 5 and 6.

## **Expected outcomes**

The following outcomes were expected, to:

- develop a framework that will guide policy makers, such as the National Department of Agriculture, Forestry and Fisheries, when establishing policies related to sustainable agriculture
- promote the establishment of sub-directorates to manage the sustainable agriculture process at a provincial and municipal level
- encourage support for sustainable agricultural practices
- argue that public agricultural practitioners are well suited to promote sustainable agriculture
- encourage further training of extension practitioners of the concept of sustainable agricultural practices
- encourage additional research in defining sustainable agriculture in the context of the five-pillared framework on a farm level

## **Significance of the project**

The promotion of sustainable agricultural practices has not been possible in South Africa due in part to a lack of coherence in policy development. This study is based on existing literature and quantitative research so as to support the conclusion that there is a need for frameworks and guidelines to promote sustainable agriculture in Mpumalanga province. This study draws on relevant published papers to argue that extension is well positioned to promote sustainable agriculture through the Five Pillars of sustainability. In general, extension is viewed as a process of working with farmers or farming communities to assist them in acquiring relevant agricultural or related knowledge and skills in order to increase farm productivity, competitiveness, and sustainability (Duvel, 2004). This study gives direction to policy makers to consider the Five Pillars as a suitable framework for the evaluation of sustainable agricultural practices.

The study found that extension practitioners in Mpumalanga are not aware of the five pillars of sustainable agriculture. However, the responses suggest that they fully understand the three common pillars of sustainability economic, social, and environmental viability. There is a need to define the five pillars of sustainability in their totality. There is a need for the training of

extension practitioners on the five-pillared framework of sustainability. There is also a need to establish a sub-directorate that will focus on sustainable agriculture in Mpumalanga. Potential studies should be conducted to further categorize sustainable agricultural practices according to five pillars in sustainable agriculture. Finally, this study hopes to make contributions in promoting sustainable practices in Mpumalanga province and ultimately in South Africa.

### **Limitations and delimitations of the study**

This section highlights the limitations and delimitations of the study.

#### **The limitations of the study include:**

##### a) Generalisation of findings and conclusions

The study, apart from detailed literature review in chapter 2-4, sampled relevant stakeholders from Mpumalanga province. Therefore, the findings and general conclusion of the study are specific to that province, and may not necessarily be applicable to the other eight provinces in South Africa. However, such findings could be used as guidelines for other provinces, as all provinces are bound by national policies and have access to existing literature and other related researched documents.

##### b) Details of respondents' proficiency

The study did not scrutinize the details of the technical proficiency needs of both extension practitioners and extension managers towards promoting sustainable agricultural practices. The questions were open-ended and there were no short questions that were designed for statistical purposes or quantitative research which may have enhanced that aspect of the study. The study used a thematic analysis. The collection of data was the longest exercise as the researcher had to arrange and schedule appointments with respondents. Some questions were not fully completed on the first attempt, however the researcher had to do follow-ups on questionnaires that were not full completed, and this was done on the same day of collecting data. The researcher had to administer questionnaires from all the seventeen municipalities throughout Mpumalanga province. Listening to audio recording was strenuous and time consuming. The researcher had to travel to all the four districts of Mpumalanga to administer audio recording to farmers. The design of the questionnaire was not meant for statistical findings. However, there is a need for further studies in order to investigate the detailed biographical information of respondents. The study specifically focused on evaluating extension practitioners and



extension managers towards promoting sustainable agriculture in Mpumalanga province. There was no tool that was designed specifically for farmers as they were not directly linked to the findings of the study. However, this line of investigation should be carried out in the near future with the purposes of including amongst both, farmers, extension practitioners and extension managers. In this study four farmers were verbally interviewed per each district on their understanding of sustainable agricultural practises. Their responses were recoded and there was general trend of their knowledge of only three common pillars of sustainable agriculture, economic, social and economic viability.

**The delimitations of this study are:**

a) Low number of samples from farmers and extension managers

The purpose of the study was to evaluate extension practitioners' perspective towards promoting sustainable agriculture in Mpumalanga province. As farmers are the end users of sustainable agricultural practices, the samples obtained were enough to validate the information gathered from extension practitioners and managers. One advantage of this small sampling was that the farmers were interviewed in groups of 8-12 and were audio-recorded. The small sampling of extension managers was due to the structuring of extension services within each of the 17 municipalities –one extension manager per municipality. However, all 17 managers did participate in the study, giving the study a provincial-wide viewpoint from management.

b) Policy on sustainable agriculture

There is no inclusive policy on sustainable agricultural practices in South Africa. The researcher had to search for policies that are related to sustainable agriculture, hence these policies are scattered as demonstrated in chapters 3. All the related policies only give emphases to the three pillars of sustainability instead for the inclusive five-pillared framework. The researcher had to scrutinize all related policies to suit the purpose of this study.

c) Policy on agricultural extension and advisory services

Although South Africa has a national policy on agricultural extension and advisory services, the policy does not take into account the five pillars of sustainable agriculture. The national policy was only used to enhance the validity of the study, since the main focus was on extension practitioners and managers. There are other related international policies on agricultural extension which were not interrogated as the study was based on the South African perspective.

## **Thesis presentation**

With the exception of Chapters 1 and 8, this dissertation is presented in the form of published peer-reviewed papers and publishable chapters, with minor formatting changes to align them with the production of the dissertation. Chapters 2, 3 and 4 were published prior to completion of the thesis. Given the nature of these publications, there will necessarily be a certain amount of repetition of background, setting and methods.

Chapter 1 provides a general overview of the entire study. It introduces the background, basic theoretical approach and the research design for the study. It provides a brief overview of the significance of the study as well as the research questions and objectives. To ensure that the research presented in the body of the thesis in chapters 2-7 is tied together, the background, setting and methods are presented in greater detail and with further justification and referencing per individual chapter.

Chapter 2 is a published peer-reviewed journal article entitled “The sustainable agricultural imperative: implication for South African Agricultural Extension”. It was published in the *South African Journal of Agricultural Extension*. Volume 44. No: 2. (2016). It is a philosophical paper that draws on relevant literature to argue that public agricultural extension is well positioned to promote sustainable agriculture as defined in this study. The paper argues that agriculture is not only greatly influenced by the environment in which it operates, but that in recent decades some modern farming practices may harm the natural environment to the extent that in most countries in Southern Africa are experiencing severe environmental problems. It argues further that as pressure grows to meet the needs of the ever-growing human population in South Africa, farmers often resort to farming practices that will increase productivity, but compromising the natural environment. The paper highlights the need for establishing frameworks, methods and processes that support agricultural production that is profitable and sustainable, particularly in South Africa with its primacy on transforming the agricultural sector where efforts to redress issues of the past run the danger of replicating the inefficient, unsustainable practices of that same past. Ultimately, this has significant implications for South African agricultural extension, which needs to be able to help the nation balance the increasing demand for more efficient production, greater inclusion of marginalised smallholder farmers, and creating wealth in impoverished rural communities. The paper concludes by presenting

some philosophical recommendations that agricultural extension can utilize in promoting sustainable agriculture.

Chapter 3 is a published peer-reviewed journal paper entitled “Evaluation of policies promoting sustainable agriculture in South Africa”. It was published in the *South African Journal of Agricultural Extension. Volume.45. No: 2 (2017)*. It examines the current key policies promoting sustainable agriculture in South Africa and argues that South Africa will require the establishment of a formal inclusive policy on sustainable agricultural practices. Current policy needs to be updated to incorporate more explicitly the five pillars of sustainable agriculture and the need for formal legislation to govern the implementation of sustainable agricultural practices.

Chapter 4 is a published analytical, peer-reviewed journal paper entitled “Evaluation of South Africa's public extension in the context of sustainable agriculture”. It was published in the *South African Journal of Agricultural Extension. Volume.47. No: 1 (2019)*. It evaluates the extent to which public agricultural extension in South Africa promotes the five pillars of sustainable agriculture. The paper defines agricultural extension, presents an evolution of public agricultural extension in South Africa, and finally highlights the imperative of aligning extension policies towards the five pillars of sustainable agriculture presented as a part of this study. The paper presents a philosophical argument that the promotion of sustainable agricultural practices should remain the domain of public extension and advisory services. To provide context, the paper firstly defines agricultural extension and the role extension could play in promoting the five pillars of sustainable agriculture. Secondly, it evaluates South African national policy on extension and advisory services to determine the extent to which it addresses the framework of the five pillars for sustainable agriculture. The paper then evaluates the Extension Recovery Plan (ERP), norms and standards for agricultural extension and the National Development Plan (NDP) against the framework of sustainable agriculture. The paper also explores government initiatives to support extension and advisory services. Finally, the paper presents conclusions related to amending national policy on extension and advisory services to align it to the five pillars of sustainable agriculture.

Chapter 5 presents part of the study findings in the form of a paper entitled “Promotion of sustainable agriculture by Mpumalanga agricultural extension services: perspective of extension practitioners”. At the time of publishing this dissertation, this paper had been

submitted and was under review for publication in *the Journal of Agricultural Extension (Nigeria)*. This and the following chapter are the core of this dissertation and present the empirical data collected through structured questionnaire with 68 respondents, comprised of various extension practitioners in all seventeen districts in Mpumalanga province. It evaluates the extent to which public agricultural extension services promote sustainable agricultural practices in the province. Thus, the paper addresses the main objective of the study to determine how and through what means public extension practitioners in Mpumalanga province could promote sustainable agriculture through the five pillars of sustainability. The paper concludes its argument by addressing the need for frameworks and support for extension practitioners in promoting sustainable agricultural practices.

Chapter 6 presents another part of the study findings in the form of a paper entitled “Promotion of sustainable agriculture by Mpumalanga agricultural extension services: perspective of extension managers”. At the time of publishing this dissertation, this paper was submitted and under review for publication in the *International Journal of Agricultural Sustainability*. It presents and discusses data from structured questionnaire with extension managers exploring the role of public agricultural extension managers in promoting sustainable agriculture in Mpumalanga province in the context of the five-pillared model.

Chapter 7 is a paper entitled “A model to promote sustainable agriculture”. It is yet to be submitted for publication. It integrates, discusses and interprets the findings presented in Chapters 5 and 6.

Finally, Chapter 8 provides a general summary, conclusions and recommendations based on the study findings in the context of the theoretical framework presented in Chapters 2-7. This chapter also provides suggestions for future research on sustainable agricultural practices using the five-pillar framework.

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## CHAPTER 2

### THE SUSTAINABLE AGRICULTURE IMPERATIVE: IMPLICATIONS FOR SOUTH AFRICAN AGRICULTURAL EXTENSION

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## **Abstract**

This paper draws on relevant published (review) papers to argue that extension is well positioned to promote sustainable agriculture through five pillars of sustainability. Agriculture is not only greatly influenced by the environment in which it operates, but in recent decades it has become increasingly apparent that some modern farming practices may harm the natural environment. In fact, in most countries of the Southern Africa, severe environmental problems are direct results of modern farming practices. As a result of the ever-growing human population in South Africa, farmers are forced to resort to farming practices that will increase productivity, but compromising the natural environment, in order to meet food security. Thus the need for establishing frameworks, methods and processes that support viable and attractive sustainable agriculture is imperative. This is particularly true in South Africa's context with its primacy on transforming the agricultural sector where, in the efforts to redress issues of the past, it runs the danger of replicating the inefficient, unsustainable practices of that same past. Ultimately, this has significant implications for South African agricultural extension, which need to be able to help the nation balance the increasing and often conflicting demand for more efficient production, greater inclusion of marginalised smallholder farmers, and creating wealth in impoverished rural communities. The paper concludes by presenting some philosophical recommendations that agricultural extension can utilize in promoting sustainable agriculture.

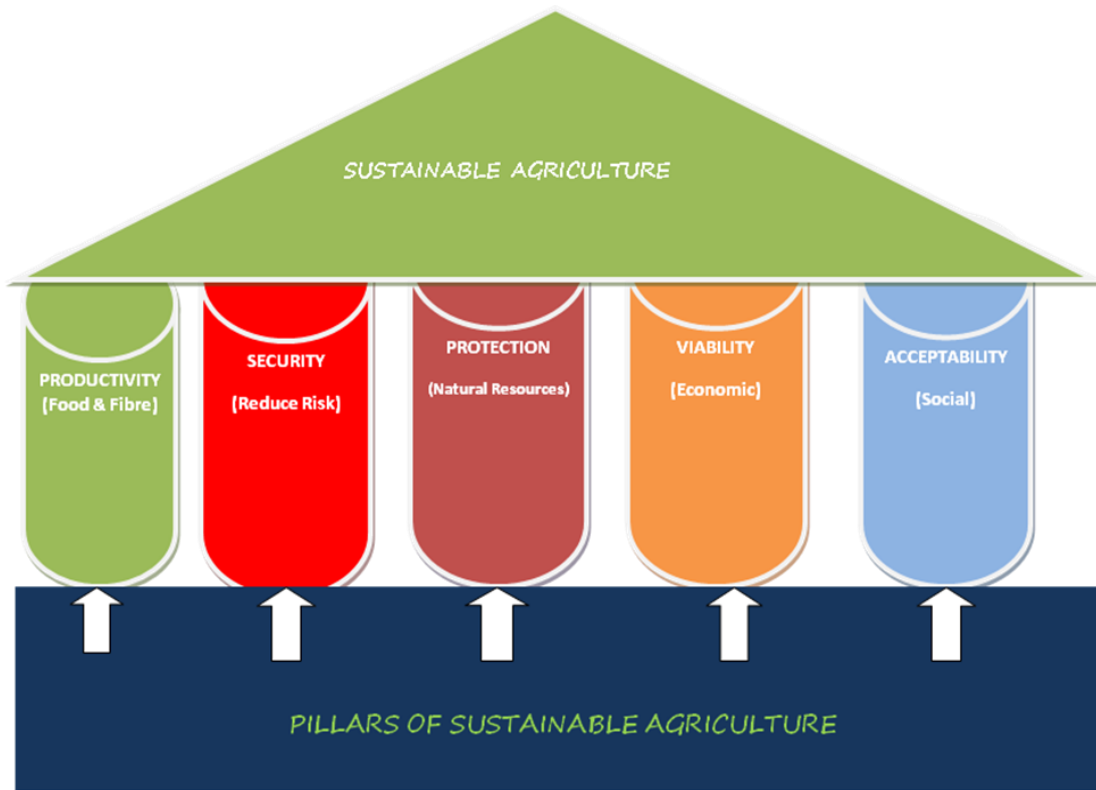
**Keywords:** Environment, food security, farming practices, Sustainable agriculture, agricultural extension

## **Introduction**

The protection of our resources is vital for the continued viability and productivity of agriculture in South Africa. This paper explores the definition of sustainable agriculture and discusses in detail why it has become imperative, during the last decade, to focus on the sustainable agricultural practices. Existing literature on sustainability mostly emphasizes three pillars of sustainable agriculture namely; environment, social and economic aspects. This paper put emphasis on five pillars of sustainable agriculture and how extension can help farmers in promoting the pillars. For agricultural production systems to be sustainable, such systems should meet requirements of biological productivity, economic viability, protection of all natural resources, reduced levels of risk and be social acceptable. The specific examples of change in the agricultural environment and why it is now imperative to scrutinise agricultural production practices for their sustainability are also discussed. Agricultural extension should have a deeper understanding of how natural ecosystems function. This will help to plan more efficient and sustainable cropping systems (Francis, 1990). Most practical examples are based on cropping system because of availability of literature and also that the principal author is a crop scientist. Finally, the paper discusses the application of sustainable agriculture to South Africa's agricultural development agenda.

## Background

### Focus towards sustainable agriculture



**Figure 2: Five pillars of sustainable agriculture** (adapted from Khwidzhili, 2012)

Figure 2 graphically depicts the elements of sustainable agriculture. These elements frame the space in which farmers and extension must operate if farmers are to be successful at genuinely engaging in sustainable agriculture and if extension services are to be successful in supporting them. The five pillars are:

- Maintaining and increasing biological productivity;
- Decreasing the level of risk to ensure larger security;
- Protecting the quality of natural resources;
- Ensuring agricultural production is economically viable; and
- Ensuring agricultural production is socially acceptable and acceptance.

The discussion of pillars presents the relevant principles for each pillar and gives a few, perhaps obvious, examples of their practical application to illustrate the point in each case. The challenge is in engaging farmers in honest conversations about the respective pillar as it applies to their farming operation and assist them to develop appropriate responses that meet the

conditions of sustainable agriculture (as defined by these pillars) and fits their unique circumstances. As will also be discussed, these pillars are meant to be addressed in an integrated fashion, not as individual aspect to be addressed in isolation. And the second challenge will be in resolving the inevitable tension that attempt to correct farming operations relative to one pillar will create on the ability to address the requirements of others. At the ecological level, land scarcity is causing food scarcity for the ever-increasing population. Brown, Abramovitz and Starke (2000) pointed that resources are becoming scarce, natural species and forests are destroyed which also leads to destruction of wildlife and fisheries. Extension should play a pivotal role in discouraging further exploitation of the natural environment.

### **Objectives**

The main objectives of this study are;

- To investigate existing literature on pillars of sustainable agriculture and how public agricultural extension can facilitate the realization of sustainable farm production practices.
- To analyse why it became imperative in the last decade to focus on pillars of sustainable agriculture (implications for agricultural extension).
- To determine some of the challenges faced by farmers and how agricultural extension could help to mitigate them.
- To highlight the importance of preventing further degradation of the natural resources.

### **Research methods**

This paper was published as a result of thorough process of reading some background information that already exist and appear relevant to the topic (Bless & Higson-Smith, 1995). A number of documents were used as a major source of evidence to support this study. Merriam and Associates (2002) also support this kind of study. These authors emphasize that the strength of documents as a data source is that information already exist and do not intrude upon or alter the settings in a way that the presence of the investigator might be influenced. Literature on sustainable agriculture mostly provides emphasis on three pillars of sustainable agriculture

which are; economic, social and environment sustainability. This paper further explores extra two pillars of sustainability which are production and risk. This is a case study which was aimed at reviewing already existing literature. This paper draws its theoretical framework from Dumanski, Tery, Byerlee and Pieri (1998) in their publication, performance indicators for sustainable agriculture. This framework can be used nationally and internationally to evaluate sustainability. A Framework for Evaluation of Sustainable Land Management (FESLM) was developed through collaboration among international and national institutions as a practical approach to assess whether farming systems are trending towards or away from sustainability (Dumanski *et al*, 1998). Nieuwenhuis (2007) suggested that case study research is a systematic inquiry into an event or a set of related events which aims to explain the phenomenon of interest in social setting so as the researcher understand how it operate or function. As supported by Yin (2003) a blend of data gathering techniques were used to compile this study and these included literature review, document analysis, and some already analysed data information.

## **Discussion**

### **The definition of sustainable agriculture**

According to Francis (1990), sustainable agriculture is a philosophy based on human goals and understanding the long-term impact of human activities on the environment and, consequently, on other species. Use of this philosophy guides our application of prior experience and the latest scientific advances to create integrated, resource-conserving, equitable systems. Sustainable agriculture is not a return to pre-industrial methods, and the rejection of modern techniques. Sustainable agriculture must necessary transcend this dichotomous view and operate solely from the entrenched principles of sustainability. It may well be that the resulting technologies reflect a combination of traditional and modern techniques. Issues central to sustainable agriculture are the necessity of taking a long-term view, thereby ensuring the supply of products to future generations, the necessity to maintain and enhancing soil fertility, veld condition, water supply, water quality, and generic resource on which agriculture depends. Sustainable agriculture delivers on these critical elements through a variety of technology options.

Sustainability is a direction rather than destination (Dumanski, 2007). First we must agree on what is to be sustained, for whom, and for how long? If we degrade our natural

resources and poison our natural environment, we will degrade the productivity of agriculture and ultimately destroy human life on earth. Thus, sustainable agriculture must be ecological sound, economically viable and social responsible (Botha & Ikerd, 1995). Dumanski (1997) in the context of, planning for sustainability in agricultural development projects, reinforced the generally accepted definition of sustainability put forward by the 1987 Bruntland Commission that “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs”.

Dumanski (1997), further insisted that the aim of sustainability is to leave future generations as many, if not more, opportunities as we had ourselves. He further stressed that sustainable land management combines technologies, policies and activities aimed at integrating socio-economic principles with environmental concerns so as to simultaneously:

- Maintain or enhance production/services;
- Reduce the level of production risk;
- Protect the potential of natural resources and prevent degradation of soil and water quality;
- Be economically viable; and
- Be socially acceptable.

The meaning of sustainability was further highlighted by Pearson (2003) who defined a sustainable system as one in which: resources are kept in balance with their use through conservation, recycling and renewal; practices preserve agricultural resources and prevent environmental damage to the farm and off-site land, water and air; and production, profit and incentives retain their importance, because not only agriculture needs to be sustained, but so do farmers and society. These definitions of sustainability pose challenges to farmers (both established and new) and for the South African government, in particular its agricultural extension policies, agencies and operations. They need to be translated into practical measures for agriculture. However, as domestic and international economic pressures and competition cuts profit margins, farmers will need clear guidelines and support if they are to build the capacity to engage in sustainable agriculture.

## **Maintaining and increasing biological productivity**

The first pillar of sustainable agriculture is the requirement that the biological productivity of the soil is maintained and, if possible, increased. Biological productivity refers to the ability of soil to promote microbial activities. Farmers will need to explore ways to achieve this. A key element is to the percentage of organic matter in the soil. For example, extensive open cast mining completely removes biological communities and presents conditions which are extremely hostile for invertebrates. According to Carry and Good (1992), features of newly restored mining and industrial waste sites are likely to inhibit faunal establishment include, lack of suitable food and adverse physicochemical conditions, particularly unfavourable moisture conditions and excessive fluctuations in surface temperature.

Many soil micro-organisms cannot function in acidic soil. The most common way of correcting the pH level of acidic soil is by applying agricultural lime to the soil (Barrett, Pieterse, & Strydom, 2008). Farmers need first to understand the productivity status of the soil and take appropriate actions. These actions, however, must be implemented in consent with responses to the other pillars- that is the essence of 'sustainability'- which as stated earlier is more a direction than a destination.

## **Decreasing the level of risk to ensure larger security**

The second pillar of sustainable agriculture is that the level of production risk must be minimised (it can never be totally eliminated). Risk is endemic to all human endeavours, be they social or economic, it is also clearly true to agriculture. On a simple production level, planting of crops that are not suitable for a particular area increases the chances of production risk. Matching climate and cultivar will eliminate production risk.

Water erosion is another example of risk in agriculture. Rainfall deficiencies limit crop production in dry-land regions; many soils in dry-land regions are highly susceptible to water erosion. Susceptibility will result in, low crop yield, low soil organic matter content, high intensity rainstorm and poor soil-water management (Unger, 1990). Sustainable agriculture will demand that the farmer take command of the risk of water erosion through appropriate crop production operation such as tillage and the use of seedlings which can decrease the



impact of rain drops on the soil; maintain favourable water infiltration; decrease run-off velocity; and decrease soil detachability.

### **Protecting the quality of natural resources**

This third pillar of sustainability is directly linked to the biological productivity (first pillar). Sustainable agriculture will have to work within the bounds of nature, not against it. This means matching land uses to the constraints of local environment, planning for production not to exceed biological potentials, and carefully limiting chemical fertilisers, pesticides and other chemicals inputs to ensure that they do not exceed the capacity of the environment to absorb and filter any excess (Dumanski, 1997) or in considering alternative less measures. Deeper understanding of how natural ecosystems function will help farmers plan more efficient and sustainable cropping system (Francis, 1990).

Land degradation is driven by a combination of forces, such as poverty, excessive population, low productivity, lack of knowledge, ability and desire, or disincentives to adopt technology, and poorly defined or inadequate land tenure systems (Miller & Wali, 1995).

In their conclusion Miller & Wali (1995), highlighted some of the premises of sustainability and indicated that;

- Traditional agricultural systems; some which are sustainable, are disappearing.
- They are being replaced by farming systems that are more intensive and (or) dependent on finite fossil fuel and off-farm resources etc.

### **Ensuring agricultural production is economically viable**

One of the challenges facing South African agriculture is the shift from production of food primarily for home consumption to farm businesses aimed at generating sustained income via profits attained through marketing of agricultural products. Economic viability is vital. The income from selling products must at least equal or, preferably exceed the cost of producing them. However, such economically viability must be sustained without compromising the natural environment.

Technological and scientific advances will be instrumental in the transition to sustainable agriculture, but political, economic and institutional structures will also have to be part of the solution. According to Dumanski (1997), the procedures being developed to assess and monitor farm-level, agricultural sector and even national wealth, and the concept of ‘sustainability as opportunity’ need to be further developed to balance the bias towards economic efficiency as a primary criterion for sustainability.

### **Ensuring agricultural production is socially acceptable and accountable**

The principle of this pillar is that agricultural production and post-harvest activities must fit the society in which they occur. This covers substantial territory from the choice of products themselves, to the raw (genetic) material used, to the inputs used, and to the production, processing and marketing used. All of these are subjected to the social acceptability and accountability.

A case in point is the use of genetically modified organisms (GMO); to increase agricultural production which has received negative reception by the society. The negative perception towards GMO products is linked to sustainable health of end- users as well as to the impact they have on traditional farming methods, seed storage, and economic viability, among others. Many other such examples are extant.

The economic and social sciences are fundamentally different from physical and agricultural sciences and the natural science of ecology. Agriculture involves self-conscious attempts by human to change or manage natural ecosystem. Human are unique among species in that we make purposeful, deliberate decisions that can either enhance or degrade the health of the environment (Botha & Ikerd, 1995). While these two branches of science have different agendas, both of which must be addressed. A key to addressing these different agendas is to avoid dichotomous thinking, but to view them as a coherent whole. Again, farmers, who live in both these worlds, will need assistance in addressing these fundamental challenges.

## **Challenges to sustainable agriculture in South Africa**

### **Overgrazing**

Masiteng, Van der Westhuizen, and Matli (2003), recommended that a detailed survey and evaluation of the extension services available to farmers grazing on commonage land needs be done. They further insisted that extension services from the Department of Agriculture are insufficient and ineffective due to lack of capacity. There are very few extension officers with proper knowledge of pasture management. Pasture management research and extension education, training and practice in general must be taken in consideration and also reflect the leaning towards more participatory approaches to extension. Training should basically focus on helping farmers towards self-reliance, and environmentally sound practices (NDA, undated). Poor management has led to overgrazing through overstocking and limited grazing rotations, leaving the large tracts of land severely denuded and under threat of desertification. Extension officers should also work with traditional leaders in communal land to encourage villagers on proper grazing management.

Studies conducted by Buttel (2001), predicts that environmental degradation will continue unabated until more preventive measures are taken to alter the behaviour of producers and the trajectory of farming and grazing industries throughout the world. Preventive measures as suggested by Pietikainen and Lehtila (2006) include amongst others minimum number of livestock to avoid exceeding the carrying capacity of local grazing. Some measure includes putting a price on grazing on control areas. Communities should decide on which areas will be used for farmland, grazing land or forest. Extension practitioners should also advice farmers to sell their stock and invest in cultivation (this advice could only be done when necessary). Finally, Oba & Kaitira (2006) highlighted that rotational grazing and management of multiple livestock are traditional methods that can be recognised as Traditional Economic Knowledge. Traditional Economic knowledge emphasizes that villagers should not work in isolation, instead they should be governed by the same rules and procedures. Extension officers should assist farmers to determine the caring capacity and appropriate stocking rate in a particular season (Walker and Hodgkinson, 2000). Emphasis should be to keep minimum stock in winter unless there is provision of adequate supplementary feeding.

## **Pollution by chemical fertilizers**

Inorganic fertilisers are often environmental costly. They can leach from the soil and contaminate ground water and streams. Other consequences of injudicious use of fertilisers can reflect in the built-up of toxicity, acidification and salinization (NDA undated, pp 8). According to the report by OECD (1999) excessive use of nutrients in the soil contribute to eutrophication problem and pollution of drinking water. Excessive levels of nutrients in soils may also result in soil acidification. For example; excessive use of nitrogenous fertilizers concentrates nitrates in the soil and water. Nitrate rich water is carried off into surface water bodies such as ponds, rivers and lakes where it accelerates the growth of algae. These algae consume dissolved oxygen from water and thus deplete the water of its oxygen content leading to the death of useful aquatic life such as fish.

Excessive use of fertilizers over a long period may affect the acidity of the soil and may adversely affect the crop production. They contain ingredients that are toxic to the skin or respiratory system. Incorrect measure of fertilizers can also burn crops. Chemical fertilizers can build up in the soil, causing long-term imbalances in soil pH and fertility. Apart from the essential nutrients required by plants, chemical fertilizers contain certain compounds and salts which a plant is unable to absorb, which are left behind in the soil. With time, these compounds build up in the soil and can even change its structure. Pearson (2003) emphasized that a sustainable system should be kept in balance with their use through conservation, recycling and renewal. He further argued that practices should preserve agricultural resources and prevent environmental damage. It is therefore apparent that extension should assist to educate farmers on the use of both organic and inorganic fertilizers.

## **Pollution by pesticides, herbicides and fungicides**

Pesticides are known to also kill non-target and often beneficial organisms in the immediate area of application. Others chemicals are not biodegradable and may accumulate in the soil and water with hazardous consequences to both animal and human life (NDA undated, pp 8). Pesticides have contributed greatly to increased agricultural productivity and crop quality, but once in the environment can accumulate in soil and water, and damage flora and fauna as concentrations in food-chains become high enough to harm wildlife (OECD, 1999). Pesticide residues also impair drinking water quality, contaminate food for human

consumption, cause adverse health effects from direct exposure to farm workers, while some pesticides contain bromide compounds which, when volatilised, convert into stratospheric ozone-depleting gases.

A difficulty with establishing indicators that address the issue of agricultural pesticide use is that pesticides vary strongly in their degree of toxicity, persistence and mobility, depending on the type and concentration of their active ingredients, and hence vary in the environmental risk they impose. Also an increase in pesticide use could coincide with a reduction of environmental damage, when more but less harmful pesticides are used, and vice versa, which emphasises the need to undertake pesticide use risk assessment (OECD, 1999). Furthermore, the quantity of pesticides that leach into soil and water depend on, for example, soil properties and temperature, drainage, type of crop, weather, and application method, time and frequency. Moreover, where pesticides are used in combination with certain pest management practices, such as integrated pest management, it may have little or no harmful impact on the environment, pesticide users, or food consumers.

### **Soil crusting**

Regular and/or incorrect tillage changes the structure of the soil causing soil compaction resulting in slower water infiltration, increased run-off and greater risk of erosion. Intensive cultivation and loss of organic materials, together with excessive overhead irrigation, can aggravate the problem. An examination of South Africa's rural areas reveals the extent to which the country's ecology has been damaged. Political, economic and social factors impact on the sustainability of agriculture and livelihood of people living in rural areas (NDA, undated). According to a review by Miller and Wali (1995), the world's soil resources have been pressured not only by food production of indigenous populations but also by advent of modern transportation and storage systems, which brings many of the world's unique and, therefore, unused resources to market worldwide.

Agricultural extension practitioners should work to assist farmers in minimising or even avoiding soil crusting. These amongst others should include practices that protect or increase soil structure and organic matter and provide protective vegetation on the soil surface. Practices such as no-till or reduced tillage of cropland reduce or eliminates crust formation. Extension

practitioners should promote the use of organic matter and plant residues on the soil to avoid the physical impact of rain drops.

## **Water**

Water scarcity is receiving more attention as an increasingly land-related problem. A recent report from Population Action International predicts that by the year 2025, the number of people living in water deficient countries will approach three billion up from 335 million in 1990 (Miller & Wali, 1995). The implications of water shortage for agriculture are obvious. Studies conducted by Angadi, Cutforth, Mcconkry, and Gan *et al* (2003) reveals that growing plants in area with low rainfall patterns will require planned irrigation to avoid plant water stress. Water quality is an important aspect in the bid to achieve sustainable management of irrigated land. The quality of irrigation water affects soil salinity and cation exchange, soil acidity and alkalinity, nutrient availability and soil structure. Sustainable water usage should aim to prevent degradation of ground and surface water (Hillel, 2000).

Water shortage is a major obstacle to agricultural production and also damage aquatic habitats and wildlife. The need to maintain and restore the “natural” state of water resources is an integral part of water management and sustainable agriculture practices. The intensification of agricultural practices in many countries has increased the abstraction rates of limited surface and groundwater resources (OECD, 1999). With the higher demand for water from industrial and public consumers, in addition to agriculture, the growing competition for water resources within the economy is of great concern to policy makers in many countries. Extension officers should assist farmers in measurement of agricultural water use in terms of developing water balances for both the use of surface and groundwater resources by agriculture, together with exploring possible linkages with indicators related to farm management, especially aspects of irrigation management. As part of sustainable water use, agricultural extension should endeavour to encourage farmers on various water use efficiency equations, monitoring stream and river flows (surface water) and also groundwater levels. This can be achieved by making it a point that farmers record or measure the amount of water used for both domestic and agricultural purpose. Farmers should be made aware of the water requirements for crops during different growth stages.

## **Conclusion and recommendations**

The foregoing discussion highlights two things. First, in defining sustainable agriculture, it is seen that elements of it are technical, but that its underpinning is essentially philosophical in which farmers will operate at a level of principle while exploring specific options to specific issues related to production. Second is the essential aspect that these pillars must be viewed in their totality and to avoid dichotomous thinking, but recognising that it is a matter of 'considered choice' within recognised limits. Agricultural extension can play a considerable role both in raising farmers' awareness of the individual pillars and their application to their respective farms and in integrating their application.

The concept of sustainability will remain uncertain and imperfect until better procedures for assessment and evaluation are available. However, the concept can be usefully employed in development projects even with the current imperfections in the definition. It is important that people, farmers and the community at large should engage themselves in practices that will not degrade their natural environment. The probability and capacity for a sustainable future rest largely on our ability to tap the earth's natural resource with sustainable management strategies.

Sustainable land management in developing countries requires long-term, sustained support and investment in the prudent management and conservation of natural resources to achieve the combined goal of increased production and environmental maintenance. The government, private sectors, non- government organisations, including the international communities should join together in developing policies and guidelines that promote sustainable agricultural practices. Extension officers should continue to give a necessary advice to the farming community on practices that will not degrade our natural environment. In conclusion the big challenge is to ask what will happen in the future if farmers continue to use unsustainable farming practices that continue to harm the natural environment. Finally, a follow up question should be what agricultural extension will do to assist the farmers in producing food that will meet the needs of the ever growing world's population without compromising the natural environment.

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## **CHAPTER 3**

### **EVALUATION OF POLICIES PROMOTING SUSTAINABLE AGRICULTURE IN SOUTH AFRICA**

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## **Abstract**

South Africa will require the establishment of a formal inclusive policy on sustainable agricultural practices. This will not only assist the country in avoiding further exploitation of the natural environment, but will also position agricultural extension in promoting the five pillar of sustainable agriculture. A comprehensive review using conceptual reflection presented in this paper confirms that most of the sustainable aspects are covered in both the white paper in sustainable agriculture and policy on agriculture in sustainable development. The existing documents, legislation and policies available should be integrated into a working document that promotes sustainable agricultural practices. This paper, thus, gives a philosophical comparison between South Africa's policy on agriculture in sustainable development and its white paper on agriculture. The review found that these two key South African agricultural policies are closely related in terms of the five pillars of sustainable agriculture. This paper argues that the two policies reviewed could be used in the formulation of national policy on sustainable agriculture. In conclusion this paper, however, also suggests possible legislation addressing sustainable agriculture that must be integrated to develop a national policy on sustainable agriculture.

**Keywords:** sustainability, policy, agricultural extension, social acceptance, economic viability, environment.

## **Introduction**

There is no final or approved policy on sustainable agriculture in South Africa. However, there is a working document on agriculture in sustainable development and a number of draft policies and guideline documents delineating South Africa's intentions regarding sustainable agriculture. These policies seek to promote sustainable agricultural practices throughout the nine provinces of the country. This paper evaluates these policies in terms of five pillars of sustainable agriculture: biological productivity; economic viability; protection of natural resources; reduced levels of risk; and social acceptance (Khwidzhili & Worth, 2016). The policies are evaluated as to the extent to which they address the five pillars. This paper highlights on which amongst the five pillars are most prominent in the policies, both individually and in terms of their integration. Integration is important because the five-pillar framework, like sustainability, is essentially a function of interdependent processes and is less informative if implemented in isolating of any of the five pillars. This paper draws from other published papers and relevant policy documents to argue for possible establishment of a policy on sustainable agriculture. The paper emphasises that the philosophy of sustainable agriculture is not a mere application of organic practices in agriculture, but rather a synergy of practices that are aimed at promoting agricultural production with little or no harm to the environment. The paper concludes with recommendations that will help policy-makers in establishing a policy promoting sustainable agriculture in South Africa.

## **Objectives**

The main objective of this paper is to examine the current policies promoting sustainable agriculture in South Africa to determine:

- The extent to which policy-makers considered five pillars of sustainable agriculture when developing the policies;
- The extent to which the policies contribute to the promotion of sustainable agriculture in the country; and
- Whether there is a need for a review of these and related policies in order to promote sustainable agriculture.

The paper also aims:

- To make agricultural extension officers and their managers to be aware of the policies and the relevant documents promoting sustainable agriculture in South Africa to aid them in their work; and
- To provide the National Department of Agriculture, Forestry and Fisheries (DAFF) with insight relevant to drafting a national policy promoting sustainable agriculture in the country.

### **Research method**

Using the pillars of sustainable agriculture (Khwidzhili & Worth, 2016), an in-depth comparison between South Africa's policy on agriculture in sustainable development and its white paper on agriculture was done to establish the presence of the pillars in both documents (Hart, 1998). This paper is a result of an informative, critical and useful synthesis of already existing literature on sustainable agriculture (Bolderston, 2008). A conceptual reflection in this paper explores a detailed evaluation of existing literature on sustainable agriculture to determine shortfalls in terms of the five pillars of sustainable agriculture. Findings are consolidated in a table followed by a discussion related to each of the two policies.

### **Conceptual reflections**

The premise of this discussion is that the five pillars of sustainable agriculture while being distinct as they are, must, to be effective, be viewed in their totality. Attempts to analyse them individually will distract from the value of the holistic approach. These conceptual reflections give perspectives of already available literature and give a direction when developing a policy on sustainable agriculture. Some limitations emanating from the findings of this study indicate clearly that there is still a vacuum in South Africa to develop an integrated policy on sustainable agriculture.

The philosophical argument by OECD (2006) reflects that policies which intend to promote agricultural development (policies in agriculture) might not be effective unless accompanied by policies for agriculture, which include education, transport, communication infrastructure as well as private sector development. About three decades ago Yudelman (1987)

had already observed sustainable agricultural production system as a major concern for research and policy makers in both developed and developing countries. Medugu and Jahor (2006) similarly concluded that several human activities such as inappropriate technology, overpopulation, pollution, overgrazing, deforestation and mining are a result of poor policy regulation. Further, Phrek *et al* (1999) suggested that the most important element of success in policy formulation should involve intergraded marketing arrangements initiated by private or government sector.

Policies should not be formulated for farmers; this should rather be a collaborative process which includes many stakeholders including farmers. Implementation of sustainable agricultural practices remain of paramount importance (Mazumadar, 2006), and it requires reduced use of chemicals and increasing internal farm skills and sound management to reduce the use of chemical in farms. Further emphasis was given by the World Bank (2006) supported by Ahmadvand and Karami (2007) who concluded that agricultural extension should be used to champion sustainable agriculture. Similar notions were also confirmed by Allahyari (2009), who proposed that agricultural extension should take a lead role in promoting sustainable agriculture. However, this responsibility must be carried out with the understanding that the role of agricultural extension agents is also changing from transferring knowledge and technology to consultants, advisors and facilitators of the farmer learning processes (Abrasion, 2007). Historically, as cited by Dart (2000), agricultural extension worldwide has shifted from an emphasis on production at the beginning of the 21st century, to productivity (or efficiency) based agriculture and to the more recent philosophy of sustainability.

An ecological report by Lundberg and Albaeco (2008) puts forward that agriculture must be based more on ecosystem services than on fossil fuels. This will assist in access to healthy food and clean water; climate change will be limited; and, ultimately biological diversity will be protected. A major obstacle facing agricultural extension systems in sub-Saharan Africa is how to contribute to the process of transforming rural and agricultural systems in sustainable ways (Korma, 2003). Extension scholar, Röling (1999), reminds us that a knowledge-driven, extension system constitutes the most effective means to strengthen and creatively reconstruct the entrepreneurial, social, and ecological capacities of people to successfully engage in production and livelihood activities that demand on the one hand, a strong competitive orientation, and on the other, heightened sensitivity to environmental issues. Conway and Pretty (1991) documented a number of environmental and human effects caused

by modern agriculture. These amongst others include the use of pesticides, the inclusion of nitrate and phosphate on fertilizers, soil erosion, destruction of micro-organisms, air pollution, etc. Studies by Bollman and Bryden (1997), as supported by Eutrostat (1997), established that modern agriculture impacts on social aspects. For example, through the introduction of mechanisation, more than 1.93 million jobs were lost across the European Union in the 1980s. Similarly, in the United Kingdom, the shift to fewer farms using capital-intensive technologies contributed to job losses resulting in rural poverty and economic disadvantage (Pretty, 1998; Ministry of Agriculture Fisheries and Food (MAFF), 1997).

The world's biological diversity is reported to be decreasing rapidly; the decrease is in natural ecosystems, agriculture, forestry and aquaculture. For example, today just four species rice, maize, wheat and potato make up about half the energy intake of humans from the plant kingdom. In a similar way, almost half of the global meat production comes from only a few breeds of pigs, chickens and cattle. Furthermore, the richness of variation within the different species used in agriculture is declining. One example of loss of diversity is the loss of rice varieties. Only a few decades ago, farmers in India grew almost thirty thousand different varieties of rice, which were adapted to local conditions. Since the inception of green revolution, these have been replaced by a few high-yielding rice varieties that are often grown in monoculture (Lundberg & Albaeco, 2008). Drawing from the above argument, it is clear that farmers prefer to resort to farming practices that are aimed at increasing production, and do so without necessarily considering the natural environment and human health. A report by World Conservation Monitoring Centre (1992) indicated that South Africa ranks third in the world with regard to biodiversity distribution. The country has almost one million species that need to be conserved for future generations. This is confirmed by Wynberg (2002) who emphasised that many species that exist in South Africa do not exist anywhere in the world. This diversity of species in South Africa contributes to soil fertility, aquaculture, atmosphere, food, ecosystem and many more (Shackleton, 2009). In contrast, South Africa also contributes enormously to threatening biodiversity through unsustainable agricultural practices, mining and industrialisation (Twine *et al*, 2003).

Antonaci *et al* (2014) indicate that agricultural production is highly susceptible to risks which affect farmers and consumers of agricultural products. They argue that coherent and integrated long-term strategies and policies are required to lower production risks with the aim of promoting sustainable agricultural production. They argue further that the government



should ensure protection of farmers against production risks and price shocks through incentives, development of agricultural markets and access to easy access to financial institutions. Siegal and Alwang (1999) had earlier indicated that production risk triggered by extreme occurrences would require high insurance premiums by farmers which they are unlikely to be able to afford. This could result in farmers defaulting on bank loans (Anderson, 2002). As a partial means to address this susceptibility, risk management and price stabilization policy should focus on long-term investments to increase the role of the private sector and build confidence in a market-based approach (World Bank, 2005; Byerlee, Jayne & Myers, 2005). Government intervention is needed because lack of access to credit and saving facilities in rural areas are the major constraints in all African countries (Allen *et al*, 2011).

Although technology brought enormous changes in the agricultural sector especially on resource rich farmers, Altier (2002) supported by Ray *et al* (2003) argues that poor farmers, due to social constraints and insufficient training remain laggards in adoption. Still the adoption of technology to the extent that it has been adopted has created uncertainty in the labour force (e.g. leading to unemployment). Intensive irrigation, modern machinery and hybrid varieties have been major source of job losses (Todaro, 1996). Considering another aspect of this discussion, the transfer of technology model used in extension, which promotes a top-down transmission of agricultural knowledge from extension officers to farmers, strengthened the adoption conventional (mechanized) agriculture by converting research results into easily transmittable production recommendations (Chambers, 1989), while bypassing small-scale farmers' own needs and insights and ignoring holistic ecological approaches. This raises the question as to the legitimacy of imposing any technology innovation on (poor) farmers; and suggests that they are involved in all processes that involve developing and testing technologies before implementation. An ineffective regulation on pesticides is a major challenge in developed countries (Murray, 1999).

Agriculture is major user of natural resources, albeit in different ways and to different extents depending on farming system. According to Kabat (2013), globally, agriculture uses almost 80% of all agricultural land while globally (suggesting there is little room to expand), and about 70 % of the world's fresh water resource used is consumed by the agricultural sector. Within this high resource use, some agricultural systems are the drivers of environmental degradation and loss of biodiversity (e.g. the practice of monoculture and high use of pesticides) (FAO, 2009; IAASTD, 2009, UNEP, 2010) to the extent that over 60 % of the

world's goods and services are being degraded or used unsustainably (MEA, 2005), while the genetic diversity of crops, breeds, trees and aquatic resources on which agriculture depends is at severe risk. Global environmental changes as well as the loss of knowledge associated with agricultural practices based on local varieties remains a major challenge. Today, four crops only – potato, wheat, maize and rice – supply more than half of humanity's calories.

## Findings

Table 1 provides a comparison of the policies reviewed in this study against the framework of the five pillars of sustainable agriculture.

**Table 1: Comparison of policies review in this study**

	<b>Policy on agriculture in sustainable development</b>	<b>White paper white paper on agriculture</b>
<b><u>Pillar no: 1</u> Maintaining and increasing biological productivity</b>	<ul style="list-style-type: none"> <li>• Agricultural chemicals</li> <li>• Limited crop rotation</li> <li>• Monoculture</li> <li>• Industrial developments</li> <li>• Integrated production</li> <li>• Integrated Pest Management</li> <li>• Organic fertilisers</li> <li>• Minimum tillage</li> <li>• Intercropping</li> <li>• In-cropping</li> <li>• Biodiversity conservation</li> </ul>	<ul style="list-style-type: none"> <li>• Ecosystem</li> <li>• Inorganic fertilisers</li> <li>• Pesticides</li> <li>• Rural biodiversity</li> <li>• Indigenous fauna and flora</li> </ul>
<b><u>Pillar no: 2</u> Decreasing the level of risk to ensure larger security</b>	<ul style="list-style-type: none"> <li>• Farm inputs</li> <li>• Poor subsidy</li> <li>• Re-train extension officers</li> <li>• Effective risk management strategies</li> <li>• Famers training</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> <li>• Poor risk management</li> <li>• Legal instruments</li> <li>• Water catchment management</li> <li>• Risk reducing mechanisms</li> <li>• Farmers training on finance</li> <li>• Training extension officers</li> </ul>
<b><u>Pillar no: 3</u> Protecting the quality of natural resources</b>	<ul style="list-style-type: none"> <li>• Protection of natural resource</li> <li>• Preventing soil erosion</li> <li>• Contamination of ground water</li> <li>• Land degradation</li> <li>• Intensive tillage</li> <li>• Pollutants</li> <li>• Collection of firewood</li> <li>• Overgrazing</li> <li>• Deforestation</li> <li>• Industrial developments</li> </ul>	<ul style="list-style-type: none"> <li>• Limited arable land</li> <li>• Lack of water supply</li> <li>• Sustainable utilisation of natural resources</li> <li>• Resource conservation</li> <li>• Incorrect irrigation methods</li> <li>• Pollution of ground water</li> <li>• Destructions of natural forest</li> </ul>
<b><u>Pillar no: 4</u> Ensuring agricultural production is economically viable</b>	<ul style="list-style-type: none"> <li>• Contribution to the economy</li> <li>• Poor financial market</li> <li>• Farmer support</li> <li>• Research funding</li> <li>• Infrastructural support</li> </ul>	<ul style="list-style-type: none"> <li>• Successful agriculture</li> <li>• Economic growth</li> <li>• Market</li> <li>• Financing for farmers</li> <li>• Reduce financial regulations</li> <li>• Subsidise repayment of loans</li> <li>• Marketing information</li> <li>• Increase production</li> </ul>

	<b>Policy on agriculture in sustainable development</b>	<b>White paper white paper on agriculture</b>
<b>Pillar no: 5 Ensuring agricultural production is socially acceptable</b>	<ul style="list-style-type: none"> <li>• Social well-being</li> <li>• Human health</li> <li>• Safeguard livelihood</li> <li>• poverty alleviation</li> <li>• Food insecurity</li> <li>• Crime</li> <li>• Education</li> <li>• Microbial contaminations</li> <li>• Equity</li> <li>• Unemployment</li> <li>• Trade opportunities</li> <li>• Biotechnology</li> <li>• Indigenous pest control</li> </ul>	<ul style="list-style-type: none"> <li>• Food safety standards</li> <li>• Consumer satisfaction</li> <li>• Quality products</li> <li>• Food security</li> <li>• Hybrid plants</li> <li>• Biotechnology</li> <li>• Technology</li> </ul>

### **Policy on agriculture in sustainable development**

Sustainable agriculture and sustainable development are two different concepts; however, there is a direct linkage between the two. The policy identifies strategies, guidelines, and practices that constitute the South African concept of sustainable agriculture. It emphasises that farming plays a crucial role in the growth of South Africa's economy. The policy reviewed used the traditional pillars sustainability- environment, economic and social aspects of development- and does not explicitly use the five pillars of sustainable agriculture. Within the traditional three pillars, the policy argues that the following should be at the centre of sustainable agriculture;

- *Environmental*: protection of the natural resource; prevention of water and soil erosion and biodiversity conservation;
- *Economic*: assurance of a safe and high-quality supply of agricultural products; and
- *Social*: Contribution to social well-being.

This policy submits that some agricultural practices impact negatively on human health. Chemicals such as pesticides and fertilisers used in agriculture can contaminate groundwater. The policy declares that land degradation is the primary environmental issue affecting sustainability. This policy argues that soil degradation, resulting from soil impoverishment, leads to greater susceptibility of vegetation to drought. The main contributors to soil impoverishment, particularly in the commercial sector, are monoculture in cereal production, intensive tillage and limited crop rotation. Soil degradation in communal land is caused by excessive collection of firewood, inappropriate land use, population density and overgrazing. The policy acknowledges that South Africa is ranked third in the world for biodiversity

distribution. However, it notes also that species extinction rates in the country are high due to unsustainable farming practices, deforestation and industrial developments. Also on the environmental front, the policy cautions that the quality and quantity of water in South Africa is unlikely to be sustainable for future generations primarily due to the projected growth in population and industrialisation.

Economic sustainability is hampered by poor financial markets, especially in rural areas, that make it difficult for farmers in these areas to cope with various risks. They cannot afford to purchase risk ameliorating farm inputs even if it would be profitable to do so. The draft policy suggests that constraints such as inadequate physical infrastructure, unstable market opportunities, lack of market information, poor subsidies and unfair market competition all contribute to hindering farmers in accessing markets. The policy also argues that research that can provide sustainable increases in agricultural production and improve management of natural resources among poor population is seriously underfunded.

Relating to the first of the five pillars (biological productivity), the policy warns of negative effects of pesticides, industrial development and the advantages of organic production, minimum tillage and inter-cropping. The second pillar (decreasing the level of risk) is also covered in this policy in the intension to provide example farm inputs, subsidies to poor farmer, re-training of extension officers, effective risk management strategies and famer training. The third sustainable agriculture pillar (protecting the quality of natural resources) is also covered by the policy through calling for protection of natural resources, stemming or minimising soil erosion, contamination of ground water, land degradation, intensive tillage, the use of pollutants, collection of firewood, overgrazing, and deforestation and limiting industrial developments. The fourth pillar of sustainability ensures that agricultural production is economically viable. Some elements of the fourth pillar are also addressed by this policy; for example, the policy speaks to economic factors such as agriculture's contribution to the economy, the poor financial market, farmer support, research funding and poor farmers' infrastructural support. Some elements of the fifth pillar (socially acceptable agricultural production) are also covered in this policy with reference to social well-being of farmers, human health, safeguarding sustainable livelihood, poverty alleviation, food insecurity, crime, education, microbial contaminations, equity, unemployment, poor trade opportunities, the usage of biotechnology, and the use of indigenous pest control. In conclusion, as shown in Table 1, although the policies reviewed do not explicitly address all the elements the five pillars

of sustainable agriculture, the language used and the issues addressed in the policy can be related to each of the pillars.

### **White paper on agriculture**

One of the two objectives of the white paper on agriculture was to reflect on principles of successful agriculture. ‘Successful’ and ‘sustainable’ can sometimes be confused. In the context of agriculture, successful is not always sustainable in the long-term. Agriculture can be successful in the short-term, but at the cost compromising the natural environment to attain that success. While the South African constitution states that the governance of agriculture functions falls within the competence of provinces, that governance needs to be guided by policy on a national level in which the distinction between the role of provincial and national agricultural administration and governance are clear (National Department of Agriculture, 1995). Through its nine provincial Department of Agriculture, the South African government has the mandate to implement agricultural policies using agricultural extension service. The main objective of the white paper suggests that the National Department of Agriculture, Fisheries and Forestry (DAFF) have the obligation to establish policies that promote sustainable agriculture through inclusive consultation with the relevant stake holders. Such a policy should integrate the five pillars of sustainable agriculture.

Poor risk management causes farmers to use high risk farming methods that could endanger resource conservation. The white paper notes that unsustainable farming practices are common in South Africa, although which practices are not identified. There is provision of mechanisms for relief for natural disasters. However, some events that occur on a regular basis are not covered in the relief program. These amongst others include areas that are prone to particular disasters like hailstorms. The relief program could include financial assistance and provision of government relief resources. The white paper links agricultural marketing to the right to freedom of association entrenched in the South African constitution and consider this right as a cornerstone of agricultural marketing policy- but limited by the requirements for maintaining order. Whatever marketing arrangements and regulations are put in place should emanate from thorough consultation with farmers. The white paper acknowledges that marketing of agricultural products plays an important role in the production cycle of any category of farmers. Thus farmers need knowledge about marketing their produce. They should also be assisted by the National Agricultural Marketing Council. The composition of the

council should have commercial agricultural producers, small scale farmers, agriculture-related commerce and industry, as well as consumers. Specifically, the white paper cautions on the over regulation of the market, but that the government does need to step in to correct market imperfections and social unacceptable effects resulting from marketing. The paper contextualises agricultural marketing in a wider commitment of the state to social justice and welfare. Thus, the state should assist in marketing arrangements which will enhance the welfare of the nation (National Department of Agriculture, 1995).

The white paper emphasises that natural resources are national assets. It also confirms the definition of sustainability by stressing that natural resources are essential for the economic welfare to present and future generation. The country is partially endowed in both the land and water resources. Agriculture depends on how these two assets are conserved. In this context the white paper also emphasises that South Africa's soil is fragile and prone to erosion, especially if farmers use incorrect or improper irrigation and other farming techniques. Excessive use of pesticides and chemical fertilizers in their farms by farmers, leads to the pollution of ground water as well as rivers and dams. The paper further highlighted that new cultivars that are produced by hybrid plant breeding and biotechnology may threaten indigenous species that are cultivated over generation by traditional farmers. The government should play a lead role in the legislation to prevent further harm of the natural environment. As part of this, the government will ensure there is collaboration among the extension officers, research institutes and farmers. The main goal for the collaboration is to ensure that the latest knowledge and technology should be affordable to farmers and not in the expense of the natural environment (National Department of Agriculture, 1995).

At the time of writing the white paper, financial institutions, including government and private, generally served commercial agriculture only. The paper registers the need to regulate financial assistance to beginner's (small-scale) farmers and those who lacked sufficient power. The white paper suggests that the beginners' (small scale) farmers should be assisted with government-linked agricultural loans subjected to performance auditing and review on regular basis. Financial institutions need to show greater flexibility in rescheduling loans or adjusting repayments to suit the cash flow of individual farmers (National Department of Agriculture, 1995). Financial assistance is not only restricted to monetary value; farmer can also be assisted with resources or even encourage to share resources in the form of cooperatives. Forming cooperatives is encouraged as an effective tool for networking amongst farmers. Finally, the

white paper promotes that agricultural research should always be in consultation with the farmers. This means that researchers should start their programme planning by gaining an understanding of the wider context of farming by consulting farmers, extension officers and other stake holders.

### **Legislation impacting on sustainable agriculture**

The following are fundamental South African legislations impacting on sustainable agriculture and which could be integrated to develop a national policy on sustainable agriculture in the country:

- Fertilisers, Farms Feeds, Agricultural Remedies and Stock Remedies Act of 1947 (Act No. 36 of 1947). The Act provides for the registration of fertilisers, farm feeds, agricultural remedies, stock remedies, sterilising plants and pest control operators. The Act further regulates the importation, sale, acquisition, disposal or use of fertilisers, farm feeds, agricultural remedies and stock remedies. This legislation has both environmental and social impacts through pollution and negative impact on human health if used injudiciously.
- Livestock Brands Act, 1962 (Act No. 87 of 1962). The Act provides for an identification system for stockowners. This is important for traceability, minimizing stock theft and the monitoring of animal diseases. This legislation has economic impact through minimizing risk of theft and disease surveillance.
- Fencing Act, 1963 (Act No. 31 of 1963).The Act specifies fencing standards and regulates the relationship between neighbours regarding construction and maintenance of fencing. This legislation has economic impact through minimizing risk posed by spread of diseases from one area to the other.
- Plant Breeders' Rights Act of 1976 (Act No. 15 of 1976). Any variety for which a Plant Breeders' Right is sought must comply with the provisions of this act. The variety must also be "new", i.e. newly developed or bred. This legislation has economic impact through protection of intellectual property rights of breeders.

- Plant Improvement Act, 1976 (Act No. 53 of 1976). The aim of this Act is to ensure the availability of high quality propagating material to all users. This legislation has economic impact by contributing to high productivity through ensuring the availability of propagation materials of high quality. Livestock Improvement Act, 1977 (Act No. 25 of 1977). This Act is aimed at development and importation of animal breeds of high quality. This legislation has economic impact by contributing to high productivity through ensuring the availability of animal breeds of high quality.
- Agricultural Pests Act of 1983 (Act No. 36 of 1983). This Act provides for measures to prevent the introduction and establishment of pests. The Act ensures that import of controlled goods is done in such a way that exotic pests and diseases are not imported and allowed to be established in South Africa, as well as preventing their spread to other countries. This legislation has both environmental and economic impacts by minimizing risks posed by possible spread of pests and diseases, and thus protection of the agricultural from adverse effects of these pests and diseases.
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983). The Act provides for the control over the utilisation of the natural agricultural resources of South Africa in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants. This legislation has environmental impact by promoting sustainable use of natural resources in order to ensure long-term productivity of the plant production sector.
- Animal Diseases Act of 1984 (Act No. 35 of 1984). This Act provides for development and enforcement of measures for the prevention and control of diseases and parasites to promote animal health. This legislation has economic impact by minimizing risks posed by possible spread of diseases and parasites, and thus protection of the agricultural from adverse effects of these diseases and parasites.
- Liquor Products Act, 1989 (Act No. 60 of 1989). This Act provides for the control on the sale, as well as import and export of liquor products. This legislation has both the economic and social impacts by ensuring the quality and safety of liquor products.



- Agricultural Product Standards Act of 1990 (Act No. 119 of 1990). The Act, among other things, provides for control on the sale of agricultural products by ensuring that they comply with certain minimum quality standards. This legislation has both the economic and social impacts by ensuring the quality and safety of agricultural products.
- Genetically Modified Organisms Act, 1997 (Act No. 15 of 1997). The act provides measures to promote the responsible development, production, use and application of genetically modified organisms (GMOs). This legislation has the environmental and economic and social impacts by ensuring the safety of GMO products, changing the nature and cost of production requisites (in particular seed), as well as minimizing possible negative impacts of these products on the environment.
- Meat Safety Act, 2000 (Act No 40 of 2000). This act is aimed at promoting meat safety, establishing and maintaining national standards in respect of abattoirs and export control. This legislation has both the economic and social impacts by ensuring the quality and safety of meat and regulating export market of meat.

### **Conclusion and recommendations**

This paper has reviewed two anchor policies against the framework of the five pillars of sustainable agriculture (Khwidzhili & Worth, 2016). The review highlights the fundamental need for the South African government to develop a policy for sustainable agriculture to harmonise its plan for agriculture as reflected in the white paper with the objectives of its policy on sustainable development. Because there are some essential differences between the more generic concept of sustainable development and sustainable agriculture, the paper suggests the proposed policy should be based on the five pillars of sustainable agriculture. Further, to insure integration, the proposed policy on sustainable agriculture should take into account with the existing agriculturally related policies. With such a comprehensive and integrated policy, the government through DAFF can create an enabling environment for investors, farmers, producers, processors, financial institutions, traders and other sector stakeholders to carry-out activities that are consistent with sustainable agricultural practices. By extension, (e.g. through the increased investment in the agricultural value chain) this should contribute to create more sustainable employment.

Sustainable agricultural policies should take a holistic approach of the five pillars of sustainable agriculture. Sustainable agricultural policy should focus on catastrophic risks that are rare but cause significant damage to many farmers at the same time. Contingency plans should define in advance the procedures, responsibilities and limits of the policy response. Subsidized insurance is one way of providing disaster assistance, but it tends to crowd out the development of private insurance markets and has not been successful in preventing additional ad hoc assistance being granted after the event. Agricultural extension should play a pivotal role in assisting farmer to avoid further exploitation of the natural environment; hence this could be a futile exercise without a formal policy on sustainable agriculture. Policies should be formulated in inclusion of all relevant stakeholders in agricultural sector. The current situation makes it difficult for extension officers to promote sustainable agriculture. It becomes uneasy for officers to source all relevant policies, documents, legislation and guidelines that are so scattered in order to promote sustainable agriculture. If all relevant information is arranged in a single document called a national policy on sustainable agriculture, it will make it easier for extension to promote sustainable agriculture throughout all the provinces in South Africa.

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## **CHAPTER 4**

### **EVALUATION OF SOUTH AFRICA'S PUBLIC AGRICULTURAL EXTENSION IN THE CONTEXT OF SUSTAINABLE AGRICULTURE**

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## Abstract

South Africa's public agricultural extension services evolved from as early as the beginning of 1900. Agricultural extension is now recognised as a science by South African Council of Natural Science Profession (SACNASP). This paper presents a philosophical argument that the promotion of sustainable agricultural practices should remain the domain of public extension and advisory services. To provide context, the paper firstly defines agricultural extension and the role extension could play in promoting the five pillars of sustainable agriculture. Secondly, it evaluates the national policy on extension and advisory services to determine the extent to which it addresses the framework of the five pillars for sustainable agriculture. Thirdly the paper evaluates the Extension Recovery Plan (ERP), norms and standards for agricultural extension and the National Development Plan (NDP) against the framework of sustainable agriculture. The evaluation indicates that only three pillars of sustainability are emphasised. There is a need to subdivide the traditional pillars to align with the full framework for sustainability. The initial findings suggest that, while South Africa's agricultural extension policy often refers to sustainability and even to sustainable agriculture, they do so using the traditional three-pillared framework of economic, environmental and social sustainability and thus fall short on key elements essential to sustainable agriculture – namely maintaining and increasing biological productivity, decreasing the level of risk to ensure larger security, protecting the quality of natural resources, ensuring agricultural production is economically viable and ensuring agricultural production is socially acceptable. The paper also explores government initiatives to support extension and advisory services. Finally, this paper concludes by giving emphases that the national policy on extension and advisory services should be amended to suit the five pillars of sustainable agriculture.

**Keywords:** Sustainable agriculture, extension and advisory services, extension, pillars of sustainability, agricultural policy.

## **Introduction**

The continued provision of food, fuel and fibre to a growing world population depends, in large measure, on the practice of sustainable agriculture. This paper argues that, in the case of South Africa, adoption of sustainable agricultural practices falls in the domain primarily of public sector agricultural extension (DOA, 2014). It is thus valuable to understand the extent to which South Africa's public extension service is positioned to promote sustainable agriculture amongst the farmers it serves. This paper first examines the discipline of agricultural extension in the context of sustainability and discusses the role it should play in promoting sustainable agriculture. The paper then presents a brief outline of the evolution of public sector extension in South Africa, and argues that, given the role extension has played over the last several decades; the state extension service should be well-positioned to promote sustainable agriculture even if this has not been its primary focus in the past. Further, because extension services are driven by policy, the paper next examines the extent to which current South African national policy guiding extension and advisory services supports the promotion of sustainable agriculture using the five pillars of sustainable agriculture established by Khwizhili and Worth (2016). Other initiatives to support extension and advisory services are also discussed.

## **Objectives of the paper**

The main objective of this study is to evaluate public agricultural extension in South Africa and its alignments to the five pillars of sustainable agriculture. This entails the following:

- Defining agricultural extension and the role it plays in the agricultural sector;
- Providing an overview of the evolution of agricultural extension in South Africa;
- Evaluating the current national policy on extension and advisory services and other public documents in the context of South Africa's extension services' position to promote sustainable agriculture with specific reference to the five-pillars framework; and
- Providing guidance to policy makers for incorporating all the five pillars of sustainable agriculture when developing agricultural extension policy and programmes.

## **Research method**

This was a desk-top study examining relevant policies documenting the involvement of South Africa's public extension services in the context of sustainable agriculture. The data

analysed were drawn primarily from existing articles, documents and policies filtered through the five pillars of sustainable agriculture to identify embedded themes and recurring patterns of meaning and relationships (Cohen *et al*, 2011). This is a review paper based on already existing literature (Yin, 2003), i.e. secondary data. The following documents were evaluated as they were found to be relevant to the delivery of agricultural extension in South Africa: national policy on extension and advisory services; extension recovery plan; and the norms and standards for agricultural extension and the national development plan.

### **The evolution of public agricultural extension in South Africa**

The evolution of agricultural extension in South Africa dates back to the reconstruction that followed from 1902 when agricultural scientists were imported from England. Drawing from expertise of outsiders was futile as they were unfamiliar to South Africa's local conditions. In response, in 1907, the first cohort of potential South African scientists was identified to study abroad (Van Vuuren, 1952).

Agricultural extension started to take shape in South Africa around 1925, supported by the then National Ministry of Agriculture. The Ministry had approved about six agricultural advisors (extension officers) to serve the entire country in rendering extension services.

The primary role of extension from its initial stage was to assist farmers to make decisions that will better their farming practices and ensure food security in the country (Koch & Terblanche, 2013). In the early 1940s, agricultural extension was incorporated as an academic career within institutions of higher learning. This was initiated by the University of Pretoria, University of Stellenbosch and Elsenberg College of Agriculture where the faculties of agriculture were established (Van Vuuren, 1952). Over the ensuing decades, other South African universities and colleges started to offer agricultural extension. Among these are the Universities of Fort Hare, KwaZulu-Natal, Limpopo, the North West, and Venda, the Cape Peninsula University of Technology and Tshwane University of Technology (Koch & Terblanche, 2013). The now eleven agricultural colleges have also played an important role in training in agricultural advisors, particularly for the former so-called homelands.

Concurrent with the expansion of extension in higher education, the profession of extension grew, and in 1966, the South African Society of Agricultural Extension (SASAE)

was established at the University of Pretoria as a professional body supporting the extension practitioners. Despite its inclusion in higher education programmes, and despite its contribution to the livelihood of farmers and the agricultural economy, for eight decades after the establishment of extension, agricultural extension was not considered as a science by the South African Council of Natural Science (SACNASP). However, the SASAE championed the cause of extension with SACNASP, and since 2013, agricultural extension has been officially recognised as a science (extension science) with three possible categories of registration (depending on the nature of the extension practitioner's qualification). The categories are: professional (post-graduate degree in agricultural extension coupled with relevant experience); candidate (supported by a degree in agriculture with no experience in extension); and certificated scientist (supported by a degree in agriculture and least experience in agriculture).

The adoption of the South African Constitution in 1994 established that board extension policy (as an element of national aspects of agriculture) would be a national competency, while the delivery and management of extension to farmers would be done through the provincial governments, with substantial latitude regarding modes of operation, operational focus and developmental priorities. This resulted in nine separate extension services, which, while being bound to broad national policy, are not subject to any meaningful national coordination or collective accountability; rather they are solely accountable to the provincial legislatures and governments and ultimately individual provincial political leaders (Worth, 2012).

### **Public agricultural extension perspective and the role it plays in agriculture**

There is no single definition that can be used exclusively to define agricultural extension. According to the then South African Department of Agriculture (2005), agricultural extension is the art of assisting commercial, small-scale and subsistence farmers with agricultural related knowledge and skills that will make them productive, competitive to ensure sustainability (Hedden-Dunkhorst & Mollel, 1999). Van den Ban and Hawkins (1997) earlier defined extension as the conscious use of communication of information with the aim of assisting people to make good decisions. Purcell and Anderson (1997) similarly confirm that agricultural extension is a key element in enabling farmers to obtain information and technologies that can improve their livelihoods. The concept of a livelihood is broader and more comprehensive and integrated than simply 'farming'. A livelihood is a means of

supporting one's existence most often through multiple strategies of which, for farmers, farming is one.

Most commonly, extension generally is viewed a process of working with farmers or farming communities to help them acquire relevant and useful agricultural or related knowledge and skills in order to increase farm productivity, competitiveness, and sustainability (Duvel, 2004). However, in practice, it is a continuum ranging from the narrow technology transfer focusing specifically on farming practices within the specific context of an agricultural enterprise, to advisory services that address farming and related practices in the wider context of social, economic and environmental perspectives including education, human development and critical public priority issues such as food security, poverty alleviation, environmental degradation, and social equity (De Klerk *et al.*, 2004).

Increasingly, the role of agricultural extension extends beyond technology transfer with primary aim of assisting farmers to adopt new technology. Extension's role encompasses linking farmers to domestic and international markets, assisting farmers reduce their vulnerability and enhance their livelihoods, promoting environmental conservation (Alex *et al.*, 2001), and taking a leading role in rural development and even non-farm employment (Riveria, 2001). Extension is expected to include strengthening innovation processes and building linkages between farmers and other agencies, and assist farmers to bargain for inputs and access credit to advance their farming practices (Aneato, 2012). In this expansive context, it is evident that agricultural extension requires a holistic approach.

Agricultural extension is an important factor in promoting agricultural development (Birkhaeuser *et al.*, 1991; Anderson & Feder, 2007). Most governments in sub-Saharan Africa, including South Africa, have invested in agricultural extension as the primary tool for improving agricultural productivity and farmers' income. In South Africa, agricultural extension is used to support agricultural development and specifically to play a pivotal role in educating farmers to practice more efficient and profitable farming. It is, thus, posited that South Africa's public agricultural extension should be well-suited to promote sustainable agriculture.

Agricultural extension services depend upon knowledge, skills, and insights concerning the multifaceted process of behaviour change (Griffith, 1994). While extension should help

teach new farming practices and assist rural people to build leadership and organisation skills (Van der Ban & Hawkins, 1997), more recently, extension has experienced a major shift towards participatory models (Duvell, 2005) in which stakeholders take a more active role in agricultural extension processes and decision-making. Most recently is the introduction of a learning-based model that emphasises the need to build capacity for learning throughout the extension system, but especially among the farmers for which learning is described as the capacity to engage with scientific enquiry (Worth, 2006). The table below (Table 2) summarises some common agricultural extension models that are used in South Africa.

**Table 2: Extension models**

<i>Models</i>	<i>Core principles</i>	<i>Implications</i>
<i>Linear</i>	<ul style="list-style-type: none"> <li>- Top-down approach</li> <li>- Based on extension expertise</li> <li>- The farmer is the recipient</li> </ul>	<ul style="list-style-type: none"> <li>- Farmers cannot solve their problems</li> <li>- Adoption of technology is not questionable by farmers</li> <li>- Farmers less interested</li> </ul>
<i>Advisory</i>	<ul style="list-style-type: none"> <li>- Farmers solve their problem</li> <li>- Extension required on farmer's request</li> <li>- Based on farmer's expertise</li> </ul>	<ul style="list-style-type: none"> <li>- Extension is the last option</li> <li>- Extension has less influence</li> <li>- Farmer solve their own problems</li> </ul>
<i>Participatory</i>	<ul style="list-style-type: none"> <li>- All stakeholders participate</li> <li>- Encourage mutual respect</li> <li>- Joint problem solving</li> </ul>	<ul style="list-style-type: none"> <li>- Everyone feel important</li> <li>- Expertise from both participants</li> </ul>
<i>Learning</i>	<ul style="list-style-type: none"> <li>- Based on learning from each other</li> <li>- Based on continuous reflection from both parties</li> <li>- Collective decision are taken and based on both parties expertise.</li> </ul>	<ul style="list-style-type: none"> <li>- Create sustainable relation</li> <li>- Encourage learning and research</li> <li>- Some participants might be illiterate</li> </ul>

*Adapted from Abdu-Raheem & Worth (2011)*

Depending on the aim and objective of an extension engagement or intervention, different extension models are used by extension. The first extension model in Table 1 is called the linear model with focuses on transfer of technology in which the (mostly off-farm) extension research centre is the source of technology and innovation that is then ‘transferred’ to farmers who ‘adopt’ the technology (Rolling, 1995). This is a so-called ‘top-down approach’ because the farmer is only the recipient of technology that has been designed and delivered ‘from above.’ The linear model requires high-level knowledge from specialised scientist and specialised extension skills to disseminate innovations to farmers (Dexter, 1986). However,

not all farmers will adopt all new technology from extension practitioners, especially technology developed in their absence. Adoption of technology is influenced by the farmers' resources and their past experience. Thus, this approach is not appropriate in all cases, and should not be the 'default' approach.

The second extension model is the advisory model which views farmers as active problem solvers and will seek advice from extension only if they fail to solve their problems themselves (Rolling, 1995). The model encourages farmers to share information and learn from each other with least influence from extension services. The advice from extension comes as a request from the farmer. The model recognises and appreciates the role that farmers could play in problem solving.

The third model is the participatory model where the knowledge and expertise of farmers (often referred to as indigenous knowledge) that they have accumulated over generations (Agrawal, 1995), and perhaps more recently. This knowledge is best understood as local memory (the collection of practices handed down from past generations, but which is no longer used), local practice (knowledge compiled from various second-hand sources or unstructured trial and error), and/or local science (knowledge and practices currently in use or not a result of deliberate and conscious innovation and experimentation conducted by the farmer) (Masere & Worth, 2015). Local science would result from an extension engagement that employs a learning posture with the primary aim of building capacity of farmers to learn, innovate and experiment (Worth, 2006) systematically, methodically and deliberately. Thus extension should recognise farmers' knowledge and should incorporate it in their work (Agrawal, 1995; Hart, 2003; Swanson, 2006).

The fourth model is a learning-centred model which focuses on learning amongst agricultural extension workers, researchers, farmers and other stakeholders. The model is based on continuous reflection amongst all stakeholders within the learning process (Worth, 2006). This model was evolved from the facilitation model and Chambers' (1997) participatory rural appraisal (PRA). It is grounded in Kolb's (1984) learning theory which embraces the iterative process of analysing, planning, acting, monitoring and evaluating (i.e. observing, reflecting, conceptualising and actively experimenting).

As noted earlier, no one extension model is suitable in all contexts. However, it can be argued that the participation of both the extension practitioner and farmers in addressing farmers' issues can yield profound benefits. It is thus imperative, whatever model is applied, and that learning should be encouraged and promoted, as it is the basic component of knowledge management. Each stakeholder should be treated with respect and be afforded the opportunity to display and apply their expertise.

These shifts in approach and process suggest that extension services respond well to working within the bounds of theoretical frameworks, including those guiding sustainable agricultural practices (Rivera, 2006). Existing frameworks could be adopted, adjusted or developed and adapted to extension's multiple roles ranging from advisory, technician, educator, middleman, facilitator, analyst, researcher and teaching partner (Bembridge, 1991; Van den Ban and Hawkins, 1997; Department of Agriculture, 2005, Duvel, 2005; Worth 2006). Globally, public agricultural extension is faced with a huge challenge of being relevant and effective. To achieve this, it is essential to develop and implementing relevant frameworks.

A case in point is a framework for sustainable agriculture. Currently, with regard to sustainable agriculture, agricultural extension advises farmers based on the three traditional pillars of sustainability, namely, economic, environmental and social viability (Magoro & Hlungwani, 2014). However, more current thinking suggests that a five-pillar framework should be applied (Khwidzhili & Worth, 2016): maintaining and increasing biological productivity; decreasing the level of risk to ensure larger security; protecting the quality of natural resources; ensuring agricultural production is economically viable; and ensuring agricultural production is socially acceptable.

The national policy on agricultural extension and advisory services has clearly defined the role of agricultural extension agents. The study also supports the four extension models described by Abdu-Reheem and Worth (2011) which extension can use to promote sustainable agriculture. As noted, no single approach suits all environments; extension will have to choose approaches that will be relevant to their target clients (farmers), their situations and the issues to be addressed.

However, the failure of the exclusive use of conventional top-down approaches which excluded farmers' participation is well documented. Thus, in general, agricultural extension



should prioritise participatory approaches when engaging farmers. Leeuwis and Van den Ban (1996), for example, argued that farmers should be involved directly in the planning of agricultural extension activities. Participatory agricultural extension encourages joint learning amongst farmers (Hagmann *et al*, 1999; Wettasinha *et al*, 2003). Promoting participation of farmers in the extension process reduces barriers that impact the rate of adopting sustainable agricultural practices (Ajeigbe & Dashiell, 2010). Specifically, according to Nagel (1997), understanding, working with, accommodating and otherwise building on the local knowledge of farmers helps promote sustainable agricultural practices.

Early in the provision of extension to smallholder black South African farmers, Bembridge (1979) argued that extension services were meant to transfer skills and knowledge to farmers. This suggests that the knowledge and skills held within the agricultural extension system should be assessed and updated on a regular basis to ensure extension services stay relevant to the ever-changing agricultural landscape.

In addition to the knowledge and skills within extension and the choice of extension models and frameworks, the reach of the service is also an important factor. Williams *et al* (2008) reported that access to quality extension and advisory services depends on the ratio of extension to farmers. The lack distribution of extension and advisory services in South Africa was also highlighted as a major constraint for farmers (Nel & Davies, 1999; Van Niekerk, 2011, Ndoro *et al*, 2014). They argued that the distribution of extension and advisory services is relatively low among emerging farmers (who arguably have the greatest need for extension), compared to so-called commercial farmers. The poor distribution is a result that most emerging farmers depends entirely on public extension services (Ngomane, 2000; Oladele & Mabe, 2010), while commercial farmers rely on private extension that is often costly. Similarly, the South African Extension Recovery Implementation Plan (2008), indicated a lack of adequate extension services in the country, indicating the ratio of extension to farmers was 1:1500, this figure is still high considering that some farms are commercial (the scope of work is extended) while others are producing on small scale. Additionally, factors such as low morale, lack of mobility, and low salaries were found to contribute to high turnover in the extension services, and make it difficult to attract recruits (Kaimowitz, 1991; Belay & Abebaw, 2004). The recovery plan was designed to address these various challenges in South African extension.

## **Review of secondary sources**

The study examined four public documents that are considered fundamental in promoting agricultural extension and advisory services in South Africa: National Policy on Extension and Advisory Services; Norms and Standards for Agricultural Extension; Extension Recovery Plan; and National Development Plan. A brief overview of these policies is presented below:

### **National policy on extension and advisory services (NPEAS)**

South Africa developed a national policy on extension and advisory services in order to set a regulatory framework to guide public and private extension throughout the country (DOA, 2014). The policy states that extension and advisory services should be relevant, efficient, accountable and sustainable, and that extension should support sustainable agriculture. The policy notes that South African extension faces “major challenges in the areas of relevance, efficiency, accountability and sustainability” and that it needs to be sufficiently flexible to “respond to a wide set of local, national and global pressures to the agriculture, forestry and fishery sectors across [many] value chains” (DOA, 2014:4). The policy does not specifically provide details on the sustainability of extension, but does provide some clues.

The policy suggests that extension is sustainable when (DOA, 2014: 4-6): it operates within a “developmental and systems approach” in which extension workers “have a holistic view and understand the total value chain and linkages”; extension is governed and operates within a common set of principles and values; extension genuinely responds to the needs, aspirations, opportunities and other circumstances of the many actors in the respective value chains extension workers trained with a multidisciplinary approach capacitating them with relevant and diverse knowledge and tools while retaining subject-specific technical knowledge and skills; extension reaches beyond just production aspects of farming and addresses other elements of the value chain and subsectors such as forestry and fisheries – and these in the context of sustainable economic development a holistic and collaborative approach is applied in a truly decentralized and pluralistic approach in which of all role-players stakeholders and service providers work together and share knowledge and information; and The extension service is directly accountable to clients at field level.

Figure 3: shows the proposed arrangement for coordinating and delivering extension in South Africa. The national Department of Agriculture, Forestry and Fisheries (DAFF) will establish a National Extension Forum whose members are drawn from public, private and NGO-sector stakeholders and role-players within the agri-food system. Each of South Africa's nine provinces (these includes Gauteng(GP), Free State (FS), Mpumalanga (MP), Limpopo (L), Eastern Cape (EC), Western Cape (WC), Northern Cape (NC), North West (NW) and Kwa-Zulu Natal (KZN)) will have a provincial extension coordinating forum as well as district extension forums through the province (DOA, 2014). The forums will articulate, prioritise and coordinate the provision of extension and advisory services within their respective designated geographical areas.

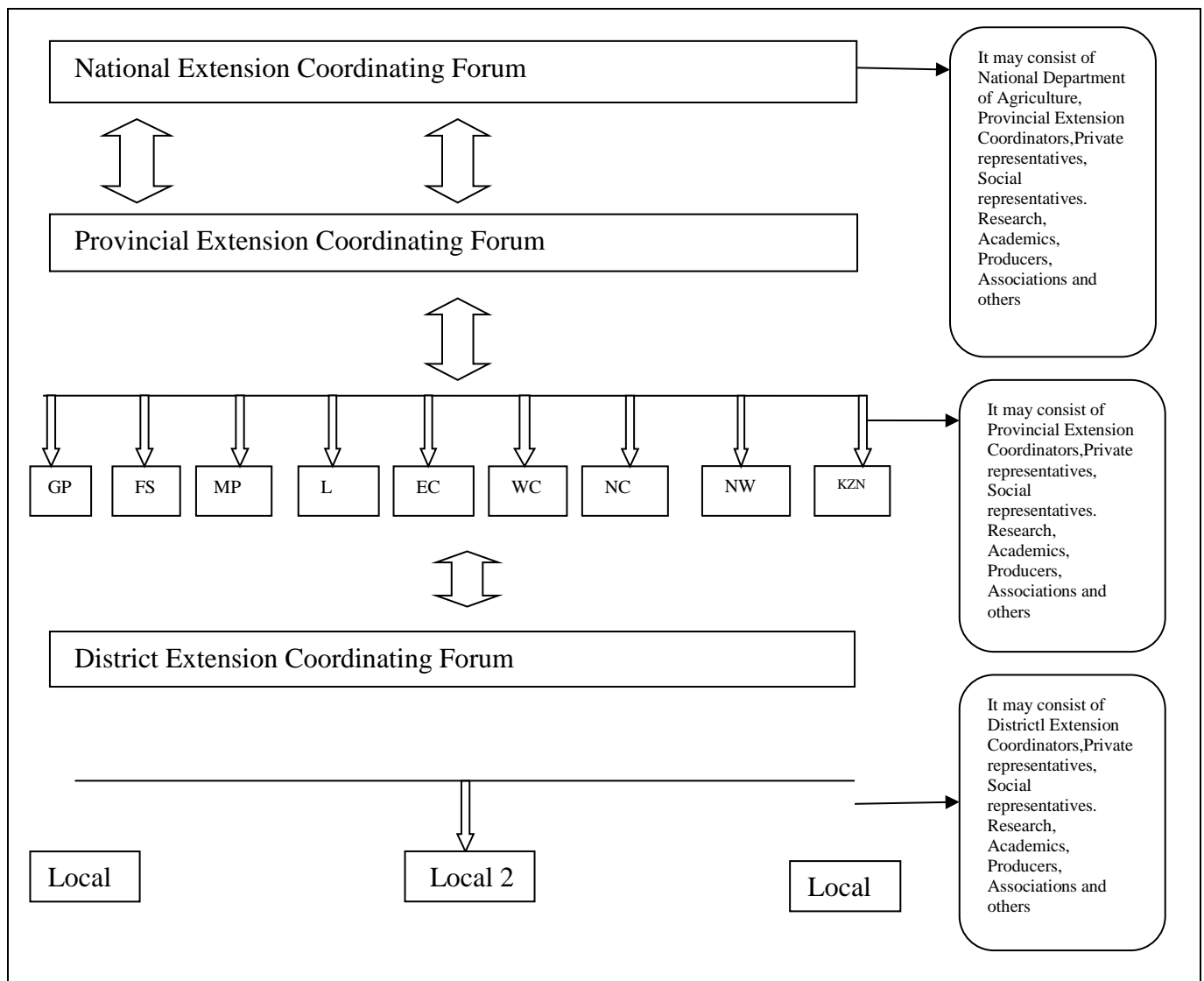
Similar to the National Forum, provincial and district forums will comprise relevant stakeholders from the public, private and NGO sectors, including farmers and others in the value chain. The composition of the forum is determined by the policy and may be extended or reduced depending on the scope of the forum. Information relevant to coordinating extension should flow in all directions within the system – not merely top-down. This underscores the intended collaborative mode of this proposed approach to coordinating extension. It is also in keeping with operating holistically and collaboratively using a systems approach, and makes extension more accountable at the 'field level' – all of which are needed to ensure the sustainability of extension. Although not expressly articulated in the policy, this proposed arrangement for coordination will also encourage and facilitate learning.

### **Extension Recovery Plan**

The Extension Recovery Plan (ERP) was developed to capacitate or revitalise extension and advisory services in the country. This initiative sought to address various challenges and limitations in the sustainability of farmers and farming activities. The five strategic objectives or pillars of the ERP initiative are to: ensure visibility and accountability of extension; promote professionalism and improve the image of extension; recruit extension personnel; re-skill and re-orientate extension workers; provide information and communication technology (ICT) and other resources (DOA, 2011).

## Norms and Standards for Agricultural Extension

Norms and Standards for South African Extension and Advisory Services (NSAEAS) were also developed as a result of lack of framework for these services (DOA, 2005). Among other objectives, the Norms and Standards promote participatory approaches to extension and advisory services that lead to sustainable income generation by extension's clients in the context of fostering learning on sustainable agricultural production, including the conservation of natural resources. The Norms and Standards specifically define sustainability with six factors: productivity; risk reduction; protection of the environment; economic viability; social acceptability; technical feasibility; and commercial feasibility (DOA, 2005).



**Figure 3: Institutionalization of extension coordination forum in South Africa** (Adapted from Draft National Policy on Extension and Advisory services DOA, 2014)

Additionally, the Norms and Standards emphasise strengthening the link between research, extension and farmers to promote research that supports sustainable agriculture. Finally, the Norms and Standards also emphasise the need to revitalise curriculum at institutions of higher education. The curriculum should enable extension practitioners to address issues such as increasing food security, economic growth, globalisation and environmental conservation (DOA, 2005).

### **National Development Plan**

The National Development Plan (NDP) is considered a major step in the process of charting a new path for the Republic of South Africa – including promoting agriculture as an important path to eliminate poverty, reduce inequalities and redress the imbalances caused by apartheid. It is anticipated that much agricultural land will be urbanised which potentially creating uncertainties regarding food production and food insecurity. The NDP encourages moving away from unsustainable use of natural resources – expressing the need to reduce carbon emissions, and the concern that water for agriculture and drinking is becoming scarce and exhorting farmers to use water-conserving irrigation methods (NDP, 2013).

The NDP also addresses social protection in terms of improving livelihoods, pronouncing that eliminating poverty and reducing inequalities the main drivers of social solidarity. The NDP emphasizes that South Africa's agricultural potential is much larger than its current output; that the low potential is results from poor access to agricultural land and environmental degradation of land controlled by foreign and private entities. The NDP proposes a 'green revolution' to encourage food security by promoting sustainable agricultural among smallholder farmers.

### **Findings and implications of the study**

The main objective of this study was to evaluate South African public agricultural extension and its alignment to the five pillars of sustainable agriculture. The premise of the study was that there is no inclusive policy dealing specifically with sustainable agricultural practices in South Africa (Khwidzili & Worth, 2017). Thus, it was necessary to study various

policies to determine the criteria being used when discussing or promoting sustainable agriculture. To facilitate this discussion, each of the five pillars is discussed.

### **Maintaining and increasing biological productivity**

The NPEAS refers several times to improving productivity of agricultural production, with emphasis on the production of food. However, no reference is made to organic matter in the soil, which is a key factor in sustained productivity. The ERP developed to capacitate extension and advisory services, focuses on improving the role of extension and advisory services with reference to promoting sustainable agricultural practices. However, no reference made to biological productivity. The NSAEAS gives a framework for conducting extension, with specific reference to “improved agricultural productivity” (DOA, 2011:2) and includes it as part of sustainability (DOA, 2011:4), but with little elucidation about it except that it is function of innovation. The NDP emphasises the production of food to eliminate food insecurity by 2030.

### **Decreasing the level of risk to ensure larger security**

This pillar is often confused with economic viability. While they are related, they are separate elements of sustainability. The NPEAS and the ERP both conflate risk and economic viability into the traditional economic viability pillar of sustainability, thus losing the nuance of risk which is inherent in agricultural production and therefore cannot be totally eliminated. The ERP makes reference to risk in relation to agriculture, noting only that extension should (among other things) address “dealing with changing patterns of risk” and that risk reduction is part of sustainable production (DOA, 2011:1). The NDP broadly discusses risk across all development endeavours covered by the policy, and in particular lifestyle risks faced by individuals. Specifically, it refers to climate-change risk and the related risk of insufficient irrigation water. It raises concern regarding bio-security risk in the context of promoting export-quality production from smallholder farmers, but does not specifically speak to risk in agricultural development as an element of sustainability.

### **Protecting the quality of natural resources**

This pillar is well-emphasised in all four policies. This is not unexpected as it originates from the three traditional pillars of sustainable agriculture. It is, however, always referred to

environmental viability. It is noted that the policies, not dissimilar to literature on sustainable agriculture, integrate this pillar is integrated with biological productivity – masking the distinct role of biological productivity in sustainable agriculture. This is the case with the NPESA and the ERP which define this pillar in terms of environmental viability. The NSAEAS specifically refers to the objectives of “endowing farmers with skills and knowledge for ensuring sustainable resource management” (DOA, 2005: 2) and cites this as a specific function of extension.

The NDP refers specifically to the need to address the “extreme pressure on natural resources” – which resources it states “include its adjacent oceans, soil, water, biodiversity, sunshine and a long coastline” (NDP, 2013:47). To achieve this, the intention is to establish an environmental framework that indicators for natural resources to be publicly monitored. As noted, the NDP makes specific reference “long-term planning to promote biodiversity and the conservation and rehabilitation of natural assets” (NDP, 2013). Specifically needing attention is “damage to the environment includes soil loss due to erosion, loss of soil fertility, salination and other forms of degradation” and the harmful practices where “water extraction for irrigation is exceeding rates of replenishment” (NDP, 2013: 92.)

### **Ensuring agricultural production is economically viable**

This is one of the three traditional pillars of sustainable agriculture. Thus, it would be reasonable to expect to find reference to it in each of the policies reviewed. However, this is not the case. The NPEAS refers to economic viability in the context that extension should foster economic “economic sustainability of the agriculture, forestry and fishery sectors” (DOA, 2013:4), and with specific reference to land reform. The NSAEAS indicates that extension “projects/activities must consider economic impacts” and includes “economic viability” (together with “commercial feasibility”) as a part of its definition of sustainability (DOA, 2013:4). The ERP makes no mention of economically viable agricultural production. The NDP alludes to the need for land reform to result in economically viable agricultural production; otherwise it makes no reference to the economic viability of agriculture.

### **Ensuring agricultural production is socially acceptable**

Again, given that social acceptability is one of the original pillars of sustainability, it should appear in each of the policies reviewed. Surprisingly, there is little reference to social

acceptability in agriculture. The NPEAS notes that extension should lead to “wise decision-making about the socially...sustainable use of resources” in farmers’ efforts to advance their livelihoods. It notes also that, in the pursuit of commercialisation, more attention must be given to social impacts of commercialisation. The NSAEAS indicates that extension “projects/activities must consider social impacts” and includes “social acceptability” as a part of its definition of sustainability (DOA, 2013:4). The ERP makes no reference to social acceptability in any context. The NDP considers social acceptability as fundamental to sustainable development. It refers to the need to produce food that is socially acceptable.

### **Conclusion**

This paper provided a succinct evolution of agricultural extension in South Africa with special emphasis that extension services were imposed on farmers through the transfer of technology extension approaches. Since its inceptions in South Africa, agricultural extension is now recognised by the South African Council for Natural Science Profession (SACNASP). This implies that agricultural extension practitioners should register as scientists. The implication for this is that extension should work under code of conduct regulated by SACNASP. Drawing from the evidence presented in this paper it can therefore be argued that South African public agricultural extension is best placed to promote sustainable agriculture through the five pillars of sustainability. Apart from the conventional approaches there are a number of models the extension could use to disseminate information. The definition of agricultural extension was highlighted starting from the early years, beginning of second millennium and beyond. The paper highlighted the role of public extension services in South Africa.

The promotions of sustainable agricultural practices amongst farmers remain the domain of public extension in South Africa. Central to promotion of sustainable agricultural practices is the knowledge, skills and insight concerning the multifaceted process of changing farmers' behaviours. The national policy on extension and advisory services serves as a framework guiding the role of different stakeholders that are involved in public extension services. The extension and advisory policy support the establishments of extension coordinating forums ranging from districts, provincial and national. These forums will be vital in promoting sustainable agricultural practices provided that all stakeholders remain relevant. Judging from its composition which ranges from researchers, academics, private sector,



associations, social representatives and other, these forums could play a pivotal role in shaping the landscape of extension and advisory services in South Africa.

The paper also identified other initiatives by the government to support extension and advisory service. These initiatives include amongst others the extension recovery plan (ERP) and the norms and standards for extension and advisory services. The paper also confirmed that a four-year degree in agriculture is required in order to practice extension and advisory services in South Africa. The study also observed that in few years to come, no one will be allowed or appointed as an extension practitioner if they are not registered with SACNASP. Registration to SACNASP should be preceded by registering to the South African Society of Agricultural Extension. SASAE is the voluntary organisation which acts as a mouthpiece of advocating extension and advisory services in the country. Finally, the establishment of a national policy on sustainable agricultural practices would serve as a compliment for the national policy on extension and advisory services in South Africa.

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## **CHAPTER 5**

### **PROMOTION OF SUSTAINABLE AGRICULTURE BY MPUMALANGA AGRICULTURAL EXTENSION SERVICES: PERSPECTIVE OF PUBLIC EXTENSION PRACTITIONERS**

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## **Abstract**

The ever growing population of the world compels most farmers to resort in farming practices that are unsustainable. This is particularly factual in Mpumalanga province, South Africa, where there is a lack of support towards promoting sustainable agriculture. This study evaluates the role of public agricultural extension in promoting sustainable agriculture in Mpumalanga province. The role of public agricultural extension is evaluated against the framework of the five pillars of sustainable agriculture. The study evaluates the context of dominant agricultural extension approaches used in Mpumalanga province. Data was collected through semi structured interviews with 68 respondents, comprising of various extension practitioners in all seventeen districts in Mpumalanga province. The study provides an analytical emphasis on the premise that the assessment of farmers' livelihoods will assist extension practitioners to customise their interventions based on farmers' needs. The study further evaluates extension practitioners' knowledge of the concept of sustainable agriculture. The support provided to extension practitioners in promoting sustainable agriculture was also appraised. Table 1 in this paper presents consolidated responses on extension practitioners' knowledge of the five pillars of sustainable agriculture. Extension practitioners provided their suggestions on what measures could be taken to promote sustainable agriculture in Mpumalanga province. Drawing from the conclusions of this study, it is evident that there is a need for frameworks and support for extension practitioners in sustainable agricultural practices.

**Keywords:** Mpumalanga province, extension practitioners, sustainable agriculture, five pillars, natural environment

## Introduction

About sixty percent of the land in Mpumalanga province is used for agricultural purposes. Mpumalanga is one of the nine provinces in South Africa. The name Mpumalanga means east or literally the place where the sun rises. Mpumalanga lies in the central eastern area of South Africa and shares its border with two African countries, Mozambique and the Kingdom of eSwatini (Swaziland). The province also shares borders with other South African provinces which include Limpopo to the north, Gauteng to the west, the Free State to the south west and Kwa-Zulu Natal to the south. The province is divided into the three district municipalities of Ehlanzeni, Nkangala and Gert Sibande.

The province is further sub-divided into seventeen local municipalities which are Albert Luthuli, Depaliseng, Goven Mbeki, Lekwa, Mkhondo, Msukalikwa, Pixley ka Seme, Delmas, Dr. JS Moroka, Emalahleni, Highlands, Steve Tshwete, Thembisile Hani, Bushbuckridge, Nkomazi, Thaba Chweu and Mbombela.

The study was conducted in Mpumalanga province. In each of the seventeen local municipalities, four extension practitioners were interviewed through a structured questionnaire for total of 68 practitioners throughout the province. A number of farmers were also interviewed throughout Mpumalanga in order to triangulate the validity of data collected from extension practitioners. The study provides a perspective of some common extension approaches that are used in Mpumalanga province. This study outlines the imperative for considering farmers' livelihood prior to providing extension services. The argument for considering livelihoods is based on the premise that farmers' attitudes differ- in terms of their well-being related to income, education, experience, and other determining baselines.

Some respondents were quoted from audio recordings or questionnaire. The study assessed the respondents' knowledge regarding the concept of sustainable agriculture. It came somewhat clear that their knowledge was primarily based on the three pillars of sustainable agriculture social, environmental and economic viability (Tey, *et al*, 2012: 379-396) instead of the total five-pillared framework (Khwidzhili & Worth, 2016).

The study gives a perspective of the respondents' attitudes and practice towards promoting sustainable agriculture in Mpumalanga province, as well as the support they receive

towards this end. Table 1 provides consolidated responses of the respondents towards the five pillars of sustainable agriculture. The imperial perspectives of farmers towards sustainable agricultural practices were also highlighted. Finally, initiatives for promoting sustainable agriculture in Mpumalanga were also outlined. The study concluded by providing philosophical conclusion and recommendations based on the results of this study.

### **Objectives and purpose of the study**

This study evaluated the promotion of sustainable agriculture by Mpumalanga public agricultural extension practitioners. It evaluated whether or not current agricultural extension services are aligned to the five pillars of sustainable agriculture. The study evaluates the degree to which extension practitioners get support towards promoting sustainable agricultural practices in Mpumalanga province. The study also highlighted the reaction of farmers towards sustainable agriculture. The study draws from public agricultural extension on what could be initiated to promote sustainable agriculture in Mpumalanga province. The purpose of the study also compliments the main objective which was to determine how and through what means public extension could promote sustainable agriculture through five pillars of sustainability.

### **Research methodology**

Data was collected through structured questionnaires with sixty-eight public agricultural extension practitioners in Mpumalanga province. Mpumalanga province consists of seventeen municipalities. In each municipality four extension practitioners were purposively selected to take part in this study. The researcher arranged with extension managers of all seventeen municipalities for the purpose of collecting data. Respondents were given questionnaires to respond and the researcher was always available to give clarity and follow-up questions. Each respondent answered the questionnaires separately from one another to avoid biasing or influencing responses. All the completed questionnaires were collected by the researcher for analysis.

According to Cohen (2007), purposive sampling allows for selecting rich information from respondents with specific characteristics relevant to the objectives of the research. Purposive sampling will enable the researcher to select a case which demonstrates some characteristics or processes of which the researcher is interested (Cohen *et al*, 2007:254). The

selection considered gender, age, experience and qualification of the respondents, this was purposeful to ensure there is even distribution of respondents. The study adopted a basic qualitative approach. The research drew its methods from the interpretive paradigm which focuses on relevant experiences and interpretation, (Nieuwenhuis, 2007:50).

The study also used convenience sampling which allowed for the selection of respondents from the relatively homogenous population that were available and willing to participate at the time of data gathering (Saunders, Lewis & Thornhill, 2007). During collection of data most information was saturated (Glaser & Strauss, 1967). This did not stop the research from collecting further information for the purpose of final triangulation. Triangulation technique was used to determine points of similarities and variations in qualitative data collection from participants through questionnaires, interviews and related literature review to improve the credibility of findings and interpretations.

Data was collected between June 2017 and July 2018. The respondents were informed about the purpose of the study and requested to sign a consent of participation. Respondents were not required to sign the form. The respondents were given a questionnaire with enough space for them to explore their understanding. After completing the questionnaire, the respondents were interrogated using supplementary questions to get their insight and clarity on their initial responses.

The researcher held an advantage, having served as a member of an adjudication panel for the best extension practitioners Mpumalanga province. Similar questions related to sustainable agriculture were asked during the adjudication. The interactions were recorded and notes were also taken during a panel of adjudication. The researcher was also able to access all power-point presentations from extension practitioners. The researcher was also able to access the final consolidated report from all the fellow adjudicators. Finally, various relevant documents and existing literature were used to relate the outcome of the study (Downe-Wamboldt, 1992; Hsieh & Shannon, 2005).

## **Results/ findings**

This section presents the results of the responses of 68 purposively selected respondents to the study questionnaire (See Appendix 6). The analyses also included documents, journal articles and other related information on sustainable agriculture in order to triangulate and give insight of the data.

### **Agricultural extension approaches**

This paper identifies some common extension approaches that are used in Mpumalanga province. Extension practitioners use these approaches to convey information to farmers. The farm visit or face to face interaction and system approach are the most commonly used extension approached in Mpumalanga Province. Some respondents indicated that they prefer farmer to farmer approach. Farmer to farmer approach involves farmers assisting one another through the help of extension practitioners. Farmers are likely to learn from each other's experiences. Some respondents indicated that it is unethical to disclose farmers' information without their consent. System approach extension recognizes the farmers work within certain systems, meaning that apart from agricultural activities, farmers have internal and external forces the influences their decision making.

This paper also revealed that majority of extension practitioners use participatory approach which recognizes that farmers are part of decision making. In order to facilitate a successful participatory approach, the following platform should be organized; workshops, meetings, awareness, campaigns and trainings. Other information includes information and farmers' days. Another successful approach involves grouping farmers according to their commodities. A Commodity group approach involves farmers who produce similar products. A good example is that of maize farmers; they relate to each other as they experience similar challenges and success about maize production.

Some extension practitioners prefer to organize farmers according to farming categories. Farmers are categorized according to their scope of production such as subsistence, small scale or commercial. The need drive in approach is determined by farmers who require specific support from extension practitioners. Another approach that extension uses is the farmers' forum association where all stakeholders meet quarterly to evaluate the challenges and achievements of their projects. The study also reveals that extension practitioners make use of

agricultural development committees at a ward level in order to share relevant information with farmers.

A majority of practitioners still have a preference on bottom -up extension approach in which farmers identify their problems and seek advice from extension services. The top-down approach, a traditional transfer of technology which dictates that farmers are only recipients of technology from extension practitioners, is fading away as most practitioners avoid using this approach. Some extension practitioners are engaged with home or community project approaches. In this method, practitioners consult with the traditional authorities and organize meetings with this category of farmers.

As a result of the growing digital platforms, some extension practitioners prefer to utilize cellular phones for direct calls, SMSs and WhatsApp to the farmers. A few extension practitioners create group chats amongst the farmers in order to exchange information and challenges affecting their farming enterprise.

### **Assessing farmers' livelihood**

This paper evaluates the degree to which extension practitioners consider farmers' livelihoods when providing extension services. All respondents indicated that they do consider farmers' livelihoods. The concept of livelihoods comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shock, maintain or enhance its capabilities and assets, while not undermining the natural resource base (Chambers, 1994; Glew *et al*, 1995; DFID, 2000; Heller, 2003; Misturelli & Heffernan, 2008). Practitioners indicated that the farmers they served were diverse in terms of their wellbeing related to income, education and experiences and other baselines.

Extension practitioners highlighted that livelihoods assessments assist them to identify farmer's needs and the extension services they require. They declared that livelihoods assessments also assist them to ensure that they operate from the perspective of the farmer. They also indicated that farmers are located in different areas and that this tends to direct the way they think and do things. However, individual characteristics also affect the adoption of sustainable agricultural practices, such as level of income, education and age (Cary, Webb & Barr, 2001). The following statements were said by some respondents:

*“Categorizing farmers according to their livelihood assist with planning of extension programs. Livelihood goes hand in hand with the bottom-up extension approach which promotes that farmers should identify their challenges and look for advice from extension services. Farmers feel happy when they are involved in every step of their projects”*

*“That is the first thing I consider before assisting farmers, I do situation analysis. I ask for farmer's background and current situation regarding their families. I also prefer to do the actual farm visit to understand what support will be best suited for individual farmer”*

Some respondents indicated that the department's limited resources should be channelled to the most vulnerable farmers in order to improve their livelihoods. On the other hand, they also argue that assessing livelihoods will assist the department to draft budgets reflecting farmers' needs in order to improve farmers' livelihoods. They emphasized details to be collected as part of livelihoods include, but are not limited to, farmers' background, their age and the language they speak. Other extension practitioners pointed out that livelihoods assessments assist farmers when drafting business plans and accompanying budgets to present to the department for approval. They also indicated that the rate of adoption in extension services or innovations differs depending on farmers' livelihoods.

Extension practitioners indicated that consideration of livelihoods helps them evaluate whether they are achieving their goals and objectives. Livelihoods assessment assists the department to allocate resources according to farmer's needs. Practitioners will therefore develop a database for allocation of inputs such as seeds, fertilizers and mechanization amongst others. A database on livelihoods assessment is a detailed questionnaire which contains farmers' information. The practitioners highlighted that farmers are content when their livelihoods are considered as resources will be allocated according to their farming categories. The challenge is that some farmers tend to provide incorrect information about their livelihoods especially relating to financial statements. When a farmer's livelihoods are improved their farms tend to be sustainable due to positive contributions.

*“It is advisable to include farmers when making decisions. Livelihood assessments assist us as extension practitioners to render an extension service that is relevant in*



*accordance with specific commodity. I organize meetings, farmers' days and also invite farmers who already succeeded in farming.”*

### **Knowledge of sustainable agriculture**

This section reflects on public extension practitioners' knowledge in Mpumalanga province towards their knowledge of sustainable agriculture. This section explores the definition of sustainable agriculture as well as how extension practitioners acquired such knowledge. The respondents indicated that sustainable agriculture involves focusing on farming practices where farmers are taking care of the natural environment (Altieri, 1996; Hobbs *et al*, 2008; Martin & Sauerborn, 2013). In this way, the land is protected from degradation and avoids pollution of the atmosphere. This is further supported by Mokoto (2014) who argued that water, soil, atmosphere, animals and plantation are the most affected natural resources. The respondents emphasized that they always advise farmers to use animal manure as compared to inorganic fertilizers.

The integration of crops and livestock is reported to be an important factor towards improving soil fertility. This is particularly important when planting crops which improves soil fertility like legumes (Iiyama *et al*, 2007). Variety of crops in one area can also improve soil control from different pests and diseases (Gautam & Andersen, 2016). There is a strong sentiment amongst most extension practitioners that crop rotation is closely linked to sustainable agriculture. The following statements also reflect on extension practitioners' views on sustainable agriculture:

*“Sustainable agriculture involves farming in sustainable way considering ecosystem and the environment. Such farming practices should provide and protect human health, environment and animal welfare.”*

*“To me sustainable agriculture is all about meeting societal food needs and also use methods reserve the ability of future generation to meet their needs e.g. maintaining soil health, minimum water use, lower pollution levels, economic profitability and social equity”*

*“Sustainable agriculture encourages farm productivities that will produce good return for an extended period using similar resources and without depleting the natural environment. It should protect human health and also improves soil microbial activities”*

The respondents pointed out that sustainable agriculture recognizes the practice of Integrated Pest Management (IPM). IPM promotes the use of different methods for controlling pests (Blackshaw *et al*, 2001; Caamal-Maldonado *et al*, 2001; Inderjit & Foy, 2001). If farmers alternate different methods of controlling pests, it will avoid the frequency of solely depending on chemical pesticides and herbicides (Letourneau, 1998; Nicholls, *et al*, 2001; Letourneau & Bothwell, 2008; Shennan, 2008). They further indicated that chemicals may harm beneficial species and pollute the natural environment.

Other respondents maintain that minimum tillage is part of sustainable agriculture. The practice of minimum tillage has least effect on soil compaction and erosion. Higher proportion of soil water retention can be achieved if farmers practice minimum tillage (Karlen *et al*, 1998 Abid & Lal, 2008). The respondents also indicated that rotational grazing is part of sustainable agriculture. Rotational grazing prevents animals from overgrazing. Overgrazing may lead to shortage of vegetation or pastures for animals in the future. Overgrazing may also lead to soil erosion (Khwidzhili & Worth, 2016).

This paper also highlights on how the respondents acquired their knowledge for sustainable agriculture. Most of them indicated that they attended a workshop on sustainable agriculture organized by the land care section within Mpumalanga Department of Agriculture, Land and Environmental Affairs. Some knowledge was acquired through reading journal articles and documents on sustainable agriculture. Few respondents have indicated they have a master's degree in sustainable agriculture acquired from universities. The majority of the respondents possess four year degrees in agriculture while some have relevant diplomas from agricultural colleges and universities of technology. Some respondents attended workshops on climate change and climate smart agriculture organized by the department.

This paper also reveals that other respondents attended conferences, seminars, symposia and other training on sustainable agriculture. The Agricultural Development

Committee (ADC) is also a platform where different stakeholders share their experience on sustainable agriculture. The stakeholders are composed of various members depending on the location of the ADC. In most cases the stakeholders include various government departments, municipalities, research institutes, communities and representatives of traditional leaders. Sustainable agriculture should emerge as a result of individual or collective intelligence to maintain the long-term productivity of the natural resources on which they depend (Sriskandarajah, 1991; Pretty 1995; Rolling 1994).

The knowledge of respondents on the concept of sustainable agriculture practices is summarized in Table 3 (thematic analysis).

**Table 3: Understanding pillars of sustainable agriculture**

	Understanding pillars of sustainable agriculture by respondents (Indicators of sustainable agricultural practices)
<b>Pillar 1</b> Maintaining and increasing biological productivity	<ul style="list-style-type: none"> <li>• Implementation of conservation or organic farming.</li> <li>• Farmers should avoid soil degradation and disturbance to the ecosystem.</li> <li>• Natural vegetation should be protected to avoid soil erosion.</li> <li>• Crop rotation and rotational grazing should be encouraged.</li> <li>• Some portion of the farm should be rested (fallowing).</li> <li>• Encourage minimum or zero tillage.</li> <li>• Uncontaminated water should be used for irrigation.</li> <li>• Farmers should limit or avoid the use chemicals such as pesticides, fungicides, inorganic fertilizers and herbicides.</li> <li>• Promote the use of animal or kraal manure.</li> <li>• Mulching and making compost heap.</li> <li>• Chemicals pollute ground water.</li> <li>• Farmers should be encouraged to plant green manure to improve soil fertility.</li> <li>• Avoid movement of heavy machines (soil compaction).</li> <li>• Promote microbial activity (encourage earthworms, micro- fauna and flora).</li> <li>• Planting should be against contour lines to prevent soil erosion.</li> </ul>
<b>Pillar 2</b> Decreasing the level of the risk to ensure larger security	<ul style="list-style-type: none"> <li>• Planting date for farmers no longer predictable as a result of climate change.</li> <li>• Theft in farms.</li> <li>• Natural disasters and man- made farmers.</li> <li>• Financial risk associated with high cost of chemicals and other farm inputs.</li> <li>• Market risk associated with competition amongst farmers in relation to quality farm produce.</li> <li>• Planting crops that are adaptable to local conditions.</li> <li>• Choosing resistance or adaptable cultivars.</li> <li>• Planting of certified seeds.</li> <li>• Continuous training of both extension and farmers.</li> <li>• Linking farmers with formal markets, logistical support, and agro-processing and other market hubs.</li> <li>• Post-harvest risk (storage and handling).</li> <li>• Conservation farming.</li> <li>• Planting in controlled environment (considers both plastic and shade tunnels).</li> <li>• Farmers should have insurances for their farm and produces.</li> <li>• Farmers should guard against diseases outbreak for animals.</li> <li>• Labour unrest (strikes) and pickets.</li> <li>• Farmers should have proper fences in their farms.</li> </ul>
<b>Pillar 3</b> Protecting the quality of natural resources	<ul style="list-style-type: none"> <li>• Rain water harvesting.</li> <li>• Training is required for administration and safe keeping of agricultural chemicals.</li> <li>• Farmers should be encouraged to use irrigation systems that save water.</li> <li>• Farmers should avoid spraying of chemicals which pollute the atmosphere.</li> <li>• Climate smart agriculture.</li> <li>• Biological control of pest.</li> <li>• Protection of beneficial insects such as bees and ladybirds.</li> <li>• Intercropping with repellents or herbs to avoid the use of pesticides.</li> <li>• Integrated pest management.</li> <li>• Chemicals pollutes rivers and dams (pose danger on aquatic life).</li> </ul>

Understanding pillars of sustainable agriculture by respondents (Indicators of sustainable agricultural practices)	
<b>Pillar 4</b> Ensuring agricultural production is economical viable	<ul style="list-style-type: none"> <li>• Farmers produce for commercial purpose.</li> <li>• Farmers should know budgeting processes and planning (clear understanding of all financial statements).</li> <li>• Price of farm inputs and inflation.</li> <li>• Production should be above break-even -point.</li> <li>• Efficient record keeping.</li> <li>• Good profit without harming the natural environment.</li> <li>• Farmers should make money (profit) from farming practices.</li> <li>• Farmers should be encouraged to invest their profit.</li> <li>• Increased production in farms.</li> </ul>
<b>Pillar 5</b> Ensuring agricultural production is socially acceptable	<ul style="list-style-type: none"> <li>• Farmers produce for own consumption.</li> <li>• Farmers avoid the production of genetically modified organisms.</li> <li>• Farmers should produce products that are acceptable by consumers (Products should not have health issues).</li> <li>• Farmers should form cooperatives and relevant forums.</li> </ul>

*Adapted from Khwidzhili & Worth (2017)*

### **Promoting sustainable agriculture**

*The respondents were asked on which role public agricultural extension could play in promoting sustainable agriculture.*

They indicated that farmers should be trained in conservation farming. In conservation farming the soil is less disturbed by tractors. Farmers should be encouraged to produce products that are accepted to the market. Farmers should be taught using practical demonstration rather than theories. The respondents indicated that farmers should be encouraged to use environmentally friendly inputs such as inorganic fertilizers and other chemicals; this assertion is confirmed by (Shah, Ganji & Coutrousbis, 2017). The innovation should first be tested or researched and thereafter be shared with farmers. Other respondents proposed for coordinated resource management. Coordinated of agricultural resources will help facilitate farmers to use inputs that are not harmful to the natural environment (Manale *et al*, 2009; FAO, 2014; Krall, 2015).

Extension practitioners should organize workshops and awareness committees on sustainable agriculture. Farmers should be encouraged to form partnership with other farmers in order to discuss and share expertise of sustainable agricultural practices. Cary *et al* (2001) argued that sustainable agricultural practices differ with the environment as there is no specific practice for all users. They indicated that there should be introduction of farmers' training

centres in the province (Mpumalanga). The respondents proposed that participatory and bottom-up extension approaches should be emphasized, as these approaches make farmers part of problem solving and decision making.

The respondents were further asked if they would encourage other extension practitioners to promote sustainable agriculture. These were their responses:

All respondents indicated they will encourage sustainable agricultural practices to prevent further degradation of the natural environment. Farmers are likely to adopt agricultural advice if they know such innovation has worked for other farmers. There is no single extension approach that will suit all occasions. This means that extension approaches should be used alternately depending on categories of farmers. Some various views about promotion of sustainable agriculture are:

*“Yes, I encourage others to promote sustainable agriculture because agriculture depends on scarce natural resources such as water, soil and the ecosystem. Therefore, it is critical that all agricultural producers should practice sustainable agriculture”.*

*“Yes, because this is for the benefit of farmers who are poor and living in rural areas. These farmers can't afford food without farming. Farming helps them produce food and generate income. Extension should assist farmers produce more food without harm to the natural environment”*

*“Yes, we must remember that we are not only doing for farmers but also for the future generation of farmers. Farmers should take care of the natural environment and not forgetting that farmers should still get good return from their produce”.*

*“Definitely since extension officers have high influence towards farmers. Farmers will be able to move from conventional to conservation agriculture. In conservation agriculture farmers will save water and practice minimum tillage”.*

### **Supporting extension practitioners towards sustainable agriculture**

*Respondents were asked on what kind of support they will require from their managers to promote sustainable agriculture:*

Most respondents highlighted that they require regular training and workshops on sustainable agriculture. They pointed out that managers approve both weekly and monthly itineraries so that they can attend farm visit, workshops and campaigns. There should be intervention from the national Department of Agriculture Forestry and Fisheries and the Agricultural Research Council (ARC). Some respondents indicated they still need a formal training in institution of higher learning such as Technical Vocational Education Training (TVET) colleges, colleges of agriculture, universities and universities of technologies.

*“I require more training, workshops, exposure, farm visit and even more. This can assist our farmers and extension services to understand and contribute towards sustainable agriculture. Trainings can also help extension practitioners understand some risk that affects farmers. Extension service will help disseminates information and mitigation of risk and disasters”.*

Most respondents indicated that they receive no support from their manager in order to support sustainable agriculture. They suggested that information from other districts should be shared amongst officials. The support will assist the respondents in relaying information to farmers. Most extension practitioners have subsidy cars or government vehicles that they use when providing extension services. Other tools include cellular phones, laptops, extension apps (applications) and extension suite online a that assist them in providing extension services to farmers The respondents also reveal that most extension managers visit projects in order to monitor if the respondents are providing service to farmers.

*“My manager gives me contact for different stakeholders so that we share information on sustainable agriculture”.*

*“The manager is responsible for both production and administrative policies. This makes it difficult to focus on sustainable agriculture. The support given is general and not specific to sustainable agriculture”*

*“No support I get from my manager except that she travels a lot to claim fuel from the department and not monitor work done. Extension manager often spoil farmers by giving production inputs instead of farmers buying inputs for themselves”.*

## **Reaction of farmers towards sustainable agriculture**

In response to the pressure for food production to meet the demand of the ever-growing world population, many farmers have resorted to use farming practice that increase agricultural production without considering the potential harm to the natural environment (Khwidzhili & Worth, 2017). Respondents were asked the following question:

*What is the reaction of farmers as you advise them about the importance of sustainable agriculture?*

Farmers are positive about sustainable agricultural practices in response to zero tillage method. In zero tillage less soil is disturbed by machinery. The respondents indicated that farmers are willing to reduce their stocking order to avoid overgrazing. Overgrazing exposes soil to erosion. There is some resistance by farmers who perceive sustainable agricultural practices as unprofitable. Farmers are comfortable to use irrigation systems that save water and other practices such as water harvesting. Farmers replace chemical fertilizers with animal manure.

*“Most smallholder farmers have challenges with access to market. The engagement that I always have with farmers is on compliance to good practice (sustainable agriculture). The compliance helps with market access certification. The reaction of farmers is always positive because sustainable agricultural practices help in accessing markets”.*

This paper noted that most commercial farmers are money driven and therefore it is difficult for them to practice sustainable agriculture. However, there is an indication that shows that farmers are gradually moving towards adopting sustainable agricultural practices. This is as a result that farmers have noticed continuous decline of the natural resources. In most circumstances they are interested in increasing yield without considering the natural environment. Farmer requires more land for agricultural purpose in order to farm for markets. Even though awareness of sustainable agricultural practices to farmers may be available, some farmers are reported to not adopt these practices even when they are aware of them (Rodriguez *et al.*, 2009).

*“Farmers responded very well on taking care of natural resource because we do advise them, that if they don't protect it, they will lose their treasure. This can be witness when we are visiting their farms. Farmers have made gabions to prevent soil erosion. They also construct some waterways and build earth dams to store water. Other farmers bought some water tanks to store water and also use drip irrigation systems to prevent waste of water”.*

A study by Alonge & Martin (1995) argued about different barriers which influence the level of adoption by farmers. Among these barriers are human behaviour and their perception toward the sustainable agriculture as well as resources means to adopt the practices.

### **Initiatives for promoting sustainable agriculture in Mpumalanga province**

*Respondents were asked on what measures should be in place to promote sustainable agriculture in Mpumalanga province:*

The Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) should partner with relevant stakeholders to create awareness on sustainable agriculture. Most respondents indicated that more trainings, workshops and dialogues should be organized to promote sustainable agriculture. It is imperative that workshops on sustainable agriculture be prioritized in order to improve the knowledge on the subject. Knowledge on sustainable agriculture is important in compliance with market access certification such as South African Good Agricultural Practice (SAGAP). The lack of knowledge among the extension practitioners is that they do not receive any training in the service they provide. They also neglect the research findings, which carry the scientific findings of the sustainable agriculture (Agunga, 1995). Lack of information by the change agents can also affect the distribution of practices to the farmers.

Some respondents indicated that institutions of higher learning especially the University of Mpumalanga should introduce formal and short courses on sustainable agriculture. In support of institutions of higher learning, sustainable agricultural practices should be initiated in the foundation education system. The respondents indicated that there should be a departmental grant dedicated to farmers who are already practicing sustainable agriculture. This will encourage many small holder farmers to engage in sustainable



agricultural practices. Farmers should be provided with resources that promote sustainable agricultural practices.

*“There should be adequate provision of budget available to purchase no till implements especially for small holder farmers. On-farm training and demonstration should be emphasized. Pezukwemkhono and other departmental programs should be designed to promote sustainable agricultural practices.”*

Most respondents proposed that there should be forums that are targeting farmer who are practicing sustainable agriculture. They proposed that the department should formalized forums for relevant stakeholders that will meet to promote and share ideas on sustainable agricultural practices. Departmental programs of mechanization should support or prioritize implements that promote sustainable agricultural practices at a farm level.

### **Conclusion and recommendations**

The study found that extension practitioners in Mpumalanga are not aware of the five pillars of sustainable agriculture. However, the responses suggest that they fully understand the three common pillars of sustainability --economic, social, and environmental viability. There is a need to define all the five pillars of sustainability in their totality. Table 3 presents consolidated responses of all sixty-eight respondents. The subdivision on the five pillars of sustainable agriculture in Table 1 was categorized by the researcher and not by individual respondents. The researcher had to classify the sustainability indicators in Table 1 according to five-pillared framework. The study reveals that there are no framework or guideline documents supporting sustainable agriculture in Mpumalanga province. This might be a result that South Africa does not have an inclusive policy on sustainable agricultural practices (Khwidzhili & Worth, 2017).

The study shows that the extension practitioners in Mpumalanga are aware of the concept of sustainable livelihood and that it is imperative to consider and understand farmers background prior providing extension services. The study also discovered that the promotion of sustainable agricultural practices is dependent on the knowledge of individual extension practitioners. This is dictated by the level of education and experience on the concept of

sustainable agriculture. There are no clear benchmarks or targets in place towards promotion of sustainable agricultural practices in Mpumalanga province.

The study further reveals that there is formal support towards promoting sustainable agriculture. There is a conflicting argument amongst farmers who support sustainable agriculture and those against the concept. Most farmers prefer to take care of their natural resources in order to conserve it for future generation. The latter argument is based on that sustainable agricultural practices are not practically income orient. There is a need for training of extension practitioners on the five-pillared framework of sustainability. There is also a need to establish a sub-directorate that will focus of sustainable agriculture in Mpumalanga. Finally, potential studies should be conducted to further categorize sustainable agricultural practices according to five pillars in sustainable agriculture.

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## CHAPTER 6

### PROMOTION OF SUSTAINABLE AGRICULTURE BY MPUMALANGA AGRICULTURAL EXTENSION SERVICES: PERSPECTIVE OF EXTENSION MANAGERS

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## **Abstract**

Over-exploitation of the natural resources by farmers poses challenges to future generations who will farm on the same land. This has a direct implication for extension practitioners in South Africa. Most of the farms stay fallow as a result of repeated use of agricultural chemicals. This study evaluates the support of agricultural extension managers towards promoting sustainable agriculture in Mpumalanga province. The evaluation is based on whether extension managers supports agricultural extension practitioners in promoting sustainable agriculture in the context of five-pillared framework: maintaining and increasing biological productivity, decreasing the level of risk to ensure larger security, protecting the quality of natural resources, ensuring agricultural production is economically viable and ensuring agricultural production is socially acceptable. The finding of this study reveals that respondents were mostly aware of the commonly known three pillars of sustainability: environmental, economic and social viability. Some legislations impacting on sustainable agriculture are also highlighted. The knowledge and understanding of sustainable agriculture between extension managers and extension practitioners is comparable. There is no formal enforcement for promoting sustainable agricultural practices by extension managers. This is due to lack of inclusive policies and guidelines towards promoting sustainable agriculture in South Africa. The consecration of promoting sustainable agriculture is not formal and therefore rests on individual extension practitioners. There is a need for training of farmers and extension practitioners in sustainable agriculture in the perspective of the five-pillared framework in Mpumalanga province.

**Keywords:** Extension managers, Mpumalanga province, sustainable agriculture, supporting extension, five pillars

## **Introduction**

Sustainable agricultural practices should be promoted by extension managers through supporting agricultural extension practitioners. The study was done in Mpumalanga province in South Africa. The study evaluated the extent to which extension managers provide support in promoting sustainable agricultural practices within the province. Data was collected from seventeen extension managers in seventeen municipalities of Mpumalanga province. Each of the seventeen municipalities was represented by one extension manager.

Data collected from this study is minimal due to the fact that each of the 17 municipalities has only one extension manager. However, all 17 managers participated in the study, thereby creating a rich and full representation of the province. Extension managers were evaluated on whether they understand the concept of sustainable agriculture in the context of five-pillared framework. Some relevant legislation impacting on sustainable agriculture was also highlighted with the aim providing guidance towards policy formulation, especially on sustainable agriculture.

The study concluded by providing recommendations on initiatives to be considered towards promotion of sustainable agricultural practices in Mpumalanga province. Areas of further research on sustainable agriculture were also recommended.

### **Purpose and objectives of the study**

The main purpose of the study is to evaluate the extent to which the extension managers support their agricultural extension practitioners in promoting sustainable agriculture in Mpumalanga province. The objectives of the study are:

- To suggest relevant legislation related to sustainable agricultural practices.
- To assess the understanding of extension managers on the five-pillared framework and the concept of sustainable agriculture.

## **Research methodology**

Data was collected from seventeen agricultural extension managers in Mpumalanga province. The province consists of seventeen local municipalities. In each municipality there is one extension manager who is responsible of managing agricultural extension practitioners. Arrangements were made to meet with the extension managers for the purpose of collecting data. A structured questionnaire was designed to collect data from all extension managers. After completion of the questionnaires by extension managers, follow-up questions were asked to understand the depth of their responses.

The respondents were informed of the purpose of the study and given opportunity to ask questions before completing questionnaires. They were also given the option to sign a consent form indicating their willingness to participate in the study. The data collection took place between June 2017 and August 2018. Follow-up data collection was completed in September 2018. Respondents were given questionnaires to respond and the researcher was always available to provide clarity and follow-up questions. Each respondent responded separately from others to avoid bias. The respondents completed the questionnaire and this resulted to getting their insight about the topic. All the completed questionnaires were collected by the researcher on the same day.

Notes were taken for follow-up questions and discussions were recorded for validation and crosschecking. According to Canfield (2011), the notes refer to qualitative notes recorded by researchers during field research, during or after their observation of a specific phenomenon that they are studying. The notes are intended to be evidence that provides meaning and support in the understanding of the phenomenon. Notes allow the researcher to access the subject and record what they observe in an unobtrusive manner. The respondents were given more time to respond to the questionnaires.

The researcher held an advantage, having served as a member of and also took an advantage as he was appointed to, an adjudication panel for the best extension practitioners in Mpumalanga province. Similar questions related to sustainable agriculture were asked during the adjudication. The interactions were recorded and notes were also taken during a panel of adjudication. The researcher was also able to access all power-point presentations from extension practitioners. The researcher was also able to access the final consolidated report

from all the fellow adjudicators. Finally, various relevant documents were used to relate the outcome of the study (Downe-Wamboldt, 1992; Hsieh & Shannon, 2005) and already existing literature.

The study also used convenience sampling which allowed for the selection of respondents from relatively homogenous population that were available and willing to participate at the time of data gathering (Saunders, Lewis & Thornhill, 2007). During collection of data most information was saturated (Glaser & Strauss, 1967) but did not stop the researcher from collecting further information for the purpose of final triangulation. Triangulation technique was used to determine points of similarities and variations in qualitative data collection from participants through questionnaires, interviews and related literature review to improve the credibility of findings and interpretations (Khwidzhili & Worth, 2018).

## **Results/findings**

### **Policies and guidelines promoting sustainable agriculture**

*The respondents were asked to give a list of policies and relevant guidelines promoting sustainable agriculture. Below is a consolidated list:*

- Land care programme
- Land policies
- Environment and conservation policies
- Animal disease and protection policies
- Fertilizers and agricultural chemicals policies
- Air and water policies
- Phezu kwemkhono mlimi program
- Masibuyele e sibayeni

**Other legislation impacting on sustainable agriculture** (*Adapted from Khwidzhili & Worth, 2017*)

The following are fundamental South African legislations impacting on sustainable agriculture and which could be integrated to develop a national policy on sustainable agriculture in the country:

Fertilisers, Farms Feeds, Agricultural Remedies and Stock Remedies Act of 1947 (Act No. 36 of 1947). The Act provides for the registration of fertilisers, farm feeds, agricultural remedies, stock remedies, sterilising plants and pest control operators. The Act further regulates the importation, sale, acquisition, disposal or use of fertilisers, farm feeds, agricultural remedies and stock remedies. This legislation has both environmental and social impacts through pollution and negative impact on human health if used injudiciously.

Livestock Brands Act, 1962 (Act No. 87 of 1962). The Act provides for an identification system for stockowners. This is important for traceability, minimizing stock theft and the monitoring of animal diseases. This legislation has economic impact through minimizing risk of theft and disease surveillance.

Fencing Act, 1963 (Act No. 31 of 1963). The Act specifies fencing standards and regulates the relationship between neighbours regarding construction and maintenance of fencing. This legislation has economic impact through minimizing risk posed by spread of diseases from one area to the other.

Plant Breeders' Rights Act of 1976 (Act No. 15 of 1976). Any variety for which a Plant Breeders' Right is sought must comply with the provisions of this act. The variety must also be "new", i.e. newly developed or bred. This legislation has economic impact through protection of intellectual property rights of breeders.

Plant Improvement Act, 1976 (Act No. 53 of 1976). The aim of this Act is to ensure the availability of high quality propagating material to all users. This legislation has economic impact by contributing to high productivity through ensuring the availability of propagation materials of high quality.

Livestock Improvement Act, 1977 (Act No. 25 of 1977). This Act is aimed at development and importation of animal breeds of high quality. This legislation has economic impact by

contributing to high productivity though ensuring the availability of animal breeds of high quality.

Agricultural Pests Act of 1983 (Act No. 36 of 1983). This Act provides for measures to prevent the introduction and establishment of pests. The Act ensures that import of controlled goods is done in such a way that exotic pests and diseases are not imported and allowed to be established in South Africa, as well as preventing their spread to other countries. This legislation has both environmental and economic impacts by minimizing risks posed by possible spread of pests and diseases, and thus protection of the agricultural from adverse effects of these pests and diseases.

Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983). The Act provides for the control over the utilisation of the natural agricultural resources of South Africa in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants. This legislation has environmental impact by promoting sustainable use of natural resources in order to ensure long-term productivity of the plant production sector.

Animal Diseases Act of 1984 (Act No. 35 of 1984). This Act provides for development and enforcement of measures for the prevention and control of diseases and parasites to promote animal health. This legislation has economic impact by minimizing risks posed by possible spread of diseases and parasites, and thus protection of the agricultural from adverse effects of these diseases and parasites.

Liquor Products Act, 1989 (Act No. 60 of 1989). This Act provides for the control on the sale, as well as import and export of liquor products. This legislation has both the economic and social impacts by ensuring the quality and safety of liquor products.

Agricultural Product Standards Act of 1990 (Act No. 119 of 1990). The Act, among other things, provides for control on the sale of agricultural products by ensuring that they comply with certain minimum quality standards. This legislation has both the economic and social impacts by ensuring the quality and safety of agricultural products.

Genetically Modified Organisms Act, 1997 (Act No. 15 of 1997). The act provides measures to promote the responsible development, production, use and application of genetically

modified organisms (GMOs). This legislation has the environmental and economic and social impacts by ensuring the safety of GMO products, changing the nature and cost of production requisites (in particular seed), as well as minimizing possible negative impacts of these products on the environment.

Meat Safety Act, 2000 (Act No 40 of 2000). This act is aimed at promoting meat safety, establishing and maintaining national standards in respect of abattoirs and export control. This legislation has both the economic and social impacts by ensuring the quality and safety of meat and regulating export market of meat.

### **Knowledge of the concept on sustainable agriculture**

The respondents were asked on their understanding of sustainable agriculture and these were their responses:

*“Sustainable agriculture is the interaction of the utilisation of natural resources in an economic way that is also environmentally friendly”*

*“Sustainable agriculture is a process where agriculture meet all the different needs in such a manner that all natural resources are used in harmony and they are well taken care. Sustainability also focuses on what farmers should produce for the market.”*

The paper reveals that extension managers always gives emphasis on the three traditional pillars of sustainable agriculture: economic, environmental and social viability and therefore shortfall of the total framework suggested by Khwidzhili & Worth (2016). The respondents indicated that sustainable agriculture seeks to sustain farmers, resources and communities. This means that sustainable agriculture is a concept of farming, by caring for natural resources and sustaining communities in the process. The main focus would be to ensure food security without damaging the environment for communities to survive.

Some extension managers indicated that sustainable agriculture is similar to no-till practice. It promotes organic agriculture and improves microbial activities in the soil. Sustainable agriculture encourages farmers to have an understanding of the ecosystems in their farming areas (Calderia *et al*, 2001; Loreau *et al*, 2002).

Most respondents indicated that sustainable agriculture requires the interaction of different stakeholders. It should not only focus on extension practitioners and farmers. They pointed out that sustainable agriculture should include the participation of all relevant stakeholders such as chemical companies, seed companies, commodity association and different markets. The involvement of all stakeholders create stability and therefore sustainability.

Farmers should be encouraged to alternate various methods of pest control. Frequent use of chemical pesticides destroys insects that are beneficial in the soil. The market is very sensitive when it comes to choice of products. Therefore farmers should be encouraged to practise integrated pest management (Hajjar *et al*, 2008). This will leave them with a plethora of market accessibility.

Farmers need to be exposed to sustainable agricultural practices. The extension managers indicated that sustainable agriculture should be promoted through organizing workshops, trainings, commodity meetings and farm demonstrations by extension practitioners. Extension managers highlighted that they organise agricultural development committees where different stakeholders including extension practitioners interact on a monthly or quarterly basis. It is important to promote sustainable agriculture to avoid further degradation of the natural environment. The respondents pointed out that extension practitioners are encouraged to further their studies through the extension recovery plan (ERP) program. The challenge is that the extension practitioners are encouraged to enrol for any course in agriculture, and not necessary in sustainable agriculture. There are few universities offering undergraduate degrees and diplomas in sustainable agriculture in South Africa. However, there are a few extension practitioners who possess a master's degree in sustainable agriculture, acquired from the University of Free State.

### **Supporting extension practitioners by their managers towards promoting sustainable agriculture**

*Extension managers were asked about their support to extension practitioners towards promoting sustainable agriculture. These were their responses:*

Extension practitioners should work with farmers and other relevant stakeholders to promote sustainable agriculture. The extension managers indicated that they support extension



practitioners with registration in relevant professional bodies such as South African Society for Agricultural Extension, South African Council for Natural Science Profession and others. Workshops, trainings, conferences and symposiums are organised to equip extension practitioners with necessary expertise in sustainable agricultural practices.

*“Sustainable agriculture can be easily promoted to farmers who understand the concept. To understand the concept is one thing, and to adopt the concept is also another thing. This means that farmers could understand the concept of sustainable agriculture but lack the resources to adopt it. Technology is best transferred through practical demonstrations. A project can only be recommended if the farmer take part or own the project.”*

Farmers should be encouraged to use agricultural practices that are not harmful to the natural environment. Extension practitioners are encouraged to promote agricultural practices such as planting of cover crops (Derpsch & Friedrich, 2009; Priess, *et al*, 2007), crop rotation (Kasam *et al*, 2009; Machado & Silva, 2001) and rotational grazing. There is always an intervention to capacitate extension practitioners. Extension practitioners need to be supported with the necessary resources to promote suitable agriculture. The following support should be provided to farmers;

- Financial support
- Market support
- Information support
- Production support

Some initiatives to promote sustainable agriculture include:

- To encourage extension practitioners to do their services with dedication and full commitment.
- To identify extension practitioners with necessary expertise in sustainable agriculture. They are encouraged to train others.
- To encourage extension practitioners to feel happy and secure in their jobs.
- To insist on raising pride and dignity through motivation of extension practitioners.
- To reward for good work and excellence through districts, provincial and national extension awards.
- To facilitate programs focusing on the wellbeing of extension practitioners.

- To encourage youth and women extension practitioners to further their studies in sustainable agriculture.

The respondents emphasized that there should be a good technical advice to farmers on sustainable agricultural practices. They indicated that farmers learn more through demonstrations. The extension managers also emphasized that extension practitioners submit monthly and quarterly reports on the work they are doing. Sustainable agricultural practices are part of their key performance area. The respondents also indicated that, apart from reports of extension practitioners, they also visit farmers to verify if work was done as per the reports. Extension practitioners are also encouraged to collaborate with research institutes such as Agricultural Research Council and universities.

### **Understanding five pillars of sustainable agriculture**

The respondents were asked on their knowledge of the five pillars of sustainable agriculture and these were their responses:

#### *Pillar 1: Maintaining and increasing biological productivity*

The respondents indicated that extension practitioners should first taste the innovation before transferring to farmers. Extension practitioners should conduct situation analysis of the farm before providing extension services. Farmers should do soil analysis to determine the nutrient status of the soil (Mader *et al*, 2002). The aim of the soil analysis should be to improve required nutrients for plant production. The respondents argue that crop rotation is an idea to improve soil nutrients. A good example is that of rotating legume crops with other crops, as legumes fix nitrogen to the soil (Muleta *et al*, 2007).

Biological productivity involves the use of biological materials such as plant residues, organic waste from livestock (poultry, sheep, cattle and goat). Instead of continuous use of chemicals, farmers are advised to use biological control of pests. The biological control of pests includes hand picking, using pest trappers and crop rotation. Farmers are also advised to use an integrated pest management. The respondents had strong emphasis on intercropping with herbs in order to repel unwanted insects. The respondents also emphasized the farmers should be trained and encouraged to make compost heaps. Farmers should be advised to better

understand the ecosystem around their farming area. Farmers should avoid the use of heavy machinery on the field as this may lead to soil compaction and destruction of beneficial insects.

### *Pillar 2: Decreasing the level of risk to ensure larger security*

The majority of respondents had the least information regarding this pillar. The main reason for this is that it used to be combined with pillar 4, which deals with economic viability. Risks are eminent in agriculture, therefore it is advisable to separate the two pillars in order to give full attention to each. However, these were the respondents' views about this pillar:

- The risk of planting crops that are not adaptable to a particular area.
- Continuous use of chemical fertilizers, herbicides, pesticides and fungicides.
- low rainfall -There is a growing literature that studies the impact of rainfall on agricultural production (Levine & Yang, 2014); migration (Lewin *et al*, 2012; Mueller and Osgood, 2009); poverty (Miguel, 2005; Barnett & Mahul, 2007); health and education (Maccini and Yang, 2009; Hoddinott and Kinsey, 2001); food security (Birhanu and Zeller, 2009), among others. Therefore, it is advisable to plant crops that are more adaptable to local rainfall patterns.
- Climate change
- Financial risk
- Political instabilities
- Loss of markets
- Soil erosion
- Decrease in soil fertility
- Pest and disease infestation

Although the respondents were asked to explain the risk, they chose to list them without descriptions. However, this was verified during follow-up questions. They seem to understand the meaning of each risk.

### *Pillar 3: Protecting the quality of natural resources*

This pillar belongs under traditional environmental viability. Hence it is imperative to be discussed in full and in line with the total framework for sustainable agriculture (Khwidzhili & Worth, 2017). This pillar highlights how natural resources other than soil should be protected. The resources to be protected are aquatic life, atmosphere, human and animal health. This pillar is always confused with pillar 1. It should be highlighted that pillar 1 focuses on

what happens in the soil, where most of the agricultural activities takes place. The respondents were mostly repeating what they responded in pillar one, hence they provided no information related to this pillar.

*Pillar 4: Ensuring agricultural production is economically viable*

Respondents were more comfortable towards this pillar as it always appears in the traditional pillars of sustainability. This was their responses:

*“I always evaluate all reports from extension practitioners in order to check progress for farmers in terms of their financial viability”*

The respondents indicated that farmers should always keep records of their farming enterprises. Keeping financial statements will also assist farmers to evaluate if they are making profit. Farmers should be assisted to access agricultural markets. They emphasized that economic viability can be judged by number of stable contracts farmers have with that market. Farmers should be encouraged to take care of the well-being of their employees.

Researchers across the globe have engaged in comprehensive analysis of economic viability of farms (Singh, 2009). Conclusions from these studies reveals that in farming, it is either you make profit or you get the amount you used for production (Scott, 2001) or otherwise farming becomes a hobby (Huck, 2007; Whitaker, 2009; Bouillet, George, Otmani & Hartmann, 2012).

If farmers are provided with financial assistance either by the Department of Agriculture or any potential funders, they should plan for an exit strategy. This means that farmers should reach a stage where they can able to sustain their business without external funding. Farmers should be taught on how to work with limited resources, but still get a reasonable return.

*“It is not always easy to monitor and evaluate the economic viability of farmers as most of them do not disclose their financial statements. For example, other can disclose information of paper, but refuse to disclose the actual bank balances.”*

### *Pillar 5: Ensuring agricultural production is socially acceptable*

This pillar is also dominant as it belongs to the three traditional pillars of sustainable agriculture. The following were responses in relation to this pillar:

The respondents indicated that farmers are always advised to produce products that are acceptable to the market (Davison, 1997; Huang, 2002). A good example is the choice of farmers on the use of genetically modified organisms (Hallman *et al*, 2002; Einsiedel, 2003).

*“Farmers are considering the health of end-users because most of the markets accept products are not harmful. The market also monitors if products are genetically modified and also which chemical were used to produce such products”*

The respondents indicated that farmers are comfortable to use chemicals as long as they get reasonable returns. However, there are some markets that prefer products that are produced through organic practices.

*“Most farmers use more chemical in order to produce and receive more profit in the expense of the natural environment and without considering the health of end-users. Sometimes government should be blamed as it provides farmers with genetically modified seed and agricultural chemicals”.*

#### **Initiatives to promote sustainable agriculture in Mpumalanga province**

The respondents indicated that both extension practitioners and farmers require further training on sustainable agriculture.

*“At the moment there is no specific training that was done in relation to sustainable agricultural practices”*

The respondents suggested the following initiatives to promote sustainable agriculture in Mpumalanga province:

- Organize trainings and workshops on sustainable agriculture for both extension practitioners and farmers.

- Support extension practitioners to attend conferences, symposia, and dialogues on sustainable agriculture.
- Establishment of local extension forums
- Reward extension practitioners who promote sustainable agricultural practices.
- Development of guideline documents and policies on sustainable agriculture.
- Introduction of sustainable agricultural courses at the University of Mpumalanga.

### **Conclusion and recommendations**

The lack of formal guidelines and policies on sustainable agriculture in Mpumalanga province contributes to the exploitation of natural resources. Poor linkage between extension managers and agricultural extension practitioners, especially on promoting sustainable agriculture is another limiting factor. The study reveals that extension managers are aware of the three traditional pillars of sustainable agriculture, hence there is still lack understanding of the total pillared framework. There is a need for development of guidelines and policies promoting sustainable agricultural practices.

The study recommences the establishment of a directorate specializing in sustainable agriculture in Mpumalanga province. There is a need for further training of extension managers, extension practitioners and farmers on the concept of sustainable agriculture. There is a thin line of knowledge of sustainable agriculture between extension managers and extension practitioners. The study proposes that the discretion of appointing extension managers should be based on their experience and relevance qualification. This means that there should be a degree of seniority for them on extension practitioners whom they manage. Finally, there is a need for further studies that focus on the interaction between extension managers and extension practitioners in promoting sustainable agricultural practices.

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## **CHAPTER 7**

### **A MODEL TO PROMOTE SUSTAINABLE AGRICULTURE**

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## **Abstract**

As much as public agricultural extension services lack the understanding of the total five-pillared framework for sustainable agriculture, there is e some basic foundation for improving the status. The basic foundation refers to the fact that both the extension practitioners, extension managers and farmers are aware of the traditional pillar of sustainable agriculture: economic viability, environmental viability and social acceptability. There is a need for further strengthening of public agricultural extension services in order to address the full framework for sustainable agriculture. This study draws on recently conducted research to sketch the current model with which extension could take an active role in promotion of sustainable agricultural practices. The study emphasized the imperative of establishing a national policy on sustainable practices in South Africa. This will also encourage the establishment of a directorate that focuses on promotion of sustainable agriculture on provincial and local municipalities in Mpumalanga province. The study emphasizes of the full implementation of the Extension Recovery Plan (ERP). Finally, this study seeks to highlights some initiatives to enhance the effectiveness of public extension services towards promoting sustainable agriculture.

**Keywords:** Extension services, sustainable agriculture, policy makers, extension practitioners, extension managers, training

## **Introduction**

This section provides a comparison analyses of chapter 5 and 6, which are the core of this dissertation. Firstly, chapters 5 focus on promotion of sustainable agriculture by Mpumalanga agricultural extension services: perspectives of public extension practitioners. Secondly, chapter 6 also focuses on promotion of sustainable agriculture by Mpumalanga agricultural extension services: Perspective of extension managers. Literature on sustainable agriculture is mostly based on the three pillared framework. There is a need to promote sustainable agricultural practices using the 5 pillar framework in Mpumalanga province.

This paper presents a succinct summary of suggestions of some initiatives that could aid in promoting sustainable agricultural practices. The initiatives include policy formulation and explicate the concept of sustainable agricultural practices, as well as further training of extension managers, extension practitioners and farmers in Mpumalanga province to promote sustainable agricultural practices. The suggested initiatives are based on extensive literature review on sustainable agriculture and also findings of several chapters in this dissertation. The suggestions only give a direction, not a destination and it leaves a vacuum for further studies on the concept of sustainable agriculture.

### **Policy on sustainable agricultural practices**

Policy evaluation is a process that measures the success of a policy in achieving its goals within stipulated time and cost. It is difficult to work without a policy framework, as in the case of South Africa which lacks an inclusive policy on sustainable agricultural practices. Depending on the purposes, policy evaluation may take different forms such as process evaluation, outcome evaluation, impact evaluation, and cost benefit evaluation (Dye, 2001; Makinde, 2005 Wahab, 2008). Policy analysis on the other hand is done to select the best policy from a set of alternative options. In this respect, policy evaluation is different from policy analysis in the sense that policy analysis is a tool applied before the implementation of policies, whereas evaluation is mostly done after implementation to assess the success of a policy in achieving the target (Wahab, 2008). In addition, policy analysis takes the whole policy unless it is specified, whereas evaluation may take on part of a policy or a set of activities of policies to assess their impacts.

South Africa will require the establishment of a formal inclusive policy on sustainable agricultural practices. This will not only assist the country in avoiding further exploitation of the natural environment, but will also position agricultural extension to promote the five pillars of sustainable agriculture (Chang, 2009; Khwidzhili & Worth, 2017).

### **Sustainable agricultural practices**

Promoting sustainable agriculture can potentially contribute towards the realization of conserving the natural environment in Mpumalanga province. Sustainable agriculture promotes an ecosystems inter-sector approach with a strong emphasis on the need to provide institutional and financial support for farmers and other rural people who depend on local natural resources and to allow them to access locally adapted innovations (Nunan, 2006). The approach also calls for a strong synergy between the public and the private sectors. Developing a greener economy is a part of this new vision of sustainable agriculture. A green economy seeks to promote economic growth and development as well as food security, while adopting sustainable resource management practices. In the current development model, meeting the growing demand for food requires the use of more water, electricity and fertilizers, contributing to higher levels of resource degradation and greenhouse gas emissions.

Many small-scale farmers are already engaged in the use of sustainable agriculture practices, such as traditional soil and water conservation, mobile pastoralists, and integrated pest management approaches. A transition towards a green economy approach would benefit such farmers if governments and the international community put more emphasis on strengthening and scaling up community-based approaches (Taylor *et al*, 1993). Alongside the scaling-up of useful indigenous technologies are sustainable agriculture approaches that can be developed, of which sustainable land management is an umbrella concept and conservation agriculture, organic farming and agro-forestry are among the main examples.

Sustainable land management includes all approaches that conserve soil and water. Sustainable agriculture works on the basis of reduced or no tillage, growing cover crop for mulching and crop rotations. It has expanded massively in Latin America, where it has reduced the oil-based costs of tractor cultivation. It also reduces the risk of crop failure by retaining soil moisture and produces generally higher net returns. The benefits are less dramatic where agriculture is not mechanized, but nevertheless significant. Challenges include competing uses

for biomass (livestock feed, fuel) and significant demand for labour in using digging sticks, mulching and hand weeding. Herbicides may be unaffordable and have environmental consequences.

### **Training and knowledge on sustainable agriculture**

The sustainable agriculture agenda requires local participatory planning and willingness by extension practitioners to learn from farmer's experiences, knowledge and experiences (Vanclay & Lawrence, 1995; Garforth *et al*, 1997). Farmers prefer to visualize methods including result and method demonstration (Mirani *et al*, 2002), field trip and mass media production. This implies that continues use of theoretical innovation can be a futile exercise.

Within this new paradigm, sustainable agriculture cannot be accomplished by only using conventional extension methods; rather it will require a new kind of process facilitation of learning (Allahyari & Chizari, 2006). Within the new paradigm of extension, farmers should have more control over the information that they need or want and over how it is delivered. Extension should be demand pull rather than science push (Marsh & Pannell, 1999). The sustainability framework suggested by Khwidzhili & Worth (2016) should serve as a guiding principle towards promoting sustainable agriculture.

Extension practitioners should learn facilitation skills. Not all extension models or approaches fit for every farmer. In order to support sustainable agriculture, extension approaches should use collaborative problem-solving as the dominant model of influence on farmers' behaviour, work increasingly to influence and facilitate planning, make decisions and take action at group and community levels (Roling & Pretty, 1997; Moyo & Hagmann, 2000; Braun *et al.*, 2000; Cho & Boland, 2004). One of the key elements in this type of facilitation is that it fosters discovery learning (Pretty, 1995; Roling & Pretty, 1997; Braun *et al*, 2000; Probst & Hagmann, 2005). Extension practitioners should also learn more about the participatory model. Participatory and group learning and networking for sharing and exchange of information are the most important changes relevant to extension-education methods, because participation is an important factor in agricultural sustainability (Grudens-Schuck, 2000; Kroma, 2003).

## **Extension Recovery Plan (ERP) deliverables**

In order to ensure that extension practitioners are well positioned towards extension services and promotion of sustainable agricultural practices, the Department of Agriculture, Forestry & Fisheries has established the ERP. South Africa's nine provinces are expected to provide the following deliverables under the five pillars of the ERP (DAFF, 2011) initiative:

### **Pillar 1: Ensure visibility and accountability**

- Procurement of digital pens or any other mentoring and evaluation tools deemed appropriate.
- The use of farmer's green book and Digital/ Smart Pen System.
- Uniform and transportation for agricultural advisors.
- Formation of study groups in partnership with the commodity organisations.

### **Pillar 2: Promote professionalism and improve image**

- Provide funding for extension officers to register and participate in professional bodies such as South African Council for Natural Scientific Professions (SACNASP), South African Society for Agricultural Extension (SASAE), and congresses as per provincial corporate services policies.
- Host and fund the provincial extension conferences which include the presentation of papers by extension, research, and training components of provinces.
- The recognition of excellent performance by the extension practitioners through the bestowing of provincial extension awards.

### **Pillar 3: Recruitment of extension and advisory practitioners**

- Recruit extension practitioners in line with the provincial agricultural production strategies.
- Recruit in support of the provincial growth and development strategies.

### **Pillar 4: Re-skilling and re-orientation of extension**

- Fund the qualification upgrading of practitioners.
- Fund targeted short course training in line with competency profile of extension cadres.



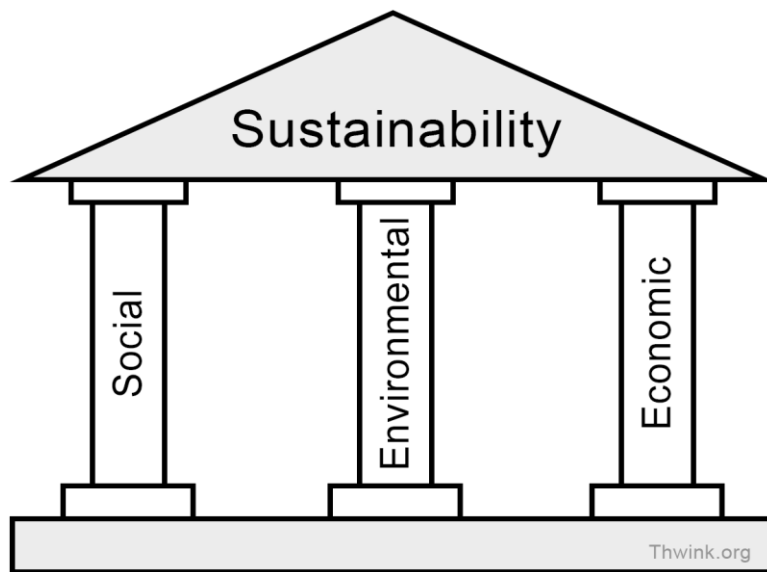
- Fund the management training of local extension managers operating at local municipality levels.

**Pillar 5: Provision of ICT infrastructure**

- Provision of ICT equipment as a package.
- Ensuring the training of practitioners on the use of Extension Suite Online (ESO) and the Digital/ Smart Pen system.
- Procure other useful resources in consultation with DAFF.

The full implementation of the ERP can solve most challenges facing extension services in Mpumalanga province, especially in the context of five-pillared framework of sustainable agriculture (Khwidzhili & Worth, 2016).

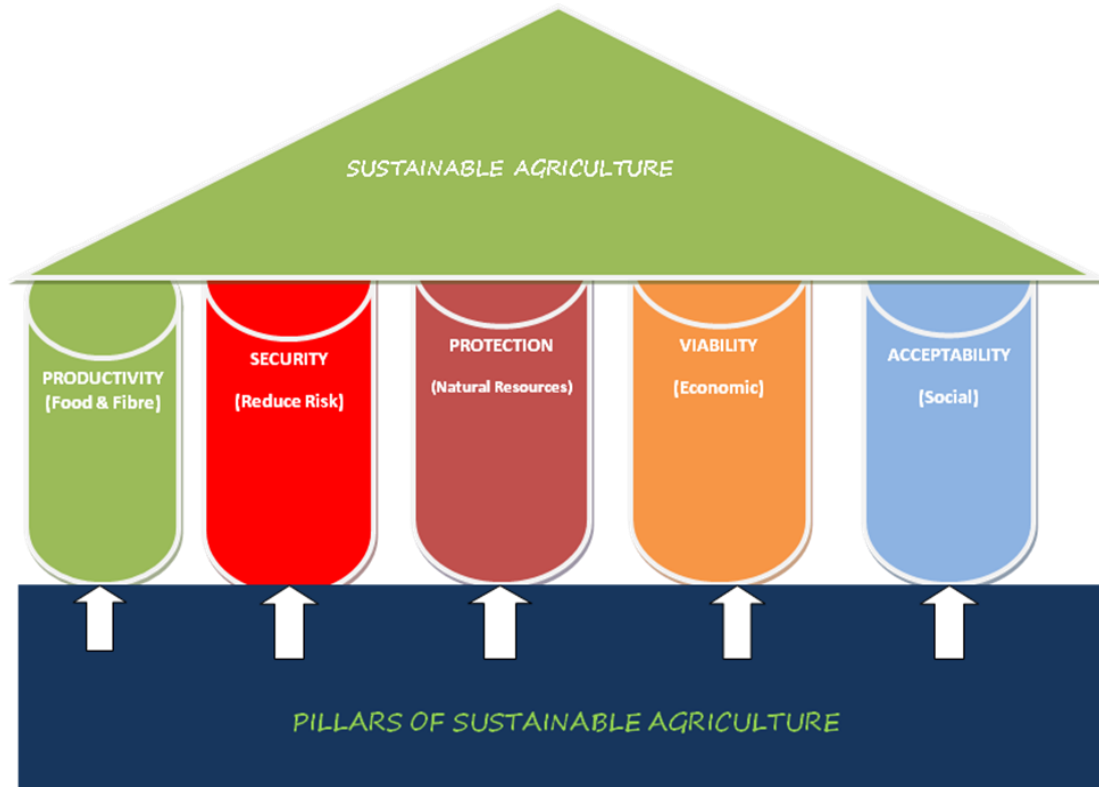
**Models for sustainable agriculture**



**Figure 4: Three traditional pillars of sustainable agriculture model (Beattie, 2009)**

Most literature is based on the three pillars of sustainable agriculture as illustrated in Figure 4. This has been demonstrated throughout chapter 2-6 of this study. This model does not address the full framework of sustainable agriculture as suggested by Khwidzhili and Worth (2016). This issue has been addressed by numerous authors who hold the term sustainable

development like that of sustainable growth to be an oxymoron (Macnaghten & Jacobs, 1997; Sneddon, 2000; Redclift, 2005; Johnston *et al*, 2007; Brand, 2012).



**Figure 5: Five pillars of sustainable agriculture model**

The model has been thoroughly discussed in almost all chapters of this study. Again, repeating of this diagram was deliberate as it is the framework of this study. Policy makers should use this framework when developing policy on sustainable agriculture in South Africa (Khwidzhili & Worth, 2017).

This framework was used as an evaluation indicator for analysing and interpreting all the data in this study. It came clear, from both philosophical and empirical findings of this study, that the knowledge of sustainable agriculture is most commonly based on the three traditional pillars of sustainable agriculture - economic, social and environmental sustainability. The framework split the two traditional pillars, environment and economic pillar. The environmental pillar was split into biological productivity and protection of natural resources respectively. This split is imperative since most of agricultural activities occur in the soil, hence it is also necessary to give attention to the atmosphere and aquatic life. The economic pillar

was split into two: economic and risk. This is because most scholars refer to economic pillar in terms of financial perspective, and therefore ignores that risk are eminent in agriculture. There is a need to fully define each pillar for the purpose of alignment with the five-pillared framework. The framework has assisted to develop a model for promoting sustainable agriculture as demonstrated by figure 3 below. The results of both philosophical and empirical findings demonstrate that the five-pillared framework is not fully implemented in Mpumalanga and South Africa as a whole. This is due to a lack of inclusive policy that promote sustainable practices in terms of five-pillared framework. Therefore, it is still early to amend, strengthen and /or refine the five-pillared framework.

### **Modelling collaboration between extension practitioners and farmers**

For many years, agricultural extension assumed that research was done by scientists, repackaged by extension officers, and launched at farmers. Both their knowledge systems and cultural roles were seen as different. Nowadays their roles are converging and their boundaries are eroding. There are fewer differences in how each group produces and uses knowledge, given its cultural specificity and context dependence.

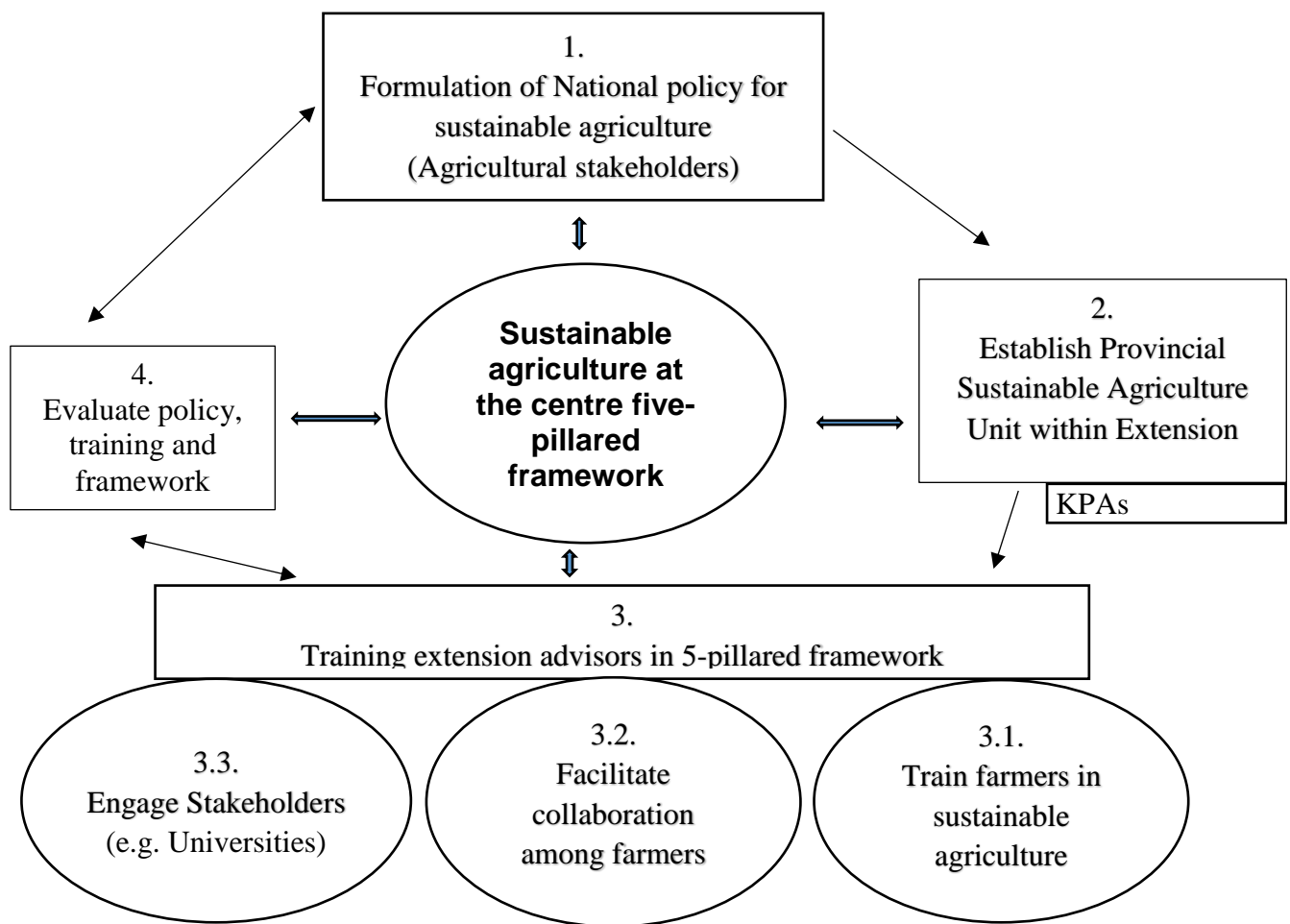
The following are suggestions that could be used to improve extension services in the context of sustainable agricultural practices:

- ❖ Emphasis should be given on indigenous solutions that are aimed at tackling farmers' problems while promoting social unity, which is one pillar of sustainable agriculture (Carayannis *et al*, 2000; Uphoff, 1996).
- ❖ There should be common objectives and goals among extension managers, extension practitioners and farmers, with the aim of achieving economic of scale as another pillar of sustainable agriculture (Castillo, 1997).
- ❖ The replication of efforts should be kept to minimum; parties should be able to embrace new innovations which do not compromise the natural environment (Fesenmaier & Contractor, 2001). Asymmetry of information should be minimised to allow interaction of both parties (Koza & Lewin, 2000).
- ❖ Extension innovation should not be enforced on farmers, instead farmers should be give the autonomy, self-management and independence in order to take decisions that will sustain their farms (Kibwana, 2000).

### **A model for promoting sustainable agriculture**

Figure 6 provides a model for promoting sustainable agriculture. The model begins with the five-pillared framework. An inclusive national policy on sustainable agriculture should be established to entrench the elements of the five-pillared framework. The formulation of this policy should include different stakeholders in agricultural sector. To implement the policy, the Mpumalanga Provincial Department of Agriculture should establish a unit that deals with sustainable agricultural practices. The unit should be incorporated within extension and advisory services directorate. Sustainable agricultural practices should form part of the key performance areas for extension practitioners.

As key agents for change extension practitioners need to be kept relevant in promoting sustainable agricultural practices. This will include training extension practitioners in the concept and practices of sustainable agriculture captured in the five-pillared framework. The training should result in three key activities: training of farmers in sustainable agriculture; facilitating collaboration among farmers; and engaging with other stakeholders (e.g. universities) in promoting sustainable agriculture. The process should be evaluated by both national and provincial departments of agriculture – the evaluation should evaluate the process itself, the national policy, the training of extension practitioners and farmer, and should revisit the five-pillared framework. The evaluation can be annual or biennial depending on the set targets.



**Figure 6: Conceptualization model for promoting sustainable agriculture**

### Conclusion

The promotion of sustainable agricultural practices remains the domain of public agricultural services in South Africa. The study emphasized the development of a sub-directorate on sustainable agriculture in Mpumalanga province. The study also put emphasis on strong collaboration amongst extension practitioners, extension managers and farmers within the province. Extension Recovery Plan program should be implemented in its totality to improve extension services and to promote sustainable agriculture in the context of five-pillared framework.

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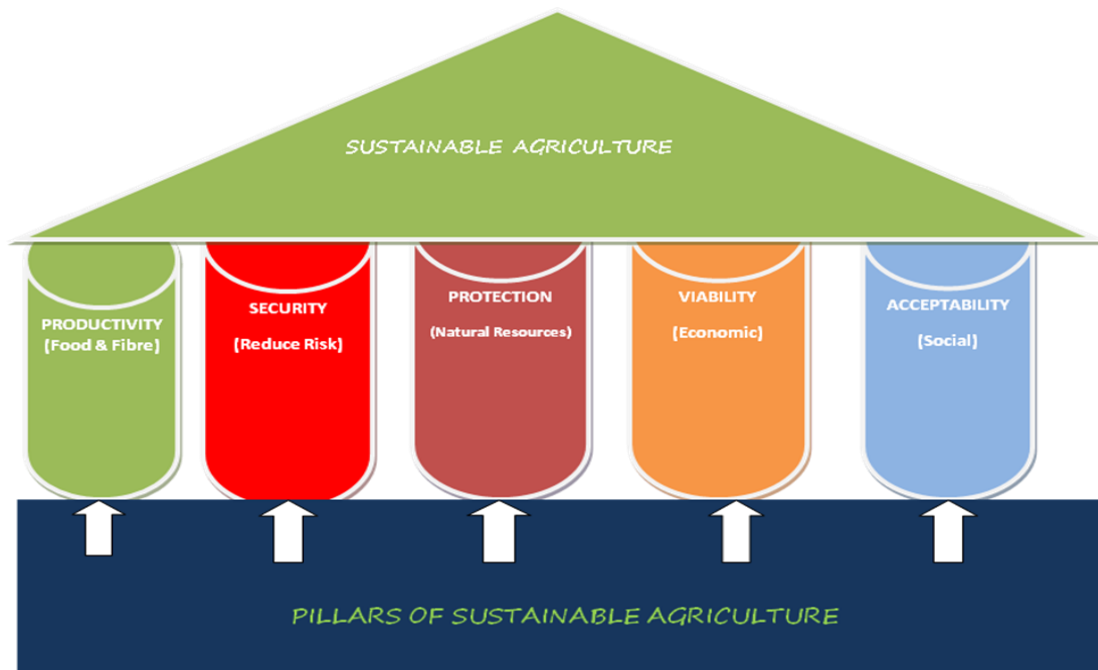
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## CHAPTER 8

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### Summary

This chapter presents an overall description of and processes involved in this study. The study evaluates the role of public agricultural extension services towards promoting sustainable agriculture in Mpumalanga province, South Africa. The study is presented in eight chapters including this chapter. Chapter 1 presents a general background of the study. Chapter 2, 3 and 4 are philosophical chapters which also portray the framework for this study. The framework is based on the five pillars of sustainable agriculture. The framework of this study is presented in the form of the figure below. This figure appears in most chapters and annexure of this study. This was done deliberately to keep focused on the focus of the study.



**Figure 7: Framework of the study**

Chapter 5 and 6 are empirical and are the core of this study. Firstly, chapter 5 evaluates the promotion of sustainable agriculture by Mpumalanga extension services, focusing on the perspective of public extension practitioners. Secondly, chapter 6 evaluates managerial support

given to extension practitioners towards promoting sustainable agriculture in Mpumalanga province. Finally, chapter 7 gives a philosophical analysis based on both chapter 5 and 6.

**The specific questions addressed in this study were:**

How can South Africa's public extension effectively promote sustainable agriculture in the context of sustainable agricultural practices?

*The above research question gives rise to the following sub-questions:*

- a) What is sustainable agriculture?
- b) What is the role of agricultural extension?
- c) How can agricultural extension promote sustainable agriculture?
- d) What factors limiting agricultural extension in promoting sustainable agriculture?
- e) What can the managers of public agricultural extension do to encourage the extension practitioners in promoting sustainable agriculture?

The above mentioned questions were investigated throughout all chapters in this study and are also presented as conclusions and recommendations in this chapter.

### **Conclusions**

This section presents conclusion of the entire study. The presentation will be in chronological order from chapter 2-7. There are many similarities in each chapter as they are presented as published and publishable journal articles.

The foregoing discussion in chapters 2-5 highlights two things in this study. First, in defining sustainable agriculture, while elements of it are technical, its underpinning is philosophical as farmers operate at a level of principle while exploring specific options to specific issues related to production. Secondly, the five pillars must be viewed in their totality to avoid dichotomous thinking and recognising that it is a matter of 'considered choice' within recognised limits. Chapter 2 argued that agricultural extension can play a considerable role, both in raising farmers' awareness of the individual pillars and their integrated application on their respective farms.

The concept of sustainability will remain uncertain and imperfect until better methods for assessment and evaluation are available. However, the concept can be usefully employed in development projects even with the current imperfections in the definition. It is important that farmers and the community at large engage themselves in practices that will not degrade their natural environment. The probability and capacity for a sustainable future rest largely on our ability to tap the earth's natural resource with sustainable management strategies.

The big challenge is to ask what will happen in the future if farmers continue to use unsustainable farming practices that continue to harm the natural environment. This challenge is dominant as from chapter 1 to 7. The question is what agricultural extension will do to assist the farmers in producing food that will meet the needs of the ever growing world's population without compromising the natural environment.

Chapter 4 provided a succinct evolution of agricultural extension in South Africa emphasising that extension services were imposed on farmers through the transfer of technology extension approaches. Since its inception in South Africa, agricultural extension is now recognised by the South African Council for Natural Science Professions (SACNASP). This implies that agricultural extension practitioners should register as scientists, working under the code of conduct regulated by SACNASP. Drawing from the evidence presented in this study, it can therefore be argued that South African public agricultural extension is best placed to promote sustainable agriculture through the five pillars of sustainability. Apart from the conventional approaches, there are a number of models that extension could use to disseminate information. The definition of agricultural extension was highlighted starting from the early years, the beginning of the second millennium and beyond. The study highlighted the role of public extension services in South Africa.

The promotion of sustainable agricultural practices amongst farmers remain the domain of public extension in South Africa. Central to promotion of sustainable agricultural practices is the knowledge, skills and insight concerning the multifaceted process of changing farmers' behaviours. The national policy on extension and advisory services in chapter 4 serves as a framework guiding the role of different stakeholders that are involved in public extension services. The extension and advisory policy support the establishment of extension coordinating forums at districts provincial and national levels. These forums will be vital in promoting sustainable agricultural practices provided that all stakeholders remain relevant.

Judging from its composition which ranges from researchers, academics, private sector, associations, social representatives and others, these forums could play a pivotal role in shaping the landscape of extension and advisory services in South Africa.

The study also identified other initiatives by the government to support extension and advisory service. These initiatives include, amongst others, the extension recovery plan (ERP) and the norms and standards for extension and advisory services. The study also confirms that a four-year degree in agriculture is required in order to practice extension and advisory services in South Africa. The study also observed that in few years to come, no one will be allowed or appointed as an extension practitioner if they are not registered with SACNASP. Registration to SACNASP should be preceded by registering to the South African Society of Agricultural Extension. SASAE is the voluntary organisation which acts as a mouthpiece for advocating extension and advisory services in the country.

The study found that extension practitioners in Mpumalanga are not aware of the five pillars of sustainable agriculture. However, the responses suggest that they fully understand the three common pillars of sustainability: economic, social, and environmental viability. There is a need to define the five pillars of sustainability in their totality. The study reveals in chapter 5 that there are no framework or guideline documents supporting sustainable agriculture in Mpumalanga province. This might be a result that South Africa does not have an inclusive policy on sustainable agricultural practices (Khwidzhili & Worth, 2017).

As demonstrated in chapter 5, the study discovered that the extension practitioners in Mpumalanga are aware of the concept of sustainable livelihoods and that it is imperative to consider and understand farmers background prior providing extension services. The study also discovered that the promotion of sustainable agricultural practices is dependent on the knowledge of individual extension practitioners. This is dictated by the level of education and experience as regards the concept of sustainable agriculture. Currently, there are no clear benchmarks or targets in place for promotion of sustainable agricultural practices in Mpumalanga province.

Chapter 6 further reveals that there is formal support towards promoting sustainable agriculture, but what support there is needs to be complemented by policies. There is a conflicting argument amongst farmers who support sustainable agriculture and those against

the concept. Most farmers prefer to take care of their natural resources in order to conserve it for future generation. The latter argument is based on that sustainable agricultural practices are not practically income oriented. There was a saturation of information (Glaser & Strauss, 1967) denoting that the respondents were only exposed to three traditional pillars of sustainability instead of five-pillared framework.

### **Recommendations**

Sustainable land management in developing countries requires long-term, sustained support and investment in the prudent management and conservation of natural resources to achieve the combined goal of increased production and environmental maintenance. The government, private sectors, non- government organisations, including the international communities should join together in developing policies and guidelines that promote sustainable agricultural practices. Extension officers should continue to give necessary advice to the farming community on practices that will not degrade our natural environment.

The study has reviewed two anchor policies against the framework of the five pillars of sustainable agriculture (Khwidzhili & Worth, 2016). The review highlights the fundamental need for the South African government to develop a policy for sustainable agriculture to harmonise its plan for agriculture as reflected in the White Paper with the objectives of its policy on sustainable development.

As a result of some essential differences between the more generic concept of sustainable development and sustainable agriculture, the study suggests the proposed policy should be based on the five pillars of sustainable agriculture. Further, to insure integration, the proposed policy on sustainable agriculture should take into account the existing agricultural related policies. With a comprehensive and integrated policy, the government through DAFF can create an enabling environment for investors, farmers, producers, processors, financial institutions, traders and other sector stakeholders to carry-out activities that are consistent with sustainable agricultural practices. By extension, (e.g. through the increased investment in the agricultural value chain) this should contribute to creating more sustainable employment.

Sustainable agricultural policies should take a holistic approach of the five pillars of sustainable agriculture. Sustainable agricultural policy should focus on catastrophic risks that are rare but cause significant damage to many farmers at the same time. Contingency plans

should define in advance the procedures, responsibilities and limits of the policy response. Subsidized insurance is one way of providing disaster assistance but it tends to crowd out the development of private insurance markets and has not been successful in preventing additional ad hoc assistance being granted after the event.

Agricultural extension should play a pivotal role in assisting farmers to avoid further exploitation of the natural environment without a formal policy on sustainable agriculture, this could be a futile exercise. Policies should be formulated in inclusion of all relevant stakeholders in agricultural sector. The lack of coherence in policy, documentation, legislation and guidelines makes it difficult for extension officers to promote sustainable agriculture. If all relevant information is arranged in a single document called a national policy on sustainable agriculture, it will prove easier for extension services to promote sustainable agriculture throughout all the provinces in South Africa.

The establishment of a national policy on sustainable agricultural practices would serve as a compliment for the national policy on extension and advisory services in South Africa. There is a need for training of extension practitioners on the five-pillared framework of sustainability. There is also a need to establish a sub-directorate that will focus of sustainable agriculture in Mpumalanga. Finally, further studies should be conducted to continue to categorize sustainable agricultural practices according to five pillars in sustainable agriculture.

## References

KHWIDZHILI, R.H., & WORTH, SH. 2016. *The sustainable agriculture imperative: implications for South African agricultural extension*. S. Afr. J. Agric. Ext. Vol. 44. No. 2. 19-29.

KHWIDZHILI, R. H., & WORTH, S. H. 2017. *Evaluation of policies promoting sustainable agriculture in South Africa*. S. Afr. J. Agric. Ext. Vol. 45, No. 2. 73-85.



## APPENDICES

### Appendix 1: Consent letter



agriculture, rural development,  
land & environmental affairs  
**MPUMALANGA PROVINCE**  
REPUBLIC OF SOUTH AFRICA

Building No. 6, No. 7 Government Boulevard, Riverside Park, 1200, Mpumalanga Province  
Private Bag X 11219, 1200  
Tel: +27 (013) 766 6067/8, Fax: +27 (013) 766 8295, Int Tel: +27 (13) 766 6067/8, Int Fax: +27 (13) 766 8295

Litiko Letekulima, Kutfufukiswa  
Kwetindzawo Tasemakhaya, Temhlaba  
Netesimondzawo

Departement van Landbou,  
Landelike Ontwikkeling,  
Grond en Ongewing Sake

umNyango weZelimo  
UkuThuthukiswa kweNdawo zemaKhaya,  
iNarha neeNdaba zeBhoduluko

Enq. P.E Radebe  
Tel: 013 766 6070

**Date: 06 July 2016**

Mr. RH Kwidzhili  
Senior Lecturer: Agric Extension  
University of Mpumalanga  
Private Bag 11283  
Mbombela  
1200

Dear Mr. Kwidzili

#### **RE: REQUEST TO CONDUCT A PHD RESEARCH IN THE FIELD OF AGRICULTURAL EXTENSION WITHIN THE DEPARTMENT**

I Sindisiwe Prudence Xulu, as delegated authority of Department of Agriculture, Rural Development, Land and Environmental Affairs hereby grants you; Mr. Rendani Humphrey Kwidzhili a student at the University of Kwazulu Natal with Student Number: 214584555, permission to conduct research within the Department for the PHD: Agricultural Extension and RRM.

This authorisation is based on a mutual understanding that the Department and departmental officials' names will not be mentioned anywhere in his project. Additionally, no information in his project will enable a third party to identify the name of the Department.

The information provided by the employees or any other means (such as confidential archived documents or reports) of the Department is purely for academic purposes and cannot be used for any other purpose.

Kind regards,

**Ms S.P Xulu**  
Head of Department



## Appendix 2: Consent form

Dear participant,

### LETTER AND FORM OF CONSENT

I, Mr Rendani Humphrey Khwidzhili am a senior lecture for agricultural extension at the University of Mpumalanga (Mbombela campus). I have registered for a PhD in Agricultural Extension and Rural Resource Management at the University of KwaZulu-Natal in the School of Agricultural, Earth and Environmental Sciences. I am working under the supervision of Prof Steve Worth who is a programme coordinator for Agricultural Extension and Rural Development at the University of KwaZulu-Natal. I am here by inviting you to voluntary participate in the research I am conducting under the topic 'an evaluation of the role of public extension services towards promoting sustainable agriculture in Mpumalanga province, South Africa'. The information of this research will be gathered through the use of questionnaires, interviews, observations and literature review.

Kindly note that the identity and information provided by the participants will not be disclosed and will be kept confidential. No names of the respondents will be mention on the final findings. Your response together with other participants will be combined and analysed as a group and therefore no individual disclosure. There is no direct physical and legal harm in this study. You have the right to withdraw from this study without any penalty. Where necessary I will assist to translate the questions in your own language or arrange for an interpreter. Interviews will be recorded for transcription purpose. The recording will be used for preparation of conference presentations, academic publications and reports. Your words might be quoted but no one will able to identify who was speaking as the recording is only for study purpose. Furthermore, all names that you mention will be deleted. No one will be able to access the recording except the researcher. The participation will require about 60 minute of your time. If you agree to participate kindly write your name in full and sign at the bottom of this letter. Once more your name will not be disclosed anywhere in my research. This is just for study purpose and will be burnt after completion of the study.

I would like to take this opportunity to thank you in advance for your assistance and participation. I also believe you will give your honest response for the credibility of the study. Should you require or provide any additional information kindly email me at: [humphrey.khwidzhili@ump.ac.za](mailto:humphrey.khwidzhili@ump.ac.za) or contact me on: 072 156 5711 or office number: 013 002 0144.

Should you need to ask for any further information or clarification regarding this study, you may contact me on +2782 052 0221 or my supervisor Prof Steve Worth on +27332605792. You may also contact a University Ethics Committee member should you wish to through the HSSREC Research Office (Ms P Simba, Tel: 031 260 3587, Email: [ximbap@ukzn.ac.za](mailto:ximbap@ukzn.ac.za)).

Kindly regards.

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Rendani Humphrey Khwidzhili (Researcher)

I \_\_\_\_\_ (full name of participants) hereby confirm that I understand the content of this document. I have been given the opportunity to ask questions about the research and was answered to my satisfactory. I agreed to participate in this study.

---

Signature of participant

## PRESENTATIONS

Dear participant

### LETTER AND FORM OF CONSENT

I, Mr. Rennin Humphrey Khwidzhili am a senior lecturer for agricultural extension at the University of Mpumalanga (Mbombela campus). I have registered for a PhD in Agricultural Extension and Rural Resource Management at the University of Kwa-Zulu Natal in the School of Agricultural, Earth and Environmental Sciences. I am working under the supervision of Prof Steve Worth who is a program coordinator for Agricultural Extension and Rural Development at the University of Kwa-Zulu Natal. I am here by inviting you to voluntarily participate in the research I am conducting under the topic 'an evaluation of the role of public extension services towards promoting sustainable agriculture in Mpumalanga province, South Africa'. The information of this research will be gathered through the use of questionnaires, interviews, observations, literature review and relevant documents reading.

Kindly note that the identity and information provided by the participants will not be disclosed and will be kept in confidence. No names of the respondents will be mentioned on the final findings. Your response together with other participants will be combined and analysed as a group and therefore no individual disclosure. There is no direct physical and legal harm in this study. You have the right to withdraw from this study without any penalty. As you will recall I was part of the provincial adjudication panel member. I am requesting to use part of your presentation done at Secunda especially in relation to economic, environment social viability. This information will add value to my research. Kindly confirm with Ms Phi Secom for me to access your Second presentation if you agreed or not.

I would like to take this opportunity to thank you in advance for your assistance and participation. Should you require or provide any additional information kindly email me at: [humphrey.khwidzhili@ump.ac.za](mailto:humphrey.khwidzhili@ump.ac.za) or contact me on: 072 156 5711 or office number: 013 002 0144.

Kindly regards

Rennin Humphrey Khwidzhili  
(Researcher)

## Appendix 4: Consent Letter



agriculture, rural development,  
land & environmental affairs

MPUMALANGA PROVINCE  
REPUBLIC OF SOUTH AFRICA

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Kwetlindzawo Tasemakhaya, Temhlaba  
Netesimondzawo

Departement van Landbou,  
Landelike Ontwikkeling,  
Grond en Ongewing Sake

umNyango weZelimo  
UkuThuthukiswa kweNdawo zemaKhaya,  
iNarha neeNdaba zeBhoduluko

Enq: Ms MH Sekoma  
Cell No: 0834579138

**TO : PROVINCIAL EXTENSION & ADVISORY SERVICES AWARDS PARTICIPANTS**

**FROM : DR. MS KGAPHOLA  
DIRECTOR: EXTENSION & ADVISORY SERVICES**

**DATE : 04 OCTOBER 2018**

**SUBJECT : REQUEST FOR APPROVAL TO USE THE PROVINCIAL PARTICIPANTS' PRESENTATIONS FOR EXTENSION AWARDS FOR RESEARCH PURPOSES BY MR. R.H KHWIDZHILI**

1. Attached herewith is Mr. R.H Khwidzhili's request to access your Provincial Extension and Advisory Services awards presentations.
2. All Provincial Extension and Advisory Services participants who are willing to grant him access to their presentations are requested to complete the below consent form:

I SIFISO C. SHANBU, Persal No: 62124927,

allow/disallow Mr. R.H Khwidzhili to use my presentation in his studies.

Signature: 

Date: 10/10/2018

Kind Regards,

  
**DR. MS KGAPHOLA**  
**DIRECTOR: EXTENSION & ADVISORY PROGRAMME**



11 April 2017

Mr Rendani H Khwidzhili 214584555  
SAEES  
Pietermaritzburg Campus

Dear Mr Khwidzhili

Protocol reference number: HSS/0282/017D  
Project title: An evaluation of the role of public agricultural extension services towards promoting sustainable agriculture in Mpumalanga province, South Africa.

**Expedited Approval**

In response to your application dated 29 March 2017, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

Please note: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....  
Dr Shamila Naidoo (Deputy Chair)

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cc Supervisor: Prof S Worth  
cc Academic Leader Research: Prof O Mutanga  
cc School Administrator: Ms Marsha Manjoo

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Humanities & Social Sciences Research Ethics Committee

Dr Shenuka Singh (Chair)

Westville Campus, Govan Mbeki Building

Postal Address: Private Bag X54001, Durban 4000

Telephone: +27 (0) 31 260 3587/8350/4557 Facsimile: +27 (0) 31 260 4609 Email: [ximbap@ukzn.ac.za](mailto:ximbap@ukzn.ac.za) / [snymanm@ukzn.ac.za](mailto:snymanm@ukzn.ac.za) [mohunp@ukzn.ac.za](mailto:mohunp@ukzn.ac.za)

Website: [www.ukzn.ac.za](http://www.ukzn.ac.za)

**Appendix: 6: Questionnaire for agricultural extension practitioners**

1. Explain how you engage with farmers? What approaches do you use? What are you trying to achieve with them? How do you keep your relationship with farmers professional?

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2. Do you consider the farmer's livelihood when giving advice or otherwise assisting farmers?

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a. If yes:  
Why do you do this?

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b. How does this help you in your work?

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c. Explain how you do this

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d. What is the response from the farmers?

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If no:  
Why not?

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3. In the last two decades, it has become imperative to focus on sustainable agricultural. Kindly share your understanding of the concept of sustainable agriculture.

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a. How did you acquire your understanding of the concept of sustainable agriculture? (Looking for whether it was a formal or informal training; a combination; can include workshops and conferences proceeding)

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4. What role do you think public agricultural extension can play in promoting sustainable agriculture? Prompt for extension approaches that might/should be used.

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5. Would you encourage other extension advisors to promote and assist farmers to adopt sustainable agriculture? Prompt for reasons.

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6. What kind of support do you need to promote sustainable agriculture? Prompt for sources.

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7. What kind of support do you get from your manager to promote sustainable agriculture?

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a. How helpful this support? What make it more helpful?

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8. Is there any forum in the Department or elsewhere where you discuss the importance of sustainable agriculture?

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a. If yes:

Describe the forum; how it works, who runs it, who attends, follow-up, does s/he attend.

How useful is the forum? How could it be improved?

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If no:

Would such a forum be useful? Why? Who should host it? Who should attend?

How would it work?

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9. In response to the pressure for food production to meet the demands of the ever-growing world population, many farmers have resorted to use farming practices that increase agricultural production without considering the potential harm to the natural environment. What is the reaction of farmers as you advise them about the importance of sustainable agriculture? Probe for rich details.

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11. How can you assist farmers to maintain or increase biological activities in order to ensure sustainable production in their farms?

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12. What are some of the different types of risk farmer's face?

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a. For each of these do you think the farmer should do to decrease the level of risk? How will that work?

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b. What else can be done to ensure sustainability of their farming business?

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11. What are some of the main natural resources that farmers are working with?

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- a. What can be done in order to protect these natural resources? Who should take responsibility?

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13. How do you monitor and evaluate whether farmers are economically viable?

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- a. Is there any profit or is just farming for own food security?

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14. Are the farmers producing products that are acceptable to their consumers? Give examples of some of the 'acceptable' products?

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- a. To what extent do the farmers consider the health of the end-users (e.g. the use of genetically modified organisms; use of fertilisers, pesticides and herbicides; other practices that may affect the health of human beings)?

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15. What do you think it should be done in Mpumalanga province to promote sustainable agriculture?

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**Appendix: 7: Questionnaire for public agricultural extension managers**

1. What are the policies or guidelines available in promoting sustainable agriculture?  
List them.

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2. In the last two decades, it has become imperative to focus on sustainable agricultural. Kindly share your understanding of the concept of sustainable agriculture.

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a. How did you acquire your understanding of the concept of sustainable agriculture? (Looking for whether it was a formal or informal training; a combination; can include workshops and conferences proceeding)

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3. What role do you think public agricultural extension can play in promoting sustainable agriculture? Prompt for extension approaches that might/should be used.

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4. Would you encourage other extension advisors to promote and assist famers to adopt sustainable agriculture? Prompt for reasons.

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5. What kind of support do you provide to extension officers in promoting sustainable agriculture? Prompt for sources.

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6. What kind of support do you get from your province or national agriculture to promote sustainable agriculture?

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a. How helpful this support? What make it more helpful?

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7. Is there any forum in the Department or elsewhere where extension officers discuss the importance of sustainable agriculture?

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a. If yes:  
Describe the forum; how it works, who runs it, who attends, follow-up, does s/he attend

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b. How useful is the forum? How could it be improved?



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c. If no:  
Would such a forum be useful? Why? Who should host it? Who should attend? How would it work?

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8. In response to the pressure for food production to meet the demands of the ever-growing world population, many farmers have resorted to use farming practices that increase agricultural production without considering the potential harm to the natural environment. What is the reaction of famers on sustainable agriculture, as per extension services reports?

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9. One way to look at sustainable agriculture is to use a framework of five pillars:

- Maintaining and increasing biological productivity
- Decreasing the level of risk to ensure larger security
- Protecting the quality of natural resources
- Ensuring agricultural production is economically viable
- Ensuring agricultural production is socially acceptable and acceptance





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12. What are some of the main natural resources that farmers are working with?

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a. What can be done in order to protect these natural resources?

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b. Who should take responsibility?

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13. How do you monitor and evaluate whether extension officers assist the farmers to become economically viable?

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a. Is there any profit or is just farming for own food security?

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14. Are the extension officers assisting farmers in producing products that are acceptable to their consumers? Give examples of some of the 'acceptable' products as per their reports?

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a. To what extent do the farmers consider the health of the end-users (e.g. the use of genetically modified organisms; use of fertilisers, pesticides and herbicides; other practices that may affect the health of human beings)?

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Appendix: 8: A map of Mpumalanga province 1



**Appendix 9: A map of Mpumalanga province (with 17 municipalities)**

