INCORPORATION OF SOCIAL MEDIA USE IN AGRICULTURAL INFORMATION DISSEMINATION BY EXTENSION OFFICERS FOR FARMERS IN LIMPOPO PROVINCE

Doctor of Philosophy (Agricultural Extension)

PM RAMAVHALE

2024

INCORPORATION OF SOCIAL MEDIA USE IN AGRICULTURAL INFORMATION DISSEMINATION BY EXTENSION OFFICERS FOR FARMERS IN LIMPOPO PROVINCE

by

PATIENCE MANKU RAMAVHALE

Thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy (Agricultural Extension)

in the

Department of Agricultural Economics and Animal Production

in the

FACULTY OF SCIENCE AND AGRICULTURE

(School of Agricultural and Environmental Sciences)

at the

UNIVERSITY OF LIMPOPO

Supervisor: Prof EM Zwane (University of Limpopo)

Co-Supervisor: Prof A Belete (University of Limpopo)

2024

DECLARATION

I hereby confirm that this thesis submitted to the University of Limpopo for the Doctor of Philosophy degree in Agriculture (Agricultural Extension) is entirely my own work, both in design and execution. I have not submitted it previously for a degree at any other university, and all sources used in this work have been duly acknowledged.

Ramavhale PM	2024.09.12
Surname, initials (Title)	**Date**

DEDICATION

To the woman who has been my biggest inspiration and supporter, my dear mother **Manyaku Florah Ramavhale**. Your firm strength and resilience have taught me to never give up in the face of adversity, and to always strive for excellence in everything I do.

I dedicate this Thesis to you, as a symbol of my gratitude and appreciation for everything you have done for me. Your sacrifices and hard work have paved the way for my success, and I am forever grateful for all your support.

This Thesis is just a small token of my love and appreciation for you, and I hope it brings a big smile to your face knowing that you are the reason behind my success.

“Kea Leboga Molotwadi ‘a Mphele le Hlapogadi”

ACKNOWLEDGEMENTS

I want to thank the following persons for their respective contributions to this thesis:

- Firstly, I acknowledge the grace of God for guiding me throughout this journey of completing my thesis. I thank God for granting me the knowledge and wisdom that helped me to accomplish this huge task. *"Proverbs 3:5-6"*
- I would like to express my utmost gratitude to my loving husband, Pheagane William Nkoana. His unwavering support, love and encouragement have been the cornerstone of my success.
- To my dear children, Mofenyi (2013), Mokgethwa (2017), Morongwa (2021) and Mogau (2024) thank you for your understanding and support during the moments when my busy schedule kept us apart. I love you unconditionally. You have been my source of inspiration and motivation all the way.
- I am deeply grateful to my supervisors, Prof EM Zwane and Prof A Belete, for their invaluable guidance, support, and encouragement. Their expertise and mentorship have been instrumental in shaping my study and career.
- Thank you to my friends for holding my hand until the end. Thank you for listening to my frustrations and forever assuring me. I will never forget how you fought my battles just to make sure my studies continue with ease.
- My sincere thanks to the co-workers in the Centre for Rural Community Empowerment for their unwavering support throughout my research.
- I am dearly grateful to the extension officers and farmers in Limpopo Province for their participation in my study. Their valuable insights and contributions have enriched my research.
- My sincerest appreciation to the Limpopo Province: Department of Agriculture and Rural Development for granting me permission to conduct my study.
- Lastly, a special thanks to AgriSeta for funding my study and making my PhD dream a reality. Their support has enabled me to achieve my academic aspirations and for that, I am truly grateful.

ABSTRACT

The use of social media in agriculture has become essential due to its ability to promote dialogue, mass communication, marketing, and information dissemination. Social media platforms such as Twitter (now called *X*), WhatsApp, Facebook, Instagram, and TikTok enable farmers to interact with influential people in the agricultural industry, access information from several sources online, and connect with consumers. However, the traditional methods of disseminating information physically to farmers are no longer effective and only reach a small portion of farmers at a given time.

To address this issue, a survey was carried out in the Limpopo Province of South Africa, which focused on developing a model for extension officers to use when incorporating social media for information dissemination. The study utilised a convergent parallel research design and mixed-methods approach, including qualitative and quantitative data collection methods. The sample size was determined using a multi-stage sampling procedure, and data analysis techniques included descriptive statistics, Multinomial Logistic Regression Analysis, and thematic content analysis.

The study utilised Multistage Sampling and Proportional Random Sampling as its model processes for the selection of extension officers and farmers. In the first stage, the population of Limpopo Province was divided into five strata, which were Sekhukhune, Waterberg, Capricorn, Mopani and Vhembe districts. In the second stage, Multistage Sampling and Simple Random Sampling was used to select farmers and extension officers. The sample size calculated for extension officers was 194 and for farmers, it was 400 at a 0.05 margin of error.

The findings revealed the importance of considering socio-economic factors such as marital status, age, gender, and education in designing interventions for farmers. WhatsApp emerged as the most widely used platform among farmers, followed by Facebook, while Instagram, Twitter, TikTok, and YouTube, which had varying degrees of usage. For extension officers, WhatsApp emerged as the most widely used platform, followed by Facebook and YouTube. The study highlights the efficiency of

WhatsApp for communication in remote areas and the ability of Facebook to create online communities.

The model developed from this study considers the socio-economic features of farmers in the Limpopo Province, as well as their use of social media platforms, such as WhatsApp and Facebook, for agricultural purposes.

The study recommends that extension officers develop and implement training programmes that focus on teaching farmers how to effectively use social media platforms for accessing agricultural information, marketing their products, and collaborating with other farmers. Additionally, policymakers need to enhance the accessibility of traditional sources of agricultural information and improve internet infrastructure in rural areas. Overall, the study provides insights into the use of social media in agricultural communication and offers recommendations for effective information dissemination between extension officers and farmers in the context of agricultural extension services.

Incorporating social media in agriculture is a relatively new phenomenon that has the potential to revolutionise the industry. Social media platforms have the ability to provide farmers with real-time information on weather patterns, market trends, and other relevant data, allowing them to make informed decisions about their farming practices. Additionally, social media can be used to promote products and services, connect with other farmers, and exchange ideas and knowledge.

The study conducted in the Limpopo Province of South Africa sheds light on the potential of social media in agriculture and highlights the importance of considering socio-economic factors in designing interventions for farmers. The study also emphasises the need for training programmes that focus on teaching farmers how to effectively use social media platforms for accessing agricultural information, marketing their products, and collaborating with other farmers. By implementing these recommendations, extension officers can help farmers improve their agricultural practices and enhance their livelihoods.

Key Concepts: Social media, farmers, extension officers, information dissemination.

TABLE OF CONTENTS

DECLARATION i

DEDICATION ii

ACKNOWLEDGEMENTS iii

ABSTRACT iv

LIST OF TABLES xiv

LIST OF FIGURES xvi

LIST OF ABBREVIATIONS xvii

CHAPTER ONE 1

INTRODUCTION 1

1.1 BACKGROUND OF THE STUDY 1

1.2 PROBLEM STATEMENT 3

1.3 RATIONALE OF THE STUDY 4

1.4 AIM AND OBJECTIVES OF THE STUDY 6

1.4.1 Aim of the study 6

1.4.2 Objectives 6

1.4.3 Research Hypotheses of the study 6

1.5 ORGANISATIONAL STRUCTURE OF THE STUDY 7

CHAPTER TWO 8

2. LITERATURE REVIEW 8

2.1. INTRODUCTION 8

2.2. DEFINITION OF TERMS 8

2.2.1. Social media 8

2.2.2. Agricultural information 9

2.3. BENEFITS OF SOCIAL MEDIA IN AGRICULTURE 10

2.4. SOCIAL MEDIA PLATFORMS 11

2.4.1. Facebook 12
2.4.2. Twitter 12
2.4.3. YouTube 13
2.4.4. Blogs 14
2.4.5. Linkedin 14
2.4.6. Wikis 14
2.5. CHALLENGES OF SOCIAL MEDIA USE 14
2.5.1. Illiteracy 14
2.5.2. Costs 15
2.5.3. Poor infrastructure 15
2.5.4. Privacy and social media policy 16
2.6. FACTORS CONTRIBUTING TO THE USE OF SOCIAL MEDIA 16
2.6.1. Age 16
2.6.2. Education 17
2.6.3. Gender 17
2.6.4. Work experience/farming experience 17
2.6.5. Family size 18
2.7. RATE OF SOCIAL MEDIA USE 18
2.8. ICT TOOLS USED TO ACCESS SOCIAL MEDIA 19
2.9. ADVANTAGES OF SOCIAL MEDIA 20
2.10. DISADVANTAGES OF SOCIAL MEDIA 20
2.11. AGRICULTURAL INFORMATION DISSEMINATION 21
2.12. INFORMATION NEEDS FOR FARMERS 22
2.13. SOURCES OF AGRICULTURAL INFORMATION 23
2.14. CONSTRAINTS OF INFORMATION DISSEMINATION 24
2.15. AGRICULTURAL EXTENSION 24

2.16. PRINCIPLES OF AGRICULTURAL EXTENSION 26
2.17. TYPES OF AGRICULTURAL EXTENSION APPROACHES 27
2.17.1. Farming systems approach 27
2.17.2. Project approach 27
2.17.3. General extension approach 28
2.17.4. Mass-media approach 28
2.17.5. Farmer to farmer Approach 28
2.17.6. Cyber extension approach 29
2.18. The role of agricultural extension 29
2.19. THEORETICAL FRAMEWORK 30
CHAPTER THREE 33
3. RESEARCH METHODOLOGY 33
3.1 INTRODUCTION. 33
3.2 STUDY AREA 33
3.3 RESEARCH METHODOLOGY AND ANALYTICAL PROCEDURES. 45
3.3.1 Research Paradigm 45
3.4 RESEARCH DESIGN 46
3.5 RESEARCH APPROACH 47
3.5.1 Mixed-Methods Research (MRM) 47
3.5.2 Qualitative Research Approach (QRA) 48
3.5.3 Quantitative Research Approach (QRA) 48
3.5.4 The Rationale for Mixed Methods Approach 48
3.6 DATA COLLECTION INSTRUMENTS 49
3.6.1 Survey 50
3.6.2 Interview 50
3.7 SAMPLING PROCEDURE AND SAMPLE SIZE 51

3.8 DATA ANALYSIS 53
3.8.1 Thematic Analysis 53
3.8.2 Statistical Analysis 54
3.8.3 Descriptive Statistics 54
3.8.4 Multinomial Logistic Regression Analysis 54
3.9 ETHICAL CONSIDERATION 56
3.10 CHAPTER SUMMARY 58
CHAPTER FOUR 59
4. DESCRIPTIVE RESULTS: SOCIO-ECONOMIC FEATURES, SOCIAL MEDIA PLATFORMS USED AND NEEDS FOR AGRICULTURAL INFORMATION DISSEMINATION 59
4.1. INTRODUCTION 59
4.2. SOCIO-ECONOMIC FEATURES 59
4.2.1. Socio-economic characteristics of farmers 59
4.2.1.1. Gender 59
4.2.1.2. Marital status 61
4.2.1.3. Age 62
4.2.1.4. Educational Qualification 64
4.2.1.5. Monthly income range 66
4.2.1.6. Household members 68
4.2.1.7. Sources of income 70
4.2.1.8. Primary language 71
4.2.2. Socio-economic characteristics of Extension officers 72
4.3. SOCIAL MEDIA PLATFORMS USED FOR AGRICULTURAL INFORMATION DISSEMINATION 73
4.3.1. Findings from farmers 73
4.3.1.1. Social media platforms used by farmers. 73

4.3.1.2. Times in the day when farmers use social media platforms. 74
4.3.1.3. The reasons why farmers use social media platforms. 76
4.3.2. Findings from extension officers. 78
4.3.2.1. Social media platforms used by extension officers. 78
4.3.2.2. Times in the day when extension officers use social media platforms 80
4.3.2.3. The reasons why extension officers use social media platforms. 81
4.4. SOCIAL MEDIA NEEDS FOR AGRICULTURAL INFORMATION DISSEMINATION. 83
4.4.1. Findings from farmers. 83
4.4.1.1. The use of social media. 83
4.4.1.2. Challenges of social media use. 84
4.4.1.3. Type of information farmers are willing to access on social media 85
4.4.1.4. Preferred content format for viewing social media posts. 87
4.5. NON-SOCIAL MEDIA USE. 89
4.5.1. Reasons why farmers do not use social media platforms. 89
4.5.1.1. Not interested 90
4.5.1.2. Poor technology knowledge. 90
4.5.1.3. Concerned about privacy. 90
4.5.1.4. No internet access. 90
4.5.1.5. Lack of time. 91
4.5.2. Current traditional sources of agricultural information. 91
4.5.2.1. Extension officers. 91
4.5.2.2. Radio. 92
4.5.2.3. Television. 92
4.5.2.4. Family and Friends. 92
4.5.2.5. Newspapers. 92

4.5.3. Challenges for accessing agricultural information through traditional sources. 93
4.5.3.1. Limited access to information. 93
4.5.3.2. Difficulty in finding information. 94
4.5.3.3. Limited networking opportunities. 94
4.5.3.4. Time consuming. 94
4.5.4. Satisfaction of farmers on traditional information sources. 94
4.5.5. Findings from extension officers. 96
4.5.5.1. The use of social media 96
4.5.5.2. Challenges of social media use. 97
4.5.5.3. Type of information extension are willing to share on social media. 98
4.5.6. Preferred content format for viewing social media posts. 100
4.6. CHAPTER SUMMARY 101
CHAPTER FIVE 104
5. EMPIRICAL RESULTS: EFFECTIVENESS, SATISFACTION AND USE OF CURRENT SOCIAL MEDIA PLATFORMS FOR AGRICULTURAL INFORMATION DISSEMINATION 104
5.1. INTRODUCTION 104
5.2. FINDINGS FROM FARMERS 104
5.2.1. Descriptive results for the use of social media 104
a) Social media platforms used by farmers. .....**Error! Bookmark not defined.**
b) How often do farmers post agricultural information on social media? 104
c) How often do farmers access agricultural information on social media? 106
d) The benefits of social media platforms for farmers 107
5.2.2. Variance Inflation Factor (VIF) 109
5.2.3. Model estimates for Multinomial logit model (MLRM) 111
5.3. FINDINGS FROM EXTENSION OFFICERS 120

5.3.1. Descriptive results for the use of social media 120
a) Social media platforms used by extension officers..... 120
b) How often do extension officers post agricultural information on social media?. 122
c) How often do extension officers access agricultural information on social media? 123
d) The benefits of social media platforms for extension officers 125
5.3.2. Effectiveness of social media platforms 126
5.4. CHAPTER SUMMARY 128
CHAPTER SIX 130
6. QUALITATIVE RESULTS: PERCEPTIONS AND CONTRIBUTING FACTORS OF SOCIAL MEDIA USE BY EXTENSION OFFICERS AND FARMERS FOR INFORMATION DISSEMINATION IN LIMPOPO PROVINCE 130
6.1. INTRODUCTION..... 130
6.2. FINDINGS FROM EXTENSION OFFICERS 130
6.3. QUALITATIVE RESULTS FOR THE USE OF SOCIAL MEDIA 130
6.3.1. Adoption and use of social media platforms..... 131
a) Adoption of social media platforms by extension officers 131
b) Preference for WhatsApp as the primary communication tool. 132
6.3.2. Benefits and advantages of social media use 133
a) Convenient and effective communication..... 133
b) Content sharing..... 134
c) Cost-effectiveness and accessibility..... 135
d) Utilisation of Agricultural Apps for Sourcing Information..... 136
6.3.3. Limitations and challenges of social media use 136
a) Preference for a direct phone call. 136
b) Technical knowledge and information sources 137
c) Importance of personal interactions 138

d) Network connectivity issues 139

e) Privacy concerns 139

6.4. CHAPTER SUMMARY 139

CHAPTER SEVEN 141

7. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 141

7.1. INTRODUCTION 141

7.2. SUMMARY 141

7.2.1. The socio-economic characteristics of farmers 141

7.2.2. Objective 1: To describe the effectiveness of current social media platforms used by farmers and extension officers in Limpopo Province. 141

7.2.3. Objective 2: To identify the needs of extension officers and farmers in agricultural information dissemination in Limpopo Province 142

7.2.4. Objective 3: To determine the social media platforms used by extension officers and farmers in agricultural information dissemination in Limpopo Province. 142

7.2.5. Objective 4: To explore the perception and contributing factors of social media use by extension officers and farmers for information dissemination in Limpopo Province. 143

7.2.6. Objective 5: To develop a model for using social media as a tool for information dissemination in Limpopo Province. 143

7.3. CONCLUSIONS 143

7.4. RECOMMENDATIONS 145

7.5. LIMITATIONS OF THE STUDY AND FUTURE RESEARCH 153

LIST OF REFERENCES 154

APPENDIX A: Consent form 181

APPENDIX B: Social media use questionnaire. 182

APPENDIX C: Ethical clearance certificate. 194

APPENDIX D: Permission to conduct study. 195

APPENDIX E: Editorial Letter. 196

LIST OF TABLES

Table 3.1: Population of farmers in Limpopo Province. 52
Table 3.2: Themes of the qualitative analysis. 54
Table 3.3: Description of Variables for the Use of Social Media 55
Table 4.1: Gender of farmers..... 60
Table 4.2: Marital status of farmers 61
Table 4.3: Educational qualification of farmers 65
Table 4.4: Monthly income range for farmers 66
Table 4.5: Sources of income for farmers (n=420) 70
Table 4.6: Language used by farmers. 71
Table 4.7: The type of social media platforms used by farmers. 73
Table 4.8: The time of social media use in the day 75
Table 4.9: Reasons why farmers use social media. 76
Table 4.10: Social media platforms used by extension officers. 78
Table 4.11: Times in a day when extension officers use social media platforms. 80
Table 4.12: The reasons why extension officers use social media. 81
Table 4.13: The use of social media 83
Table 4.14: Challenges of social media use 84
Table 4.15 :The type of information most important to farmers 86
Table 4.16: The content format preferred by farmers. 87
Table 4.17: Reasons why farmers do not use social media. 89
Table 4.18: Current traditional sources of agricultural information dissemination. ... 91
Table 4.19: Challenges for accessing agricultural information through traditional sources 93
Table 4.20: The challenges faced by extension of social media use. 97
Table 4.21: The type of information extension are willing to share on social media. (n=50) 98
Table 4.22: Preferred content format for viewing social media posts. (n=50) 100

Table 5.1: The benefits of using social media for farmers……108
Table 5.3: A table summarising the Variance Inflation Factor (VIF) results. 109
Table 5.4: The Breusch-Pagan/Cook-Weisberg test result for heteroscedasticity of farmers in the five districts of Limpopo Province for information dissemination. (420) 110
Table 5.2: Multinomial Logistic Regression Model (MLRM) for sampled farmers in the five districts of Limpopo Province (n=420). 111
Table 5.6: Benefits of social media platforms for extension officers 125
Table 5.7: The effectiveness of social media platforms 127
Table 6.1: Themes and subthemes derived from the study……131

LIST OF FIGURES

Figure 3.1: The map of Limpopo Province 34
Figure 3.2: Capricorn District Municipality 36
Figure 3.3: Vhembe District Municipality 38
Figure 3.4: Waterberg District Municipality 41
Figure 3.5: Mopani District Municipality 43
Figure 3.6: Sekhukhune District Municipality 45
Figure 3.7*:* Convergent Parallel Research Design (CPRD) 47
Figure 4.1: Age of the farmers…….. 63
Figure 4.2: Household members for farmers 69
Figure 4. 3: Satisfaction of farmers on traditional information sources 95
Figure 5.1: Frequencies of social media platforms used by farmers……..**Error! Bookmark not defined.**
Figure 5.2: How frequently farmers post on social media..... 105
Figure 5.3: How frequently farmers access social media. 107
Figure 5.4: Social media platforms used by extension officers..... 120
Figure 5.5: How often do extension officers post agricultural information? 122
Figure 5.6: How often do extension officers post agricultural information? 124
Figure 7.1: Social media communication model for agricultural information dissemination……..147
Figure 7.2 Conceptualization model of communication. 152

LIST OF ABBREVIATIONS

ARC	Agricultural Research Council.
CDM	Capricorn District Municipality.
CPRD	Convergent Parallel Research Design.
HMNR	Hans Merensky Nature Reserve.
ICT	Information Communication Technology.
KNP	Kruger National Park.
LDARD	Limpopo Department of Agriculture and Rural Development.
LDNR	Loskop Dam Nature Reserve.
LRGR	Letaba Ranch Game Reserve.
MDM	Mopani District Municipality.
MLRM	Multinomial Logistic Regression Model.
MNP	Mapungubwe National Park.
MRM	Multiple Regression Model.
MRM	Mixed Methods Research
NGO	Non-Governmental Ogarnisation.
QRA	Quantitative Research Approach.
QRA	Qualitative Research Approach.
SDM	Sekhukhune District Municipality.
SPSS	Statistical Package for Social Sciences.
SRS	Simple Random Sampling.
TREC	Turfloop Research Ethics Committee.
UGT	Uses and Gratifications Theory.

UNESCO	United Nations Educational, Scientific and Cultural Organisation.
VDM	Vhembe District Municipality.
VIF	Variance Inflation Factor.
WDM	Waterberg District Municipality.
WGR	Welgevonden Game Reserve.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Social media refer to channels that are interactive and digital, and also allow farmers to communicate online (Mamgain et al., 2020). These channels promote dialogue, mass communication, marketing, and information dissemination (Paudel & Baral, 2018). Skiba (2017) describes social media as websites and applications that are selected and used by individuals for social interactions, content sharing, and creation in a virtual space. Social media users select these channels according to their preferences, purpose, and the type of audience they intend to reach regarding agricultural information (Rhoades & Aue, 2010).

Zhang and Wang (2016) define agricultural information as the information packaged specially for farmers about their produce and production practices. This information is very important to farmers because it helps them to plan and execute daily production activities. Social media benefit farmers by creating a platform for them to interact (Mamgain et al., 2020). They further broaden the base of agricultural communities, reduce travel costs, remove the geographical distance, and they easily eliminate remoteness (Nazari & Hasbullah, 2008). Social media are very important in agriculture because they bring consumers and farmers together and they enable interaction with influential people in the agricultural industry. They further provide farmers with plenteous information from several online sources. Social media can also help in creating well-informed farmers that are always ready to decide (Albizua et al., 2021).

Farmers use several types of social media in agriculture: Twitter, WhatsApp, Facebook, Instagram, and TikTok (Bhattacharjee & Raj, 2016). They widely use these platforms to interact with friends and colleagues to seek information and form collaborations with other farmers (Cinelli et al., 2021). Social media make it possible for farmers and their customers to interact. They have also increased the visibility of farmers and their activities on platforms such as Facebook and Twitter (Liu, 2010). Beyond receiving information and reaching out to extension officers, farmers use social media platforms like YouTube to create videos about their farming activities. Besides content creation online, the more people share information on the platforms,

the more their shared information reaches even a broader audience (Casey et al., 2016).

The popularity of social media has overshadowed their negatives in the business industry (Chang & Lindner, 2017). They further allude that these media are a big disadvantage for the business, especially if it is not making use of social media because this will hinder its growth. Extension officers in agriculture use social media to receive information in their workplaces using their electronic devices (Bhattacharjee & Raj, 2016). Since extension officers are already using social media in their day-to-day activities, they can follow the correct procedures of formalising social media use in their workspaces to include factors such as planning, security, marketing, and creating online communities (Thakur & Chander, 2018). Extension personnel uses social media metrics to measure the effectiveness of their existing social media pages on different platforms (Liu, 2010). These metrics use indicators such as comments, likes, number of friends, followers, mentions, and fans to measure the impact of the information they share with the farmers and the public. Although social media is good for extension officers, it might pose challenges to them regarding their inability to perform hands-on experiments with the farmers, acceptance of social media, and lack of adoption by traditional 'extensionists' (Kapuscinski, 2017).

The opportunities that social media present to the extension officers are the delivery of timely and science-driven information to farmers (Kapuscinski, 2017). Television, radio, newspapers, field visits, and farmers' days are used in South Africa as a means of agricultural information dissemination (Ani & Baba, 2010). Several challenges discourage the use of social media by extension officers and farmers (Lakshmi & Babu, 2018). Illiteracy, lack of awareness, expensive data costs, poor training, power outages, lack of authentic information, and cyber security issues, are but a few examples (Tire, 2006). Farmers that are without relevant and updated information develop slowly, and this slow development hinders productivity (Malekani & Mubofu, 2020). Without timely, relevant, and updated information, farmers lose much of their produce (Malekani & Mubofu, 2020). Although there are existing means of information dissemination for both farmers and extension officers, there is a need for alternative approaches to disseminating information, like the adoption of social media as a tool (Mbagwu et al., 2018). The combination of both traditional methods such as individual

visits, meetings, field days and social media for disseminating information will help extension officers and farmers in better information dissemination (Pandit & Miah, 2015).

Extension officers will save time when using social media to disseminate information to many farmers in different areas at the same time (Malhan & Rao, 2007). Farmers will benefit from this practice by making informed decisions, interacting with fellow farmers, and also asking questions from extension officers on challenges they encounter daily regarding their produce (Chander, Thakur & Chander, 2018). Farmers need information regarding weather, pests, diseases, markets, and upcoming events in the agricultural sector (Bachhav, 2012). The next section (1.2) elucidates the problem of the study.

1.2 PROBLEM STATEMENT

Agricultural information influences agricultural productivity by allowing farmers to make well-informed decisions about their produce. Well-informed farmers are well-equipped farmers (Varner, 2018). It is generally accepted that information plays a very important role in alleviating poverty by helping farmers to make informed decisions about what they produce (Sani et al., 2014). Such information, it is believed, can also help to improve the productivity of the farmers, provided it is relevant, useful, and reliable (Sennuga, 2020).

Agricultural information is very important to the farming communities, and in areas where information is limited and poorly disseminated, farmers become less productive and are at a risk of losing profit, from their daily farming activities (Odini, 2014). Farmers rely largely on extension officers to receive agricultural information (Kipkurgat et al., 2016), and this type of information is usually disseminated during farmers' days, meetings, and selected individual visits by extension officers.

Some of the disadvantages of traditional methods of providing physical information to farmers include expensive transportation costs, reaching remote locations, and poor meeting attendance, making it difficult for extension officers to reach a large number of farmers in a short period (Odini, 2014). These disadvantages results in farmers not receiving relevant and timely information that they require on a daily basis to carry out farming activities. The challenges of information dissemination to farmers as indicated

above can be addressed by incorporating social media as a communication tool for farmers by extension officers.

Lathiya et al. (2015) state that social media can be used as a tool to disseminate agricultural information on time, reduce traveling costs for extension officers to farmers, reach many farmers instantly, and encourage participation and interactivity of farmers on the social media platforms. Various studies have investigated the use and challenges of social media in agriculture. Other studies, like that of Zhang and Wang (2016), have investigated the effectiveness of social media as a tool for disseminating agricultural information.

Hansen et al. (2014) identified methods and tools used in agriculture for information dissemination. Although these studies have been conducted, there is limited literature on the existing models of social media use that extension officers can use in their daily activities of disseminating agricultural information to the farmers.

To fully understand why farmers and extension officers engage in social media activities, in-depth research is needed. There are essentially five important objectives of social media model incorporation for extension officers to disseminate information to the farmers, namely; to describe the effectiveness of current social media platforms, to identify the needs of using social media for extension officers and farmers, to determine the highly rated social media platforms, to explore the perceptions and contributing factors of social media use and develop a model for using social media as a tool for information dissemination. Given the information in sections 1.1 and 1.2 above, this study attempted to survey the incorporation of social media in agricultural information dissemination by extension officers in Limpopo Province.

1.3 RATIONALE OF THE STUDY

As a result of technological advancement, farmers have the opportunity to learn more about agriculture through the media (Busungu et al., 2019). Social media are recognised as powerful tools to communicate in the agricultural sector (Tao et al., 2020). Farmers and extension officers face challenges such as poor network access, overloading, and high fees when accessing the Internet. Most farmers have a positive attitude towards searching for agricultural information using social media (Kipkurgat et al., 2016). By tradition, agricultural information dissemination is done through the industrial media of newspapers, television, and newspapers. Nowadays, people,

including farmers, are using social media such as Twitter, Facebook, YouTube, and blogs to spread personal or agricultural information (Varner, 2018).

Based on the gaps identified, this study sought to address the need for social media use by both farmers and extension officers and the study was supported by the Use and Gratifications Theory (Ruggiero, 2000). Contrary to many media theories that view media users passively (Ruggiero, 2000), this theory perceives users as active agents in controlling their media consumption. The Use and Gratifications Theory further states that users choose the type of media and their content to meet their needs (Kipkurgat et al., 2016). Most people are still wasting time on social media sites and accessing irrelevant information (Lakshmi & Babu, 2018), and yet social media sites are considered the most important sites for building a good network, maintaining existing relationships, and accessing the latest information.

Apart from this, people also use social media to get satisfaction from social interaction, entertainment, and access to social information (Kircaburun et al., 2018). Social media play a crucial role in building relationships and facilitating the flow of information among the various actors involved in agricultural innovations. This enhances the capabilities of extension officers and other service providers (Kipkurgat et al., 2016). Nevertheless, Bhattacharjee and Raj (2016) found that social media have the following disadvantages: poor connections to the Internet, poor usage of time, and fear of missing out. In addition to these identified challenges of social media, (Meena and Singh (2012) proffered that social medial media weaken research linkages, provide irrelevant information and have time constraints. Chander, Thakur and Chander (2018) recommend that the Department of Agriculture in India use social media platforms for researching sites for the benefit of agricultural and extension agencies and providing reliable and useful information to farmers on these sites.

Limpopo Province has extension officers who can benefit from using social media in the dissemination of agricultural information to farmers. Traditional methods of disseminating physical information to farmers are no longer effective and involve only a small portion of farmers at a given time (Talebian et al., 2014). Social media can help reduce the time spent disseminating information, reach more farmers in less time, and stimulate dialogue between farmers and extension officers. This study may add to the

existing literature about social media use for agricultural information dissemination especially in Limpopo Province.

1.4 AIM AND OBJECTIVES OF THE STUDY

1.4.1 Aim of the study

The study aimed to develop a model for extension officers to use when incorporating social media for information dissemination in Limpopo Province.

1.4.2 Objectives

The specific objectives of the study were to:

i. Analyse the effectiveness of current social media platforms used by extension officers and farmers in agricultural information dissemination in Limpopo Province.
ii. Identify the needs of extension officers and farmers in agricultural information dissemination using social media in Limpopo Province.
iii. Determine the highly-rated social media platform used by extension officers and farmers in agricultural information dissemination in Limpopo Province.
iv. Explore the perceptions and contributing factors of social media use by extension officers and farmers for information dissemination in Limpopo Province.
v. Develop a model for using social media as a tool for information dissemination in Limpopo Province.

1.4.3 Research Hypotheses of the study

i. There are no current effective social media platforms used by extension officers and farmers in agricultural information dissemination in Limpopo Province.
ii. There is no need for extension officers and farmers in agricultural information dissemination using social media in Limpopo Province
iii. There are no highly rated social media platforms used by extension officers and farmers in agricultural information dissemination in Limpopo Province.

iv. There are no perceptions and contributing factors of social media use by extension officers and farmers for information dissemination in Limpopo Province.

1.5 ORGANISATIONAL STRUCTURE OF THE STUDY

Chapter one: outlines the background of the study, research objectives and hypotheses, the problem statement, and the rationale of the study.

Chapter two: provides the review of literature of the current social media platforms, the information needs of farmers, and the perceptions of social media use.

Chapter three: elucidates the research methodology, which includes the study area of the participants, the process and tools of data collection, and data analysis techniques used during the management of data.

Chapter four: presents the descriptive results on the socio-economic characteristics of the farmers, social media platforms used and needs for agricultural information dissemination.

Chapter five: discusses the empirical results on the effectiveness, satisfaction and use of current social media platforms for agricultural information dissemination.

Chapter six: presents the qualitative results on the perceptions and contributing factors of social media use by extension officers and farmers for information dissemination in Limpopo Province.

Chapter seven: outlines the summary of the study, policy recommendations, and the conclusion drawn from the study.

CHAPTER TWO

LITERATURE REVIEW

2.1. INTRODUCTION

This chapter describes the key terminology used in this study and reviews literature on the use of social media in South Africa and other countries. It further explains the use of social media in agriculture for information dissemination by listing the uses, types of social media and the factors influencing the use of social media. Agricultural extension and information dissemination are also discussed as constructs of the study.

2.2. DEFINITION OF TERMS

2.2.1. Social media

The term social media refers to computer-based technology that aids the sharing of thoughts, ideas, and information through virtual networks and communities (Novianty, 2020). According to Newman et al. (2017), social media are any digital tools that allow users to immediately create and share content with the public. Social media are further defined as an Internet-based medium and provide users with the rapid electronic communication of content such as documents, personal information, videos, and photos (Srivastava et al., 2019). Similarly, Kapoor et al. (2018) also define social media as interactive technologies that enable the creation and sharing of information, ideas, interests, and other expressions through virtual communities and networks for a specific audience. In addition to creating and sharing content, Greenhow and Galvin (2020) allude that social media are a great space to create social networks. Voorveld (2019) further states that the information shared on social media is based on the ideological and technological foundations of the users. For consumer informatics, social media are an online resource that encourages engagement among individuals (Bishop, 2019). Social media can be defined as a techno-social system for participatory culture, having characteristics like participation, openness, connectedness, conversation, and community (Samsudin, 2020).

Users interact with social media through computer, and smartphone through web-based software or applications. Social media originated as a way to communicate with friends and family, but have since been adopted by businesses and organisations that want to use a popular method of communication to reach customers and members

(Ahmad et al., 2018). The power of social media is the ability to share information with many people on Earth at the same time.

For many years, agriculture has never had such a powerful tool to connect millions of farmers and extension officers from their own homes and anywhere in the world. Social media have empowered everyone's voice, and while that may come with its challenges, there are opportunities for the taking, especially when it comes to telling the world's agricultural story (Solis & Breakenridge, 2009). Social media are now a global form of communication, and it is growing in popularity with the increasing number of smartphones and ease of use on the go (Rugova & Prenaj, 2016). The world now has 3.29 billion users of social networking sites, and other industries have adopted these platforms for business and customer interaction (Appel et al., 2020).

2.2.2. Agricultural information

The productivity and production in agriculture are highly dependent on the information the farmers receive. In areas where there is less to no access to agricultural information, their agricultural productivity becomes disadvantaged (Kelil et al., 2020). Farmers need information regularly to keep up to date with their production activities. Researchers and information providers must package information in such a way that it accommodates all farmers (Zimu-Biyela, 2021). According to Vajjhala (2020), agricultural information takes place within an agricultural information system. Agricultural information can be defined as a system where agricultural information is created, consolidated, and transferred to meet the needs of the farmers (Vajjhala, 2020). The packaged information is intended to reach the farmers through different platforms and channels such as extension officers, libraries, radio, television, and newspapers.

Agricultural information helps farmers make decisions on land, capital, and management as production factors in agriculture. Zwane (2020) states that the agricultural information system is mostly perceived to be very complete due to various communication models that cause transformations. Farmers who access agricultural information have the advantage of having reduced uncertainty, enhanced adoption of technologies, and good decision-making (Kelil et al., 2020). Additionally, Nkebukwa (2018) proffers that access to agricultural information is an indicator of agricultural development, especially in rural areas. When the farmers have relevant agricultural

information, especially in marketing, the middleman activity can be removed (Magesa et al., 2020).

Makaula (2021) indicates that, when farmers receive information that is not on time or relevant, they are unable to effectively use this type of information. To introduce new beneficial technology to the farmers, there needs to be information that can create awareness and influence the adoption of such technology (Olawuyi & Mushunje, 2020). Maree (2021) further emphasises that reliable, rich and well-researched information is needed as a strategy in animal production for sustainable agriculture.

2.3. BENEFITS OF SOCIAL MEDIA IN AGRICULTURE

Social media overcome geographical boundaries and create communities that share common interests. The users also seek out information from traditional media social media platforms (Singh, 2020). The use of social media platforms for networking among farmers reduces social isolation for farmers, enabling them to meet and network with other farmers, agribusinesses, and consumers around the world. The biggest reason that people stay active users of social media is not because they feel comfortable and secure but, rather, because they appreciate the value or service that the media provide (Anderson, 2019). These platforms can be used to mobilise farmers to come together for a common cause and strengthen their relationships (Nwakwuo & Benson, 2021). In education, social media are used by learners to connect and keep each other updated with their lives, apart from this social connection, they are further used by educators to post the content covered in class to the learners (Pandey & Dubey, 2020). Social media are used to create awareness, to also share information, engage the audience, strengthen agricultural extension, combat the feeling of isolation, overcome geographical barriers, and creation of communities with the same interests and values. Social media also help extension officers to keep themselves updated with recent developments in agriculture. If utilised well, social media are a good tool for agricultural information sharing (Lakshmi & Babu, 2018). Social media in agriculture aid with quick relationship building for farmers, raising awareness, bringing economic opportunities, increasing access to resources and education, change of influence cultures, and increasing scope of usage in various sectors. They play an influential role in agriculture and reduce the social isolation of farmers (Karle & Mishra, 2022). Social media connect people that are far from each other although this freedom

of connection can be abused by users by engaging in social hatred and social divisions.

Politically, social media are a great tool for mobilising the masses for a particular cause. They have also enhanced political participation in South Africa. Social media has also bridged the gap in terms of access to information between the old and the youth. Irrespective of these benefits, the poor and unemployed in rural areas cannot benefit from social media. People look for jobs and socialis using social media. People use social media to voice their grievances; they enable people to share real-time happenings (Legodi & Shai, 2020). Social medial platforms made access to information to be very cheap, faster, and reach a large audience (Sandeep et al., 2022a).

Social media are a good virtual tool for connecting people and they also aid in mass education (Patel & Kumar, 2021). Social media can be used as a tool for communication and networking among farmers. They can also use social media to grow their production. Social media have increased two-way communication. Social media strengthen relationships in agricultural communities (Chepkiruri, 2021). They can be used for social good, such as organising community activities, empowering citizens, and coordinating emergency or disaster relief efforts. They connect people over large geographical distances. The Ministry of Agriculture used social media to share the latest developments. Social media blur the line between social security and technology (Samsudin, 2020), as these media provide a platform for people with specific interests to connect and share knowledge and technologies through certain means such as developing groups or pages. Social media aid people to work hand in hand by forming a network base, information flow, and cost-effectiveness (Paudel & Baral, 2018).

2.4. SOCIAL MEDIA PLATFORMS

Social media platforms are used by people to publish their daily activities, comments, and photos as well as re-publish information posted by others. There are six categories of social media platforms, namely: Social network sites, blogs, microblogs, wiki, photo sharing, and video sharing. Social media platforms are effective for creating participation, collaboration, interaction, and communication among students and instructors (Alshehri, 2020). Inegbedion et al. (2021) list examples of social media

platforms in their study, such as Facebook, Instagram, and WhatsApp. On the other hand, Thakur and Chander (2018) identify popular social media platforms such as Facebook, WhatsApp, and YouTube, and further single out Facebook as the top popular of the three. Greenhow and Chapman (2020) identify Facebook and Twitter as the main platforms used in education and list various online social media platforms as blogs, business networks, collaborative projects, enterprise social networks, microblogs, forums, product review, photo sharing, social gaming, social bookmarking and video sharing (Aichner et al., 2021).

Mamgain et al. (2020) proffer that Facebook, WhatsApp, Twitter and YouTube are widely used in agricultural extension, with WhatsApp being the most used platform to communicate with both peers and farmers.

2.4.1. Facebook

Facebook is a platform used by extension officers, organisations and other networks in agriculture. Facebook is a site that enables users who create profiles to connect to family and friends (Houghton et al., 2020). According to Tandon et al. (2020), the information posted on social media platforms like Facebook, if not restricted, can be viewed by anyone on the platform or outside. Facebook has features that enable users to either make their profiles private or public to protect what they share on the platform (Kozlowska, 2018). Facebook further encourages interaction among users and also information sharing (Sandeep et al., 2022). It always allows predators to come after young users because their information is available to the public (Mico, 2019). Cyberbullying mostly takes place on social media, according to Khairy et al. (2021), and bullies are provided with enough information to use against others and to also send other users foul messages. It is for these reasons that most farmers do not like using social media, as they become afraid that strangers might start contacting them and threatening them. Irrespective of the negatives, Facebook is a great platform to create friends, connect and reunite with family members, and to also assist job seekers to secure jobs.

2.4.2. Twitter (Now called *X*)

It is a microblogging site used globally by many users; it is used for creating public opinions in a social context. Twitter makes use of interaction paradigms like mentions,

retweets and hashtags (Cinelli et al., 2021). According to Kaur et al. (2021), a few farmers use Twitter for personal networking, information sharing and entertainment. It allows users to send read short messages because it is a microblogging service; it is further widely used by media firms to increase productivity and growth (Adeyeye & Ohunyowon, 2019). Users on Twitter can specify whom they want to follow depending on the type of content they seek on the platform (Paudel & Baral, 2018), and extension officers use it for educational and marketing purposes. Although Twitter was found to be very small, according to the results of Roche et al. (2020), it was revealed that farmers who use it, interact with other herd producers about milk production. In contrast, plant producers indicated that Twitter is the mostly used platform to seek soil-plant information and networking (Alotibi & Dabiah, 2022). According to Mirembe et al. (2019), twitter enables students to actively participate in educational activities and give instant feedback On all age groups, young adults were found by Hruska and Maresova (2020) to be the heavy users of social media platforms like Twitter.

2.4.3. YouTube

It is a video sharing platform with the aim of giving people at all levels a voice in their respective communities. Roche et al. (2020) describes YouTube as a platform where users can obtain information than interacting with peers. Lecturers in engineering and computing use it to access educational information and to also create content (Mirembe et al., 2019). According to Hruska and Maresova (2020), the activity on YouTube decreases as the age of the users increase and on the other hand, men use YouTube than women. Similar to Facebook and Twitter, YouTube is widely used for personal networking and entertainment (Kaur et al., 2021). Farmers use YouTube to publish their videos about farming activities, according to Kanjina (2021). It is further used to obtain information about agriculture related news. The use of YouTube among soil-plant farmers was found to be directly related to the knowledge gain on agricultural topics (Alotibi & Dabiah, 2022). In medical education, YouTube is used to enhance quality and create educational activities through involvement of stakeholders (Latif et al., 2019). Despite all the benefits of social media, Chander, Thakur and Scientist (2018) state that agricultural extension and farmers have not fully explored the benefits of this platform to reach out to each other.

2.4.4. Blogs

Blogs entail thoroughly discussed topics on issues that affect communities and have got a platform for readers to leave comments (Mamgain et al., 2020). As compared to other social media platforms like WhatsApp and Facebook, Blogs have less popularity even though they support knowledge management and sharing, according to Nain et al. (2019). Blogs were found to be the least rated platforms, as stated by Sandeep et al. (2022), for searching information regarding agriculture. Furthermore, Blogs enable users to create content freely and provide useful information to farmers using different languages (Singh et al., 2019).

2.4.5. Linkedin

Media firms make use of LinkedIn to increase networking and organisational productivity (Adeyeye & Ohunyowon, 2019). LinkedIn is also a social network site that functions to interact and socialise with people of similar interest (Anwas et al., 2020). Additionally, Paudel and Baral (2018) state that LinkedIn is widely used as a platform for professional job seekers, academics and businesses. On this platform, jobseekers can interact directly with employers and create a massive contact network.

2.4.6. Wikis

These are online encyclopedias that allow users to add, remove, edit and modify content independently and directly from web browsers, a common example being the collaborative web-based encyclopedia project Wikipedia (Paudel & Baral, 2018).

2.5. CHALLENGES OF SOCIAL MEDIA USE

Due to many issues experienced everyday by farmers, the use of social media remains challenging in their communities. The common challenges associated with the use of social media in agriculture are: illiteracy, high cost, poor infrastructure, privacy and social media policy.

2.5.1. Illiteracy

Farmers in rural areas present with low levels of literacy and limited training opportunities from their extension support (Ofori & El-Gayar, 2021). In their studies, Paudel and Baral (2018) as well as Mwalukasa (2020) discovered that the user's low literacy is still a great concern regarding the usage of social media. Apart from literacy

as a concern to social media use, Paudel and Baral (2018) state that, the lack of awareness on using social media and all their tools contribute to the illiteracy of the users. Mwalukasa (2020) together with Darshan and Meena (2017) agree that, poor training and inadequate technical knowledge discourage students from sharing their academic work. Furthermore, Mwalukasa (2020) states that lack of support from friends and fellow students can act as a contributing factor to the challenges of social media use.

2.5.2. Costs

The high cost of current information communication technologies (ICTs) is one the challenges that discourage the use of social media (Ofori & El-Gayar, 2021). Furthermore, Nwakwuo and Benson (2021) allude that farmers lack interest in using social media platforms due to the high costs of usage and their lack of clarity on the information needs on agriculture. According to Singh (2020), the costly charges of accessing the Internet are among other challenges of using social media. Chander et al. (2018) state that Internet connection as a pre-requisite to access social media is very expensive, this is made worse by poor infrastructure. Most of the social media are a specific app which can only be found on a smart phone. Many small holder farmers use a basic phone with sms and telephony. Lastly, Mwalukasa (2020) emphasises that the challenge of the high cost of data bundles and airtime is faced by students when sharing academic information.

2.5.3. Poor infrastructure

Good infrastructure is an enabler of a good communication flow when using social media platforms. Infrastructure referred to in this review is that of ICTs such as: Internet, stable network and electricity. Chander et al. (2018) state that poor infrastructure remains a big challenge in using social media platforms for information dissemination. As has been previously reported in the literature, Internet and power supply are key needs for the proper use of social media (Ofori & El-Gayar, 2021). Ofori and El-Gayar (2021) further outline that when infrastructure is well-organised, it becomes a good driver for the use of social media. Moreover, poor network access and power outages contribute to problems encountered when accessing social media using the Internet (Singh, 2020). Findings in the studies above are consistent with the findings of Mwalukasa (2020) that slow Internet connection and low capacity on mobile

phones are a challenge to students when they have to share academic related information. In conclusion, the uneven Internet infrastructure does not only affect student and farmers, it also affects everyone engaged in social media marketing to promote and sell their products (Kongying & Purisai, 2021).

2.5.4. Privacy and social media policy

Referring to the views of Ofori and El-Gayar (2021), farmers have a lack of trust regarding social media use because they lack knowledge of how their data on different platforms can be used for them and against them. This uncertainty makes farmers not to have interest in the use of social media due to lack of knowledge of social media policy among the farmers. Although lately most social media platforms have strengthened security option regarding privacy, farmers still lack an understanding of how their information will be kept safe from hackers and human traffickers. Chander et al. (2018) further state that farmers have privacy concerns and worries on how the quality of the content found on social media is regulated. The number of false posts on social media keeps rising while some of the posts trigger fear and anxiety in the farmers.

Paudel and Baral (2018) opine that privacy concerns remain the greatest concerns amongst farmers regarding social media. In their study of aquaculture, Islam et al. (2020) state that farmers have problems with the lack of administration of other farmer's behaviour and what they share on social media. Contrary to a study conducted on students, Mwalukasa (2020) reported that without any concerns on privacy, students freely share academic related information on social media. To individuals using social media as a space for commerce, challenges such as trust and online abuse are of great concern (Schoemaker et al., 2022). In other fields like social media marketing, concerns about safety, privacy and transparency exist (Kongying & Purisai, 2021).

2.6. FACTORS CONTRIBUTING TO THE USE OF SOCIAL MEDIA

2.6.1. Age

As farmers grow old, their desire to use social media decreases (Abuta et al., 2021). Kanjina (2021) adds that, younger farmers use social media more than old farmers in their area. Furthermore, it is indicated that old farmers are more reluctant to change

and do not find it enjoyable using social media. In a study conducted in South Africa, Mdoda and Mdiya (2022) state that age has a negative influence on the use of social media among livestock farmers. In contrast, the findings of Ajah et al. (2021) show that age has a positive relationship with the use of social media.

2.6.2. Education

Educational level is associated with social media use. The higher the educational level of the user, the higher their social media use (Abuta et al., 2021). In a study that was conducted in Thailand, it was found that the farmers with high education use social media more than farmers with low education (Kanjina, 2021). Education gives skills and knowledge to those who continue to study. In addition, farmers who went to school will have more knowledge and interest to use social media than those without it (Mdoda & Mdiya, 2022). There is a positive relationship between the level of education and the use of social media (Ajah et al., 2021). This means that as the education of farmers increases, so will be their use of social media. It is further alluded that the low level of education results in not understanding the use and features of social media (Kaur et al., 2021). Since social media are centred around technology, their users are expected to have a certain level of literacy and education to be able to utilise them to their maximum potential (Oluyaire et al., 2020).

2.6.3. Gender

Despite the growing opportunities for women to partake in farming and take up spaces, they are still not yet in their majority in farming activities. Abuta et al. (2021) state that, male farmers use social media more than female farmers. Mdoda and Mdiya (2022) emphasise that men are always available and approachable when it comes to sharing their farming experience and information in general. Given this, men are found to be using more of social media than women. Women are less active on social media tools because they have more domestic responsibilities than men (Mdoda & Mdiya, 2022). During the process of agricultural information dissemination using social media, men are found to be more involved than women (Ajah et al., 2021; Oluyaire et al., 2020).

2.6.4. Work experience/farming experience

Farming experience is not related to the use of social media. This means that farmers can use social media, irrespective of their years in the farming industry (Abuta et al.,

2021). Furthermore, in a study conducted by Ajah et al., (2021), it is clearly stated that the farm experience of the youth does not justify their use of social media.

2.6.5. Family size

When the family size is large or keeps on increasing, there is the likelihood of using more social media tools and the family members are likely to learn from each other (Mdoda & Mdiya, 2022).

Several studies have investigated the relationship between household size and social media use for agricultural purposes. Freeman and Qin (2020) found that farmers with larger households were more likely to use social media due to their greater access to and comfort with technology. Rajkhowa and Qaim (2022) also found a positive association between household size and social media adoption among farmers in India. However, Okabe-Miyamoto et al. (2021) found no significant association between household size and social media use among farmers. In contrast, Krell et al. (2021) identified household size as a significant predictor of social media use for agricultural information dissemination, even among those with low income, in rural communities.

2.7. RATE OF SOCIAL MEDIA USE

According to Voorveld (2019), the most popular social media tools are Facebook, YouTube, WhatsApp, Instagram and Twitter. Pinterest, Twitter and Instagram are the commonly used social media among public and private extension officers (Abuta et al., 2021). In agricultural development, WhatsApp is the most used social media tool then followed by Facebook, as stated by Samsudin (2020).

While extension officers and other government officials prefer Twitter and Pinterest to execute their daily duties, Kircaburun et al. (2020) found that amongst university students, the most used social media was WhatsApp, Instagram and YouTube. Unlike when social media were just emerging, Facebook is now the least used social media in universities (Kircaburun et al., 2020). In contrast, in the Netherlands, Facebook, YouTube and WhatsApp are the most preferred social media tools (Voorveld, 2019). Furthermore, in the study of the improvement of agricultural extension in Indonesia, social media used were Facebook, WhatsApp and YouTube (Humaidi et al., 2020).

For instructional sharing by students and teachers in education, Twitter, WhatsApp and YouTube were found to be the most used (Alshehri, 2019). In the health sector, the commonly used social media tools were Facebook, Twitter, LinkedIn and WhatsApp (Farsi, 2021). Twitter and YouTube were found to be the most commonly used social media to obtain agricultural information (Alotibi & Dabiah, 2022), while Facebook was the least used in this regard.

Abuta et al. (2021) state that arable crop farmers in Imo State, Nigeria, use Twitter, Facebook, email, WhatsApp and Messenger to access agricultural information and to also use for their own benefit. A recent discovery by Karle and Mishra (2022) shows that in India, Instagram, Twitter, Facebook and WhatsApp are social media tools used in agricultural marketing. Lastly, in South Africa unlike other countries, the most used social media tools are Facebook, YouTube, WhatsApp, messenger and LinkedIn (Coetzee et al., 2019).

2.8. ICT TOOLS USED TO ACCESS SOCIAL MEDIA

Social media are dependent on tools that enable the social media applications and also those that have the storage for them. The typical means of sharing social media content are: shared computer, personal computer, iPad and mobile phones (Hutto et al., 2015). Mobile phone is the most used ICT tool used more than a tablet and personal computer (Francis, 2022). Postgraduate students use devices such as mobile phone, personal laptop, tablet, iPad, college computer and personal computer to access social media sites in search of information that can benefit them in their studies (Gora & Sisodia, 2021).

According to Brahma and Dutta (2020), computers were least used by postgraduate students, for entrepreneurs involved in ecommerce computers, the most used were tablets and smartphones. In ecommerce, these devices are used to engage with customers online in different areas of the world. Similar to Gora and Sisodia (2021), mobile phone was the most preferred device compared to computers for college students in Norway (Rice et al., 2018). To communicate, create and deliver information through social media, Tsai et al. (2020) state that users can make use of computers, mobile phones and other smart devices.

In agriculture, Moonsammy and Moonsammy (2020) allude that extension officers who are computer literate are likely to use social media than those that are illiterate.

Although computers and mobile phones enable farmers to easily access agricultural information, there is a need for intense training on such devices (Dan et al., 2020). In their study of investigating the impact of social media on agricultural extension officers and farmers, Sherpaw et al. (2022) found that smartphones were the most frequently used followed by tablet and then lastly computers. Due to the lack of awareness and training of farmers about smartphones, Kumar et al. (2021) reported that a majority of the farmers still used button phones while only a few used smartphones. This means that, due to no ownership of smart devices, the social media usage in the farming communities will be low.

2.9. ADVANTAGES OF SOCIAL MEDIA

Social media are cost effective and also encourage interaction among their users in agriculture (Sandeep et al., 2020). To increase traffic for the targeted audience, social media can be used to boost the business and enable the recognition of the brand (Kohli & Trar, 2021). In dermatology, Barrutia et al. (2022) alluded that social media are used for the dissemination of accurate information.

For marketing performance, social media bring about competitive advantage in companies (Wibawa et al., 2022). Due to their vast scope, according to Deodhar and Mathur (2019), social media have the capacity to revolutionise education in the globe. Additionally, in public relations, social media give a wider reach to many people and also in spreading fast information updates (Akasse et al., 2021). Furthermore, in enhancing participative learning in education (Latif et al., 2019), social media can be used as a catalyst. Al-Qahtani et al. (2018) also identify the advantage of social media as an aid to increase interaction and communication amongst patients and their doctors.

2.10. DISADVANTAGES OF SOCIAL MEDIA

Although social media are used for their many advantages and convenience, there are still some drawbacks that comes with it. In medical education, it is perceived that social media results in addiction, laziness, cyberbullying, destruction of face to face communication and poor privacy protection (Latif et al., 2019). Mostly, social media are misused and used out of purpose (Kaban, 2021). This results in privacy violations and misunderstanding in families. When students are attending lessons and surfing

through social media, they get distracted and lose focus on the lesson (Alshehri, 2020).

Lack of authenticity and unproductive use of time present as major drawbacks when using social media in agricultural extension (Mahavidyalaya et al., 2021). According to Legodi and Shai (2020), poor access to good Internet and the high cost of data limit the use of social media. In the health sector, Farsi (2021) submits that there are major concerns on the breech of privacy, more overload, unprofessional behaviour from worker and disparity in the sense of urgency. Furthermore, in ecommerce, social media create issues of limited customer service, inability to touch products and lack of gratifications (Brahma & Dutta, 2020).

2.11. AGRICULTURAL INFORMATION DISSEMINATION

Information dissemination is an act of distributing information to a targeted audience in a particular way. In agriculture, there are existing ways of disseminating information to the farmers, which are referred to as traditional methods. These methods have been used for a very long time by extension officers. Although these methods exist, there are ICT models for information dissemination that can be used in agriculture to improve economic, environmental and social sustainability. On the ITC tool and methods, social media have been pinpointed to be the most convenient and effective tool to disseminate agricultural information to a large group of farmers in a short period of time. Taking advantage of social media and their uses in agricultural extension can allow farmers to overcome their limited reach and ineffectiveness.

Dissemination of agricultural research and information innovations is critical in making reliable agricultural information available to farmers. For new information to be known and applied in agriculture, such information must reach the farmers on time. Newman et al. (2017) agree that, with relevant information, farmers will increase their yield and use new technologies by applying new agricultural research findings. A source of information is an organisation or person who creates or conveys a message (Newman et al., 2017). A good information delivery source should be relevant, timely, accurate, cost-effective, reliable, usable, and comprehensive.

Nunes et al. (2018) describe a source of information as a site where information is generated, a person transmits information to recipients after carefully translating their thoughts into words. Information sources used to disseminate agricultural research

findings to farmers for agricultural activities include researchers, extension officers, knowledge farmers and research institutes; media, business and government agencies (Msuya et al., 2017). Key channels for the dissemination of agricultural research findings emanating from researchers, extension officers, knowledgeable farmers and research institutions; mass media for farmers, business and government agencies include mass media and personal communication. Mass media and personal communication play an important role in disseminating information and creating awareness among farmers and other stakeholders, especially in rural areas (Martini et al., 2017). Key sources of agricultural information for farmers are family, markets and community-based institutions.

Knowledge and information networks are the least explored in the process of agricultural information dissemination. Studies have shown the role of social networks and actors in agricultural extension. Mittal et al. (2018) presented the heterogeneity of the available networks. Melesse et al. (2018) identified the existing communication channels that are used by farm households in the exchange of agricultural innovation and indigenous agricultural information. There are several types of agricultural dissemination methods such as interpersonal sources, institutional sources and Non-Governmental Organisations; the study further explained the extent to which information is disseminated to the farmers (Funom & Soyemi, 2020).

Mass media were discovered to be the key communication platform for the most farmers in Imo State, Nigeria (Akwiwu & Patrick, 2019). Communicating through ICTs was important and effective in enhancing the understanding and the decision-making of farmers (Nunavath et al., 2020). When examining the role of the national farmers' help line in disseminating information among crop farmers, it was found that information about cultural practices, access to fertilizer and application, information on pests and diseases was disseminated to the farmers (Bashir et al., 2020). The use of ICT tools for dissemination enhanced the productivity of the farmers (Das et al., 2021; Sulaiman, 2021).

2.12. INFORMATION NEEDS FOR FARMERS

Information plays a very important role in agricultural extension, especially when the information is well researched, timely, relevant and up to date. Farmers need this type of information to better their produce. Poultry farmers need information about the

health management of the chickens, egg production, feeds, breeds and housing (Msoffe et al., 2018). In addition, the South African livestock farmers indicated that they received information on cattle management, handling and veterinary services for a successful production (Mngomezulu-Dube et al., 2018). While on the other hand, to successfully do their day to day activities, rural farmers constantly seek information on seeds, crop production and insecticides (Bachhav, 2012). Additionally, Mubofu (2017) state that information on seedlings, crop management, harvesting and marketing, pest management and use of fertilizers were received by most farmers in Tanzania. In contrast, Brobbey et al. (2018) state that farmers are only interested in the information regarding credit access, production, and soil management. According to the findings of Phiri et al. (2019), information on crop husbandry alone was required by the farmers actively in practice. Ndimbwa et al. (2021) argue that, while farmers require important information on vaccinations, incentives, seed and weather forecast, this information was not delivered on a timely manner and this resulted in bad production. Malekani and Mubofu (2020) emphasise that the research information disseminated to the farmers is mostly on seed varieties, fertilizer use, crop and pest management.

2.13. SOURCES OF AGRICULTURAL INFORMATION

Communication to the farmers and from the farmers has to take place effectively. By means of proper channels and sources, information from both parties can be disseminated effectively. Extension officers make use of radio, church leaders, village leaders to disseminate information to the farmers (Mubofu & Watson, 2020). Informal groups, demonstration plots and farmer groups, as noted by Ndimbwa et al. (2021), are sources used to deliver agricultural information to the farmers. Similarly, a field study tour, agricultural shows and Non Governmental Organisations (NGOs) were also discovered by Ndimbwa et al. (2019), as effective in information dissemination. Contrarily, Bachhav (2012) conducted an investigation that revealed that colleagues, farmers and newspapers are the sources where farmers acquire their information. On the other hand, due to the lack of trust and independence, Phiri et al. (2019) state that some farmers only rely on their personal experiences for their agricultural activities.

A vast majority of farmers access information related to their agricultural activities from extension agents, farmer fields, radio, and farm demonstrations (Brobbey et al., 2018). In a meta-analysis for the communication channels used in agriculture, Mtega (2021)

rank radio and mobile phones highest, as tools used for information dissemination. In poultry management, information is obtained from friends, family members and television (Msoffe et al., 2018). Similarly, major sources of information dissemination in Nigeria for rural farmers, as stated by Fidelugwuowo (2021), were friends and coworkers. According to (Durgun et al. 2021), fishers in different parts of the world obtain their information primarily from other fishers, fishery cooperatives and their own experiences. To add on the findings of Mubofu and Watson (2020) of radio and extension officers as sources of information, Mdoda and Mdiya (2022) recommend that farmers use solar powered radios to easily access agricultural information.

2.14. CONSTRAINTS OF INFORMATION DISSEMINATION

Farmers still face constraints of poor production due to information that is not timely, relevant and accessible (Ndimbwa et al., 2021). Mtega and Ngoepe (2019) state that cost of transportation to the information sources in remote areas presents as a great challenge for the farmers. In Tanzania, issues like lack of communication tools, irrelevant content, illiteracy and use of foreign languages constrain agricultural information delivery (Ndimbwa et al., 2019). While lack of mobility is the major challenge of accessing information (Phiri et al., 2019), Brobbey et al. (2018) argue that time, cost and cultural differences are the only constraints of accessing agricultural information. Apart from the factors above, Mtega (2021) state that some of the factors that enable farmers to use the communication channels are availability, affordability and ease of use. The limited number of extension officers, lack of funds, few sources of information, no electricity , political interferences and no information centres cannot be ignored as some of the key factors that prevent farmers from accessing information (Mubofu, 2017).

2.15. AGRICULTURAL EXTENSION

Agricultural extension is defined as a set of organisations that facilitate people engaged in farming activities (Hlatshwayo & Worth, 2019). It also engages the farmers in problem-solving, information gathering and technology advancements. Agricultural extension is an important tool for information dissemination to the farmers about their produce and could also be a critical tool in agriculture for transformation (Ngwira & Majawa, 2016). The different models of information dissemination in extension,

according to Raidimi and Kabiti (2019), are: training and visit, farmer to farmer and farmer field schools. These models have not been maximally used in the past years.

Sulandjari et al. (2022) allude that agricultural extension is an informal type of education aiming at developing rural communities and offering farmers advice and information to help solve their current problems. It aims to improve the standards of living for farmers and increases their productivity. Additionally, extension is concerned with the development of the rural community, even those that are not participating in agriculture (Onyemekonwu & Meludu, 2022). Apart from the knowledge that farmers possess, extension adds on to it with new knowledge and information. Furthermore, extension assists farmers by providing them with advice that enables them make sound decisions about their produce (Oyegbami, 2018).

The issue of isolation is one factor that prevents farmers from reaching their full potential; agricultural extension encourages farmers to do good in the daily production activities and also supports them (Sulandjari et al., 2022). Agricultural extension does not work for the people, it works with the people to fulfil their needs and render services (Muchesa et al., 2019). Khwidzhili and Worth (2020) state that agricultural extension is a two way process of knowledge transfer and information dissemination.

There are two types of extension, namely; agricultural extension and non-agricultural extension (Muchesa et al., 2019). This study focused on agricultural extension. For agricultural extension to be effective, there needs to be accessibility to working staff, and consistent access to staff good finances to offer support (Muchesa et al., 2019). Farmers in rural areas, especially those in the north west are not progressive because they are still fully the depend on extension officers for support (Anyogu et al., 2022). Although extension officers are primarily expected to help, the farmers help themselves; in Zimbabwe, farmers argue that they do not receive any form of support from the officers (Muchesa et al., 2019). Raidimi and Kabiti (2019) state that the goals of agricultural extension are to: transfer knowledge, assess farmers' opportunities, educate farmers, and promote agricultural development. On the other hand, Olurunfemi and Oladele (2021) emphasise that for extension to keep relevant, there needs to be continuous training of extension officers to keep updated with new technology.

2.16. PRINCIPLES OF AGRICULTURAL EXTENSION

Agricultural extension has principles that guide how activities and decisions are taken. These principles enable extension activities planned for farmer motivation towards adopting new technologies. Okoedo-Okojie and Edeoghon (2017) state that extension officers identified the principle of needs and problem-solving as the most important principles in their context. Although only two were mentioned in the case of extension officers, Vanclay (2004) adds the following principles of extension to guide reasoning and behaviour of the farmers:

- Farming is a socio-cultural practice.
- Farmers are not the same.
- Adoption is a socio-cultural process.
- Profit is not the driving force for farmers.
- Farmers do not distinguish management and environmental issues.
- There is a strong desire to hand their farms to the children.
- Sustainability means staying on the farm.
- Women are the integral part of the farm.
- Marginal farmers are not marginal because of their activities.
- Farmers construct their knowledge.
- Farmers' attitudes are not their problem.
- Farmers have legitimate reasons for non-adoption.
- Top-down extension is inappropriate.
- Representation is not participation.
- Farmers need to be valued.

Zwane and Kekana (2014) only listed six principles of extension against the corporate development of cooperatives in Limpopo Province, and their principles are similar to those of Oakley and Garforth (1997), who state that extension works with the people, it accounts to its clients, it is a two-way link, it links farmers with research, it cooperates with rural development organisation and it finally works with different target groups. When engaging with farmers, extension officers must make use of principles of adult education where farmers will be given a chance to learn from what they already know (Nkoane & Mahlomaholo, 2020). Furthermore, Cloete et al. (2019) proffer that both farmers and extension officers view the following principles as important to them:

extension meetings to improve participation, the use of opinion leaders to aid effective and credible information dissemination, and the use of summative and formative methods of evaluation. In consideration of extension as rural education, Rahman (2017) outlines the following as guiding principles: Individuals are at the core of society, it provides education, it implements education, it encourages and makes use of indigenous talent and access of extension services in rural areas.

2.17. TYPES OF AGRICULTURAL EXTENSION APPROACHES

To establish a successful agricultural extension system for working with the farmers, it is very important to identify and consider the existing approaches. Different approaches can be used to work with different conditions and challenges of the farmers. Although there is a number of extension approaches that can be used in agriculture, this study identified only those that are relevant to social media use from literature as follows: general extension, project, farming system, farmer to farmer, mass media and cyber extension in no particular order. There are other extension approaches that are not mentioned above like transfer of technology, this is a top-down nature and farmers criticise it because it suppresses their experiences (Kongnso et al., 2020).

2.17.1. Farming systems approach

This type of approach involves the farm, the non-farm related activities and the household, it measures its effectiveness based on the interdependence of all factors affecting the farmers (Kaur & Kaur, 2018). On the other hand, Kusumalatha (2020) states that farming systems develop and disseminate technologies to the farmers based on their farm household settings. It is also a holistic approach of local farmers to find solutions to their problems (Kromah, 2016). This type of an approach, according to Abebe and Hailemariam (2018), assumes that the technologies that suit the needs of local farmers do not exist unless such technologies are developed by the farmers together with research partners.

2.17.2. Project approach

Project approach requires money and other resources for it to be implemented; extension officers can establish projects with farmers to demonstrate certain techniques on a particular location for a limited time (Kaur & Kaur, 2018; Kusumalatha,

2020). This approach only makes efforts on the needs of the farmers, according to Kromah (2016), and this implies that whatever the problem-solving strategy implemented must be an agreement of all parties involved. Project approach often makes use of external resources and also uses demonstrations to explain new sustainable technologies to the farmers (Abebe & Hailemariam, 2018).

2.17.3. General extension approach

For government to achieve development and agricultural goals, this system is used and carried out by extension officers (Kusumalatha, 2020). According to Kromah (2016), general extension approach is a government-centred approach and its success is measured by the national production output. Additionally, Abebe and Hailemariam (2018) mention that this approach is top-down planning that is propelled by the national ministry and does not account to its clients.

2.17.4. Mass-media approach

Through the use of radio and newspapers in India, real-time information about new farming technologies is disseminated to the farmers making use of their local languages, especially on radio (Kaur & Kaur, 2018). This type of an approach is meant to reach a large number of people at the same time making use of print or electronic media (Kusumalatha, 2020). The author further states that farmers can form groups on social media platforms like Facebook and WhatsApp to share instant information about new technologies and their farm status.

2.17.5. Farmer to farmer Approach

When farmers show interest in what other farmers are doing and share views among themselves, according to Kaur and Kaur (2018), this is viewed as an effective approach for sharing technologies. To improve the maintenance and uptake of new technologies, farmer to farmer approaches are deemed effective (Kansanga et al., 2021). Farmer to farmer is a good approach because farmers disseminate agricultural information that is detailed to other farmers and the training is conducted by other local farmers that are trusted (Goeb & Lupi, 2021).

2.17.6. Cyber extension approach

With the development of social media and ICT tools, farmers find themselves in an imaginary space on the Internet seeking information about their farming activities (Kaur & Kaur, 2018). For this type of an approach to be implemented successfully, Kusumalatha (2020) states that it should be an offline service that farmers are able to access in Kiosks that can be provided in villages. Although the use of ICTs is still limited on the side of the farmers, Gultom and Gitosaputro (2020) emphasise that this extension approach has the ability to increase the productivity of the farmers. Cyber extension encourages the use of ICTs by both farmers and extension officers to bridge the information needs of farmers using innovative communication methods (Fangohoi et al., 2018). While this approach uses online media, according to Harun et al. (2022), it also makes it easy for farmers of all age groups to access the agricultural information that will empower them and increase their productivity.

2.18. The role of agricultural extension

The agricultural extension service provides farmers with technical advice and inputs to support their agricultural production (Nedumaran & Nandi, 2019). In the views of Norton and Alwang (2020), farmers receive information and new ideas developed by agricultural research stations in a top-down manner. Extension programmes in agriculture cover a wide range of topics, including improved crop varieties, better livestock management, improved water management, and the control of weeds, pests, and plant diseases (Clarkson et al., 2019). According to Danso-Abbeam et al. (2018), agri-extension may also assist local farmers' groups and organisations in building up so they can benefit from extension programmes. Thus, agricultural extension provides farmers with the essential elements they need to improve their agricultural productivity (Fiaz et al., 2018).

In contrast, Indonesia has a low competency of agricultural extension due to the weak role of extension workers in the area that do not work closely with farmers to find solutions together (Managanta, 2020). Further, since most farming communities are located far from the district capital where most extension agents live (Antwi-Agyei & Stringer, 2021), one of the major barriers to effective extension delivery is a lack of transportation to reach farmers in remote areas. In Ethiopia, agricultural extension is currently challenged by a top-down approach, non-participatory, supply-driven rather

than demand-driven, gender bias, low staff morale, and low involvement of development agents in non-extension activities, with officers lacking supervision qualifications (Albore, 2018). Farmers were unable to receive effective agricultural extension services due to the lack of credit facilities, absentee farmers, negative attitudes, a lack of knowledge of improved farming practices, and weak farmer organisations (Modiane & Sekgwama, 2019).

2.19. THEORETICAL FRAMEWORK

According to Stewart et al. (2011), a theory is a way of providing understanding and answers to improve knowledge of a certain subject. There are different steps that researchers undertake to develop a theory. Grant and Osanloo (2014) explain that a theoretical framework is a review of literature on existing theories that assist in creating a roadmap that can be used in a study. The main use of a theoretical framework is to draw predictions and connections upon existing theories (Kivunja, 2018). It further helps in drawing results and making assumptions given its foundation. It finally explores existing relationships between components in a subject.

Social media refer to computer-based technology that simplifies the sharing of ideas, thoughts, and information through virtual networks and communities (Novianty, 2020). According to Newman et al. (2017), social media are any digital tools that allow users to quickly create and share content with the public. Social media are further defined as an Internet-based medium and provide users with the rapid electronic communication of content such as documents, personal information, videos, and photos (Srivastava et al., 2019). Inegbedion et al. (2021) list examples of social media platforms in their study as Facebook, Instagram, and WhatsApp. On the other hand, Thakur and Chander (2018) identify popular social media platforms as Facebook, WhatsApp, and YouTube. They further single out Facebook as the top popular of the three. Agricultural information can be defined as a system where agricultural information is created, consolidated, and transferred to meet the needs of the farmers (Vajjhala, 2020). The packaged information is intended to reach the farmers through different platforms and channels such as extension officers, libraries, radio, television, and newspapers.

This study was based on the Uses and Gratifications Theory (UGT) by Ruggiero (2000). The Uses and Gratifications Theory states that social media users do not only make use of one social media platform; on the contrary, they use a variety of them for different communication reasons following the current social trends (Quan-Haase & Young, 2010). Some social media platforms become very popular and grow, but they quickly lose their popularity and growth, as new ones are introduced. Unlike other communication theories, the Use and Gratifications Theory places its main focus on what the users do with social media other than theories that focus on what social media do to them (Ruggiero, 2000). The users of this theory are perceived as motivated and active in their use of the chosen media. Research brings knowledge on the source of motivations for the users and also identifies and examines the type of gratifications social media can bring about (Quan-Haase & Young, 2010). The focus on social media in the study helped bring understanding on users' motivations to use different social media platforms and the benefits thereof. The main usefulness of the Uses and Gratifications Theory is to help explain the reasons why users engage in social media activities (Whiting & Williams, 2013). The uses and gratifications of social media are as follows: passing time, information seeking, social interaction, relaxation and entertainment, expression of opinions, convenience, surveillance and information sharing. The interest of this study lay on the choice of social media, information seeking and information sharing of agricultural information (Quan-Haase & Young, 2010). To fulfil their shared interests, social media users are able to share information in the form of text, photos and videos that can either be uploaded or downloaded at any time (Hossain, 2019). The basic two principle assumptions made by this theory, according to Shaochieh (2022), are that the media users are active in choosing the type of media they want and also assumes that users understand their reasons for choosing different social media platforms to meet their specific needs. Apart from the two basic assumptions of this theory, there are other five reasons listed by Stafford et al. (2004) as follows :

- "Media use is goal-oriented, people have the motivation to use media.
- Media selection is based on meeting specific needs and expectations.
- The influence of media on behaviour is indirectly caused by social and psychological factors. Thus, personality and social context can influence the media choices one makes and one's interpretation of media messages.

- One medium competes with other forms of media for the attention of individuals. For example, a person might choose to have a face-to-face conversation about an issue or watch a documentary about the issue.
- People generally have control over the media and are therefore not passively influenced by the media."

Given the above assumptions, the impact of media will fully depend on the type of content they deliver and also the personal characteristics of the users, even if the users can receive the same message over one platform, the message will be interpreted differently by users and develop different results from it (Song et al., 2004). Even though this theory seemed good to apply in this study, other researchers like (Shaochieh, 2022) produced relevant criticisms of it as follows:

- "The use and satisfaction theory ignores the influence of the media themselves.
- Some communication scholars believe that the use and satisfaction theory do not meet the criteria of symmetry theory and can only be used as an analytical method.
- The use and gratification theory ignores the role of media in the structure of society.
- Use and gratification theory ignores the fact that audiences may not always be proactive."

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION.

The arrival of technology has opened up numerous opportunities for farmers to expand their knowledge about agriculture through various media channels (Busungu et al., 2019). Among these channels, social media have become a powerful communication tool in the agricultural sector (Tao et al., 2020). This chapter outlines the research methodology utilised for gathering and analysing data on the use of social media by extension officers in disseminating agricultural information to farmers in Limpopo Province. Specifically, the chapter details the research design, sampling procedure, study area, data collection methods, and data analysis techniques employed in the study. In addition, the chapter examines the anticipated outcomes, restraints, and ethical considerations related to the study. Furthermore, the chapter provides insights into the types of analysis utilised and the rationale behind their selection for data analysis.

3.2 STUDY AREA

The researcher conducted the study in the Limpopo Province in South Africa. Limpopo Province borders three countries: Mozambique, Botswana, and Zimbabwe. It also borders three provinces, namely; Mpumalanga, Gauteng, and North-West. This province is well-known to be the fruit basket of South Africa (Lahiff, 1997), but it has other agricultural activities such as vegetable farming, wildlife, bushveld, and rain-fed crop farming. The province's population comprises rural black people who speak Sepedi, Xitsonga, Tshivenḓa, and other Bantu languages (Sibanda, 2019). Many people from this province earn a living through grants, small-scale and backyard farming. Limpopo takes up to 10.2% of the country's total land. This province produces main crops like potatoes, tomatoes, citrus, avocado, and mangoes. About 700 000 tons of timbre are made in this province annually. Most of the farmers in the province produce vegetables for household consumption and selling. Limpopo Province has five district municipalities: Capricorn, Vhembe, Mopani, Waterberg, and Sekhukhune. The study focused on all the district municipalities in the province. These district municipalities have varied agricultural land for production with different farming categories.

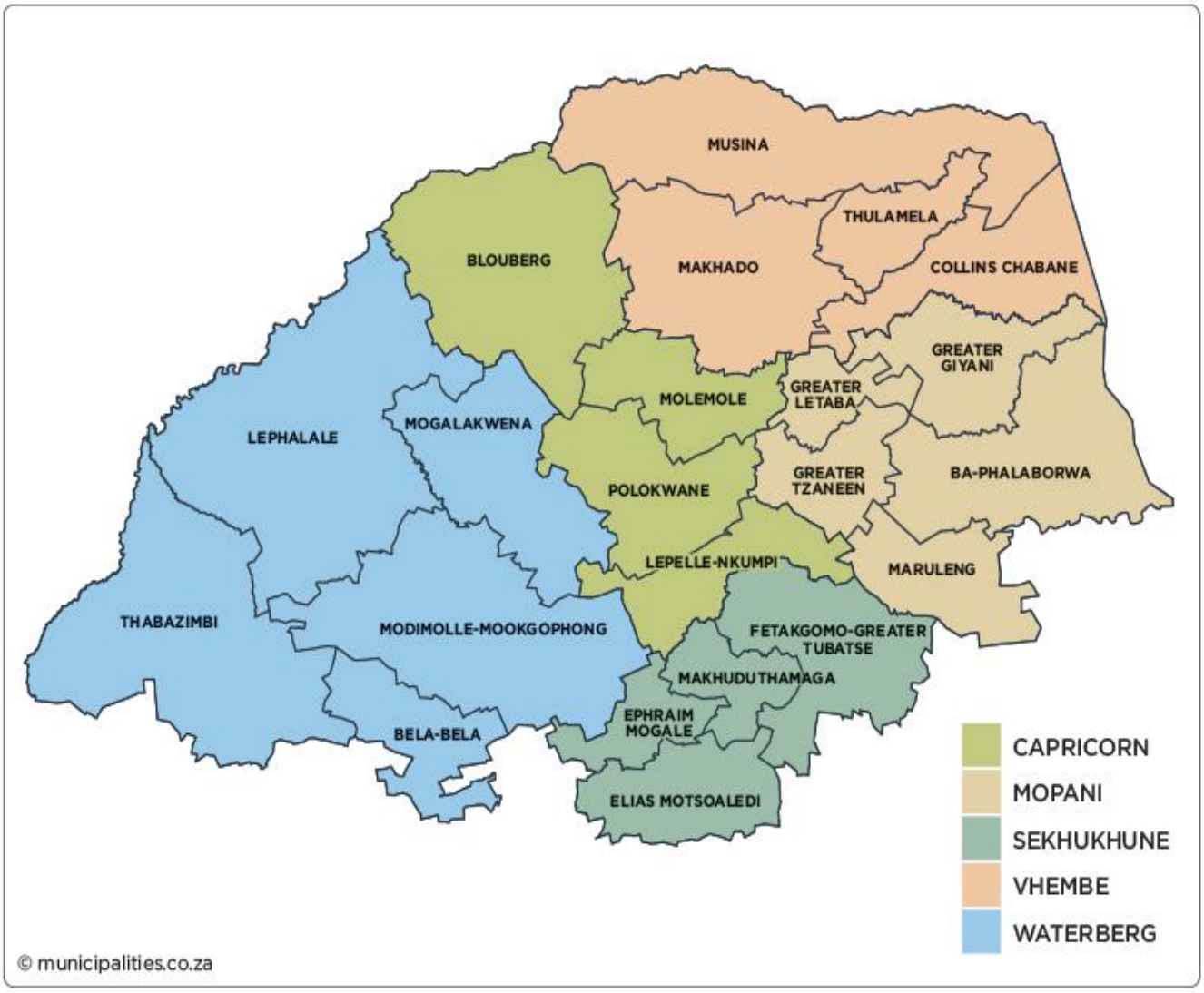


Figure 3.1: The map of Limpopo Province
Source: Municipalities.co.za (2022)

Capricorn District Municipality (CDM)

Capricorn District is one of the five districts in the Limpopo Province of South Africa, encompassing an area of approximately 18,000 square kilometres. Capricorn District is located in the province's centre, with Polokwane as its capital. According to Muller (2023), the District has varied topography ranging from high hills to low-lying plains. It is home to several major rivers, including the Olifants, Limpopo and Ledaba Rivers, which provide water for agricultural activities and support a rich diversity of flora and fauna. Capricorn District has several game reserves, including the Polokwane Game Reserve and the Makapansgat Valley. The Polokwane Game Reserve is famous for

its population of white rhinos, while the Makapansgat Valley is home to various antelopes and other wildlife.

The District has many traditional villages and homesteads where visitors can learn about the local people's customs, traditions and lifestyle. Tourism is a significant industry in the District, with tourists attracted to the region's natural beauty, wildlife sanctuaries, cultural and historical sites, and outdoor activities. The District offers many tourist attractions, including game reserves, cultural villages, museums, and adventure activities like hiking, camping, and river rafting (Muller, 2023).

Muller (2023) describes Capricorn District as a major economic centre in Limpopo Province with various industries. Several sectors, such as mining, agriculture, manufacturing, and tourism, drive the District's economy. Mining significantly contributes to the District's economy, with several large-scale mining operations operating in the region, including platinum, chrome and limestone mines. Agriculture is a significant industry in the district, with various crops and livestock produced by farmers. The District is known for planting crops such as maize, sunflower and citrus fruits grown by large and small-scale farms for export and local consumption.

Animal husbandry, including cattle, goats and sheep, is also essential to the District's agricultural economy, with many farmers raising these animals for meat and dairy products. In addition, the District has many emerging farmers supported by government programmes to promote local food security and economic development and start their agricultural businesses. The District's favourable climate and fertile soil make it ideal for agriculture, and the sector provides employment and income to many families in the region.

Figure 3.2: Capricorn District Municipality
Source: Municipalities.co.za (2022)

Vhembe District Municipality (VDM)

Vhembe District is in the northern part of Limpopo Province, covering an area of 25,000 square kilometres. It shares borders with Zimbabwe to the north and Mozambique to the east; the District is rugged by a terrain with numerous hills, mountains and valleys (Muller, 2023). The Limpopo River forms the District's northern boundary and is the region's primary water source. Vhembe District has several wildlife sanctuaries and national parks, including Mapungubwe National Park, Makuya

Park and Pafuri Game Reserve. These reserves are home to various wildlife, including elephants, lions, leopards, rhinos, giraffes and many other antelope species. The District is also home to many bird species, including the African fish eagle, Patelur's eagle and the defensive eagle. Vhembe District has many cultures and languages, such as Tshivenḓa, Xitsonga and Sepedi. The District is rich in culture and has many cultural and historical sites, including Mapungubwe World Heritage Site, Thulamela Archaeological Site and Dzaṱa Ruins. These sites provide insights into the District's past and a glimpse into the lives of the people who lived in the region centuries ago (Muller, 2023).

Tourism is a significant industry in Vhembe District, with crop farming and many natural and cultural attractions that attract visitors from all over the world (Muller, 2023). Mapungubwe National Park (MNP) is one of the main tourist attractions in the District, offering visitors the opportunity to spot wildlife, visit Mapungubwe World Heritage Sites and explore the park's rugged terrain. The District is also the hub of several cultural festivals, including the Venḓa Arts and Culture Festival, which celebrates the rich cultural heritage of the Vhavenḓa people. Agriculture is the backbone of the economy of Vhembe District, providing employment and income to thousands of families in the region. The District produces subtropical fruits, vegetables and cash crops like cotton and tobacco. The region's fertile soil and favourable climate make it ideal for agriculture.

Mango is the District's most important crop, with many large commercial farms producing high-quality fruit for local and export markets. Vhembe District is the largest mango-producing District in the province, and its mangoes are known for their excellent quality and taste. Avocado is an essential crop in the District, with many small and large commercial farms producing high-quality fruit for local and export markets. Subtropical fruits such as litchis, bananas and papayas are also grown in the District, with many small and large commercial farms producing high-quality fruits for local and export markets. The District has high-quality subtropical fruits due to its favourable climate and fertile soil.

Vegetable farming is a significant activity in the District, with many small and large commercial farms producing a variety of vegetables for local and regional markets. Commonly grown vegetables are tomatoes, onions, peppers and cabbage. Cash

crops such as cotton and tobacco are also grown in the District, with small and large commercial farms producing high-quality crops for local and export markets. These crops provide employment and income to many families in the region. Animal husbandry is also essential in the district, with many small and large commercial farms producing cattle, sheep and goats. The livestock sector provides employment and income to many families in the region and contributes to food security in the District.

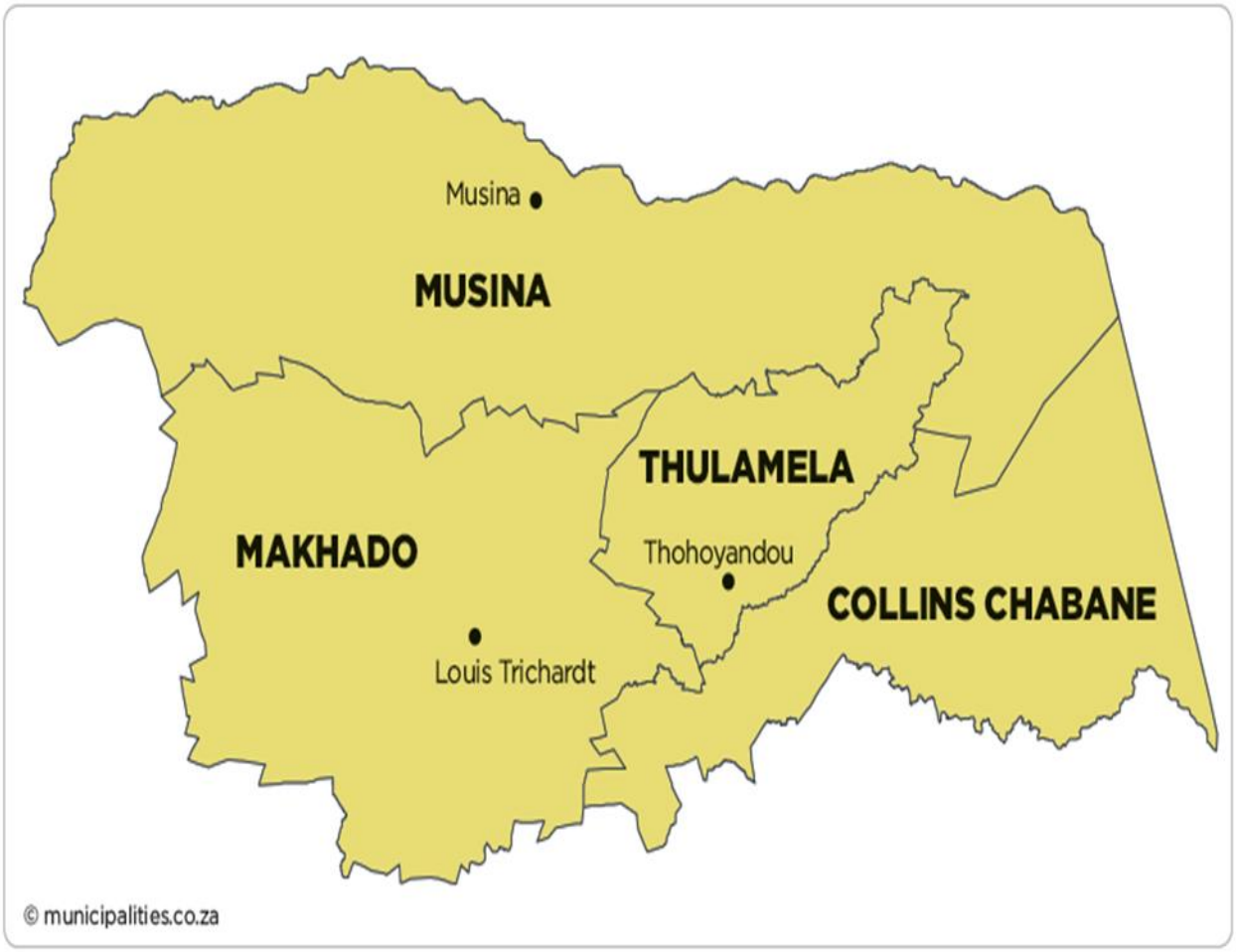


Figure 3.3: Vhembe District Municipality
Source: Municipalities.co.za (2022)

Waterberg District Municipality (WDM)

The name Waterberg was derived from the Waterberg mountain range that stretches over 150 km from Thabazimbi in the south to Mokopane in the north. The Waterberg is one of South Africa's most ecologically diverse regions, known for its rugged beauty, rich cultural history and abundant wildlife. The range contains several major rivers,

including the Limpopo, Mogalakwena and Nyl Rivers, which provide water for irrigation, domestic use and wildlife.

The District has several significant nature reserves, including Marakele National Park (MNP), Lapalala Wildlife Sanctuary and Welgevonden Game Reserve (WGR) (Muller, 2023).

It is rich in cultural heritage and is home to several important archaeological sites, including the Makapansgat Caves, where scientists discovered fossils of the earliest human species. The District has several important historic sites, including the Voortrekker Monument at Mookgophong and the Blood River Heritage Site near Vaalwater.

The Waterberg District is home to several important cultural and linguistic groups, including the Bapedi, Batswana and Afrikaans-speaking communities. The region is known for its traditional arts and crafts, including pottery, beadwork and weaving. The District has several major cultural events, including the Makabeng Festival, which celebrates the region's rich cultural heritage. The region is known for its luxury lodges and resorts, allowing visitors to experience its natural beauty in comfort and style. The District has several major tourist attractions, including Modimolle and the Waterberg Biosphere Reserve.

The Waterberg Biosphere Reserve is one of South Africa's most important conservation areas and is home to many vital ecosystems, including montane grasslands, savannas, and riparian forests. The reserve has several essential wildlife species, including the African wild dog, leopard, and black rhino. It is also home to several important cultural sites, including the United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site of Mapungubwe, the site of an ancient kingdom (Muller, 2023).

The Waterberg District is an important agricultural area known for citrus fruits, vegetables and game production. Several critical mining operations occur in the District, including platinum mines near Mokopane and coal mines near Lephalale. The mining sector plays a dynamic role in the local economy, providing employment and income to thousands of people in the region.

Agriculture is a significant industry in the Waterberg District of Limpopo Province. The District is famous for citrus fruits, vegetables and game production. The region's fertile soil and favourable climate make it ideal for agriculture.

Citrus fruits, orange, lemon and grapes are among the major crops in the District. The region's citrus industry has several large commercial farms producing high-quality fruit for local and export markets. Vegetable farming is a significant industry in the District, with crops such as tomato, pepper, cucumber and onion grown for domestic and export markets. Smallholder farmers in the region also produce a variety of crops, including maise, beans and sweet potatoes, for local consumption. Game ranching is a growing sector in the District, with several private game reserves and wildlife breeding programs operating. Game meat and tourism are the main drivers of the industry, with visitors from all over the world coming to enjoy the region's natural beauty and abundant wildlife.

The District has several agricultural research institutions, including the Agricultural Research Council (ARC) and the Limpopo Department of Agriculture and Rural Development, which support regional research and farmers. In particular, agriculture plays a vital role in the economy and livelihoods of the people of Waterberg District, providing employment, income and food security to thousands of families in the region (Muller, 2023).

Figure 3.4: Waterberg District Municipality
Source: Municipalities.co.za (2022)

Mopani District Municipality (MDM)

Mopani District is in the north-eastern part of the Limpopo Province of South Africa. Mopani is named after the Mopani tree, a common tree species of the region. The District has various natural and cultural attractions, including national parks, game reserves and historical sites.

Mopani District lies on the northern side of the Great Range and is characterised by rugged terrain, deep valleys and rolling hills. The District is home to several major rivers, including the Letaba and Olifants rivers, which flow through the region and provide water for irrigation, domestic use and wildlife. It is home to a wide variety of wildlife, including the “Big Five” (lion, rhinoceros, leopard, buffalo and elephant), as well as giraffe, zebra, wildebeest, hyena and many more. The District is home to

several important nature reserves, including Kruger National Park (KNP), Letaba Ranch Game Reserve (LRGR) and Hans Merensky Nature Reserve (HMNR).

The Mopani District is rich in cultural heritage and is home to several important archaeological sites, including the ancient Iron Age settlements of Thulamela and Masorini. The District is home to several important historical sites, including the Voortrekker Monument at Potgietersrus and historic Leiderdorp. The District is home to several important cultural and linguistic groups, including Vatsonga, Bapedi and Afrikaans-speaking communities. The region is known for its traditional arts and crafts, including pottery, beadwork and weaving. The district is home to several major cultural events, including the Mopani Festival, which celebrates the region's rich cultural heritage.

Mopani District is a popular tourist destination offering many outdoor activities including game drives, hiking, bird watching and fishing. The region is known for its luxury lodges and resorts, offering visitors a good experience. There are several major tourist centres in the District, including Phalaborwa and Hoedspruit.

The Kruger National Park is one of South Africa's most important tourist attractions and is home to a wide variety of wildlife. Covering an area of approximately 20,000 square kilometres, the park is home to a number of key ecosystems, including savannahs, woodlands and riparian forests. The park contains many important cultural and historical sites, including the Masorini Iron Age site and several historic battlefields.

Mopani District is an important agricultural region known for the production of citrus fruits, mangoes, avocados, macadamia nuts and subtropical fruits. Several major mining operations are carried out in the District, including copper and phosphate mines near Phalaborwa. The mining sector provides employment and income to thousands of people in the region. Agriculture is a major industry in Mopani District, Limpopo Province. The region's fertile soil and favourable climate make it ideal for agriculture.

Citrus fruits are the most important crops in the District along with oranges, lemons and grapes. The region's citrus industry is well-developed with several large commercial farms producing high-quality fruit for local and export markets. Mango is also an important crop in the District with several large commercial farms producing high-quality fruit for local and export markets. Due to its favourable climate and fertile

soil, the District is known for its excellent quality mangoes. Avocado is another important crop in the District with many small and large commercial farms producing high-quality fruit for local and export markets. The District is known for its high-quality avocados.

Many small and large commercial farms in the District grow macadamia nuts, and most of the production is exported. The District is known for producing high-quality macadamia nuts due to its favourable climate and fertile soil. Subtropical fruits such as litchis, bananas, and papayas are also grown in the District, with many small and large commercial farms producing high-quality fruits for local and export markets.

Agriculture is an important component of the economy and livelihood of the people of Mopani District, providing employment, income, and food security to thousands of families in the region. The District has a number of agricultural research institutions, including the Agricultural Research Council (ARC) and the Limpopo Department of Agriculture and Rural Development, which support research and farmers in the region.

Figure 3.5: Mopani District Municipality

Source: Municipalities.co.za (2022)

Sekhukhune District Municipality (SDM)

Sekhukhune District is located in the eastern part of Limpopo Province and covers an area of 14,850 square kilometres. It borders Mpumalanga Province to the east and Gauteng Province to the south. The District is characterised by a diverse terrain with many hills, mountains and valleys. Olifants River flows through the District, providing water for irrigation and domestic use. Sekhukhune District is home to several wildlife sanctuaries and protected areas, including Loskop Dam Nature Reserve and Marakele National Park. These reserves are home to a wide variety of wildlife, including elephants, rhinos, lions, leopards, buffaloes and many other species of antelope. The District is also home to several bird species including the African Fish Eagle, Secretary Bird and Southern Ground Hornbill.

Sekhukhune District is home to many cultures and languages, including the Sepedi, isiNdebele and Sesotho. Rich in cultural heritage, the District is home to many cultural and historical sites, including the UNESCO World Heritage Site Makapansgat Valley. The District has many traditional villages and homesteads where visitors can learn from the local customs and ways of life. Tourism is a major industry in Sekhukhune District, which has many natural and cultural attractions, attracting visitors from all over the world. Loskop Dam Nature Reserve is one of the major tourist attractions in the District, offering visitors the opportunity to spot wildlife, enjoy water-based activities and explore the rugged terrain of the park. The District is home to numerous cultural festivals, including the Sekhukhune Arts and Culture Festival, which celebrates the rich cultural heritage of the Bapedi people.

Agriculture is the mainstay of the economy of Sekhukhune District, providing employment and income to thousands of families in the area. The District is known for its production of subtropical fruits like citrus fruits, mangoes and avocados. Maize and sunflower are important crops in the District, providing food and income to local communities. The district has many small and large livestock farms producing cattle, sheep and goats. Mining is an important industry in the District, with several coal mines operating in the area. Sekhukhune District is rich in cultural heritage and has many important historical sites and monuments. Makapansgat Valley is one of the most

important historical sites in the District, providing an insight into the lives of the early humans who inhabited the region two million years ago. Agriculture is the mainstay of the economy of Sekhukhune District, which provides employment and income to thousands of families in the area. The District is known for its production of subtropical fruits like citrus fruits, mangoes and avocados. Maize and sunflower are important crops in the District, providing food and income to local communities. The District has many small and large livestock farms producing cattle, sheep and goats. Mining is an important industry in the District, with several mines operating in the area.

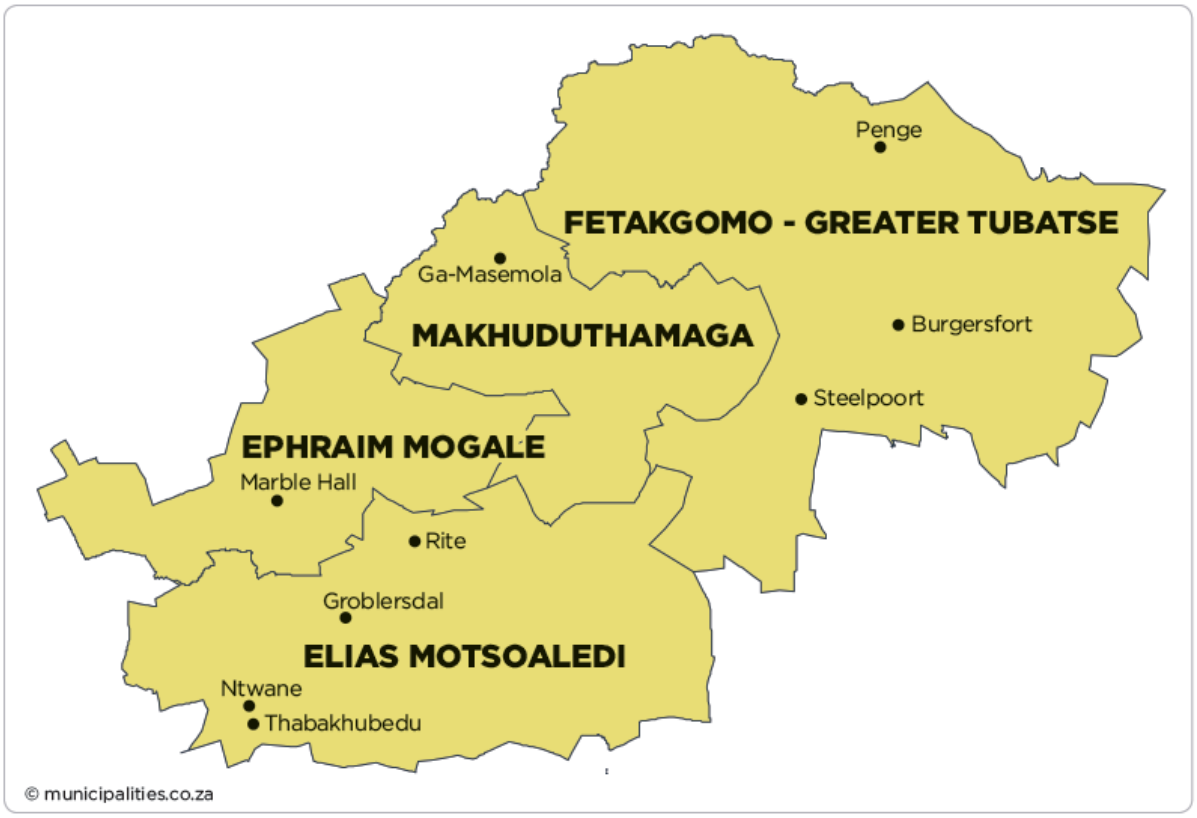


Figure 3.6: Sekhukhune District Municipality
Source: Municipalities.co.za (2022)

3.3 RESEARCH METHODOLOGY AND ANALYTICAL PROCEDURES.

3.3.1 Research Paradigm

A research paradigm is a research methodology, concept, or trend. It is a system of thoughts, attitudes, or interpretations that allow conceptualisations to operate. The bulk of paradigms originates from either “positivism or interpretivism” as research approaches. Each proposed research uses a specific paradigm as a roadmap for developing a methodological approach and conducting the study most lawfully and

reasonably. The significance of selecting paradigms for a pilot study comes from the belief that it lays the groundwork for the study's methods (Kumatongo & Muzata, 2021). A paradigm studies how information is comprehended and investigated and clearly states the study's purpose, motivation, and anticipated results. Implementing a research paradigm effectively offers investigators a defined way to investigate the issue of relevance. In this research, a pragmatic research paradigm was applied. Pragmatism is defined by the research questions. Based on the study's specific objectives, pragmatics may combine "positivism and interpretivism" in the same investigation (Allemang et al., 2021). It is a "problem-solving" philosophy that asserts that exquisite research approaches are the ones that give the most appropriate solution to the research objective (Allemang et al., 2021). This is accompanied by an assessment of several facets of a research question utilising both quantitative and qualitative methods.

3.4 RESEARCH DESIGN

Given the nature of the research, a convergent parallel research design was used in the research to address the research objectives. A convergent parallel research design, according to Declercq et al. (2022), is a design that involves collecting and analysing qualitative and quantitative data, evaluating or linking them, and afterward analysing them. This method includes gathering distinct but interrelated evidence regarding the same phenomenon. Consequently, it is adapted to the convergence and progressive development of statistical and qualitative information. This method is sometimes described as the "concurrent triangulation design (single-phase)" since the data are gathered and evaluated simultaneously yet independently (Dawadi et al., 2021). The below-given figure presents the chosen approach for the undertaken study.

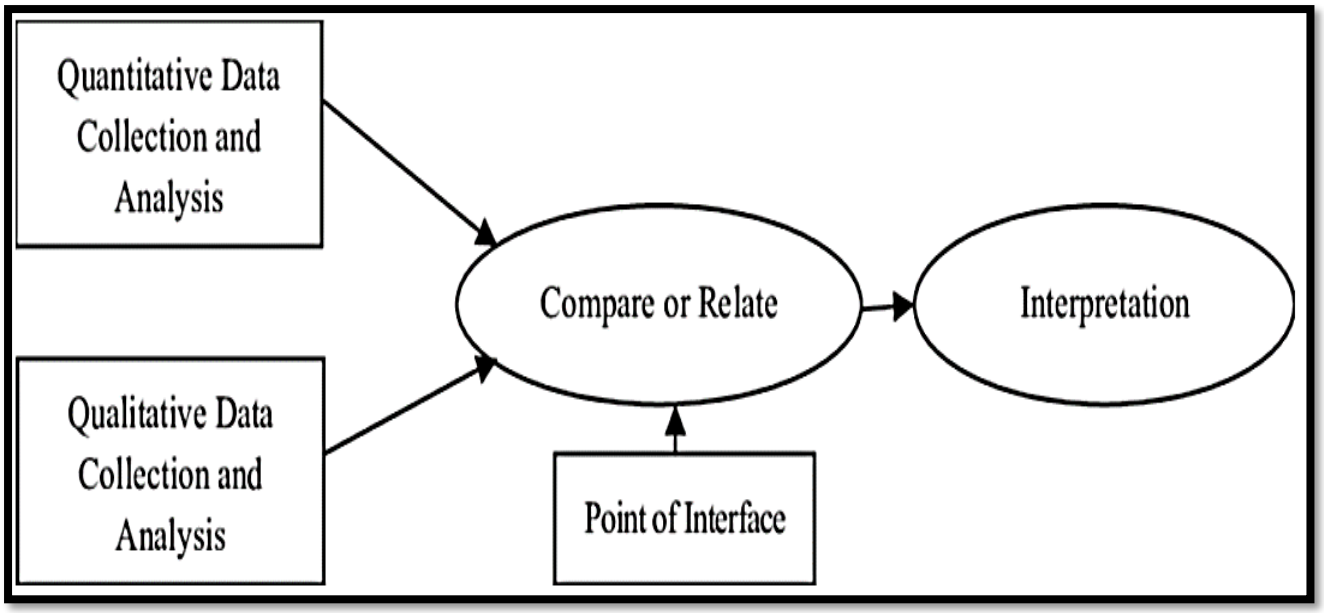


Figure 3.7*:* Convergent Parallel Research Design (CPRD)
Source: (Dawadi et al., 2021)

The research examined how extension officers and farmers utilise social media to disseminate information. There were two phases of the investigation. Phase one included situational analysis, while phase two involved model development. Phase one consisted of a survey using both qualitative and quantitative research methods (Latif et al., 2020). The phenomenological qualitative technique was used for objective iv, which attempted to identify the significance of people's interactions with a notion. On objectives i, ii, and iii, a descriptive quantitative technique was employed to characterise the features, trends, and tendencies of the collected data. There were certain conclusions derived from the sample to the population. A logistic regression approach was employed to determine whether extension staff and farmers utilise social media channels for agricultural information exchange in Limpopo.

3.5 RESEARCH APPROACH

Research approaches are the tactics, procedures, or techniques used to gather information or facts for evaluation to acquire new knowledge or get a more profound knowledge of the subject. Mixed method research was adopted for this research.

3.5.1 Mixed-Methods Research (MRM)

Mixed methods research is a method of research that utilises both qualitative and quantitative research methods. According to Menon et al. (2021), a mixed-method

research broadens the objectivity of research by employing both numerical and non-numerical information to satisfy the overall objective of the research. Given the research, mixed methods research was proven to be effective in analysing information dissemination patterns using social media platforms concerning farmers and extension officers in the Limpopo Province.

3.5.2 Qualitative Research Approach (QRA)

A qualitative research approach is the subjective collection and evaluation of “non-numerical” data for understanding ideas, perceptions, and events. The qualitative research approach as chosen for this research incorporated “open-ended and conversational communication.”

3.5.3 Quantitative Research Approach (QRA)

A quantitative research approach involves a systematic investigation of a phenomenon. Unlike qualitative research, a quantitative research approach is an objective collection and evaluation of numerical information for interpreting experiences and concepts (Kurten et al., 2022). Given the research, the quantitative research approach was employed to describe the effectiveness of contemporary social media platforms utilised by extension officers and farmers. Moreover, the quantitative approach assisted in identifying the needs associated with extension officers and farmers. Also, the approach assisted in determining the nature and type of social media platforms used for information dissemination.

3.5.4 The Rationale for Mixed Methods Approach

Mixed method techniques permit investigators to use a range of methodologies, incorporating inductive and deductive reasoning and compensating the constraints of entirely quantitative and qualitative research through the multifaceted approach that maximises the capabilities of each input data and encourages a much more complete overview of the dissemination of information through social media by farmers and extension officers. Mixed methods were incorporated to provide a comprehensive explanation and processing of the findings, provide more comprehensible statistical results, or comprehend the broader relevance of “small-sample qualitative findings” (Paoletti et al., 2021).

3.6 DATA COLLECTION INSTRUMENTS

The procedures of data collection were self-administered questionnaires for objectives I, ii, and iii and individual interviews for objective iv using an audio recorder. Participants who were unable to fill in the questionnaires were assisted by the research team to do so. The questionnaires were developed from existing literature. Permission to conduct study was first applied for and granted by the Limpopo Department of Agriculture and Rural Development (LDARD). The researcher conducted a pilot study to weigh the methodology and data collection tool. Data were collected over a period of three months from February 2023 to May 2023. The research team constituted by the PhD candidate and research assistants supervised the participants to ensure reliable and accurate data collection. The research assistants were trained on the questionnaire prior data collection. The questionnaires completed were stored in a safe place, while the recorded focus group interviews were transcribed to text and stored in a password-protected media device. The study made use of both qualitative and quantitative cross-sectional data. The cross-sectional data were collected using semi-structured questionnaires with farmers and face-to-face focus groups with extension officers in Limpopo Province.

The researcher organised dates for both the survey and interview that were suitable for the farmers and extension officers participating in the study. The researcher and enumerators appointed conducted the data collection from the participants. The research team explained the purpose of the study to the participants, their importance and also willingness to participate in the study.

Enumerator selection was done by the researcher where ten were selected to assist in collecting data of the study. The enumerators were students from the University of Limpopo, School of Agriculture. Of the ten enumerators, three were fluent in Tshivenḓa, two in Xitsonga and the other five were fluent in Sepedi. The enumerators received training over two days to be familiar with the questions and develop relevant skills for approaching the participants. After the training was conducted, the enumerators gave inputs on the questionnaire and necessary amendments were done.

3.6.1 Survey

This first part of the research focused on collecting data from farmers and extension officers through a questionnaire survey. The survey included questions related to respondents' knowledge, views, and perceptions about social media and agricultural information dissemination. The questions were be based on previously conducted research in agricultural information dissemination. Data collected using a survey focused on the following matters:

a) Socio-economic information for extension officers and farmers.
b) The effectiveness of current social media platforms used by both extension officers and farmers for agricultural information dissemination.
c) The needs for both extension officers and farmers for agricultural information dissemination.
d) The social media platforms used by both extension officers and farmers for agricultural information dissemination.

The study pre-tested the survey using 30 farmers and 3 extension officers. The data collected during the pre-testing phase were not included in the study during the process of analysing data. The errors and new ideas identified during the pre-testing phase were captured accordingly and the questionnaire was adjusted for the data collection of this study.

3.6.2 Interview

The interview part of the data collection process focused on collecting qualitative information from the extension officers employed in Limpopo Province. The questions focused on how extension officers view social media integration in their field. The questions further focused on identifying the challenges extension officers may face due to social media integration in the agricultural sector. Additionally, the interview provided insight into the level of awareness of the advantages of social media integration for information dissemination to the farmers. The collection of qualitative data proved beneficial for the research to find solutions to the challenges, level of awareness, and perception of social media integration in their line of work.

3.7 SAMPLING PROCEDURE AND SAMPLE SIZE

Sampling procedure and sample size are critical components in research studies that affect the accuracy and generalisability of the results (Onwuegbuzie & Collins, 2007). In this subsection, the sampling procedure and sample size employed in the study are explained. The sampling process involved selecting units from a population of interest, and the study aimed to obtain a representative sample that accurately reflected the population's characteristics. To achieve this, a multi-stage sampling procedure was used to select farmers from each District's municipalities. The study used both qualitative and quantitative cross-sectional data that were collected through structured questionnaires and focus groups administered face-to-face. The sample size used in the study was sufficient to ensure reliable statistical analysis, as recommended by Chuan & Penyelidikan (2006), who suggest a minimum sample size of 30 units to obtain reliable statistics.

The study used Multistage Sampling and Simple Random Sampling as its model processes for selecting extension officers and farmers. In the first stage, the population of Limpopo Province was divided into five strata: Sekhukhune, Waterberg, Capricorn, Mopani, and Vhembe districts. All districts were included in the study. In the second stage, Simple Random Sampling was employed to select farmers and extension officers in all the districts. The sample size calculated using Rao Soft for extension officers was 80, and for farmers was 373 at a 0.05 margin of error.

To ensure a representative sample of extension officers and farmers in the study, information about potential participants was obtained from the Limpopo Department of Agriculture and Rural Development's offices. A simple random sampling technique was then utilised, using probability proportional to sample size. This method helped to determine the total number of extension officers and farmers who were ultimately interviewed for the study. The table below displays the sample sizes for each municipality in the districts of the Limpopo Province, providing insight into the distribution of participants across the study area.

Table 3.1: Population of farmers in Limpopo Province.

Districts and municipalities	**Population size**	**Sample%**	**Expected sample size**	**Total farmers interviewed**
Capricorn District				
Blouberg	1303	11	39	39
Lepelle	1284	10	39	39
Molemole	554	4	17	17
Polokwane	455	4	14	14
Mopani District				
Baphalaborwa	1041	8	31	30
Greater Giyani	541	4	16	16
Greater Letaba	1074	9	32	32
Greater Tzaneen	335	3	10	10
Maruleng	1090	9	33	33
Sekhukhune District				
Elias Motsoaledi	1282	10	39	39
Ephraim Mogale	772	6	23	23
Fetakgomo/Tubatse	827	7	25	25
Makhuduthamaga	407	3	12	12
Vhembe District				
Collins Chabane	193	2	6	10
Makhado	66	1	2	10
Musina	257	2	8	10
Thulamela	358	3	11	11
Waterberg District				
Bela Bela	113	1	3	10
Lephalale	97	1	3	10
Mogalakwena	98	1	3	10
Mookgophong	74	1	2	10
Thabazambi	141	1	4	10
Total	**12362**		373	420

Source: Limpopo Department of Agriculture and Rural Development (2022).

The data above provide information on the expected sample sizes for farmer interviews in various districts in Limpopo Province. The expected sample sizes were calculated using the population size (12362) and sample percentage. The total expected sample size for all districts combined is 373, with a total of 420 farmers expected to participate in the study. The expected sample sizes varied by district, with

the highest expected sample size of 127 in the Mopani District and the lowest expected sample size of 40 in the Vhembe District. It should be noted that for some municipalities with small populations, the expected sample size was less than 10. However, to achieve the total expected sample size, the sample size was set to 10 for these municipalities.

3.8 DATA ANALYSIS

The researcher applied descriptive and inferential statistical methods and processes to analyse data collected from objectives i, ii, and iii. Descriptive analysis was used to summarise data using frequency charts and tables. When analysing continuous data that were not normally distributed, the researcher utilised measures of central tendency, such as the median or mode, to provide an estimate of the typical value. Measures of variability, such as standard deviation, to quantify the degree of dispersion in the data were also employed. Additionally, the researcher employed measures of association, such as Spearman's rank correlation to determine the nature and strength of the relationship between variables. Furthermore, the researcher utilised contingency tables and appropriate statistical tests to analyse the association between categorical variables. IBM Statistical Package for Social Sciences (SPSS) software version 26 was used to capture the data and perform analysis. Thematic content analysis was used to evaluate the qualitative data from interviews on objective iv. The focus group interviews were transcribed into Microsoft Word, and the information acquired was recorded in themes developed by the researcher.

The transcripts were then formatted to comply with NVivo and exported into NVivo as data sources. NVivo version 8 was used to aid coding and data analysis. A logistic regression model was employed to model an event with two possible outcomes for the dependent variable, where the probability lies between 0 and 1, that is, if the farmers and extension officers use social media or not (Hosmer Jr et al., 2013).

3.8.1 Thematic Analysis

Thematic analysis is a qualitative evaluation technique that identifies patterns within data, like similarities and differences. Given the research, as a part of the qualitative research approach, a sequential thematic analysis was conducted on the themes

extracted from the interview transcripts. The themes selected for the thematic analysis are given in the table below.

Table 3.2: Themes of the qualitative analysis.

No.	Themes
1	Social Media Adoption
2	Social Media preferences
3	Social Media challenges
4	Other traditional sources for communication.

Source: Research survey (2023)

3.8.2 Statistical Analysis

The statistical analysis for information collected from the questionnaires was analysed using SPSS at a 95% confidence interval level.

3.8.3 Descriptive Statistics

The descriptive part of the data included the total number of observations and percentages. Moreover, the descriptive statistics also included standard deviation and mean values. The standard deviation and mean values aided in determining the distribution of the data.

3.8.4 Multinomial Logistic Regression Analysis

Multinomial regression analysis is a statistical method that is used to model the relationship between a categorical dependent variable and two or more independent variables. This approach allows for the examination of the impact of multiple predictors on the outcome variable, which can have three or more categories (Boateng & Abaye, 2019). Unlike logistic regression, which deals with binary dependent variables, multinomial regression analysis can be used to analyze categorical data. The method involves estimating the coefficients of the independent variables to determine their relationship with the dependent variable and to identify which predictors are significant in predicting the categories of the dependent variable (Fernandes et al., 2019).

Multinomial Logistic regression model:

Prob ($y_i = j \mid x_i$) = $P_{ij} = \frac{exp\,(\beta'_j x_i)}{1+\sum_{k=1}^{j} exp(\beta'_k x_i)}$

Where: j = 0, 2, 3 … j: β = 0

j represents the categories of the dependent variable and j' is the reference category.

y_i is the dependent variable.

x is a vector of all the explanatory variables of the i^{th} observations. The specific MLR model for the study is expressed as:

$log \frac{P_r\,(Y = j)}{P_r\,(Y = j')}$ = α + β_1Language + β_2Gender+β_3Qualification + β_4Age + β_5Marital Status + β_6Income + β_7Family Members

Variables of the model

The below-given table present a list of dependent and independent variables that were used to study the incorporation of social media use in agricultural information dissemination by extension officers for farmers in Limpopo Province.

Table 3.3: Description of Variables for the Use of Social Media.

Variables	Description of variables	Measurement
Dependent Variable		
WhatsApp, Facebook, YouTube.	1 = Not effective, 2 = Less effective, 3 = Effective, 4 = Very effective.	Dummy
Independent variables		

Language (X_1)	1= Sepedi; 2= Tshivenda; 3= Xitsonga; 4= English	Dummy
Gender (X_2)	1= Male; 2= Female	Dummy
Qualification (X_3)	1= No formal education; 2= Primary; 3= Secondary; 4=Tertiary; 5= Abet	Dummy
Age (X_4)	Age of the participant	Years
Marital status (X_5)	1= Married; 2= Divorced; 3= Widowed; 4= Single	Dummy
Income (X_6)	1= <3000; 2= 3001-6000; 3= 6001-10000; 4= >10001	South African rands
Family members (X_7)	Total number of family members	The actual size of household

Source: Research survey (2023)

A model was developed from the findings of phase one of the study. Abductive, deductive, and inductive approaches and logical reasoning were applied to develop an evidence-based model from data on the effective current social media platforms and the identified needs for extension officers and farmers. This also included the used social media platforms, perceptions, and contributing factors explored by the extension officers and farmers in agricultural information dissemination.

3.9 ETHICAL CONSIDERATION

The researcher applied for clearance from the University of Limpopo Turfloop Research Ethics Committee (TREC). The researcher remained aware of the big responsibility to be sensitive and respectful towards participants of this study and their basic human rights. The researcher therefore endorsed the code of ethics of the University of Limpopo.

Ethical clearance

The research proposal was submitted to the University of Limpopo Research Ethics Committee for ethical clearance before the research was conducted.

Permission to conduct the study.

The researcher requested permission to conduct the research from the Limpopo Department of Agriculture, Capricorn, and Vhembe District.

Respect, dignity, and standard of care.

The design of the questionnaire did not contain sensitive questions that would challenge the participants' belief system, customs, and tradition. The content and design did not challenge the integrity or discredit a programme or individuals in the study.

Avoidance of harm

The questionnaire was designed in such a way that it did not include sensitive information that would cause physical or emotional harm. Had any harm arose in the process, the affected participants would have been immediately referred to the relevant professional for assistance and interventions.

Informed consent

The researcher acquired informed consent from the participants of the study through verbal or written means before they participate in the study. Participants filled and signed the consent form attached, declaring their interest and full understanding of the risks and expectations of the researcher. The participants voluntarily participated in the study and could withdraw their participation at any time during the study.

Privacy and confidentiality

The researcher informed the participants about the nature of the confidential information to be obtained from them and a consent form had to be signed by the participants as an indication of participation under informed consent. All participants' identities were kept confidential and were not be used for other purposes other than reporting on the research.

3.10 CHAPTER SUMMARY

Chapter three discussed the research methodology utilized to gather and analyse data on the use of social media by extension officers in disseminating agricultural information to farmers in the Limpopo Province. The study utilised a convergent parallel research design and mixed-methods approach, including qualitative and quantitative data collection methods.

The sample size was determined using a multi-stage sampling procedure, and data analysis techniques included descriptive statistics, logistic regression analysis, and thematic content analysis.

Ethical considerations were emphasised throughout the research process, and measures were taken to ensure participants' privacy and confidentiality. The chapter also provided an overview of the study area and the districts of Limpopo Province, including Capricorn, Vhembe, Mopani, Waterberg, and Sekhukhune, with details on their agricultural activities, cultural heritage, and tourism industry. The chapter concludes by outlining the limitations, expected outcomes, and ethical considerations related to the study.

CHAPTER FOUR

DESCRIPTIVE RESULTS: SOCIO-ECONOMIC FEATURES, SOCIAL MEDIA PLATFORMS USED AND NEEDS FOR AGRICULTURAL INFORMATION DISSEMINATION

4.1. INTRODUCTION

The purpose of this chapter is to present the study's descriptive findings based on the participants' socio-economic characteristics. The study primarily focused on the socio-economic characteristics of the sampled farmers, including gender, age, marital status, education, income, household size, social media use, and primary language used by the farmers. It further presents the research findings on using social media platforms by farmers and extension officers in the agricultural sector in Limpopo Province. The study focused on identifying the social media platforms commonly used by farmers and extension officers, the times of day when these platforms are used, and the reasons for usage.

Lastly, this chapter identifies the needs of extension officers and farmers in agricultural information dissemination using social media. Effective agricultural information dissemination through social media requires a tailored approach that accounts for the diverse needs and interests of the farmers. This study explored the challenges extension officers and farmers face when using social media for agricultural information dissemination. This chapter presents results and discusses the types of agricultural information that are most important to share on social media platforms for effective dissemination. It outlines the most effective format for conveying agricultural information on social media, considering the target audience's learning styles and preferences.

4.2. SOCIO-ECONOMIC FEATURES

4.2.1. Socio-economic characteristics of farmers

4.2.1.1. Gender

Gender considerations have become a critical issue in development interventions and research, as evidenced by numerous academic studies. Ewing et al. (2016) highlighted the considerable influence of gender relations on shaping access to resources, opportunities, and household decision-making processes. Similarly, a study by Vuong et al. (2021) showed that gendered cultural and socio-economic

factors in developing countries often restrict women's access to education and employment opportunities.

It is crucial to analyse the gender composition of a population when conducting any study related to development. Table 4.1 below provides data on the gender distribution of respondents in different districts, with a total sample size of 420.

Table 4.1: Gender of farmers

	Gender		
District	Male	Female	Total
Capricorn	56 (50%)	56 (50%)	112 (55%)
Mopani	66 (56%)	51 (44%)	117 (58%)
Sekhukhune	35 (35%)	65 (65%)	100 (46%)
Vhembe	8 (18%)	36 (82%)	44 (19%)
Waterberg	18 (38%)	29 (62%)	47 (22%)
Total	183 (44%)	237 (56%)	420 (100%)

Source: Research Survey (2023)

Data show that out of the total sample, 56% of respondents are female (237), while 44% are male (183) in Limpopo province. The district with the highest number of female respondents is Vhembe, with thirty-six females (82%) out of forty-four respondents. On the other hand, the district with the lowest number of female respondents is Mopani, with only fifty-one females out of one hundred and seventeen respondents. It is important to note that the gender distribution varies across districts in Limpopo Province. Some districts have a more balanced representation of male and female respondents, while others have a significant gender gap.

A study by Mulema and Damtew (2016) revealed that gender-based constraints, such as limited access to credit, land, and information, can impede women's participation in agricultural activities and reduce their productivity. As highlighted by various studies, these challenges will require addressing gender-based barriers in the agricultural sector (Gustavsson et al., 2021; Reshi & Sudha, 2023).

In this context, the table's data suggest that women are more inclined to participate in the study than men, which could be due to numerous factors, such as differences in socio-economic status or gender norms. Nonetheless, conclusions highlight the need

to consider gender dynamics when designing and implementing development programmes and conducting research, as emphasised by Lacey-Barnacle et al., (2020), to ensure the needs and perspectives of both men and women for information sharing. Gender dynamics play a crucial role in development interventions and research. Development programmes and research should address gender-based constraints to promote gender equality and ensuring inclusion of women in development processes.

4.2.1.2. Marital status

It is essential to consider marital status when designing interventions and conducting research, as it can impact an individual's access to resources, decision-making power, and overall well-being. For instance, studies have shown that widowed and divorced women often face economic and social vulnerabilities, as they may have limited access to resources and support networks (Gartrell et al., 2020; Mangada & Su, 2019; Srivastava et al., 2021).

Table 4.2: Marital status of farmers

	Marital Status				
District	Married	Divorced	Widowed	Single	Total
Capricorn	28 (25%)	33 (29%)	15 (13%)	36 (32%)	112 (27%)
Mopani	40 (34%)	18 (15%)	14 (12%)	45 (39%)	117 (28%)
Sekhukhune	35 (35%)	18 (18%)	14 (14%)	33 (33%)	100 (24%)
Vhembe	24 (55%)	2 (5%)	6 (14%)	12 (27%)	44 (11%)
Waterberg	15 (32%)	9 (19%)	4 (9%)	19 (40%)	47 (11%)
Total	142 (34%)	80 (19%)	53 (13%)	145 (35%)	420 (100%)

Source: Research survey (2023)

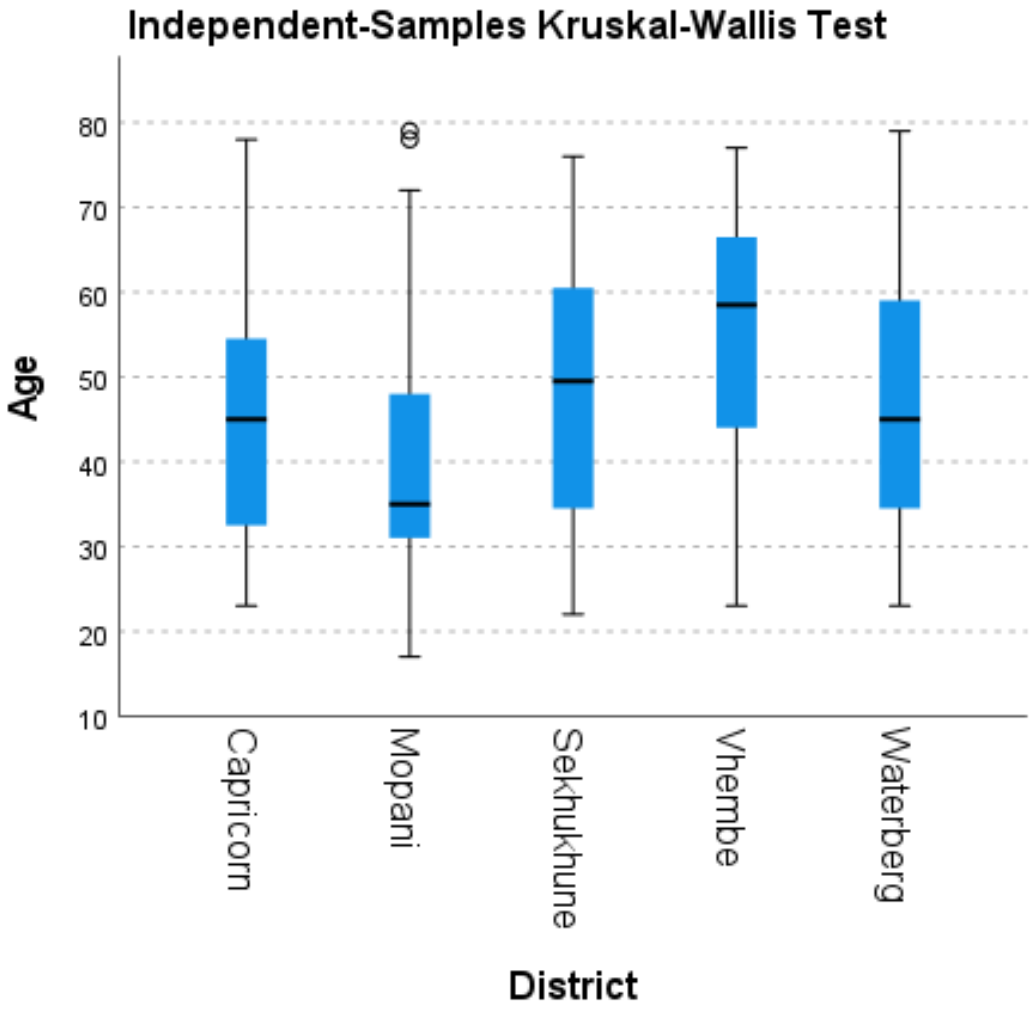
Table 4.2 presented above shows the marital status distribution among respondents in different districts, with a total sample size of 420. Most respondents are single comprising 145 respondents (35%), while married respondents constitute 142 (34%).

The remaining respondents are either divorced (19%) or widowed (13%). The data reveal that the distribution of marital status varies across districts. For instance, Waterberg has the highest number of single respondents, with forty-five respondents (40%) out of a total of 47 respondents. In contrast, Vhembe has the highest number of married respondents (55%). Sekhukhune (14%) and Vhembe (14%) have the highest proportion of widowed respondents.

Similarly, married individuals may have different priorities and decision-making processes than single individuals, affecting their engagement with development programmes. Overall, the table's data highlights the need to consider marital status when designing and implementing development interventions and conducting research to ensure that extension officers adequately address the needs and perspectives of all groups. It is also noteworthy that the sample's marital status distribution may not necessarily represent the actual distribution in the population, and sampling bias may be at play. Therefore, researchers must exercise caution when generalising the results to the broader population.

4.2.1.3. Age

The role of age in technology adoption is recognised in the literature. Studies show that younger farmers are more likely to use social media platforms than older farmers. Age affects the use of social media by farmers, and it is one of the factors that determine technology adoption among farmers (Kanjina, 2021a). This study used the Kruskal-Walli's test to examine whether there were significant differences in median age among five districts in the study area. The districts were Capricorn, Mopani, Sekhukhune, Vhembe, and Waterberg. The output shows that the chi-squared value was 37.883 with 4 degrees of freedom. The associated p-value was 0.0001, indicating convincing evidence that the null hypothesis of the same medians across the districts was sufficient. These results conclude that at least one district has a significantly different median age.



chi-squared = 37.883 with 4 d.f. probability = 0.0001

Figure 4.1: Age of the farmers

Source: Research Survey (2023)

Figure 4.1 above shows that the median age was highest in Vhembe at 58.5 years, followed by Sekhukhune at 49.5 years, Capricorn at 45 years, Waterberg at 45 years, and Mopani at 35 years. The mean age was highest in Vhembe at 54.93 years, followed by Sekhukhune at 48.38 years, Capricorn at 45.07 years, Waterberg at 47.13 years, and Mopani at 39.96 years.

The findings of this study are consistent with the previous research that has highlighted the importance of considering age as a factor in farmers' use of social media for agricultural purposes. For instance, a study by (Mbugua et al., 2019) reported that older farmers were less likely to use social media for agricultural purposes than younger farmers. Similarly, a survey by Vasumathi and Arun (2021) found that younger farmers were more reasonably adopting social media for agricultural purposes than their older counterparts.

4.2.1.4. Educational Qualification

Education is an important determinant in enhancing farmers' productivity and livelihoods for farmers. For example, a survey by Abegunde et al. (2019) on farmers found that education was positively associated with technology adoption and income. Table 4.3 below shows the distribution of educational qualifications in the different districts surveyed, with categories ranging from no formal qualification to tertiary education. This information is essential because academic qualifications can significantly affect an individual's social and economic opportunities. For example, individuals with higher levels of education may have better access to formal employment opportunities, higher income, and greater social mobility. In Capricorn, seventeen respondents had completed primary education, thirty-three had completed secondary education, and twenty-eight had completed tertiary education. However, eighteen respondents had no formal qualifications, which could limit their access to formal employment opportunities and reduce their earning potential.

In Mopani, twenty-one respondents had completed primary education, thirty-three had completed secondary education, and thirty-six had completed tertiary education. However, twenty respondents had no formal qualifications, suggesting limited access to education in the study area.

In Sekhukhune, twenty-one respondents had completed primary education, twenty-two had completed secondary education, and twenty-six had completed tertiary education. However, sixteen respondents had no formal qualifications, which could impact their access to formal employment opportunities and limit their earning potential.

In Vhembe, twelve respondents had completed primary education, sixteen had completed secondary education, and ten had completed tertiary education. Only three

respondents had no formal qualifications, which may suggest greater access to education in the study area compared to other districts.

In Waterberg, ten respondents had completed primary education, twenty-four had completed secondary education, and eleven had completed tertiary education. However, only two respondents had no formal qualifications, which may suggest greater access to education in the study area compared to other districts.

Table 4.3: Educational qualification of farmers

	Qualification					
District	No formal qualification	Primary	Secondary	Tertiary	Abet	Total
Capricorn	18 (16%)	17 (15%)	33 (29%)	28 (25%)	16 (14%)	112 (27%)
Mopani	20 (17%)	21 (18%)	33 (28%)	36 (31%)	7 (6%)	117 (28%)
Sekhukhune	16 (16%)	21 (21%)	22 (22%)	26 (26%)	15 (15%)	100 (24%)
Vhembe	3 (7%)	12 (27%)	16 (36%)	10 (23%)	3 (15%)	44 (11%)
Waterberg	2 (4%)	10 (21%)	24 (51%)	11 (23%)	0 (0%)	47 (11%)
Total	59 (14%)	81 (19%)	128 (30%)	111(26%)	41 (10%)	420(100%)

Source: Research survey (2023)

Previous studies on the education levels of farmers in Sub-Saharan Africa have shown that most farmers attained at least a primary level of education, which is consistent with the findings of this study. For example, a survey by Wongnaa and Babu (2020) on the education levels of cocoa farmers in Ghana found that 75% of the respondents had attained at least a primary level of education. Similarly, a study by Kilonzi et al. (2023) on farmers in Kenya found that 85% had attained at least a primary level of education.

However, this study's findings also reveal that only 14% respondents in the Limpopo Province do not have formal qualification, which is worrying as it may limit their access to formal employment opportunities and reduce their earning potential. These results are consistent with previous studies highlighting the importance of education in enhancing farmers' productivity and livelihoods. For example, a survey by Abegunde

et al. (2019a) on farmers in South Africa found that education was positively associated with technology adoption and income.

The variation in the distribution of educational qualifications across districts is also an essential finding of this study. This result may indicate differences in access to education and other social and economic factors, such as poverty, cultural practices, and gender inequalities; they also affect education levels in rural areas. Previous studies have highlighted the need to address these factors to improve access to education and enhance farmers' productivity and livelihoods. For example, Myeni et al.'s (2019) survey on farmers in the eastern free state South Africa found that low literacy and complex academic language were significant barriers to accessing education among farmers.

4.2.1.5. Monthly income range

Table 4.4 below shows the distribution of monthly income ranges in South African Rands (R) among respondents in different districts. Income is essential in determining an individual's living standard and access to goods and services.

In Capricorn, 37% of respondents reported a monthly income of less than R3000, 19% reported an income range between R3001 and R6000, 21% reported an income range between R6001 and R10000, and 23% reported a monthly income greater than R10001.

In Mopani, 32% of respondents reported a monthly income of less than R3000, 17% reported an income range between R3001 and R6000, 21% reported an income range between R6001 and R10000, and 30% reported a monthly income greater than R10001.

In Sekhukhune, 37% of respondents reported a monthly income of less than R3000, 26% reported an income range between R3001 and R6000, 20% reported an income range between R6001 and R10000, and 17% reported a monthly income greater than R10001.

In Vhembe, 64% of respondents reported a monthly income of less than R3000, 14% reported an income range between R3001 and R6000, 7% reported an income range between R6001 and R10000, and 16% reported a monthly income greater than R10001.

In Waterberg, 53% of respondents reported a monthly income of less than R3000, 21% reported an income range between R3001 and R6000, 13% reported an income range between R6001 and R10000, and 13% reported a monthly income greater than R10001.

Table 4.4: Monthly income range for farmers

	Monthly Income range in Rands (R)				
District	<3000	3001-6000	6001-10000	>10001	Total
Capricorn	41 (37%)	21 (19%)	24 (21%)	26 (23%)	112(27%)
Mopani	37 (32%)	20 (17%)	25 (21%)	35 (30%)	117(28%)
Sekhukhune	37 (37%)	26 (26%)	20 (20%)	17 (17%)	100(100%)
Vhembe	28 (64%)	6 (14%)	3 (7%)	7 (16%)	44(10%)
Waterberg	25 (53%)	10 (21%)	6 (13%)	6 (13%)	47(11%)
Total	168(40%)	83(20%)	78(19%)	91(22%)	420(100%)

Source: Research Survey (2023)

The findings of this study highlight the economic challenges farmers face in the study area, as a considerable proportion of respondents reported a low monthly income of less than R3000. A study by Fan and Rue (2020) showed that farmers in rural areas often face income constraints due to limited access to markets and economic opportunities.

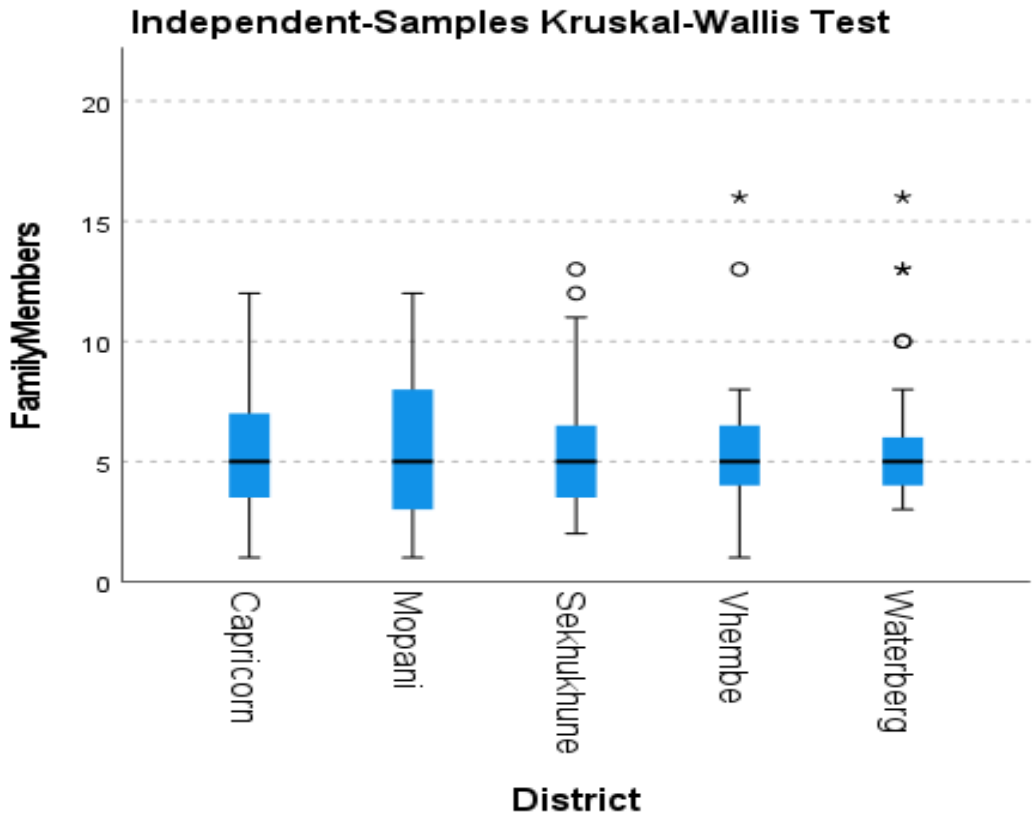
However, the variation in income ranges across districts may indicate differences in economic opportunities and other social factors. For example, Marie et al.'s (2020) study on rural found that income levels varied significantly across districts, with factors such as access to markets, infrastructure, and government support influencing economic opportunities.

Furthermore, the small number (6) of respondents in Waterberg reporting a monthly income of R6001-R10000 suggests limited access to high-paying jobs or economic opportunities in the study area. A similar study was conducted highlighting farmers' challenges accessing higher-value markets and value chains (Berends et al., 2021).

The survey results indicate that a significant percentage of respondents in each district reported a monthly income of less than R3000. In Capricorn, Mopani, Sekhukhune, Vhembe, and Waterberg, the percentages were 37%, 32%, 37%, 64%, and 53% respectively. Additionally, the income ranges between R3001 and R6000 and R6001 and R10000 varied across the districts, with each district showing different percentages of respondents in these income brackets. Furthermore, the percentage of respondents reporting a monthly income greater than R10001 ranged from 13% in Waterberg to 30% in Mopani. In summary, the survey results highlight variations in income distribution across different districts, with a substantial number of respondents earning less than R3000 per month in each district.

4.2.1.6. Household members

Household size can be essential for disseminating agricultural information on social media. For example, a survey by Freeman and Qin (2020) found that farmers with larger household sizes were likely to use social media for agricultural information dissemination, as they were more likely to have access to and be comfortable using technology. As can be seen from figure 4.2 below, the Kruskal-Walli's test results show no significant difference in family size across the five districts (chi-squared = 1.457, df = 4, p = 0.8342). The mean family size ranged from 5.17 in Sekhukhune to 5.829 in Waterberg, with an overall mean of 5.330.



chi-squared = 1.457 with 4 d.f. probability = 0.8342

Figure 4.2: Household members for farmers

Source: Research Survey (2023)

These findings suggest that household size is not a significant factor in farmers' use of social media for agricultural information dissemination. However, remarkably, other studies have found conflicting results. For instance, a study by Rajkhowa and Qaim (2022) found that a larger household size was positively associated with farmers' adoption of social media for agricultural purposes in India. In contrast, another study by Okabe-Miyamoto et al. (2021) found that household size was not associated with higher social media use among farmers. Additionally, a study by Krell et al. (2021), social media was a significant factor in the dissemination of agricultural information in rural communities even to those with low income. However, it must be noted that the relationship between household size and social media use for agricultural information dissemination may vary depending on the study area's specific context and cultural

norms. Additionally, age, education level, and income may influence farmers' social media use for agricultural information dissemination.

4.2.1.7. Sources of income

When studying social media use among farmers, it is essential to consider the source of their income. This is because the source of income can influence farmers' access and use of social media platforms, the economic benefits they derive from social media use, and their ability to access and use these platforms effectively (Hruska & Maresova, 2020).

Farmers who rely on a single crop or market for their income may be more likely to use social media platforms to access market information and connect with potential buyers (Chang & Lindner, 2017). On the other hand, farmers with diverse sources of income may have different motivations for using social media, such as networking and knowledge-sharing.

Table 4.5: Sources of income for farmers (n=420)

	Source of Income					
	Salary		Farming		Grants/Pension	
	Yes	No	Yes	No	Yes	No
Capricorn	49	63	50	62	57	55
Mopani	39	78	86	31	62	55
Sekhukhune	32	68	56	44	58	42
Vhembe	6	38	34	10	30	14
Waterberg	6	41	20	27	39	8
Total	132	288	246	174	246	174

Source: Research survey (2023)

Table 4.5 above presents the results of a study on the sources of income among farmers in five districts in Limpopo, South Africa. The results show that most farmers in all five districts rely on farming (246) and grants (246) as their primary source of income. However, the proportion of farmers dependent on agriculture varies across districts, with the highest ratio found in the Mopani District (86) followed by Sekhukhune District (56) and the lowest in the Waterberg District (20). On the other

hand, the proportion of farmers who receive a salary as their primary source of income is highest in the Capricorn District (49) and lowest in the Vhembe District (6) and Waterberg District (6).

Findings suggest there are differences in the sources of income among farmers in different districts in Limpopo. The high proportion of farmers who rely on farming as their main source of income in the Mopani District is consistent with previous studies that have shown that smallholder farmers in Sub-Saharan Africa rely heavily on agriculture for their livelihoods (Abegunde et al., 2019b; Wegenast & Beck, 2020). The low proportion of farmers who receive a salary as their primary source of income in the Vhembe District is also consistent with previous studies showing that rural areas in Sub-Saharan Africa have limited opportunities for formal employment (Blekking et al., 2020; Cieslik et al., 2022). The high proportion of farmers who receive grants/pensions as a main source of income in the Mopani District may be related to the implementation of social protection programmes for vulnerable populations in the area.

4.2.1.8. Primary language

The primary languages of farmers are important to consider in agricultural information dissemination to improve the effectiveness and adoption of innovative technologies among farmers. Adeyemi et al. (2023) found that using local languages in extension services improved the adoption of new farming technologies among smallholder farmers. However, the effectiveness of such dissemination strategies depends on the language used. Researchers must communicate to the farmers in a language the target audience understands.

Table 4.6: Language used by farmers.

	Language					
District	Sepedi	Tshivenda	Xitsonga	English	Other	Total
Capricorn	97 (87%)	2 (2%)	9 (8%)	4 (4%)	0 (0%)	112 (27%)
Mopani	34 (29%)	1 (1%)	74 (63%)	8 (7%)	0 (0%)	117 (28%)
Sekhukhune	95 (95%)	0 (0%)	1 (1%)	3 (3%)	1 (1%)	100 (24%)
Vhembe	5 (11%)	35 (80%)	2 (5%)	1 (2%)	1 (2%)	44 (10%)
Waterberg	34 (72%)	3 (6%)	3 (6%)	7 (15%)	0 (0%)	47 (11%)

Total	265 (63%)	41 (10%)	89 (21%)	23 (5%)	2 (0%)	420 (100%)

Source: Research Survey (2023)

The data in Table 4.6 above show the distribution of languages used in agricultural information dissemination through social media in five Limpopo Province, South Africa districts. Most farmers in Capricorn (87%) and Sekhukhune (95%) districts preferred using the Sepedi for agricultural information dissemination. In contrast, in the Vhembe District, Tshivenḓa was the most used language (80%). In the Mopani District, Xitsonga was the most widely used language (63%). In contrast, in the Waterberg District, Sepedi was the most preferred language (72%). This data showcases the diverse language preferences for agricultural information dissemination across the districts, highlighting the importance of considering regional languages when communicating with farmers through social media platforms.

Recent studies have also highlighted the importance of local languages in agricultural extension services and information dissemination to enhance the effectiveness and adoption of innovative technologies by farmers. A study by Zeweld et al. (2020) found that using local languages in extension services improved the knowledge and adoption of sustainable agricultural practices among smallholder farmers in Ethiopia. These findings support the importance of considering local languages in agricultural information dissemination to improve the effectiveness and adoption of innovative technologies among farmers.

4.2.2. Socio-economic characteristics of Extension officers

According to the study, the extension officers selected for the research had homogenous socio-economic characteristics, including similar educational qualifications, income range, and use of social media. These officers worked in Limpopo, suggesting they may share similar economic and cultural backgrounds. It was noted that the officers' income range had only slightly varied, indicating they were earning comparable salaries.

Additionally, the study found that the extension officers used technology for different activities both in their workplace and social lives. Furthermore, personal data such as age, gender, and years of experience were not collected by the research team for the

study because the officers' socio-economic characteristics were deemed sufficient for research purposes. While the homogeneity of socio-economic factors among extension officers in a specific region may limit the generalisability of findings, this study provided valuable insights into their perspectives, experiences, and needs.

4.3. SOCIAL MEDIA PLATFORMS USED FOR AGRICULTURAL INFORMATION DISSEMINATION

4.3.1. Findings from farmers

4.3.1.1. Social media platforms used by farmers.

The use of social media when dealing with farmers is an important aspect. For example, scholars identified platforms including usage of WhatsApp among farmers as a communication tool for agricultural information dissemination (Abbas et al., 2022; Chander, Thakur & Chander, 2018). Social media platforms are important in facilitating the dissemination of agricultural information among farmers and extension officers. This section presents the findings on the social media platforms used by farmers in the study. A total of 420 respondents participated in the study and their findings are presented in Table 4.7.

Table 4.7: The type of social media platforms used by farmers.

Social Media Platform	**Frequency**	**Percent %**
WhatsApp	240	57.14
Facebook	173	41.19
Instagram	74	17.62
TikTok	109	25.95
Twitter	83	19.76
YouTube	148	35.24

Source: Research survey (2023)

According to Table 4.7, WhatsApp was the most popular social media platforms with 57.14% of the respondents using it. Facebook then followed WhatsApp with 41.19%, YouTube with 35.24%, TikTok with 25.95%, Instagram with 17.62%, and Twitter

19.76%. The reason WhatsApp was chosen is the fact that it is an easy-to-use interface with low cost. Its ability to share multimedia content has made it a valuable platform for farmers to share information with extension officers and agribusinesses (Devanand & Kamala, 2019).

Facebook came second as a popular platform among farmers, with 41.19% of respondents using it. The possible reason for giving Facebook the second position could be the fact that it is common among farmers because of its ability to connect them with agriculture sector stakeholders, extension officers, agribusinesses, and consumers (Thar et al., 2021). In addition, Faxon (2023) indicates that Facebook groups have become a popular way for farmers to share information about their produce, including asking questions, and to seek advice from farmers in similar fields.

The low usage of Instagram and Twitter among farmers in this study is similar to previous research that found them to be less popular among farmers than other social media platforms (Mishra et al., 2022). Although Twitter is minimally used in this study, Roche et al. (2020) reported that dairy farmers preferred this platform over the others to obtain production and management practices.

Majority of the farmers in the province did not use TikTok for information dissemination. TikTok's emerging popularity among farmers is an interesting finding that warrants further investigation. In their study in the rural China, Li et al. (2022) alluded that farmers are in favour of the use of TikTok as a digital agricultural platform for information dissemination and education. Additionally, Jia and Zhang (2022) have reported TikTok as a platform where farmers can showcase their farming practices, share information about new farming technologies, and connect with other farmers globally.

4.3.1.2. Times in the day when farmers use social media platforms.

The times of day when farmers use social media have important implications for designing agricultural extension programmes that leverage social media use. The knowledge of these times helps in designing information activities for farmers. The Table 4.8 below indicates the times in the day when farmers use social media. This table only applies to the 250 farmers that are using social media.

Table 4.8: The time of social media use in the day

When Use?	Freq.	Percent (%)
In the morning, when I wake up	29	12
Lunch hour	43	17
Free time at work	57	23
In the evening, before I sleep	53	21
Frequently as part of my work routine	68	27
Total	250	100

Source: Research survey (2023)

Table 4.8 shows that 27% farmers use social media frequently as part of their work routines. Among those who use social media, the most popular time of day for usage was during free time at work, which constituted 23%, followed by the evening before sleeping 21% and during lunch hours 10.24%. Only a small percentage of farmers, 12%, reported using social media in the morning when they wake up.

These results bring about evidence of the use of social media by farmers, that is, most of the farmers in Limpopo use social media for farming purposes. The present study's results support previous research, highlighting that farmers use social media during their free time as well as during breaks from farming tasks (Ali Taha et al., 2021). Farmers also prefer to use social media on their smartphones in the evening, as they would have completed their daily farming activities (Nie et al., 2021). Furthermore, they tend to catch up on social media during lunch hours, allowing them to stay connected with their peers, latest trends, and networks.

These findings suggest that extension officers should design agricultural extension programmes to coincide with farmers' social media usage patterns. As such, agricultural extension programmes that leverage social media should be scheduled by extension officers for times when farmers are most likely to use social media, such as during working hours and free time at work. This approach should help to ensure that

agricultural extension programmes are well received, and effectively promote farming practices and dissemination of knowledge.

It is also important to note that many farmers reported using social media as part of their work routine. These findings suggest that social media have become an integral part of agricultural work in some regions of Limpopo Province. Social media may be used for various purposes, such as accessing market information or connecting with other farmers (Manca, 2020; Takahashi et al., 2020). The findings further highlight social media's potential to facilitate knowledge sharing and extension services in agriculture. Furthermore, the data above shed light on the times of day when farmers use social media and have important implications for designing agricultural extension programmes that leverage social media.

4.3.1.3. The reasons why farmers use social media platforms.

The information on why farmers use social media is crucial for designing agricultural extension programmes that suit different social media needs for farmers. Researchers can promote the use of social media for education and learning. Various social media platforms provide a range of information on various topics related to farming, such as crop production techniques, pest control, fertilizers, and soil management. Additionally, farmers can use social media to connect with experts and peers who can provide valuable insights and advice (Rust et al., 2021).

The results indicate that farmers in the sample population use social media platforms for various reasons. Of these findings, among the farmers surveyed, 40.48% reported not using social media, which was expected by the researcher given that social media usage is not universal among all populations; for those who did use social media, the most common reason reported was education and learning 25%, followed by information dissemination 13.1% and socialising 7.14%.

Table 4.9: Reasons why farmers use social media

Why use social media?	**Freq.**	**Percent (%)**
Not using social media	170	40.48
Socialising	30	7.14

Entertainment	29	6.90
Information dissemination	55	13.1
Education and learning	105	25
Marketing	31	7.38
Total	420	100

Source: Research survey (2023)

Previous studies reported the use of social media for information dissemination, and that they are used to access information about weather patterns, market trends, and government policies (Nain et al., 2019; Skaalsveen et al., 2020). This information is essential for farmers to make informed decisions about their agricultural activities, especially crop selection, planting, and marketing.

Socialising is another popular reason for social media usage among farmers. Previous studies have suggested social media as a platform for farmers to connect with peers and share farming experiences (Hudders et al., 2021; Kumar et al., 2018). Furthermore, farmers can exchange information on best practices and discuss common challenges by connecting with peers.

Entertainment is one of the reasons for social media usage among farmers in this study, although to a lesser extent than other reasons. This finding reveals that farmers use social media platforms as a form of entertainment and distraction (Paasonen, 2022). The results indicate that among the farmers surveyed, 40.48% reported not using social media, which aligns with the researcher's expectation that social media usage is not universal among all populations. For those who did use social media, the most common reasons reported were education and learning (25%), followed by information dissemination (13.1%), and socializing (7.14%). These findings suggest that while a significant portion of farmers do not use social media, those who do primarily use it for educational purposes and as a means of obtaining information. This highlights the potential for leveraging social media as an educational and informational tool for farmers.

4.3.2. Findings from extension officers.

4.3.2.1. Social media platforms used by extension officers.

Respondents were asked to indicate social media platforms used by extension officers. The results are presented in Table 4.10.

Table 4.10: Social media platforms used by extension officers.

Social Media Platform	No	Yes	Total
WhatsApp	1 (2%)	49 (98%)	50
Facebook	14 (28%)	36 (72%)	50
Instagram	34 (68%)	16 (32%)	50
TikTok	22 (44%)	28 (56%)	50
Twitter	34 (68%)	16 (32%)	50
YouTube	18 (36%)	32 (64%)	50

Source: Research survey (2023)

According to Table 4.10, WhatsApp was rated 98%, a popular communication tool in many parts of the world, particularly in developing countries (Tulgar, 2019). WhatsApp is easy to use, and messages can be sent to multiple recipients at once, making it an efficient way to disseminate information to many people at the same time. This outcome benefits extension officers responsible for sharing information with farmers in remote areas where face-to-face communication may be difficult due to transportation (Kandpal & Sharma, 2022).

Facebook, the second most used social media platform by extension officers, was rated 72% in this study. It is a popular social networking site with over 2.8 billion active users (Jain, 2021). Facebook provides a platform for users to create profiles, share photos, videos, and links, and communicate with friends and colleagues (Huang & Chang, 2020). Extension officers can use Facebook to create groups or pages dedicated to specific agricultural topics and share relevant information with farmers. Farmers can also use Facebook to create online communities where farmers can

share information and interact with each other, building their social capital (Nain et al., 2019).

The use of YouTube by extension officers for information dissemination is also noteworthy. This platform is a video-sharing website with over 2 billion active users (Lall et al., 2020). Farmers can upload videos to YouTube, and users can search for and view those videos on various topics. Extension officers can also create and upload videos on agricultural issues concerning the farmers, such as best practices for planting, pest control, and harvesting. Extension officers can also use YouTube to create instructional videos demonstrating agricultural equipment use, improving productivity and efficiency (Sari et al., 2022).

TikTok as another relatively new social media platform was rated 56%, it has recently gained popularity among younger users (Ortiz-Ospina & Roser, 2023). It allows users to create and share short videos, often featuring music and special effects. Using TikTok by extension officers for information dissemination is a new and innovative approach that may appeal to younger farmers. Extension officers can create short and engaging videos on various agricultural topics to capture the attention of younger farmers (Wiseman et al., 2019; Zhang, 2021).

Twitter with 32% usage is another social media site that enables users to exchange short messages, called tweets. Extension officers can share tweets on the platforms with followers, including text, photos, and videos (Bhattacharjee & Raj, 2016). Extension officers can use Twitter to share news and updates on agricultural developments, upcoming events, and weather information for the benefit of the farmers. Extension officers can use Twitter to create online communities to interact with farmers and share information (Nyarko & Kozári, 2021).

Instagram is a photo and video-sharing platform that allows users to share photos and videos. Although a few officials engaged on this platform (Casey et al., 2016), the users of Instagram are perceived to be rich and fashionable, and depending on content, extension officers also stand a great chance to use this platform. Extension officers can use Instagram to share photos and videos of agricultural practices, such as livestock farming, crop harvesting, and irrigation (Inegbedion et al., 2021). Instagram can also create instructional videos on various agricultural topics, such as soil preparation and seed selection.

4.3.2.2. Times in the day when extension officers use social media platforms.

Respondents were asked to indicate times in a day when they use social media platforms. The results are presented in Table 4.11.

Table 4.11: Times in a day when extension officers use social media platforms.

Whenuse	Freq.	Percent (%)
In the morning when I wakeup	4	8
Lunch hour	5	10
Free time at work	9	18
In the evening before I sleep	5	10
Frequently as part of my work routine	27	54
Total	50	100

Source: Research survey (2023)

Table 4.11 provides an overview of the time of day when extension officers use social media platforms for information dissemination. Most extension officers (54%) reported using social media platforms frequently as part of their work routine. Other times of the day when extension officers use social media for information dissemination are during their free time at work (18%), lunch hour (10%), and in the evening before they sleep (10%). Only a tiny proportion of extension officers reported using social media platforms in the morning when they woke up (8%).

Previous studies reported that the use of social media platforms for information dissemination in the agricultural sector has expanded (Chander, Thakur & Scientist, 2018; Latif et al., 2020; Oluyaire et al., 2020). These studies have shown that social media platforms have become essential tools for sharing information among extension officers, especially in developing countries with limited access to information.

This study suggests that the time of day when extension officers use social media platforms for information dissemination is mainly during their work routine like the results of the farmers. The reason for this could be that extension officers are able to

access the Internet and social media during working hours. Yusuf et al. (2022) reported that extension officers in South Africa mainly used social media platforms during working hours. Extension officers found it easy and convenient to use the social media platforms to increase their information coverage with ease.

The findings also suggest that extension officers use social media platforms during their free time at work. This could be because they have limited Internet and social media access outside their work environment. Taha et al. (2021) report that extension officers mainly used social media platforms during their free time at work.

The findings of this study also show that only a small proportion of extension officers reported using social media platforms in the morning when they woke up. Extension officers may prefer to use other sources of information in the morning, such as newspapers or radio programmes. Similarly, Raza et al. (2020) discovered that extension officers and farmers mainly used television and radio programmes in the morning for information dissemination.

4.3.2.3. The reasons why extension officers use social media platforms.

The respondents were asked to indicate reasons why they use social media platforms and the findings are presented in Table 4.12.

Table 4.12: The reasons why extension officers use social media.

Why use	**Freq.**	**Percent (%)**
Socialising	5	10
Entertainment	7	14
Information dissemination	13	26
Education and Learning	21	42
Marketing	4	8
Total	50	100

Source: Research survey (2023)

Table 4.12 provides an overview of why extension officers use social media platforms for information dissemination. The data show that most extension officers use social media for education and learning purposes (42%), followed by information dissemination (26%), entertainment (14%), socialising (10%), and marketing (8%).

The high percentage of extension officers who use social media platforms for education and learning purposes is consistent with previous research on the use of social media in the agricultural sector. For instance, a study by Antwi-Agyei and Stringer (2021a) revealed that extension officers and farmers increasingly use social media platforms for learning and capacity building. Social media platforms provide easy access to a various information and resources that can be used for learning and professional development (Skaalsveen et al., 2020).

The finding that many extension officers use social media for information dissemination is consistent with previous research. Social media platforms are vital for disseminating agricultural information to farmers in developed and developing countries (Getahun, 2020). Social media platforms enable extension officers to reach a wider audience and disseminate information more quickly and efficiently than traditional extension methods such as field days, face-to-face, general meetings and printed materials (Nyarko & Kozári, 2021).

Interestingly, the percentage of extension officers using social media platforms for entertainment is higher than expected. While social media platforms are used mainly for professional purposes, they are also for leisure and entertainment (Kanjina, 2021b; Sandeep et al., 2022a). The use of social media platforms for entertainment can be detrimental to the users.

One positive side of social media is that they can help extension officers unwind and reduce work-related stress, leading to better job satisfaction and higher productivity (Cheng, 2019). On the negative side, excessive use of social media for entertainment can lead to decreased work performance, addiction, loss of focus and procrastination (Cao & Yu, 2019). Therefore, extension officers need to be aware of their social media usage habits and balance their professional and personal use of social media platforms. Additionally, the high percentage of extension officers using social media platforms for education and learning is a positive trend, as it highlights the potential of these platforms as practical tools for professional development and knowledge sharing

in the agricultural sector. Social media platforms can provide access to valuable information, training materials, and webinars to help extension officers stay updated with the latest farming practices and technologies (Toivonen et al., 2019).

4.4. SOCIAL MEDIA NEEDS FOR AGRICULTURAL INFORMATION DISSEMINATION.

4.4.1. Findings from farmers.

4.4.1.1. The use of social media.

This section presents information about social media use amongst farmers in the Limpopo Province. Respondents were asked to indicate their use of social media. The results are presented in Table 4.13.

Table 4.13: The use of social media

Use SM?	Freq.	Percent (%)
No	170	40.48
Yes	250	59.52
Total	420	100

Source: Research survey (2023)

From the results in Table 6.1, 59.52% of the farmers in the study reported using social media, while 40.48% did not use social media. The use of social media is relatively prevalent among farmers in the province. The results of the current study suggest that the use of social media among farmers in Limpopo may be higher than in some regions. This finding could be due to various factors, such as differences in education levels, access to technology, and cultural attitudes towards social media.

Researchers have conducted several studies on the use of social media among farmers in other regions, which can provide context for interpreting these results. A survey by Riley and Robertson (2021) on social media use among smallholder farmers reported using social media for agricultural purposes. Another study by Nain et al. (2019) revealed that the use of social media is for social networking purposes rather than for agriculture-related information. Getahun (2020) found that social media among farmers were for communicating with each other and traders rather than accessing agricultural information.

One potential benefit of social media use among farmers is increasing access to information and knowledge about agricultural practices and markets. A study by Zondo and Ndoro (2021) on WhatsApp among smallholder farmers in Mpumalanga, South Africa, found that the platform was an effective tool for disseminating agricultural information and improving farmers' knowledge and productivity. Another study by Mamgain et al. (2020) on the use of Facebook among farmers found that the platform was effective for accessing market information and connecting with buyers.

However, the use of social media also presents potential challenges, such as the spread of misinformation and the risk of cyber threats. A study by Zhang et al. (2021) on the use of social media for agricultural extension services found that farmers were concerned about the accuracy and reliability of the information on social media platforms. Another study by Jouanjean et al. (2020) on the use of social media among farmers found that they were more concerned about their privacy and risks associated with social media use.

4.4.1.2. Challenges of social media use.

Table 4.14 presents the results on farmers' challenges when using social media. The research team asked the survey respondents to identify their challenges when using social media platforms.

Table 4.14: Challenges of social media use

Challenges of SM use	Freq.	Percent (%)
Limited access to information	81	32
Difficulty in finding information	65	26
Limited networking opportunities	47	19
Time-consuming	25	10
Other	32	13
Total	250	100

Source: Research survey (2023)

Difficulty in finding information is the second most common challenge, with 65 respondents (26%) highlighting this issue. Limited networking opportunities come in third place, with 47 respondents (19%) facing this challenge. Time-consuming and

other challenges are reported by 25 respondents (10%) and 32 respondents (13%) respectively. This finding is coherent with previous studies highlighting the importance of reliable and accessible information for farmers (Alotibi & Dabiah, 2022; Farooq et al., 2019). The finding suggests that farmers may have difficulty finding relevant and reliable information on social media platforms, which could impact their ability to make informed decisions and optimise their farming practices.

The second challenge is difficulty finding information, with 65 (15.48%). This finding indicates that even when information is available, it may not be easy to locate and may not be present in a user-friendly manner. This finding is confirmed by previous research highlighting the need for effective search and filtering mechanisms to enable farmers to find the information they need (López-Morales et al., 2020).

Limited networking opportunities are the third most common challenge, with 47 (11.19%) farmers. Farmers may struggle to connect with other farmers and relevant industry players through social media platforms, which could limit their ability to collaborate, share knowledge and experience, and learn from others. This challenge is consistent with previous research highlighting the importance of social capital for agricultural development (Wu & Liu, 2020).

The study also reveals time-consuming as a challenge, with 25 respondents (5.95%) indicating that they face this issue. This finding suggests that using social media platforms may require significant time and effort, which could be a barrier for farmers with other competing demands and daily duties. Previous research highlighted the importance of time management for farmers (Misra et al., 2020).

The “Other” category, with a frequency of 32 (7.62%), includes challenges not explicitly stated in the survey. This finding suggests that farmers may face additional challenges when using social media platforms that are yet to be explored by research.

4.4.1.3. Type of information farmers are willing to access on social media

Table 4.15 below represents the information farmers consider essential in their farming activities. The ability of farmers to access and utilise relevant information is a crucial factor in achieving agricultural productivity, profitability, and sustainability. Understanding the type of information that farmers consider essential is a crucial step in developing effective agricultural information systems. This information can help agricultural extension officers, researchers, and policymakers develop and

disseminate relevant and timely information to farmers, ultimately creating a sustainable and profitable agricultural sector.

Table 4.15: The type of information most important to farmers

Type of Info	Freq.	Percent (%)
Crop production and management	51	20
Livestock management	38	15
Soil health and fertility	44	18
Pest and diseases management	46	18
Climate and weather updates	27	11
Agricultural policies and regulations	16	6
Access to markets	28	11
Total	250	100

Source: Research survey (2023)

The table represents the different types of information that farmers consider essential in their farming activities, along with the corresponding percentages. Among the respondents, 20% indicated that crop production and management information is the most important, followed by pest and disease management at 18%. Soil health and fertility, as well as livestock management, both garnered 15% and 18% respectively. Climate and weather updates were considered important by 11% of the respondents, while agricultural policies and regulations and access to markets were each identified as essential by 6% and 11% of the respondents, respectively.

The results of this survey are like previous research on the information needs of farmers. Crop production and management are emphasised as one of the most important types of information for farmers (Chander, Thakur & Chander, 2018). Crop production is the primary activity for most farmers and is crucial for their livelihoods.

Livestock management is also important for farmers, as livestock rearing is a common activity in many rural areas. Farmers need information on topics such as feeding, breeding, and disease prevention to ensure their animal's health and productivity (Zimu-Biyela, 2021).

Soil health and fertility is another important area for farmers, as soil is the foundation of crop production. Farmers need information on soil testing, soil fertility management,

and soil conservation to ensure their land's long-term health and productivity (Martini et al., 2016).

Pest and disease management criteria are also critical for farmers, as pests and diseases can significantly reduce crop yields and impact food security. Farmers need information on topics such as pest and disease identification, integrated pest management, and pesticide application measures (Kumar et al., 2018).

Climate and weather updates are becoming increasingly important information for farmers, as climate change is leading to more frequent and severe weather events. Kumar et al. (2020) argue that farmers need information on weather forecasting, drought management, and flood prevention to mitigate the impacts of climate change on their crops and livelihoods.

Access to markets is also an important area for farmers, as markets provide a way for farmers to sell products and make income. Farmers consistently seek information on market prices, trends, and regulations to make informed decisions about what crops to grow and when to sell them (Wanyama et al., 2015).

4.4.1.4. Preferred content format for viewing social media posts.

Respondents were asked to indicate their preferred content format when using social media platforms to access information. Table 4.16 below represents farmers' preferred content format when using social media platforms.

Table 4.16: The content format preferred by farmers.

Content Format	Freq.	Percent (%)
Text	37	15
Images	71	28
Videos	74	30
Infographics	37	15
Livestreams	31	12
Total	250	100

Source: Research survey (2023)

The survey indicates that farmers prefer video content format, with 74 respondents (30%) expressing a preference for this format. This is closely followed by images,

which were preferred by 71 respondents (28%), and text, which was preferred by 37 respondents (15%). Infographics and livestreams were the least preferred formats, with 37 respondents (15%) and 31 respondents (12%) respectively expressing a preference for each. The high preference for video content format could be due to the effectiveness of visual storytelling in conveying agricultural information. Social media are becoming an increasingly popular tool among farmers, allowing them to access and share information quickly and efficiently. Understanding the content format preferences of farmers is crucial in developing effective agricultural extension programs that utilise social media platforms. By understanding the most preferred content formats, agricultural extension officers can tailor their content to maximise its effectiveness in meeting the farmers' needs.

Video content is engaging and provides an opportunity for farmers to see the information in action, making it easier for them to understand and apply the knowledge. Video content was the most effective method of communicating agricultural information to farmers (Banmeke et al., 2021; Rose et al., 2021).

Images are useful for conveying visual information to farmers and are easily shareable on social media platforms. Khan Tithi et al. (2021) found that images effectively convey information on agricultural practices and technology to farmers. However, it is important to note that images alone may not provide enough information to all farmers.

Text is a traditional format of sharing information on social media platforms and it is effective in conveying detailed information. However, a text may require integration with other available formats to make the content more appealing. This finding is consistent with a study conducted by Kumar et al. (2020), which found that farmers preferred visually engaging and interactive content.

Infographics and Livestreams were the least preferred formats. Infographics are useful for carrying out complex information in a visually appealing manner to farmers, but they require a certain level of design skill to be effective. On the other hand, livestreams provide an opportunity for farmers to engage with experts in real-time, but they require a stable internet connection, which is not available in all areas. Agricultural extension officers can use the results to tailor their content to meet the farmers' preferences, increasing the likelihood of the content being received positively. It is important to note that the preferences for content formats may vary depending on the

context and the recipients. For example, older farmers may prefer text- and voice-based formats, while younger farmers prefer more visually engaging formats.

4.5. NON-SOCIAL MEDIA USE.

In today's digital age, social media platforms have become integral to communication and information sharing. However, not all farmers have embraced these technological advancements. This section explored the phenomenon of farmers who do not use social media and delved into the reasons why this was the case. It also examined the current sources of agricultural information available to these farmers and the challenges they faced in accessing such information through traditional sources. Finally, it investigated the level of satisfaction of farmers who rely on traditional sources of agricultural information. This study has revealed that out of 420 participants in the five districts of Limpopo Province, only 170 (40.5%) farmers did not use social media. Understanding these issues is essential to develop effective strategies for improving access to agricultural information for all farmers.

4.5.1. Reasons why farmers do not use social media platforms.

Farmers have used social media platforms such as Twitter, Facebook, and Instagram to access information on weather patterns, market trends, and other agricultural-related information. Despite the numerous benefits of social media, some farmers still do not use these platforms. The respondents were asked the reasons why they do not use social media. The results are presented in Table 4.17.

Table 4.17: Reasons why farmers do not use social media.

Why Not Use	Freq.	Percent (%)
Not interested	36	21.18
Poor technology knowledge	48	28.24
Concerned about privacy	25	14.71
No internet access	32	18.82
Lack of time	29	17.06
Total	170	100

Source: Research survey (2023)

4.5.1.1. Not interested

According to the study, one of the reasons why some farmers do not use social media is that they are not interested (21.18%). This finding is confirmed by previous studies that have reported that lack of interest is a common reason for low social media adoption rates among farmers (Das et al., 2019). Some farmers still rely on traditional sources of information and are sceptical about the accuracy of the information available on social media platforms (Jost et al., 2016; Naab et al., 2019). Therefore, it is important for agricultural stakeholders to design social media campaigns that appeal to farmers' interests and address their scepticism to increase social media adoption rates among farmers.

4.5.1.2. Poor technology knowledge.

This study found that poor technology knowledge is another reason why some farmers do not use social media (28.24%). This finding is in line with previous studies that have reported that farmers' lack of technical skills is a significant barrier to social media adoption (Das et al., 2021). Farmers in rural areas, in particular, may have limited access to technology training, which makes it difficult for them to use social media (Antwi-Agyei & Stringer, 2021a). Therefore, agricultural extension officers and other stakeholders should provide training programmes to farmers to improve their technology skills, and enhance their ability to use social media platforms effectively.

4.5.1.3. Concerned about privacy.

The study found that 25 farmers (14.71%) reported concerns about privacy as a reason for not using social media. Kaban (2021) revealed that privacy and security concerns are significant barriers to social media adoption among farmers. Agricultural stakeholders should take measures to ensure that farmers' data are safe and secure online. This can be done by providing farmers with data security information and by implementing measures such as two-factor authentication and regular password changes for the platforms they use (Sandeep et al., 2020).

4.5.1.4. No internet access.

The study found that 32 farmers (18.82%) do not use social media because they do not have access to the internet. According to Kongnso et al. (2020), lack of Internet access is a significant barrier to social media adoption among farmers. Governments and other stakeholders should work to ensure that remote areas have affordable and reliable internet connectivity (Alshehri, 2019).

4.5.1.5. Lack of time.

The study found that lack of time is another reason why some farmers, precisely 29 farmers (17.06%), do not use social media. Vayro et al. (2020) reported that farmers have competing demands on their time, such as caring for their farms and families. Lack of time is one of the major constraints that inhibit the use of social media platforms, as reported by Sandeep et al. (2022a). To create content on some social media platforms requires time and knowledge regarding the agricultural produce and practices (Barrutia et al., 2022).

4.5.2. Current traditional sources of agricultural information.

Access to information is crucial for the success of any agricultural enterprise. Farmers require information on a variety of topics, including soil management, pest control, and marketing strategies, to name a few. Respondents were asked to indicate their current traditional source of agricultural information dissemination. The results are presented in Table 4.18.

Table 4.18: Current traditional sources of agricultural information dissemination.

Current Trad. Source	Freq.	Percent (%)
Extension officers	52	30.59
Radio	36	21.18
Television	25	14.71
Family and Friends	30	17.65
Newspapers	27	15.88
Total	170	100

Source: Research survey (2023)

4.5.2.1. Extension officers.

Extension officers are a valuable source of information for farmers, especially those in rural areas (Nyarko & Kozári, 2021). Although this is the case, a study by Cloete et al. (2019) differs and alludes that extension officers contribute minimally to the knowledge of farmers in Thaba Nchu, South Africa. In the study, 52 farmers (30.59%) reported that they relied on extension officers as their primary source of agricultural information. Extension officers are government or non-governmental organisation (NGO) workers who provide technical advice to farmers and facilitate the adoption of new practices

and technologies by providing training and demonstrations. Their personalised advice and solutions to farmers' specific problems make them an advantageous source of information.

4.5.2.2. Radio.

Radio is a popular source of agricultural information, particularly in rural areas where access to other sources of information may be limited (Mtega, 2021; Subashini & Fernando, 2018). In this study, 36 farmers (21.18%) reported that they relied on radio as their primary source of agricultural information. Radio programmes can provide farmers with information on a variety of topics, including weather forecasts, pest control, and marketing strategies (Subashini & Fernando, 2018). They are typically inexpensive to produce and can reach a large audience.

4.5.2.3. Television.

Television is another popular source of agricultural information, particularly in urban areas (Fidelugwuowo, 2021; Ndimbwa et al., 2019). In the study, 25 farmers (14.71%) reported that they relied on television as their primary source of agricultural information. Television programmes can provide farmers with visual demonstrations of agricultural practices and technologies, and they can also provide information on markets and market prices (Kapuscinski, 2017).

4.5.2.4. Family and Friends.

Family and friends are a common source of agricultural information for farmers (Msoffe et al., 2018; Odini, 2014). In the study, 30 farmers (17.65%) reported that they relied on family and friends as their primary source of agricultural information. They can provide farmers personalised advice based on their experiences and emotional support and encouragement (Fidelugwuowo, 2021; Tandon et al., 2021). However, the advice provided by family and friends may not always be accurate or based on sound agricultural practices (Kelil et al., 2020).

4.5.2.5. Newspapers.

Newspapers are an underutilised source of agricultural information for farmers (Malekani & Mubofu, 2020). In the study, 27 farmers (15.88%) reported that they relied on newspapers as their primary source of agricultural information. Newspapers can provide farmers with valuable information on markets, weather forecasts, and agricultural policies (Roche et al., 2020). They can also provide information on new

technologies and practices. Although newspapers are still a preferred means of communication by some farmers, the delivery of these tools is still limited by the road infrastructure in remote villages (Mtega, 2021).

4.5.3. Challenges for accessing agricultural information through traditional sources.

Access to agricultural information is crucial for farmers to make decisions about their produce, adopt new technologies and practices, and improve their overall productivity and income (Zimu-Biyela, 2021). However, accessing reliable and timely agricultural information can be a challenge for many farmers, particularly those in rural areas (Islam et al., 2020). The respondents were asked about the challenges they face in accessing agricultural information from traditional sources. The results are presented in Table 4.19.

Table 4.19: Challenges for accessing agricultural information through traditional sources.

Trad. Source Challenges	Freq.	Percent (%)
Limited access to information	41	24.12
Difficulty in finding information	61	35.88
Limited networking opportunities	34	20
Time consuming	34	20
Total	170	100

Source: Research survey (2023)

4.5.3.1. Limited access to information.

Access to information is a crucial factor in farmers' decision-making processes, particularly in adopting new technologies and practices. The study found that 41 farmers (24.12%) reported limited access to information as a major challenge in accessing agricultural information. Inadequate infrastructure, such as lack of electricity and poor internet connectivity, can limit farmers' access to information from traditional sources such as extension officers, radio, and television. Furthermore, the availability of extension officers may be limited in some areas, which can further exacerbate the issue of limited access to information. According to Mapiye et al. (2021), limited access to agricultural information through extension services is a significant factor affecting farmers' adoption of new technologies.

4.5.3.2. Difficulty in finding information.

Farmers, particularly in rural areas, can be challenging to find relevant and reliable information. The study also found that 61 farmers (35.88%) reported difficulty in finding information as a major challenge in accessing agricultural information. Farmers may have difficulty finding information on specific topics or may not know where to look for information. A few of the studies conducted found that shortage of access to relevant and reliable information was a significant barrier to the adoption of new agricultural technologies (Chander, Thakur, & Chander, 2018; Paudel & Baral, 2018).

4.5.3.3. Limited networking opportunities.

This study found that 34 farmers (20.00%) reported limited networking opportunities as a major challenge in accessing agricultural information. Networking opportunities can play an essential role in providing farmers with access to information, particularly in remote areas. Farmers may not have access to peer groups, cooperatives, or other organisations that can provide them with information and support. Limited networking opportunities can lead to a lack of awareness of new technologies and practices, which can limit farmers' productivity and income. A study conducted in India found that networking opportunities significantly influence farmers' adoption of new agricultural technologies (Oksa et al., 2021).

4.5.3.4. Time consuming.

Farmers often have limited time to seek out information due to other responsibilities, such as household chores or other jobs. The study also found that 34 farmers (20%) reported time-consuming as a major challenge in accessing agricultural information. This challenge can lead to poor adoption of new technologies and practices, which can limit farmers' productivity and income. A study conducted by Chander, Thakur and Chander (2018) found that time constraints were a significant factor affecting farmers' access to agricultural information.

4.5.4. Satisfaction of farmers on traditional information sources.

Traditional sources of agricultural information such as extension services, radio, television, and print media have a significant role in providing information to farmers in many regions. The satisfaction of farmers with traditional sources of agricultural information is an important indicator of their effectiveness. The respondents were asked to indicate satisfaction with traditional sources of agricultural information. The survey results are presented in figure 4.3.

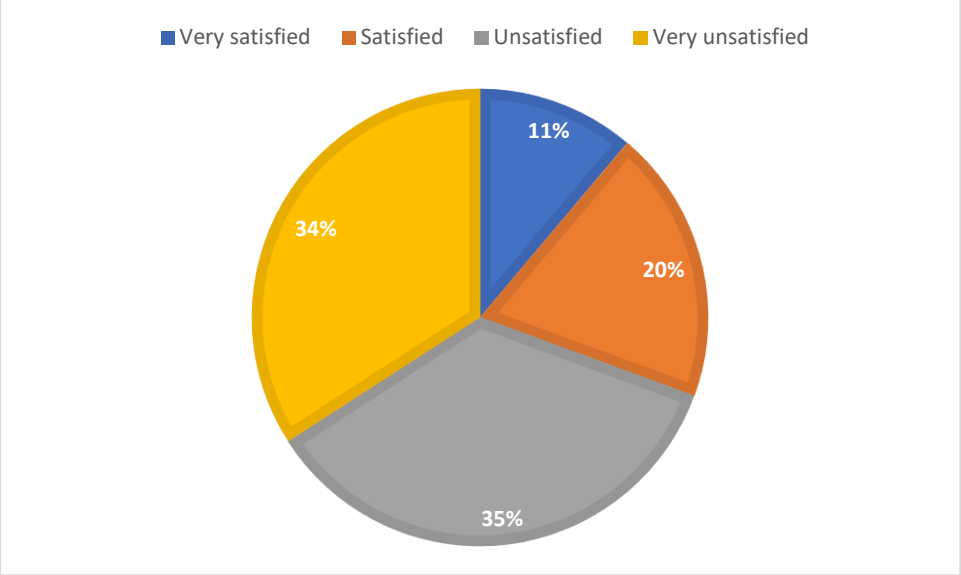


Figure 4. 3: Satisfaction of farmers on traditional information sources

Source: Research survey (2023)

The survey results reveal that 34% of farmers reported being very unsatisfied with traditional sources of agricultural information, while 20% reported satisfied. In contrast, 19% of farmers reported being unsatisfied. The high level of satisfaction reported by farmers suggests that these sources continue to play an important role in providing agricultural information. However, it is crucial to address the reasons behind the dissatisfaction reported by some farmers to enhance the effectiveness of these sources.

Possible reasons for dissatisfaction with traditional sources of agricultural information may include the quality and relevance of the information provided, the accessibility of the information, and the level of interaction and engagement with extension agents. Previous studies have shown that the quality and reliability of agricultural information provided through traditional sources can be a concern for farmers (Tewari, 2014; Yusuf & Yenesew, 2020). Improving the quality and relevance of information provided through traditional sources can help address this issue.

In addition, accessibility of information can be a significant challenge for farmers, particularly those in remote areas. Access to the mobile phones and Internet is limited in many rural areas, which can limit farmers' access to online and mobile-based agricultural information sources (Acevedo et al., 2020; Odini, 2014). Improving the infrastructure and availability of mobile-based agricultural information services can

help address this issue. Moreover, the level of interaction and engagement between farmers and extension agents is an essential factor in determining the effectiveness of traditional sources of agricultural information. Studies have shown that personalised communication and engagement with farmers can lead to higher levels of adoption of new technologies (Caffaro et al., 2020).

4.5.5. Findings from extension officers.

4.5.5.1. The use of social media

This study has revealed that all extension officers that participated were using social media platforms. The use of social media in agriculture extension services has increased due to the widespread availability of smartphones and the Internet. A study by Devanand and Kamala (2019) found that the use of WhatsApp by extension officers has become more common, with many officers using it to communicate with farmers, share information, and provide advice. Additionally, a study by Antwi-Agyei and Stringer (2021b) found that extension officers are increasingly using social media platforms like Twitter and Facebook to share information and connect with farmers.

It is essential to note that the use of social media in agriculture extension services can enhance the efficiency and effectiveness of extension services. For example, a study by Nyarko and Kozári (2021) found that the use of social media platforms like WhatsApp and Facebook by extension officers led to improved communication and collaboration among stakeholders in the agriculture sector.

However, the use of social media in agriculture extension services also presents its own challenges. One of the challenges is the quality of information that is shared on social media platforms. Akinwale et al. (2019) found that while social media platforms like WhatsApp are useful for disseminating agricultural information.

The use of social media in agriculture extension services has become more widespread in recent years. The use of social media presents both opportunities and challenges, and it is important to ensure that extension officers are trained on how to use social media platforms effectively and responsibly.

4.5.5.2. Challenges of social media use.

The use of social media by extension officers presents numerous challenges, ranging from technical issues to privacy concerns. The respondents were asked about the challenges of social media use. The results are presented in Table 4.20.

Table 4.20: The challenges faced by extension of social media use.

Challenges	Freq.	Percent (%)
Expensive data	8	16.00
Limited resources	11	22.00
Difficulty in creating content	10	20.00
Lack of technical knowledge	3	6.00
Privacy concerns	18	36.00
Total	50	100.00

Source: Research survey (2023)

One of the major challenges of social media use for extension officers is the privacy concern. A study by Aronowitz et al. (2021) found that extension officers often struggle to afford data bundles for their smartphones, which limits their ability to use social media platforms effectively, but this is not the case in South Africa. This challenge is particularly significant in low-income countries where data costs are high and extension officers have limited resources. Extension officers are often concerned about the privacy and security of their personal information and data when using social media platforms (Kozlowska, 2018). This challenge can be addressed through the development of clear guidelines and policies for social media use in agriculture extension services, as well as training programmes that focus on data protection and privacy.

Another challenge is limited resources, which can make it difficult for extension officers to access the technology and infrastructure needed for social media use. Content creation for social media is also a challenge for extension officers, particularly for those with limited technical knowledge. A study by Steinke et al. (2021) found that many extension officers lack the technical skills required to create engaging and informative content for social media platforms.

4.5.5.3. Type of information extension are willing to share on social media.

The respondents were asked to indicate the type of information they were willing to share on social media. Table 4.21 presents results on the types of information that extension officers were willing to share on social media platforms for information dissemination.

Table 4.21: The type of information extension were willing to share on social media. (n=50)

Topics	Freq.	Percent (%)
Crop production and management	8	16
Livestock management	5	10
Soil health and fertility	3	6
Pest and diseases management	11	22
Climate and weather updates	10	20
Agricultural policies and regulations	4	8
Access to markets	9	18
Total	50	100

Source: Research survey (2023)

The results show that most extension officers were willing to share information on pest and disease management (22%), followed by crop production and management (16%), access to markets (18%), climate and weather updates (20%), livestock management (10%), soil health and fertility (6%), and agricultural policies and regulations (8%).

From the data, it is evident that pest and disease management is the most popular topic with a frequency of 11, accounting for 22% of the total responses. This finding is not surprising as pest and disease management is a crucial aspect of agricultural production, and extension officers play a vital role in educating farmers on how to prevent, control, and manage pests and diseases effectively (Kumar et al., 2018).

Crop production and management ranked second, with a frequency of 8, accounting for 16% of the total responses. Crop production and management is another critical aspect of agricultural production, and extension officers play a vital role in educating farmers on how to improve their crop yields and productivity. According to Zwane and Kekana (2014)Extension officers are crucial in transferring agricultural technologies

and information to farmers, and social media platforms can be an effective tool for disseminating such data.

Access to markets ranked third, with a frequency of 9, accounting for 18% of the total responses. Access to markets is a crucial aspect of agricultural production, and extension officers play a critical role in linking farmers to markets and helping them to market their produce effectively. According to Maulu et al. (2021), extension officers play a critical role in facilitating the linkage between farmers and markets, and social media platforms can be an effective tool for disseminating market information to farmers.

Climate and weather updates ranked fourth, with a frequency of 10, accounting for 20% of the total responses. Extension officers are an important component of educating farmers on how to adapt to changing weather patterns and climate variability. According to (Nyarko & Kozári, 2021) Extension officers can use social media platforms to disseminate weather information and advisories to farmers, thus enabling them to make informed decisions regarding their farming activities.

Livestock management ranked fifth, with a frequency of 5, accounting for 10% of the total responses. Livestock management is a critical aspect of agricultural production, and extension officers play a vital role in educating farmers on how to manage their livestock effectively. According to Antwi-Agyei and Stringer (2021b), extension officers play a critical role in transferring livestock management technologies and information to farmers, and social media platforms can be an effective tool for disseminating such information.

Agricultural policies and regulations ranked sixth, with a frequency of 4, accounting for 8% of the total responses. Agricultural policies and regulations are critical for the development of the agricultural sector, and extension officers play a vital role in educating farmers on government policies and regulations that affect their farming activities. According to (Kumar et al., 2020)Extension officers can use social media platforms to inform farmers about government policies and regulations, thus enabling them to comply with such policies and regulations.

Soil health and fertility ranked seventh, with a frequency of 3, accounting for 6% of the total responses. Extension officers have a crucial role in educating farmers on how to improve soil health and fertility. According to Nedumaran and Nandi (2019), extension

officers use social media platforms to disseminate information on soil health and fertility management to farmers, thus enabling them to improve their crop yields and productivity.

4.5.6. Preferred content format for viewing social media posts.

Respondents were asked to give insights into the format of content they preferred when using social media to access information. The results are presented Table 4.22.

Table 4.22: Preferred content format for viewing social media posts. (n=50)

Format	Freq.	Percent
Text	7	14.00
Images	9	18.00
Videos	19	38.00
Infographics	7	14.00
Livestreams	8	16.00
Total	50	100.00

Source: Research survey (2023)

The findings indicate that the majority of extension officers were willing to share and access videos (38%) followed by images (18%), livestreams (16%), infographics (14%), and text (14%). These results suggest that extension officers are open to using multimedia content to disseminate information, which is similar to previous studies that have reported the effectiveness of multimedia in promoting knowledge acquisition and retention (Sugumar et al., 2018; Yen et al., 2018). Videos were the most preferred format of content, which is unsurprising given that videos are a highly engaging and interactive format of content that can effectively convey complex information in an easy-to-understand manner (Banmeke et al., 2021). Videos have been found to be effective in promoting learning and retention among agricultural stakeholders (Wickman et al., 2021), and they can be easily shared and accessed on social media platforms. Extension officers can leverage videos to demonstrate farming techniques, showcase success stories, and provide updates on current agricultural practices.

Images were the second most preferred format of content, with 18% of extension officers willing to share and access image-based content. Images are an effective tool for conveying information, especially when used in conjunction with text or as part of a larger multimedia campaign. Images can be used to demonstrate agricultural practices, showcase product offerings, or to capture the attention of audiences in a

visually appealing way. Furthermore, images can be easily shared and accessed on social media platforms, making them an ideal format for disseminating information to a wider audience.

Livestreams were the third most preferred format of content, with 16% of extension officers willing to share and access livestreams. Livestreams are an emerging trend in social media marketing, allowing extension officers to broadcast live videos to their audiences in real-time (Meisner & Ledbetter, 2022). Livestreams can be used to provide updates on current events, answer questions in real-time (Muthuprasad et al., 2021).

Infographics and text were the least preferred formats of content, with 14% of extension officers willing to share and access each of these formats. Infographics are a visual representation of information that combines images, text, and graphics to convey complex information in an easily digestible format. Infographics can be used to demonstrate trends, statistics, or to showcase product offerings. While infographics are less preferred compared to videos or images, they still have the potential to effectively communicate information to audiences. Text, on the other hand, is the least preferred format of content. Text-based content can be less engaging compared to multimedia formats and may not be as effective in promoting knowledge acquisition and retention (Lochner et al., 2021).

4.6. CHAPTER SUMMARY

This chapter presented the descriptive results of a study conducted in the Limpopo Province of South Africa, focusing on the socio-economic features of farmers, social media platforms used, and social media needs for agricultural information dissemination. This chapter aimed to understand the use of social media by farmers and extension officers in addressing the challenges faced by farmers.

The findings revealed the importance of considering socio-economic factors like Age, gender, marital status, and education in designing interventions for farmers.

The findings from the study further revealed that WhatsApp is a popular social media platform among farmers, followed by Facebook and YouTube. WhatsApp’s popularity for information dissemination is attributed to its ease of use and cost-effectiveness. Farmers also widely use Facebook, primarily for connecting with peers and other stakeholders in the agricultural sector and participating in information-sharing groups.

The study also explored the timing of social media usage by farmers, indicating that they primarily use it during their free time at work and in the evening before they sleep.

The reasons farmers use social media platforms vary, with education and learning being the most common motivation. Farmers use social media to access information on various agricultural topics and connect with experts and peers.

For extension officers, WhatsApp and Facebook were the most used platforms for information dissemination, followed by YouTube, TikTok, Twitter, and Instagram. The study highlights the efficiency of WhatsApp for communication in remote areas and the ability of Facebook to create online communities.

Social media offer benefits such as increased access to agricultural information and markets but pose challenges, including misinformation, information accuracy and reliability, privacy, and security risks. The survey also revealed the types of information that farmers considered essential, such as crop production and management, livestock management, soil health and fertility. Farmers preferred video content, followed by images and text, indicating the importance of engaging and visually appealing formats. Additionally, the study examined the reasons behind the non-adoption of social media among farmers, including lack of interest, poor technology knowledge, privacy concerns, lack of internet access, and lack of time. To improve social media adoption rates, designing targeted campaigns, providing technology training programs, addressing privacy and security concerns, and ensuring affordable and reliable internet connectivity are crucial.

Farmers expressed satisfaction with traditional sources, but highlighted issues related to information quality, relevance, accessibility, and interaction with extension agents. Understanding the non-use of social media and challenges with traditional sources is essential for developing effective strategies to improve information access for farmers, enhancing productivity and income in the agricultural sector.

Extension officers can leverage these usage patterns when designing agricultural extension programmes, ensuring that information is shared when farmers are most likely to be active on social media. Targeted and context-specific approaches are needed to address the challenges of farmers in South Africa. Extension officers can use these insights to design programmes that provide relevant educational and informational content. YouTube and TikTok offer opportunities for extension officers

to share instructional videos and engage younger farmers. The usage patterns of extension officers align with the findings from previous studies.

CHAPTER FIVE

EMPIRICAL RESULTS: EFFECTIVENESS, SATISFACTION AND USE OF CURRENT SOCIAL MEDIA PLATFORMS FOR AGRICULTURAL INFORMATION DISSEMINATION

5.1. INTRODUCTION

This chapter discusses the results and discussions of the study. It aimed to explore the social media platforms used by farmers and extension officers, frequency of posting and accessing the platforms, and the effectiveness of Facebook, WhatsApp, and YouTube as communication tools in the agricultural sector. This study also sought to determine the level of satisfaction and efficacy among farmers and extension officers regarding social media platforms.

This chapter presents specific social media platforms farmers and extension officers commonly use. It then proceeds to show the study's results, including farmers' and extension officers' frequency of posting and accessing social media platforms and their preferences for specific platforms. It also examines the effectiveness of Facebook, WhatsApp, and YouTube as social media platforms in the agricultural sector using multinomial regression for socio-economic characteristics. It lastly analyses the level of satisfaction among farmers and extension officers regarding the use of these platforms.

5.2. FINDINGS FROM FARMERS

5.2.1. Descriptive results for the use of social media

a) How often do farmers post agricultural information on social media?

Social media platforms such as WhatsApp, Twitter, and Facebook have simplified ways for farmers to access and share information on modern technologies, weather forecasts, market prices, and other agricultural topics. However, the frequency with which farmers post information on social media is not precise.

Respondents were asked to indicate how often they posted agricultural information on social media. Figure 5.1 below presents the results of a survey conducted among farmers.

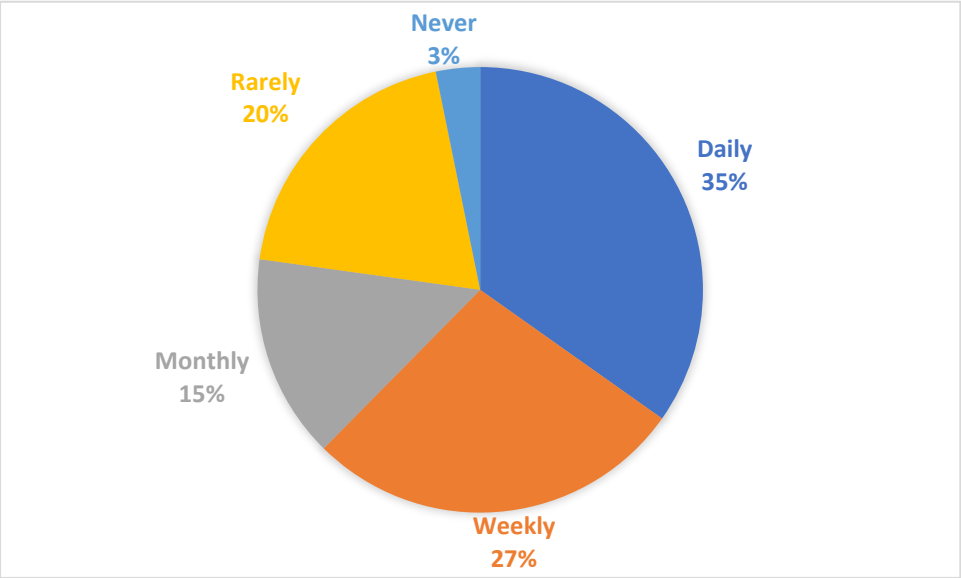


Figure 5.1: How frequently farmers post on social media.

Source: Research survey (2023)

The data on participants' posting frequency on social media indicates that 35% of the participants post on a daily basis, while 28% post weekly. A further 15% of the participants post on a monthly basis, 20% post rarely, and 3% reported that they never post on social media. The study shows that farmers are active on social media and use them frequently to share agriculture-related information. Bachhav (2012) agrees with these results and mentions that farmers need information on a daily basis as a necessity because they have access to mobile phones. In a health sciences study by Al-Qahtani et al. (2018), 95% of the participants used social media daily.

According to Casey et al. (2016), farmers access social media mostly on a daily basis followed by a weekly basis. Farmers rarely use social media to blog their farming activities (Rhoades & Aue, 2010).

Recent research has demonstrated that social media is an effective tool for sharing information and promoting agricultural development. A study by Chander, Thakur and Scientist (2018) found that social media platforms like WhatsApp and Facebook have

enabled farmers to access information on good agricultural practices, market prices, and weather forecasts. The study found that farmers who use social media were able to increase their yield and income compared to those who did not use social media.

Similarly, a study by Schoemaker et al. (2022) found that social media platforms like WhatsApp and Facebook effectively disseminate information to farmers. The study found that farmers who received information through social media were more likely to adopt modern technologies and practices than those who did not receive such information. The study also found that social media platforms effectively reached farmers in remote areas who may not have access to traditional extension services.

This survey's findings align with other studies, showing that farmers are active on social media and use them frequently to share information. Social media platforms can be advantageous for agricultural extension services and other stakeholders to contact farmers and share information on modern technologies, market prices, and weather forecasts. However, it is significant that not all farmers are active on social media, and those who are active may not post information frequently. A study by Kimani (2019) found that only a small percentage of farmers use social media for agricultural-related activities. The study found that lack of Internet access, inadequate skills, and lack of awareness were the main reasons why farmers do not use social media for agricultural-related activities.

b) How often do farmers access agricultural information on social media?

The ease of access to social media platforms has made it easier for rural farmers to access this information and communicate with other farmers and experts in the agriculture industry. Respondents were asked to indicate how often they accessed agricultural information on social media. The results are presented in Figure 5.2.

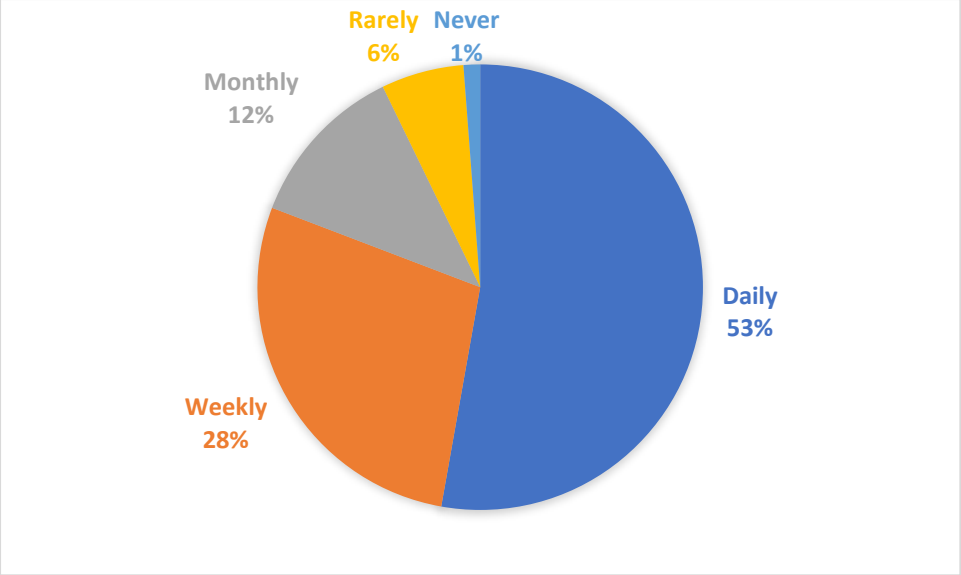


Figure 5.2: How frequently farmers access social media.

Source: Research survey (2023)

The data illustrates that the majority of participants, specifically 132 individuals accounting for 53% of the total, access social media on a daily basis. Additionally, 70 participants, constituting 28% of the sample, access social media weekly. Furthermore, 30 participants (12%) access social media monthly, while 15 (6%) do so rarely. There are also 3 individuals (1%) who reported never accessing social media. In addition, agricultural extension services and other stakeholders can use social media platforms to inform farmers about agricultural practices, technologies, and innovations. By doing so, they can reach many farmers quickly and easily.

The findings of this study were also in line with previous studies conducted in the same field. For instance, a survey conducted by Gray et al. (2020) found that farmers accessed social media at least once a day to obtain information on crop management techniques, pest control, and marketing. Similarly, another study by Khou and Suresh (2018) found farmers used social media platforms such as WhatsApp and Facebook to access daily agricultural information. Lastly, Sherpaw et al. (2022) revealed that farmers rely use social media due to their high cost and poor network service in their areas.

c) The benefits of social media platforms for farmers

Social media provide an interactive platform for farmers to share ideas, knowledge, and experiences. They also offer a cost-effective way of disseminating information to

a large audience. However, the benefits of social media for farmers have not been fully realised. The respondents were asked to identify the benefits of social media platforms. The results are presented in Table 5.1.

Table 5.1: The benefits of using social media for farmers.

Benefit of SM	Freq.	Percent (%)
Increased reach	64	26
Cost-effectiveness	42	17
Real-time communication	56	22
Information dissemination	58	23
Collaboration	30	12
Total	250	100

Source: Research survey (2023)

Table 5.1 shows 26% of the respondents identified increased reach as a benefit, while 17% highlighted cost-effectiveness. Additionally, 22% perceived real-time communication as a benefit, and 23% noted information dissemination. Furthermore, 12% mentioned collaboration as a benefit of using social media. These findings suggest that farmers recognize various advantages of using social media, including increased reach, cost-effectiveness, real-time communication, information dissemination, and collaboration.

The study's results resonate with those of previous literature highlighting the potential benefits of social media for farmers. (Tambo et al. (2019) states that the use of technology enabled extension enables extension officers to reach many farmers at the same time. Additionally, Akasse et al. (2021) notes the advantage of social media as an enabling tool to reach a large audience. Access to agricultural information and knowledge is one of the primary benefits of social media for farmers. Social media allow farmers to access the latest agricultural news, research, and best practices. They are particularly important for the developing world, where access to agricultural information is limited. A study by Sandeep et al. (2022b) found that social media were an effective platform for disseminating agricultural information to farmers. The study concluded that extension officers can use social media platforms such as WhatsApp and Facebook to provide farmers with accurate agricultural information and improve their farming practices.

Social media provides an effective way for farmers to promote their products to a larger audience. A study by Pechrová et al. (2015); Zhang et al. (2021) found that social

media were an effective marketing tool for farmers. This study demonstrates that extension officers could utilize social media platforms such as Facebook and WhatsApp to promote agricultural product sales and increase farmers' income.

Social media provide farmers a platform to connect and share knowledge and experiences with other farmers. (Joshi and Dhaliwal (2019) found that social media platforms such as WhatsApp and Facebook were effective for communication and knowledge sharing among farmers. Social media provide farmers with a platform to access up-to-date weather information, which is critical for making informed decisions about crop management. Patel et al. (2020) found that social media platforms such as WhatsApp and Twitter effectively disseminate weather information to farmers.

Networking with other stakeholders is another benefit of social media for farmers. Social media provide farmers with a platform to connect with other stakeholders, such as agricultural extension workers, researchers, and policymakers. Pandey and Dubey (2020) found that social media platforms such as WhatsApp and Facebook effectively connected farmers with agricultural extension workers and researchers in India.

5.2.2. Variance Inflation Factor (VIF)

Testing for both Variance Inflation Factor (VIF) and heteroskedasticity are necessary diagnostic tests in regression analysis that help to ensure the validity of the results obtained from the regression model. The VIF measures the degree of multicollinearity between predictor variables in the model. When there is high multicollinearity, it can be difficult to distinguish the different effects of each predictor variable on the outcome variable, leading to unstable and unreliable regression coefficients. Therefore, checking for high VIF values is essential to ensure that the high multicollinearity does not affect the model.

Table 5.2: A table summarising the Variance Inflation Factor (VIF) results.

Variable	VIF	**1/VIF**
Salary income	1.56	0.640
Income	1.50	0.665
Farming income	1.24	0.808
Age	1.16	0.864

Gender	1.14	0.875
Marital status	1.13	0.884
Qualification	1.10	0.909
Language	1.06	0.941
Family members	1.04	0.961
Mean VIF	1.20	

Source: Research survey (2023)

This table above shows the VIF and 1/VIF values for each variable in the model. VIF measures how much each variable is related to the other variables in the model, with higher values indicating more relationships. A high VIF value can make it difficult to see the individual effects of each variable. A mean VIF of 1.20 shows no significant multicollinearity in the model, which means that each variable is independent and can be analysed separately. In other words, the results from this model are reliable and can be trusted.

Table 5.3: The Breusch-Pagan/Cook-Weisberg test result for heteroscedasticity of farmers in the five districts of Limpopo Province for information dissemination. (420)

Variable	$X^2(1)$	Prop > X^2	Tabulated X^2 value
Effect Facebook	0.58	0.4455	3.841

Source: Research survey (2023)

In contrast, heteroskedasticity refers to a situation where the variance of the residuals is not constant across different values of the predictor variables. This can result in biased and inconsistent standard errors of the regression coefficients, which can lead to the validity of statistical inferences made from the regression model. By testing for heteroskedasticity, we can determine if the assumption of constant variance of the residuals is breached and take appropriate steps to rectify it, such as using robust standard errors or transforming the data. According to Table 5.3 above, there was no heteroscedasticity since the calculated $\chi 2$ value (0.58) was smaller than the tabulated $\chi 2$ value (3.841) at the 5% significance.

5.2.3. Model estimates for Multinomial logit model (MLRM)

With the advent of smartphones and inexpensive Internet data, social media platforms such as WhatsApp, Facebook, Instagram, TikTok, Twitter, and YouTube have become increasingly accessible to individuals in various sectors, such as agriculture. This study investigated factors that affect the use of social media platforms for farming purposes, focusing on farmers in a particular district. The study utilised a multinomial logit (mlogit) model to analyse the relationship between the use of social media platforms and several socioeconomic factors such as income, language, family members, qualification, age, marital status, gender, and district. The empirical results of the mlogit model are presented in Table 5.2 below, with significance levels denoted by *t* statistics in parentheses.

Table 5.4: Multinomial Logistic Regression Model (MLRM) for sampled farmers in the five districts of Limpopo Province (n=420).

	WhatsApp	Facebook	Instagram	TikTok	Twitter	YouTube
Income	-0.174 (-1.79)	0.172 (1.82)	0.099 (0.82)	0.181 (1.78)	0.246* (2.09)	0.243* (2.53)
Language	-0.440*** (-3.72)	0.351*** (3.30)	0.365** (2.94)	0.164 (1.51)	0.496*** (4.17)	0.259* (2.50)
Family members	-0.073 (-1.72)	-0.015 (-0.37)	0.108 (2.08)	0.022 (0.50)	0.016 (0.31)	0.017 (0.41)
Qualification	-0.221* (-2.38)	0.227 (2.40)	0.215 (1.68)	0.110 (1.08)	0.245 (1.95)	0.070 (0.74)
Age	0.026*** (3.38)	-0.030*** (-3.82)	-0.026 (-2.58)	-0.008 (-0.99)	-0.027** (-2.67)	-0.022** (-2.81)
Marital status	-0.033 (-0.38)	0.022 (0.26)	0.124 (1.14)	0.134 (1.45)	0.211* (1.96)	0.005 (0.06)
Gender	0.755*** (3.26)	-0.488* (-2.16)	0.317 (1.09)	-0.328 (0.174)	-0.322 (-1.6)	0.027 (0.12)
Constant	**-0.062 (-0.09)**	**-0.229 (-0.32)**	**-4.112*** (0.984)**	**-1.807* (-2.33)**	**-3.133*** (-3.35)**	**-1.533* (-2.11)**
Observations	**420**	**420**	**420**	**420**	**420**	**420**
Pseudo R2	**0.118**	**0.0977**	**0.091**	**0.034**	**0.127**	**0.056**
t statistics in parentheses * p<0.05, ** p<0.01, *** p<0.001						

Source: Research survey (2023)

a) WhatsApp

The multinomial logistic regression results indicate that language, qualification, age, and gender significantly and more likely influence farmers' use of WhatsApp for agricultural information dissemination. However, access to WhatsApp and other mobile technologies remains limited in many areas due to language barriers and are less likely to influence farmer's use of WhatsApp.

- Language

Language was a significant predictor, with those who spoke the local language being less likely to use WhatsApp than those who did not ($p < 0.001$). This finding is based on past research that suggest that language is an important factor in farmers' access to information and their ability to understand and use technology (Krell et al., 2021).

In a recent study by Sherpaw et al., (2022), language proved a significant predictor of WhatsApp use among farmers in a rural area of Afghanistan . Specifically, those who spoke the local language were less likely to use WhatsApp than those who did not.

The importance of language in farmers' access to information is acknowledged in previous research. For example, Anwas et al. (2020) found that language was critical in determining the effectiveness of agricultural extension services. The study found that farmers who received information in their local language were more inclined to adopt improved agricultural practices than those who received information in a foreign language. Similarly, a study by Krell et al. (2021) found that language barriers were a significant obstacle to accessing agricultural information through mobile phones in Pakistan.

- Educational Qualification

The role of education in farmers' adoption of technology is widely recognised in literature. In the current study's context, education significantly predicted WhatsApp use for agricultural information dissemination. Specifically, farmers with lower levels of education were less likely to use WhatsApp than those with higher levels of education. This finding is similar with previous research showing that education is crucial to farmers' technology adoption. For example, Kanjina (2021b) found that farmers with higher education levels were likelier to adopt modern technologies such as mobile phones for agricultural information dissemination. The study suggested that education played a critical role in farmers' ability to understand and use technology effectively. Similarly, Busungu et al. (2019) found that education significantly predicted farmers'

use of mobiles for agricultural information dissemination in Pakistan. Language barriers, as discussed in the previous paragraph, may also limit farmers' ability to use WhatsApp for agricultural information dissemination.

- Age

The role of age in technology adoption is recognised in literature. In this current study, age was a significant predictor of WhatsApp use for agricultural information dissemination, with older farmers being more likely to use the platform than younger farmers. This finding is compatible with previous research suggesting that younger people are more likely to adopt and utilise technology.

For example, Subashini and Fernando (2018) found that younger people were likelier to use mobile phones for banking and other services than older people. The study suggested that younger people were more comfortable with technology and open to using it to meet their needs. Similarly, a survey by Kanjina (2021a) found that younger farmers were more likely to adopt modern technologies, like smart phones and social media, for agricultural information dissemination.

- Gender

The role of gender in technology adoption has been the subject of investigation for many years. In the current study, gender was a significant predictor of WhatsApp use for agricultural information dissemination, with male farmers being more likely to use the platform than female farmers. This finding is coherent with earlier research showing that women in rural areas have less access to and use technology than men.

Rola-Rubzen et al. (2020) found that women in rural areas face multiple barriers to accessing and using technology, including limited access to education, lower levels of income and financial resources, and cultural and social norms that limit their mobility and opportunities to participate in public life. As a result, women are denied the benefits of technology, including improved access to information, markets, and services.

b) Facebook

Facebook has become a beneficial tool for businesses and marketers looking to reach potential customers. The study focused on Facebook usage based on language, age, and gender. The study analysed a multinomial logit table to identify the factors affecting Facebook usage below.

- Language

Language is a significant factor in determining Facebook usage. The mlogit table indicates that language has a significant negative effect on WhatsApp usage (-0.440, $p<0.001$) but a significant positive effect on Facebook usage (0.351, $p<0.001$) and Instagram usage (0.365, $p<0.01$). These findings suggest that people who speak specific languages other than English are more likely to use Facebook over other social media platforms.

One explanation for this trend is that Facebook has been available in multiple languages since 2008, which has made it more accessible to people from different regions. This has allowed Facebook to expand its user base beyond English-speaking countries. Moreover, Facebook and Instagram have features such as translation options that enable users to communicate in their preferred language.

- Age

Age is another crucial factor that affects Facebook usage. The mlogit table shows that age has a significant positive effect on WhatsApp usage (0.026, $p<0.001$) but a significant adverse effect on Facebook usage (-0.030, $p<0.001$) and Twitter usage (-0.022, $p<0.01$). These findings suggest that younger people are more likely to use WhatsApp over Facebook and Twitter. Younger people prefer private messaging over public social media platforms. Moreover, younger people are likely to be early adopters of modern technology. They may choose newer social media platforms such as TikTok over Facebook.

- Gender

Gender is another factor that affects Facebook usage. The mlogit table indicates that gender has a significant positive effect on WhatsApp usage (0.755, $p<0.001$) but a significant adverse effect on Facebook usage (-0.488, $p<0.05$). These findings propose that females are more likely to use WhatsApp over Facebook than males in the study. Additionally, research has shown that females tend to be more concerned about their online privacy and security than males (Lee et al., 2019), which could explain their preference for messaging apps like WhatsApp.

c) Instagram

Instagram is a social media platform allowing users to share photos and videos Instagram’s popularity is due to its user-friendly interface, ease of use, and various

features, such as filters and stories, which allow users to edit and share their content. Instagram's user base is diverse and includes people of all ages, genders, and backgrounds. This section discusses Instagram based on language and district, using the multinomial logit table provided.

- Language

The mlogit table shows that language significantly affects Instagram usage ($p<0.001$). Specifically, the coefficient for language is 0.365, which means that for every one-unit increase in language, the odds of using Instagram increase by a factor of 1.44. Rathje et al. (2021) proffered that language is a significant predictor of social media usage.

People who speak the same language tend to share common interests and cultural norms. As a result, they are more likely to use social media platforms catering to their language and cultural preferences. Like many other social media platforms, Instagram has features tailored to specific languages and cultures. For example, Instagram allows users to search for content by language and offers language-specific filters and hashtags.

d) TikTok

Social networking platforms such as TikTok for information dissemination have gained increasing attention in recent years, particularly in the agricultural sector. This study investigated the use of TikTok among farmers for information dissemination. The results indicate that the coefficient for TikTok is not statistically significant at the significance levels (i.e., $p>0.05$), suggesting that TikTok has no statistically significant relationship with the variables. However, it is essential to note that the significance of a variable is context-dependent and is influenced by sample size. Previous studies have shown that social media platforms such as Facebook and Twitter have been valuable tools for farmers to obtain and share information, improving agricultural productivity and income (Mills et al., 2019; Sinpeng, 2021). Additionally, research has indicated that TikTok has the potential to be an effective platform for information dissemination in other fields, such as health and education (Song et al., 2022).

Therefore, this study did not find a significant relationship between TikTok and the outcome variable; TikTok could be a significant predictor in other models or under different contexts.

e) Twitter

Twitter has become an essential platform for agricultural information dissemination, political figures, and individuals to connect with their audiences and share ideas. However, not all Twitter users are the same. Differences in income, language, age, and marital status can all impact how people use the platform and engage with content. To better understand these dynamics, this study was conducted on a sample of farmers to explore the relationships between these variables and Twitter use. The results of this study, presented in a mlogit table above, provide insight into how income, language, age, and marital status influence Twitter use and may be helpful for businesses and other organisations looking to tailor their social media strategies.

- Income

The multinomial logit analysis conducted in this study shows that higher-income farmers are more likely to use Twitter for information dissemination than those with lower incomes. This finding could be because higher incomes enable farmers to afford the necessary technological devices and Internet connectivity to access Twitter. In contrast, lower-income farmers are less likely to access Twitter due to the prohibitive cost of devices and internet connectivity. Furthermore, the study's findings suggest that income may also influence the type of information disseminated through Twitter. Anang et al. (2020) conducted a survey showing a positive relationship between income and technology adoption among farmers. Higher-income farmers were more likely to share information on crop management, marketing, and financing topics. In contrast, lower-income farmers were likely to share information on basic farming techniques and practices than high-income farmers. This difference may be because higher-income farmers have access to more resources and knowledge, enabling them to engage in more complex farming practices and marketing strategies.

- Language

Language is a critical factor that can impact farmers' use of social media platforms such as Twitter for information dissemination. According to the mlogit analysis, farmers who speak languages other than English are likely to use Twitter, suggesting that language may be a barrier to accessing and sharing agricultural information.

Sennuga (2020) studied the impact of language on smallholder farmers' access to agricultural information, found that language was a significant barrier to accessing information. The study showed that farmers who spoke minority languages had limited

access to agricultural extension services online and were less likely to access agricultural information through mainstream media outlets, which are in English. Incorporating local languages into agricultural extension programmes is vital to ensure that all farmers can access relevant information with the language they can better understand. The findings of the mlogit analysis conducted in this study support the notion that language can be a significant barrier to accessing and sharing agricultural information.

- Age

Age is a crucial factor that impacts farmers' adoption of modern technologies and their use of social media platforms such as Twitter for information dissemination. The mlogit analysis conducted in this study indicates that older farmers are less likely to use Twitter than younger farmers. According to Adams et al. (2021), age is a significant determinant of technology adoption among farmers. The study showed that younger farmers were more likely to adopt modern technologies, including social media platforms, than older farmers. Antwi-Agyei and Stringer (2021b) note that older farmers often lack the necessary technological skills, education, and cognitive abilities needed to use these platforms effectively. Similarly, a study by Thar et al. (2021) on social media adoption among smallholder farmers found that older farmers were less likely to use social media for agricultural purposes than younger farmers. The authors attributed this to the low level of technological literacy among older farmers. However, older farmers may face challenges in using Twitter due to limited technological skills and education, which can make it more difficult for them to navigate the platform effectively.

- Marital status

Marital status is a crucial factor that can impact farmers' use of Twitter for information dissemination. The mlogit analysis conducted in this study suggests that married individuals are more likely to make use of Twitter than unmarried individuals.

Wang et al. (2020) found that social networks and support systems are essential factors that influence technology adoption among farmers. The study showed that farmers with strong social networks and support systems were more likely to adopt modern technologies, including social media platforms than those with weak social networks. The authors noted that social networks and support systems provide

farmers with the information, resources, and guidance needed to adopt and use modern technologies effectively. Furthermore, research has shown that marital status can impact the adoption of technology, with married individuals being more likely to adopt modern technologies than unmarried individuals (Roh & Park, 2019). This may be because married individuals often have more stable and predictable lifestyles, making it easier for them to adopt and use modern technologies effectively.

f) YouTube

Multinomial logistic regression is a statistical analysis method used to investigate the relationship between a categorical dependent variable with three or more categories and multiple independent variables. In this study, the outcome variable was YouTube usage, while the predictor variables were language, income, family members, qualifications, age, marital status, gender, and district. This section only presents results on income, language, age, and district as the only significant variables according to the model.

- Income

The results of the mlogit analysis conducted in this study shows that income has a positive and significant relationship with the use of YouTube for information dissemination. Individuals with higher income are more likely to use YouTube than those with lower incomes. This finding is similar to earlier studies which show that income is a significant factor in adopting modern technologies. For instance, a survey by Quandt et al. (2020) found that higher incomes were positively associated with the adoption of mobile phones among smallholder farmers. Similarly, income significantly predicted the adoption of precision agriculture technologies amongst farmers in different areas (Acevedo et al., 2020; Anang et al., 2020).

The positive relationship between income and technology adoption may be attributed to several factors. First, higher-income individuals are more likely to have access to the necessary resources to acquire and use technology. This includes access to devices like smartphones, laptops, and computers and the connectivity of the Internet required. Second, higher-income individuals may have more education and technological skills, making adopting and using modern technologies easier.

- Language

The role of language in influencing technology adoption, including the use of social media platforms like YouTube, has been a topic of interest in recent years. The results of the mlogit analysis conducted in this study indicate that language has a positive and significant relationship with the use of YouTube for information dissemination. This discovery is coherent with earlier studies that show that language can be a barrier to accessing and sharing agricultural information. For instance, a survey by Naab et al. (2019) found that language can be a significant challenge for smallholder farmers, limiting their access to information and extension services. Similarly, a study by Ogunnaike et al. (2021) found that language barriers can hinder the adoption of agroforestry technologies among farmers in Malawi. The positive relationship between language and technology adoption may be attributed to several factors. First, individuals who speak languages other than English are less likely to access information from mainstream media outlets, mainly in English. YouTube, however, offers a platform for accessing information in different languages, thus reducing language barriers for farmers. Second, individuals who speak languages other than English may have more specific information needs not addressed by mainstream media. With its diverse range of content, YouTube can offer a more customised and targeted source of information.

- Age

The mlogit analysis conducted in this study indicates that older farmers are less likely to use Twitter than younger farmers. The finding that older individuals are less likely to use YouTube than younger individuals is consistent with previous research on technology adoption. Studies have shown that younger people are more likely to adopt modern technologies than older people (Antwi-Agyei & Stringer, 2021b). The cause may be several factors, including differences in attitudes towards technology, access to resources and support systems, and cognitive abilities.

Older individuals may be less familiar with the platform and its features than the younger ones. Sometimes, farmers do not know how to search for and access relevant content or create and upload videos themselves. This outcome may be complicated because YouTube's interface can be complicated for some users, especially those unfamiliar with digital technologies (Alvarado et al., 2020). Moreover, older people may have different information needs and preferences than younger people, influencing their choice of information sources. For example, older people may prefer more

traditional forms of information, such as print media or television, over digital platforms like YouTube. They may also be more likely to seek information from trusted sources, such as family members or healthcare providers, rather than relying on online sources (Zhao et al., 2023).

5.3. FINDINGS FROM EXTENSION OFFICERS

5.3.1. Descriptive results for the use of social media

a) Social media platforms used by extension officers

Social media platforms are an efficient tool for communicating and engaging with clients, which is especially important for extension officers who are tasked with providing information and support to farmers and other stakeholders in the agriculture sector. In this regard, Figure 5.3 provided gives an overview of the social media platforms used by extension officers for information dissemination.

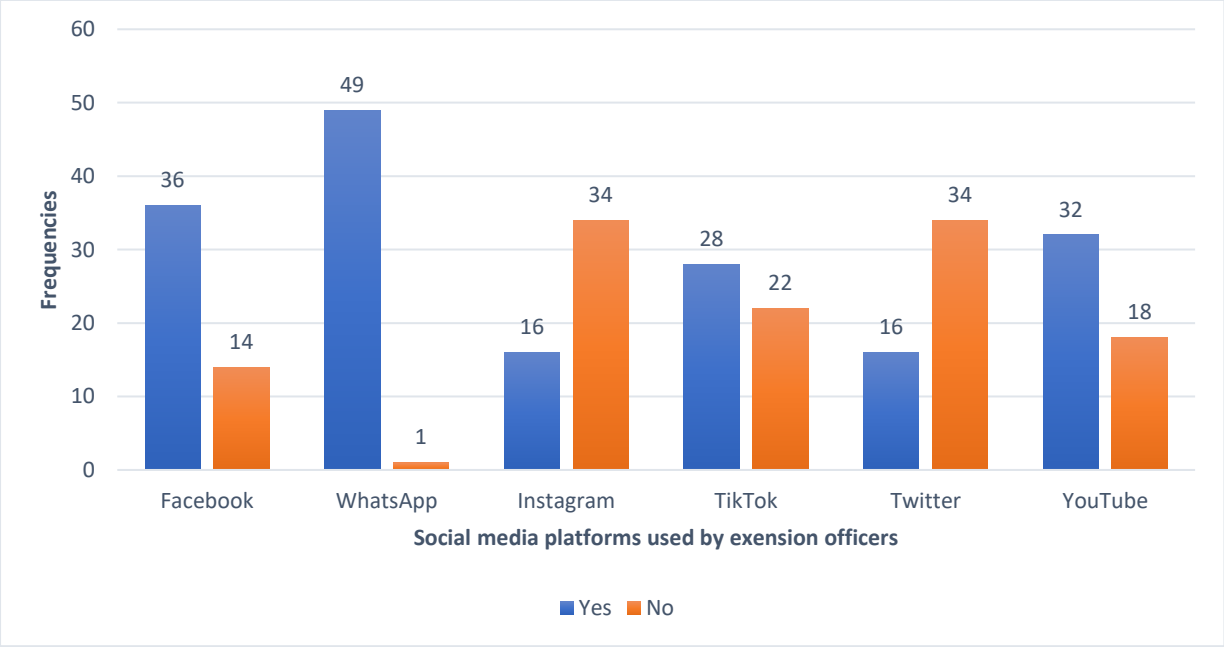


Figure 5.3: Social media platforms used by extension officers.

Source: Research survey (2023)

The results indicate that WhatsApp has the highest usage rate among extension officers, with 49 respondents reporting that they use this platform for information dissemination. Facebook and YouTube also have a high usage rate, with 36 and 32 of extension officers saying that they use these platforms, respectively. In contrast,

Instagram, Twitter, and TikTok have lower usage rates, with only 16, 16, and 28 of extension officers reporting that they use these platforms, respectively.

The high usage of WhatsApp and Facebook, by extension officers, can be attributed to the ease of use and accessibility of these platforms (Nyarko & Kozári, 2021). These social media platforms provide a straightforward way for extension officers to communicate and share information with farmers and other interested parties in the agricultural sector. A study conducted by Ghosh et al. (2019) also found that WhatsApp was the most popular social media platform used by farmers for seeking agricultural information (Chander, Thakur, & Chander, 2018; Kesherwani et al., 2022).

The popularity of YouTube and TikTok among extension officers suggests a growing trend towards the use of video content in agricultural extension services. This trend is in line with previous studies that have shown that video content is an effective tool for communicating complex agricultural concepts to farmers (Wilmes & Swenson, 2019). Video content is also an effective way to increase engagement and retention of information among audience (Yee et al., 2020). According to a study by Tambade et al. (2019), YouTube is the most used social media platform for educational purposes in the agricultural sector.

The low usage of Instagram and Twitter, by extension officers, can be attributed to the fact that these platforms are primarily used for personal or leisure purposes rather than professional purposes. However, there is potential for extension officers to utilise these platforms to reach a wider audience and engage with farmers and stakeholders in a more interactive manner. For example, Twitter can be used to share real-time updates on weather conditions, pest outbreaks, and other relevant information, while Instagram can be used to highlight success stories and visual representations of agricultural practices. A study by Tao et al. (2020) found that Instagram was an effective platform for increasing the visibility of agricultural products and building brand awareness among consumers.

The use of social media platforms facilitates the development of networks and collaborations among extension officers, farmers, and other stakeholders in the agricultural sector (Munthali et al., 2021). This can lead to the exchange of ideas and knowledge and the establishment of new opportunities for innovation and growth in the sector. The use of social media platforms can also help to bridge the digital divide

and reduce information asymmetry between different actors in the agricultural value chain (Baumüller et al., 2023).

One major challenge is the lack of access to reliable Internet services in some rural areas, which can limit the stretch and effectiveness of social media platforms (Chander, Thakur & Chander, 2018). In addition, there are concerns about the quality, relevance, timeliness and accuracy of information shared on social media platforms, which can have negative implications for farmers and other interested parties in the agricultural sector (Khan & Idris, 2019).

The use of social media platforms by extension officers for information dissemination is a promising approach to improving effectiveness and efficiency of agricultural extension services.

b) How often do extension officers post agricultural information on social media?

The frequency with which extension officers post agricultural information on social media platforms is a crucial factor in determining the effectiveness of their outreach efforts. The respondents were asked to indicate how often the post agricultural information on social media. The results are presented in Figure 5.4.

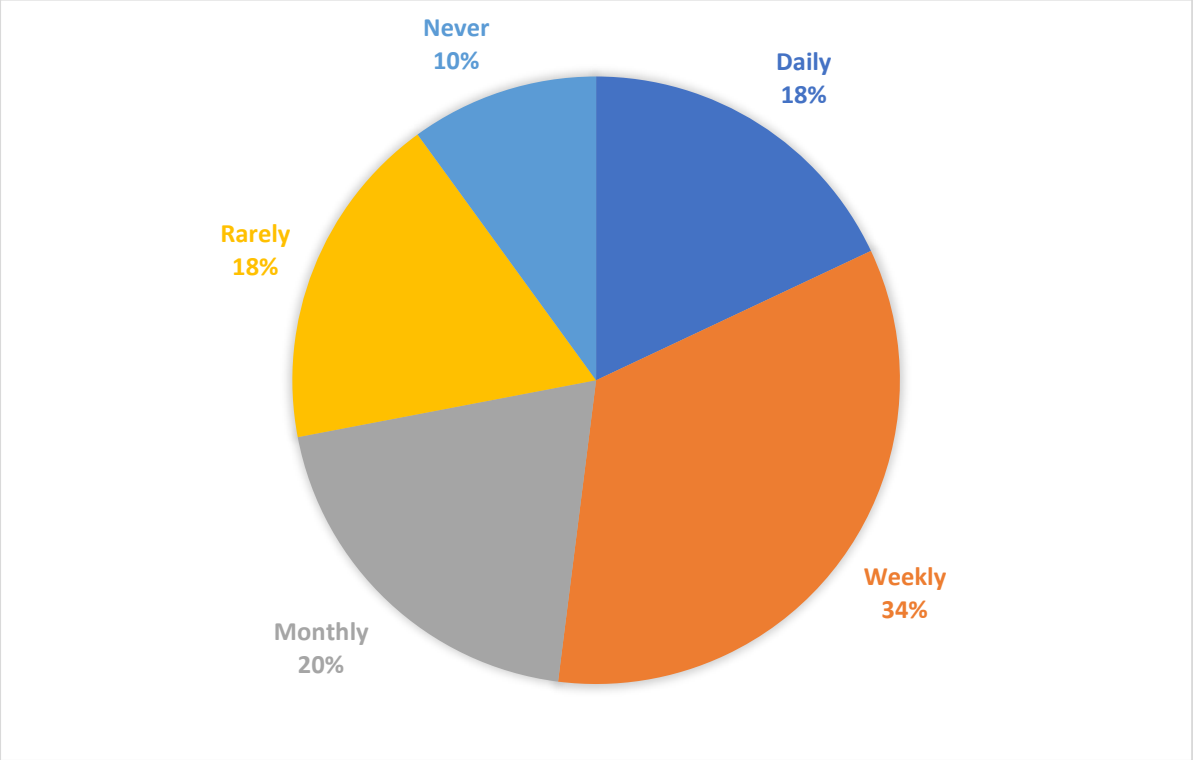


Figure 5.4: How often do extension officers post agricultural information?

Source: Research survey (2023)

The results in Figure 5.4 suggest that the majority of extension officers post information on a weekly basis (34%), followed by those who post daily (18%) and lastly, 20% posting monthly. This indicates that there is a consistent flow of information being shared on social media platforms, which is crucial for keeping farmers and other stakeholders engaged and informed.

The finding that 20% of extension officers post information monthly suggests that there may be room for improvement in terms of the frequency of their outreach efforts. Research has shown that frequent communication is critical to building trust and credibility with stakeholders in the agricultural sector (Fernandes et al., 2019). Therefore, extension officers may need to consider increasing the frequency of their posts to maintain engagement and build stronger relationships with their audience.

It is also worth noting that 18% of extension officers reported posting information on social media platforms rarely. This could be for a variety of reasons, including a lack of time, resources, or technological knowledge. However, it is essential for extension officers to recognise the potential benefits of social media outreach and to try to overcome any barriers that may be preventing them from utilising these platforms effectively.

The fact that 10% of extension officers reported never posting information on social media platforms is concerning, as it suggests that some officers may not fully recognise the potential benefits of these platforms for agricultural extension services. Social media platforms have been shown to be practical tools for disseminating agricultural information to farmers and other stakeholders (Mamgain et al., 2020), and can help to bridge the gap between research and practice in the agricultural sector.

c) How often do extension officers access agricultural information on social media?

Respondents were asked to indicate how often they accessed agricultural information on social media platforms. The results are presented in Figure 5.5.

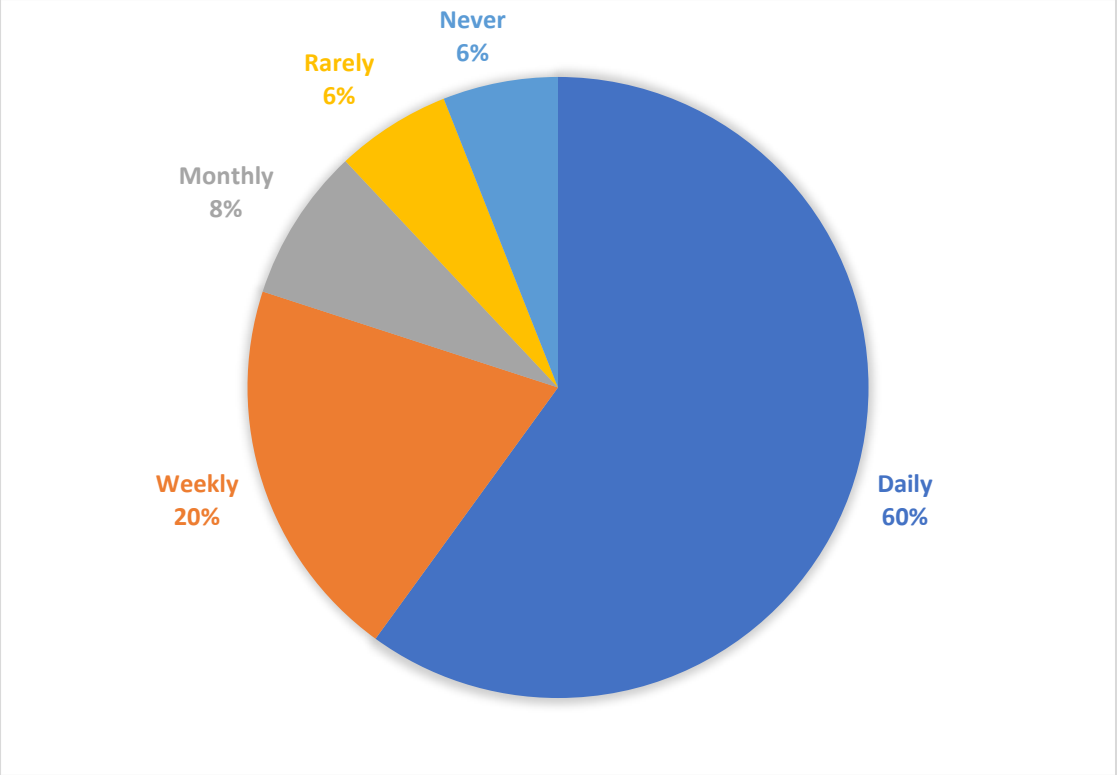


Figure 5.5: How often do extension officers access agricultural information?

Source: Research survey (2023)

Out of the fifty extension officers surveyed, 60% reported accessing agricultural information on social media platforms daily, while 20% reported accessing the information on a weekly basis. Only 8% reported accessing the information monthly, while 6% reported rarely accessing the information, and another 6% never accessing it.

The high percentage of extension officers who access agricultural information on social media platforms daily is a clear indication of the increased importance of these platforms as sources of information for agricultural extension services. The conclusion is similar with previous studies that have shown the increasing role of social media in agriculture information dissemination and extension services (Wang et al., 2020). The ease of accessing social media platforms, as well as the availability of a diverse range of agricultural information, are some of the reasons why extension officers use these platforms for information access.

The high frequency of access to social media platforms for agricultural information among extension officers highlights the potential of these platforms as effective tool

for agricultural extension services. Extension officers can use social media platforms to disseminate agricultural information to a large audience, including farmers and other stakeholders. Social media platforms can also be used to reach a wider audience and provide real-time updates on issues such as weather conditions, pest outbreaks, and other relevant information.

The finding that only a small percentage of extension officers accessed agricultural information on social media platforms on a monthly or periodic basis is an indication of the growing importance of these platforms as sources of information for agricultural extension services. This discovery is like other studies that have shown that the frequency of social media use for agricultural information is associated with the level of education and awareness of extension officers (Mubofu & Watson, 2020; Nyarko & Kozári, 2021). Extension officers with a higher level of education and awareness are more likely to use social media platforms for agricultural information dissemination and extension services. It is essential for extension officers to consider the preferences and desires of their target audience when selecting which platforms to use.

d) The benefits of social media platforms for extension officers

Respondents were asked to identify the benefits of social media platforms. The results are presented in Table 5.5.

Table 5.5: Benefits of social media platforms for extension officers

Benefit	Freq.	Percent (%)
Increased reach	5	10.00
Cost-effectiveness	3	6.00
Real-time communication	8	16.00
Information dissemination	21	42.00
Collaboration	13	26.00
Total	50	100.00

Source: Research survey (2023)

The high percentage of extension officers (42%) who reported that social media platforms are helpful for information dissemination is not surprising. Social media platforms such as Twitter, Facebook, and WhatsApp have been widely used to disseminate agricultural information to farmers and other stakeholders (Verma & Rani, 2023). According to Paudel and Baral (2018), social media platforms offer a cost-

effective way to disseminate information and reach a large audience. This is particularly important for extension officers who often have limited resources and face challenges in getting farmers in remote areas.

Real-time communication is also an essential benefit of using social media platforms for agricultural information. Real-time communication allows for quick and efficient responses to inquiries and enables extension officers to provide timely and accurate information to farmers (Deodhar & Mathur, 2019; Ndimbwa et al., 2021). This is important in situations where farmers may need urgent assistance, such as during crop emergencies or disease outbreaks.

Collaboration is another benefit of using social media platforms for agricultural information. Social media platforms provide a platform for extension officers to collaborate with other stakeholders in the farming sector, such as researchers, policymakers, and other extension officers. This can lead to the exchange of best practices and the development of innovative solutions to challenges in the industry.

The low percentage of extension officers who reported cost-effectiveness as a benefit of using social media platforms for agricultural information is surprising. However, it is possible that some extension officers may not be aware of the cost savings associated with using social media platforms or may not have the necessary resources to use these platforms effectively.

Increased reach was reported by 10% of extension officers as a benefit of using social media platforms for agricultural information. This is a low percentage, but it is still a significant benefit. Social media platforms have the potential to reach out to a large and diverse audience, including farmers in remote areas (Nwakwuo & Benson, 2021). This can be particularly important for extension officers who are looking to engage with hard-to-reach populations.

5.3.2. Effectiveness of social media platforms

The use of social media platforms for agricultural information is increasing rapidly, and the effectiveness of social media has been recognised as a valuable tool for agricultural extension officers. Respondents were asked to rate the effectiveness of social media platforms. The results are presented in Figure 5.6.

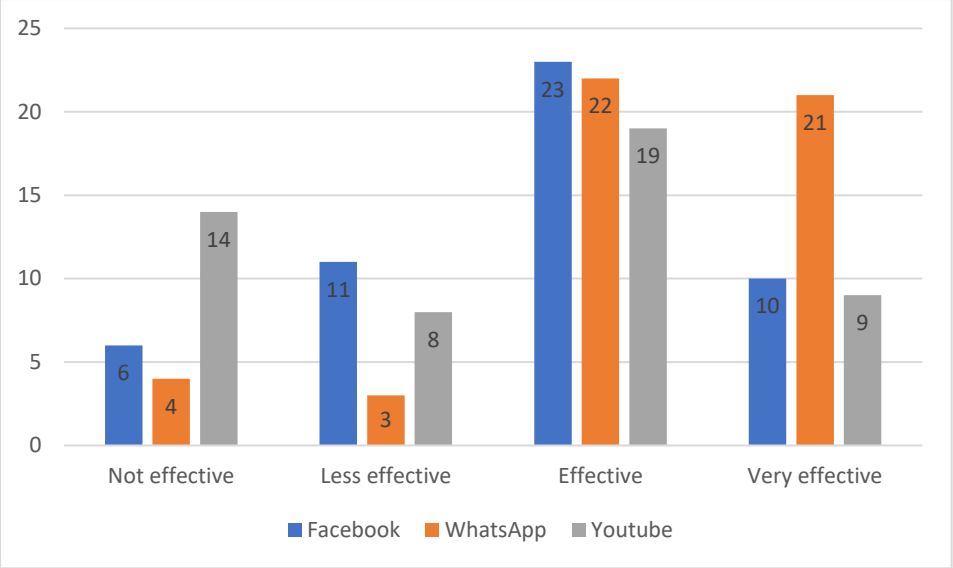


Figure 5.6: The effectiveness of social media platforms

Source: Research survey (2023)

Figure 5.6. presents data on the effectiveness of social media platforms for agricultural information among extension officers. The effectiveness is measured based on the respondents' opinions, who classified the platforms as ineffective, ineffective, or amazingly effective.

Looking at the figure above, most respondents found Facebook to be an effective platform for agricultural information, with twenty-three respondents classifying it as effective and ten as amazingly effective. On the other hand, WhatsApp was perceived as the most effective platform by respondents, with twenty-two categorising it as effective and twenty-one as surprisingly effective. In contrast, YouTube was the least effective platform for agricultural information among extension officers, with nineteen managing it as effectively and only nine as remarkably effective.

The effectiveness of social media platforms for agricultural information can be attributed to several reasons. Firstly, social media platforms allow extension officers to reach a wider audience efficiently and cost-effectively (Isaya et al., 2018). With more social media users globally, it is easier for extension officers to reach a vast audience with minimal cost compared to existing traditional methods such as radio and television (Mavhunduse & Holmner, 2019).

Secondly, social media platforms provide real-time communication, enabling extension officers to provide quick responses to questions and concerns raised by

farmers (Tsai et al., 2020). This real-time communication feature has been identified as one of the most crucial factors in the adoption of social media by extension officers.

Thirdly, social media platforms allow for collaboration and knowledge sharing among extension officers and other stakeholders in the agricultural sector (Alshehri, 2019; Liu, 2010). Through social media, extension officers can collaborate with other stakeholders to share knowledge, ideas, and best practices in agricultural production and management. This can lead to high productivity, better decision-making, and better management of resources. Facebook and WhatsApp are perceived as the most effective platforms, while YouTube is the least effective. The effectiveness of social media platforms can be attributed to their ability to reach a wider audience, provide real-time communication, and allow for collaboration and knowledge sharing among extension officers and other stakeholders.

5.4. CHAPTER SUMMARY

This chapter explored the use of social media among farmers and extension officers for agricultural purposes. The findings revealed that WhatsApp is the most widely used platform among farmers, followed by Facebook, while Instagram, Twitter, TikTok, and YouTube have varying degrees of usage. Farmers actively engage in posting agricultural information on social media platforms, with a significant proportion posting at least once a week. Farmers also access agricultural information on social media daily, highlighting its importance as a primary source of information. The benefits of social media platforms for farmers include increased reach, cost-effectiveness, real-time communication, information dissemination, and collaboration.

Factors such as age, location, language, education, and gender influence the use of social media platforms among farmers. Language diversity, educational background, age, gender, and geographic location should be considered when designing policies and outreach efforts. The regression analysis conducted on social media platforms' effectiveness indicated that language, age, gender, and district significantly influence their usage among farmers. Addressing these factors can enhance farmers' access to agricultural information and improve farming practices. The validity of the regression model's results was confirmed through diagnostic tests for variance inflation factor

(VIF) and heteroskedasticity, ensuring the independence and reliability of the predictor variables.

For extension officers, WhatsApp emerged as the most widely used platform, followed by Facebook and YouTube. The usage of YouTube and TikTok suggests a growing trend toward video content in agricultural extension services. Extension officers generally post agricultural information on social media platforms weekly or daily, and accessing agricultural information on social media is a daily activity for them. Benefits of using social media platforms for extension officers include increased reach, cost-effectiveness, real-time communication, information dissemination, and collaboration. Social media platforms offer valuable tools for agricultural information dissemination by extension officers, allowing for wide reach, real-time communication, and collaboration. However, challenges such as limited internet access and concerns about information quality need to be addressed.

CHAPTER SIX

QUALITATIVE RESULTS: PERCEPTIONS AND CONTRIBUTING FACTORS OF SOCIAL MEDIA USE BY EXTENSION OFFICERS AND FARMERS FOR INFORMATION DISSEMINATION IN LIMPOPO PROVINCE

6.1. INTRODUCTION

This study investigated the utilisation of social media platforms for information dissemination in agriculture. The study focused on the experiences and views of extension officers and farmers in Limpopo Province. The findings highlight extension officers' adoption of social media during information dissemination, the participatory nature of communication, and the benefits and challenges associated with social media use. The researcher conducted focus groups with a group of extension officers from Limpopo Province who actively utilized social media platforms to conduct their work. The focus groups aimed to gather insights into the adoption and use of social media and the perceived advantages and limitations of these platforms. The researcher recorded the focus groups using a media device, transcribed and thematically analysed them.

6.2. FINDINGS FROM EXTENSION OFFICERS

In recent years, social media platforms like Facebook, WhatsApp, YouTube, TikTok and Twitter have gained significant prominence as communication tools in various sectors, including agricultural extension services. Among these platforms, WhatsApp has emerged as a primary communication tool for extension officers in their interactions with farmers and colleagues.

6.3. QUALITATIVE RESULTS FOR THE USE OF SOCIAL MEDIA

The table 6.1 below presents the themes and subthemes derived from the focus groups with farmers. These themes from the study are discussed in the subsection that follows.

Table 6.1: Themes and subthemes derived from the study.

Themes	**Subthemes**
Adoption and use of social media platforms	Adoption of social media platforms by extension officers
	Preference for WhatsApp as the primary communication platform
Benefits and advantages of social media use	Convenient and effective communication
	Content sharing for swift responses
	Cost-effectiveness and accessibility
Limitations and challenges of social media Use	Preference for direct phone calls
	Technical knowledge and information sources
	Importance of personal interactions
	Network connectivity issues
	Privacy concerns

Source: Research survey (2023)

6.3.1. Adoption and use of social media platforms

a) Adoption of social media platforms by extension officers

Extension officers have recognised the potential of social media platforms as valuable tools for engaging with farmers and delivering timely information. One of them mentioned that:

> *"WhatsApp has made my life easy; I can work effectively and talk to many people simultaneously."*

These platforms provide a range of features and functionalities that support effective communication and information sharing. In focus groups conducted among extension officers in the districts, extension officers reported using social media platforms as part of their extension activities (Nyarko & Kozári, 2021). This high adoption rate

demonstrates the growing recognition of social media platforms' benefits in reaching a wider audience and fostering interactive communication.

Extension officers have embraced various social media platforms to cater for communication needs. Citing one extension officer in his own words are presented as follows:

"I have seen Facebook and twitter, but I found WhatsApp easy to use".

WhatsApp has become a popular choice among extension officers due to its ease of use, widespread availability, and versatile features (Naneetha, 2018). It allows extension officers to create dedicated groups, facilitating direct and instant communication with farmers, agricultural experts, and other stakeholders (David, 2020a). The ability to share text messages, photos, videos, and voice recordings on WhatsApp enhances the effectiveness and richness of communication (Lee et al., 2023).

b) Preference for WhatsApp as the primary communication tool.

WhatsApp has gained significant traction as the preferred primary communication platform among the social media platforms adopted by extension officers. One extension officer had this to say:

"I use WhatsApp because is a good tool and easy to understand."

The survey conducted by Umbara et al. (2021) indicated that extension officers considered WhatsApp as their primary mode of communication with farmers. This preference can be associated to several factors. WhatsApp offers a user-friendly interface that requires minimal technical expertise, making it accessible to extension officers and farmers alike. The platform's simplicity and design contribute to its widespread adoption and ease of use (Diano et al., 2023). Additionally, WhatsApp's compatibility across various mobile devices and operating systems ensures broad reach and inclusivity for extension officers (Dube, 2020).

WhatsApp's real-time messaging capabilities enable extension officers to promptly address queries, provide timely updates, and engage in discussions with farmers (Roberts et al., 2021). The instant nature of WhatsApp communication allows for swift responses, fostering efficient and convenient information exchange between extension officers and farmers.

Moreover, the multimedia sharing features of WhatsApp enable extension officers to disseminate visually appealing and informative content. By sharing images, videos, and documents, extension officers can enhance the communication experience, enabling farmers to grasp concepts more effectively and facilitating knowledge transfer (Peng et al., 2021).

6.3.2. Benefits and advantages of social media use

a) Convenient and effective communication

Extension officers widely reported WhatsApp as their primary communication platform, enabling effective interaction with farmers and colleagues (Nyarko & Kozári, 2021). One notable feature of WhatsApp is the ability to create groups categorised by commodities, which facilitates the organisation of meetings and provides a medium for exchanging technical advice among farmers and extension officers. One of the extension officers mentioned that:

> *"Social media is quick and cheap to disseminate agricultural information."*

These groups act as virtual communities where farmers and experts can share their experiences, challenges, and solutions (David, 2020b). The use of WhatsApp groups allows for the efficient dissemination of information to a larger audience, promoting collaboration and knowledge sharing (Garba & Hasan, 2022).

Extension officers highlighted the convenience of social media platforms, particularly WhatsApp, for communication among themselves and with farmers. One of them emphasised that:

> *"I like how we can communicate very well amongst ourselves; social media is more convenient."*
>
> *"We have created WhatsApp groups according to commodity, for example, Litchi farmers have their group with the extension officers in charge."*

They emphasised the ease and efficiency of communication within WhatsApp groups categorised by commodities, which facilitated the organisation of meetings and exchange of technical advice. There is a current problem of lack of toner and papers in government offices that can cause delay in printing forms for the farmer support programme. Regarding this issue, the extension officers expressed the benefit of social media as follows:

“Now we do not have paper and toner to print the farmer support forms, but we sent those farmers with WhatsApp so that they can print for themselves.”

WhatsApp’s user-friendly interface and widespread adoption among farmers and extension officers contributed to its popularity as a communication tool (Sivakumar et al., 2022). Extension officers in Limpopo also emphasised WhatsApp’s cost-effectiveness, especially for calls.

b) Content sharing

Another significant advantage of WhatsApp in agricultural extension is sharing images depicting plant and animal diseases. It enables farmers to seek expert guidance and receive swift responses to agricultural challenges. One of the extension officers highlighted that:

“Farmers take pictures of their produce challenges and post on WhatsApp for extension officers to attend to them.”

Farmers can capture and share images of diseased crops or livestock, allowing extension officers and specialists to diagnose and provide appropriate recommendations remotely (Otieno et al., 2021). This real-time assistance improves the efficiency of agricultural extension services, leading to better crop yields and livestock health. Extension officers acknowledged the advantages of social media platforms for seeking solutions and exchanging knowledge. One of them said that:

“Social media helps us with appointment confirmations, such that all meetings take time successfully.”

“Sometimes, we get stuck when we advise the farmers, but we can quickly go to the internet and seek solutions or even consult colleagues via WhatsApp.”

Extension officers mentioned accessing the Internet and consulting colleagues through WhatsApp as effective ways to address challenges faced by farmers. Additionally, specialised apps, such as Plantix, provided quick access to information on diseases and pests, enabling extension officers to offer timely support. Plantix is a mobile agricultural advisor on plants, diseases and pests, it is widely used by extension officers, farmers and gardeners (Samal et al., 2023).

WhatsApp groups categorised by commodity were perceived as valuable resources for sharing knowledge among farmers and extension officers by the interviewees.

These groups facilitated discussions, problem-solving, and sharing experiences within specific agricultural sectors. However, challenges such as group size limitations and the exclusion of some farmers due to maximum participant limits were reported.

c) Cost-effectiveness and accessibility

As far as cost effectiveness and accessibility is concerned, the extension officer had this to say:

"The government gives us mobile cell phones, data and airtime."

Extension officers highlighted the cost-effectiveness of mobile data for calls and messages, with WhatsApp calls being particularly accessible for communication (Ziegler et al., 2020). This cost-effectiveness is crucial, especially for farmers in settings with constrained resources, as this enables them to engage in timely and efficient information exchange with extension officers. With WhatsApp, farmers can access valuable agricultural knowledge and advice without incurring additional costs (Nyajeka & Duncombe, 2022). The affordability and accessibility of WhatsApp contribute to enhancing the digital divide and ensuring equal access to extension services, regardless of the geographical location and financial constraints.

The provision of subsidised cell phones, data, and airtime by the Department of Agriculture has made social media and associated technology tools financially viable for extension officers (Mwalupaso et al., 2019). The extension officers indicated that:

"Using WhatsApp call is much more convenient and cheaper than using airtime, even when there is not network, WhatsApp calls mostly go through."

The affordability and accessibility of WhatsApp calls compared to traditional airtime usage provided a cost-saving advantage for extension officers and farmers in this study. Furthermore, extension officers noted that WhatsApp calls often worked even in areas with limited network coverage. This financial support from the Department of Agriculture ensures that extension officers can access the necessary tools and resources for utilising social media platforms effectively. By reducing the financial burden, extension officers can focus on leveraging social media to disseminate information and provide support to a broader audience.

d) Utilisation of Agricultural Apps for Sourcing Information

Extension officers reported using various agricultural apps, such as Plantix, Arc, Survey123, and eSuite, to access information. For example, this is what was said:

> *"We have an app called Plantix to see all diseases and pests, it is quick to access information from it."*

These apps were described as engaging, informative, and user-friendly. However, it was noted that not all districts were utilising these apps. One specific app mentioned was Plantics, which allowed extension officers to quickly access information on diseases and pests. This app facilitated the identification and management of agricultural challenges, pests and diseases of plants.

6.3.3. Limitations and challenges of social media use

a) Preference for a direct phone call.

While WhatsApp offers cost-effective communication options, some extension officers prefer direct phone calls due to their immediate interaction (Yusuf et al., 2022). The following is what was reported by one extension officer during the interview:

> *"I prefer calling farmers directly than sending WhatsApp messages, when I call them, they answer their phones immediately."*

Farmers in remote areas may delay opening WhatsApp messages until they have mobile data available, which can disrupt timely communication. Direct phone calls allow instant dialogue and clarification, ensuring efficient information flow between extension officers and farmers (Kigatiira, 2019). The extension officer mentioned that:

> *"Farmers prefer talking to us directly because they prefer asking questions and making follow up as you speak over the phone."*

Additionally, extension officers mentioned the existence of a provincial WhatsApp group. However, they highlighted challenges related to the high volume of messages received within a short period, making it difficult to read and respond to all messages effectively. This is what was uttered by them during the interview.

> *"We have a provincial WhatsApp group, but the problem is receiving a lot of messages in a short period, we end up not reading all the messages sent."*

Furthermore, they have said:

> *“WhatsApp groups have maximum participant limit of 1000, so some farmers are not in the group because its full.”*

They also noted that WhatsApp groups have a maximum participant limit of 1000, resulting in some farmers being unable to join due to group capacity limitations. These limitations potentially hindered the dissemination of information to a broader audience within the agricultural community.

b) Technical knowledge and information sources

Extension officers expressed dissatisfaction with their limited technical knowledge in today's world. They highlighted a lack of skills programmes provided by the department to enhance their technical competencies (Antwi-Agyei & Stringer, 2021a). Additionally, they reported a lack of reliable information sources from the Department of Agriculture (Nkiaka et al., 2019). They relied heavily on Google to address farmers’ challenges. The absence of departmental newspapers, magazines, and agricultural libraries further hindered their access to the latest trends and knowledge.

The report recommends implementing Continuous Professional Development programmes in collaboration with agricultural research institutions and universities to address the extension officer’s technical knowledge gaps. Furthermore, collaborations with local Universities for research will help in knowledge generation. These programmes can offer skill courses and workshops focused on digital literacy, social media management, and information technology tools relevant to agricultural extension services (Davis et al., 2021).

Collaborations with agricultural research institutions and universities can help populate the digital library with valuable content and ensure regular updates. This is what was expressed.

> *“We are willing to go back to school and learn these new technologies in farming, we are ready and just waiting for that call from the employer.”*

Implementing Continuous Professional Development programmes in partnership with agricultural research institutions and universities in Limpopo Province can contribute to extension officers’ professional growth and competence. These programmes can offer ongoing training, workshops, and conferences to enhance extension officers’

technical knowledge, pedagogical skills, and understanding of emerging trends in agricultural extension services.

Extension officers can stay updated with the latest advancements in information dissemination techniques, social media platforms, and technological tools relevant to their field by actively participating in continuous development programmes (Awuor et al., 2021).

c) Importance of personal interactions

While WhatsApp was the preferred platform among extension officers, other social media platforms like Facebook and Twitter were perceived as complex and more suitable for younger users. In their own words this is what they said:

> *"We are not using social media platforms like Facebook and twitter; they are complex. We like WhatsApp, those other platforms are for youngsters."*

This suggests that user familiarity and ease of use are crucial in adopting social media platforms within the agricultural context.

Extension officers acknowledged the importance of personal interactions and face-to-face visits with farmers (Narine et al., 2019). They recognised that physical engagements provided opportunities for active listening, trust-building, and a deeper understanding of farmers' unique challenges. In their own words they said:

> *"Psychologically it helps to visit the farmers, just like when you visit the doctor. You feel better as they touch you and look at you."*

> *"Messages sent via social media do not always reach farmers instantly, some farmers wait until they are done in the fields to open messages."*

Such personal interactions were deemed essential for successful knowledge transfer and the holistic development of agricultural communities. While social media platforms like WhatsApp offer numerous benefits, extension officers emphasised that personal visits and face-to-face interactions with farmers remain indispensable. For example, this is what was reported:

> *"There are farmers who can use social media, but majority of the farmers are old. We also believe seeing through our eyes."*

In agricultural extension services, physical interactions provide active listening, trust-building opportunities, and a deeper understanding of farmers' unique contexts and challenges (Carter & Hollinsworth, 2022). Personal engagements contribute to the holistic development of agricultural communities, fostering stronger relationships and facilitating effective knowledge transfer.

d) Network connectivity issues

Despite the advantages of social media use in agricultural extension, extension officers face specific challenges in utilising platforms like WhatsApp. Network connectivity emerged as a primary concern, particularly in remote areas with limited mobile network coverage. Inadequate connectivity hampers effective communication through social media platforms, posing a significant obstacle to timely information dissemination and support (Lakshmi & Babu, 2018; Sherpaw et al., 2022). This is what was expressed in relation to the challenge they faced:

> *"The challenge we have is the network issue in remote areas."*

This limitation highlights the need for improved network infrastructure to enhance the effectiveness of social media use in agricultural extension services.

e) Privacy concerns

Extension officers expressed privacy concerns, as the access farmers have to their personal lives through WhatsApp status updates can undermine trust. In their own words they noted this:

> *"Security is a problem on social media because what we put on our WhatsApp status; the farmers can see our personal lives."*

To address these concerns, extension officers suggested a separate work WhatsApp account to maintain professional boundaries.

6.4. CHAPTER SUMMARY

Although WhatsApp has emerged as the preferred social media platform for information dissemination, it is important to note that other platforms, such as Facebook, Twitter, and Instagram, offer their unique advantages and features. However, factors such as user familiarity, privacy and security, cost-effectiveness, connectivity, and local relevance play significant roles in determining the suitability and adoption of these platforms in the context of agricultural extension services.

Overall, the preference for WhatsApp as the primary social media platform for information dissemination can be attributed to its familiarity, ease of use, privacy and security features, cost-effectiveness, and local adoption patterns. These factors contribute to the limited utilisation of other social media platforms in agricultural extension services. However, researchers and practitioners must continue exploring and evaluating the potential benefits and disadvantages of various social media platforms to enhance information dissemination and communication in agricultural settings.

Adopting social media as a communication tool by extension officers in agricultural extension services offers numerous benefits, including effective information exchange, collaboration, and swift response to agricultural challenges. WhatsApp groups categorised by commodities provide a platform for knowledge sharing among farmers and extension officers. In contrast, image sharing facilitates remote diagnosis and guidance. The cost-effectiveness and accessibility of the platforms contribute to the democratisation of extension services, ensuring equal access to agricultural knowledge. However, the limitations and challenges, such as the importance of personal interactions and network connectivity issues, must be considered to maintain a balanced approach.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1. INTRODUCTION

This chapter presents a summary of key findings from a survey conducted in Limpopo Province, focusing on the socio-economic characteristics of farmers, the effectiveness of social media platforms, farmers' needs, and perceptions of social media as a communication tool. The study concludes with recommendations for promoting the adoption of social media use among farmers and enhancing agricultural communication strategies.

7.2. SUMMARY

7.2.1. The socio-economic characteristics of farmers

The survey gathered data from 420 participants, highlighting the socio-economic characteristics of farmers in Limpopo Province. The gender distribution revealed that 56% of participants identified as female and 44% as male, with variations observed across districts. Marital status was also examined, indicating that most participants were either single or married, while divorced and widowed individuals accounted for a significant proportion. Variations in marital status across districts suggested potential differences in available resources and support systems. The analysis of median age across districts showed significant differences, with age potentially influencing farmers' adoption of social media for agricultural purposes. Education levels varied among participants, with a significant number lacking formal qualifications, which could limit their access to employment opportunities and earning potential. Monthly income ranges also varied across districts, highlighting the role of income in determining living standards and access to resources. Family size and reliance on farming as a source of income were consistent across districts, while language distribution indicated that Sepedi was the most spoken language among farmers in all districts.

7.2.2. Objective 1: To describe the effectiveness of current social media platforms used by farmers and extension officers in Limpopo Province.

The usage of Facebook, WhatsApp, and YouTube is influenced by various factors such as language, age, gender, and location. Targeting users based on their preferred

language can significantly improve the effectiveness of these platforms, as people are more likely to use them in their preferred language. Additionally, younger people, men, and residents of certain areas tend to be more engaged on these platforms.

For WhatsApp, language, education level, age, gender, and location all impact its usage. Communication in a familiar language is crucial for engagement, and targeting users with higher education levels may also increase usage. Younger people tend to use WhatsApp more than older people, and males use it more than females. Location also plays a role, with engagement levels varying in different areas. Similarly, YouTube is also impacted by language, age, gender, and location. Language-specific content is crucial, and younger people tend to be more engaged on the platform. Females tend to use it less than males, and location also affects engagement levels.

7.2.3. Objective 2: To identify the needs of extension officers and farmers in agricultural information dissemination in Limpopo Province

The survey highlighted the need to address the low adoption of social media among farmers in Limpopo Province. While access to technology, education levels, and cultural attitudes may contribute to this discrepancy, the benefits of social media, such as access to agricultural information and markets, should not be overlooked. Farmers expressed a preference for user-friendly platforms with effective search and filtering mechanisms, emphasising the importance of video content for easy understanding. To promote adoption, it is recommended to provide technology training programmes, address privacy and security concerns, and ensure affordable and reliable Internet connectivity. The limitations of traditional sources of agricultural information, such as extension officers, radio, television, family and friends, and newspapers, were also identified, highlighting the need for improved information quality, relevance, accessibility, and interaction with extension agents.

7.2.4. Objective 3: To determine the social media platforms used by extension officers and farmers in agricultural information dissemination in Limpopo Province.

The report also emphasised the platforms preferred by farmers, with WhatsApp and Facebook being the primary choices. Instagram, Twitter, TikTok, and YouTube were found to have a lower usage among farmers, with preferences varying based on age, location, and type of farming. Social media platforms were found to contribute to increased yield, income, and adoption of modern technologies among farmers. Most

farmers accessed agricultural information on social media daily, making it their primary source of information. However, efforts are needed to raise awareness among farmers who rarely or never access information on social media. Social media platforms were shown to provide farmers with increased reach, cost-effectiveness, real-time communication, information dissemination, and collaboration.

7.2.5. Objective 4: To explore the perception and contributing factors of social media use by extension officers and farmers for information dissemination in Limpopo Province.

Perceptions of social media platforms, particularly WhatsApp, were positive among extension officers in agricultural extension services. WhatsApp was recognised for its user-friendly interface, privacy and security features, and cost-effectiveness, making it the preferred choice for agricultural communication. The platform's functionalities, such as WhatsApp groups categorised by commodities, facilitated knowledge sharing among farmers and extension officers. Image sharing capabilities allowed for remote diagnosis and guidance, further enhancing communication in agricultural contexts. Moreover, WhatsApp and other social media platforms were considered affordable and accessible, ensuring equal access to agricultural knowledge. However, it was acknowledged that personal interactions and network connectivity issues still hold significance and should be considered to maintain a balanced approach to agricultural communication.

7.2.6. Objective 5: To develop a model for using social media as a tool for information dissemination in Limpopo Province.

A new model has been developed to assist farmers in sharing agricultural information effectively on social media. This model considers factors such as gender, marital status, age, education level, and income to better target the intended audience. By following the guidelines provided in the study, farmers can enhance their productivity and income by successfully sharing valuable information with their target audience.

7.3. CONCLUSIONS

The findings of the survey in Limpopo Province shed light on the socio-economic characteristics of farmers and the potential for utilising social media platforms in agricultural communication. The study highlighted variations in gender distribution, marital status, age, education levels, and income ranges across districts, indicating

the importance of tailored communication strategies. Social media platforms such as Facebook and WhatsApp were recognised as the primary choices for farmers, offering opportunities for information dissemination, networking, and market access. However, challenges such as access to technology, privacy concerns, and limited Internet connectivity need to be addressed to promote widespread adoption. Traditional sources of agricultural information were recognised but also revealed limitations in terms of information quality, accessibility, and interaction. To enhance information access for farmers, a comprehensive approach is recommended, encompassing the promotion of social media adoption, technology training programmes, addressing privacy and security concerns, and improving traditional sources of information.

Hypothesis (i): There are no current effective social media platforms used by extension officers and farmers in agricultural information dissemination in Limpopo Province; This hypothesis should be rejected because, the study highlights the efficiency of WhatsApp for communication in remote areas and the ability of Facebook to create online communities. YouTube and TikTok offer opportunities for extension officers to share instructional videos and engage younger farmers.

Hypothesis (ii): There is no need for extension officers and farmers in agricultural information dissemination using social media in Limpopo Province. This hypothesis should be rejected because, the survey identified the need for user-friendly platforms with effective search and filtering mechanisms, indicating the importance of social media in agricultural information dissemination.

Hypothesis (iii): There are no highly rated social media platforms used by extension officers and farmers in agricultural information dissemination in Limpopo Province. This hypothesis should be rejected because, WhatsApp has emerged as the most popular and highly rated social media platform among farmers and extension officers due to its ease of use, low cost, and multimedia sharing capabilities.

Hypothesis (iv): There are no perceptions and contributing factors of social media use by extension officers and farmers for information dissemination in Limpopo Province. This hypothesis should be rejected because, the study reveals the factors that influence the use of social media platforms among farmers, suggesting that language, educational level, age, gender, and geographic location should be considered when designing policies and outreach efforts.

7.4. RECOMMENDATIONS

Based on the findings of this study, several recommendations can be made to promote the effective use of social media in agricultural communication:

7.4.1 Extension officers should develop and implement training programmes that focus on teaching farmers how to effectively use social media platforms for accessing agricultural information, marketing their products, and collaborating with other farmers, they need proper training on technology.

7.4.2. Extension officers should start to raise awareness among farmers about privacy settings, personal data protection, and online security measures to reduce concerns and build trust when using social media platforms.

7.4.3. To ensure affordable and reliable Internet connectivity, farmers need to collaborate with government bodies, telecommunication companies, and other stakeholders to improve internet infrastructure in rural areas, making it more accessible and affordable for farmers.

7.4.4. To develop user friendly platforms with effective search and filtering mechanisms, policy makers should work towards creating user-friendly social media platforms that provide efficient search and filtering mechanisms, enabling farmers to find relevant agricultural information quickly and easily.

7.4.5. To improve traditional sources of agricultural information, policy makers need to enhance the accessibility of traditional sources of agricultural information such as extension officers, radio, television, family and friends, and newspapers. Encourage more interactive and personalised approaches to support farmers' information needs.

7.4.6. Based on the approaches of this study, a comprehensive communication model was developed by the researcher for information dissemination between extension officers and farmers in the context of agricultural extension services. This model considers the socio-economic features of farmers in the Limpopo Province, as well as their use of social media platforms, such as Facebook and WhatsApp for agricultural purposes.

The model in the figure below represents the circular communication model developed from this study.

.

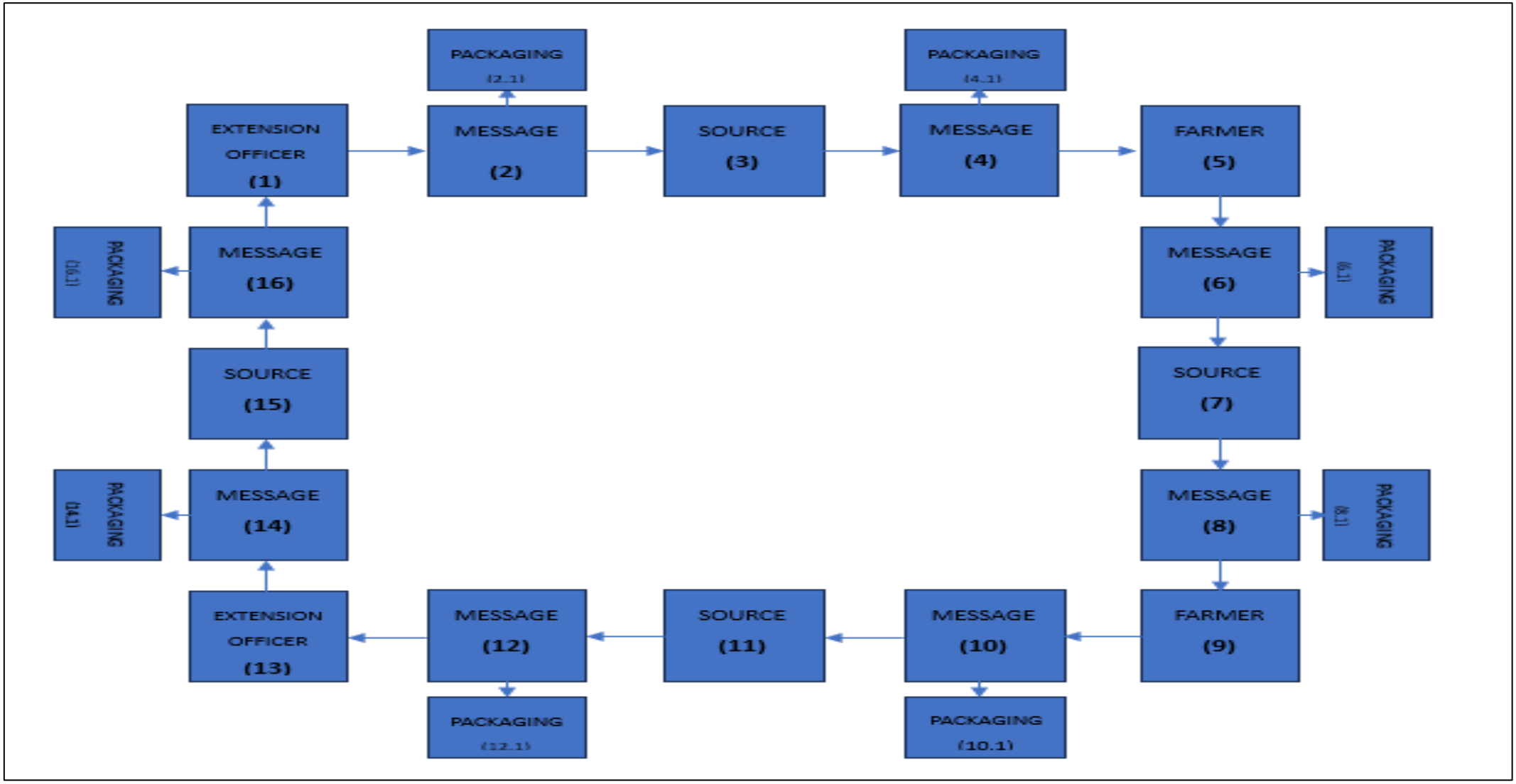


Figure 7.1: Social media communication model for agricultural information dissemination.

Source: Research Survey (2023).

- Interpretation of the model components.

A communication model in agricultural extension is very important as it provides a good way to deliver messages to the audience. Understanding the model and its components enable extension officers and farmers to communicate effectively with each other. The following are the social media communication model components:

Source: As depicted by the numbers (1, 5, 9 & 13) on the model. A source refers to someone delivering the message to recipients. In this communication model, a source can be an extension officer or a farmer. In terms of information sharing, this model presents that an extension officer can create messages for farmers and farmers can create messages for extension officers.

Message: As depicted by the numbers (2, 4, 6, 8, 10, 12, 14 & 16). Message represents the type of information coded by the source and decoded by the receiver. The type of information farmers are willing to share and receive are: crop production and management, soil health and fertility pest, and disease management.

Channel: As depicted by the numbers (3, 7, 11 & 15). Channel represents the type of social media platforms farmers are using and can disseminate agriculture information through them. The common channels identified this study are: WhatsApp, Facebook and YouTube.

Receiver: The receiver is the person getting the message from any social media platforms mentioned above. According to this model, an extension officer can send a message to farmers, farmers can send messages to fellow farmers, farmers can send messages to extension officers and lastly, extension officers can send messages to fellow extension officers regarding agricultural information.

The nature of this model is interactive and resembles that of Osgood-Schramm. The model is circular and allow interaction between farmers and extension officers in different location. This approach, feedback is encouraged, and good communication is exhibited. When the sender shares messages with the receivers, the receivers are able to interact with and share their opinions with the sender over the identified social media platforms in the study.

The guidelines for the social media communication model for information dissemination as indicated below emphasise the importance of gathering socio-economic information to effectively segment farmers and tailor communication efforts accordingly. It also highlights the timing of social media usage, the creation of relevant and engaging content, language and cultural considerations, and the integration of traditional sources of agricultural information. The model is presented as figure 7.2 below. By following these communication guidelines, extension officers can effectively disseminate agricultural information to farmers, considering their socio-economic features and utilising the preferred social media platforms as revealed by the study. The guidelines below emphasize the importance of targeted and context-specific approaches, leveraging technology, and integrating traditional sources to enhance communication and improve farming practices in the Limpopo Province of South Africa.

Targeting and Segmentation.

Extension officers should gather information about the farmers' socio-economic characteristics, including gender, marital status, age, educational qualifications, and income. This information will help in segmenting the farmers depending on their specific needs and preferences, allowing for targeted communication strategies.

Platform Selection.

Facebook and WhatsApp are the most common social media platforms among farmers. Extension officers should prioritise these platforms for information dissemination. WhatsApp groups can be created, categorised by commodities, to facilitate knowledge sharing among farmers and extension officers. Facebook can be utilised to create online communities and information-sharing groups, connecting farmers with other stakeholders in the agricultural sector.

Timing and Frequency.

Farmers primarily use social media during free time at work, in the evening before sleeping, and during lunch hours. Extension officers should align their communication efforts with these usage patterns to ensure maximum engagement. Information should be shared when farmers are most likely to be active on social media.

Content Creation.

Farmers use social media platforms for education, learning, information access, and dissemination. Extension officers should create relevant, educational, and informational content that addresses farmers' needs and interests. The content can include topics such as crop production and management, livestock management, soil health and fertility, pest and disease management, climate and weather updates, agricultural policies and regulations, and access to markets.

Preferred Formats.

Farmers prefer video content, followed by images and text. Extension officers should focus on creating visually appealing and engaging content to effectively communicate agricultural information. Instructional videos can be shared on platforms like YouTube and TikTok to cater to the preferences of younger farmers.

Language and Cultural Considerations.

Language diversity should be considered when designing communication strategies. Extension officers should ensure that content is available in local languages to enhance understanding and accessibility. Cultural attitudes towards social media should also be considered to address any potential barriers to adoption.

Connectivity and Technology Support.

Extension officers should be aware of farmers' access to technology and Internet connectivity. Efforts should be made to address any limitations or challenges related to Internet access, technology knowledge, and affordability. Technology training programmes can be provided to improve farmers' digital literacy skills.

Privacy and Security.

Privacy and security concerns are important considerations for farmers when using social media. Extension officers should address these concerns by emphasising the privacy features of the chosen platforms and providing guidance on how to protect personal information.

Integration with Traditional Sources.

While social media platforms offer benefits, traditional sources of agricultural information, such as extension officers, radio, television, family and friends, and newspapers, are still valued by farmers. Extension officers should integrate social media with traditional sources to create a comprehensive and effective information dissemination system.

Evaluation and Adaptation.

Regular evaluation of the communication model is essential to assess its effectiveness. Extension officers should gather feedback from farmers, monitor engagement metrics, and make necessary adaptations to improve the communication process continually.

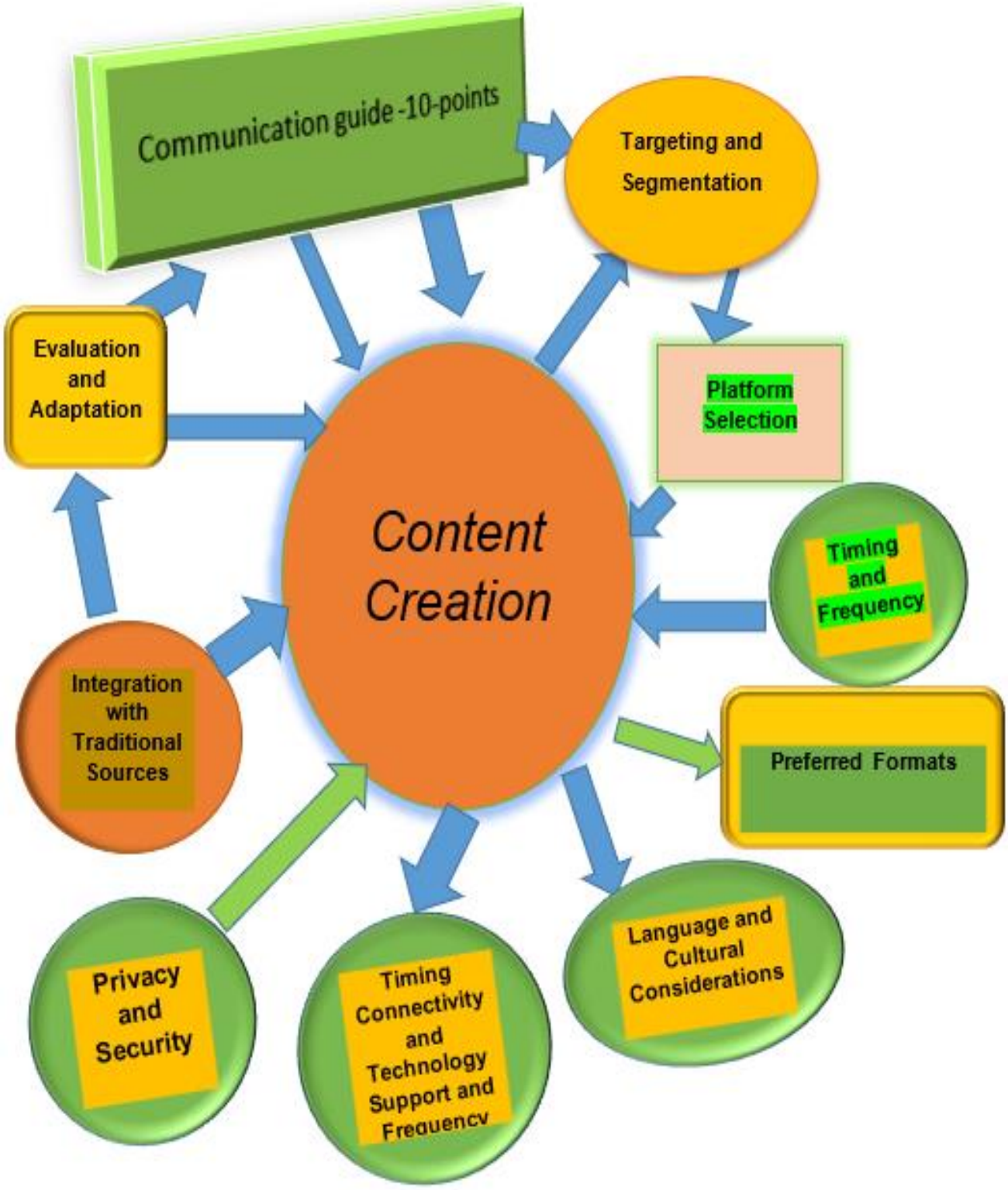


Figure 7.2 Conceptualisation model of communication guideline.

Source: Research survey (2023)

By implementing these recommendations, the agricultural sector can harness the potential of social media platforms, improve information access, enhance collaboration, and ultimately contribute to increased productivity and income for farmers.

7.5. LIMITATIONS OF THE STUDY AND FUTURE RESEARCH

The study has some limitations that need to be considered when interpreting its results. Firstly, extension officers' availability was not consistent, which may have impacted the sample selection. Additionally, the large sample size and lengthy questionnaire may have resulted in respondent fatigue, leading to incomplete or inaccurate responses.

WhatsApp and Facebook were the most frequently used platforms for information dissemination, followed by YouTube, TikTok, Twitter, and Instagram. However, the study did not delve into the reasons behind these usage patterns, and further research is required to understand why some platforms are more popular than others.

Personal interactions and network connectivity issues remain critical in agricultural extension services, and social media platforms cannot replace them entirely. As a result, a balanced approach that combines both traditional and modern communication methods is necessary to ensure effective and comprehensive agricultural information dissemination.

Despite the limitations, this study has made a valuable contribution to the existing body of knowledge on social media usage in the province for agricultural information dissemination. Moreover, the study has facilitated the development of a model for crafting content that is tailored to the needs of both farmers and extension officers in the area, leveraging insights gleaned from the findings.

LIST OF REFERENCES

Abbas, A. F., Jusoh, A., Mas' od, A., Alsharif, A. H., & Ali, J. (2022). Bibliometrix analysis of information sharing in social media. *Cogent Business & Management*, *9*(1), 2016556.

Abegunde, V. O., Sibanda, M., & Obi, A. (2019a). Determinants of the adoption of climate-smart agricultural practices by small-scale farming households in King Cetshwayo District Municipality, South Africa. *Sustainability*, *12*(1), 195.

Abegunde, V. O., Sibanda, M., & Obi, A. (2019b). The dynamics of climate change adaptation in Sub-Saharan Africa: A review of climate-smart agriculture among small-scale farmers. *Climate*, *7*(11), 132.

Abuta, C., Agumagu, A., & Adesope, O. (2021). Creative commons user license: CC BY-NC-ND. *Journal of Agricultural Education and Extension*, *25*(1), 79–90.

Acevedo, M., Pixley, K., Zinyengere, N., Meng, S., Tufan, H., Cichy, K., Bizikova, L., Isaacs, K., Ghezzi-Kopel, K., & Porciello, J. (2020). A scoping review of adoption of climate-resilient crops by small-scale producers in low-and middle-income countries. *Nature Plants*, *6*(10), 1231–1241.

Adams, A., Jumpah, E.T., & Caesar, L.D. (2021). The nexuses between technology adoption and socioeconomic changes among farmers in Ghana. *Technological Forecasting and Social Change*, *173*, 121133.

Akasse, C.S., Akbar, M., & Arianto, A. (2021). Analysis of the advantages and disadvantages of using social media in public relations practices to convey Covid-19 information in Gorontalo Province. *International Journal of Entrepreneurship, Business and Creative Economy*, *1*(2), 21–29. https://doi.org/10.31098/ijebce.v1i2.590

Akinwale, J., Owoade, E.O., & Oloruntobi, D.O. (2019). Analysis of utilization of mobile phones in agricultural information dissemination among maize farmers in Ondo State, Nigeria. *Journal of Agriculture and Environment*, *15*(2), 39–49.

Albizua, A., Bennett, E. M., Larocque, G., Krause, R. W., & Pascual, U. (2021). Social networks influence farming practices and agrarian sustainability. *PLOS ONE*, *16*(1). https://doi.org/10.1371/JOURNAL.PONE.0244619

Ali Taha, V., Pencarelli, T., Škerháková, V., Fedorko, R., & Košíková, M. (2021). The use of social media and its impact on shopping behavior of Slovak and Italian consumers during COVID-19 pandemic. *Sustainability*, *13*(4), 1710.

Allemang, B., Cullen, O., Schraeder, K., Pintson, K., & Dimitropoulos, G. (2021). Recommendations for youth engagement in Canadian mental health research in the context of COVID-19. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, *30*(2), 123.

Alotibi, Y. S., & Dabiah, A. T. (2022). Social media user's knowledge on soil plant relationship in Saudi Arabia. *Saudi Journal of Biological Sciences*, *29*(1), 355–359. https://doi.org/10.1016/J.SJBS.2021.08.090

Al-Qahtani, M., Alsaffar, A., Alshammasi, A., Alsanni, G., Alyousef, Z., & Alhussaini, M. (2018). Social media in healthcare: Advantages and challenges perceived by patients at a teaching hospital in eastern province, Saudi Arabia. *Saudi Journal for Health Sciences*, *7*(2), 116. https://doi.org/10.4103/sjhs.sjhs_36_18

Alshehri, O. (2019). Usage and perceptions of social media tools among higher education instructors. *International Journal of Information and Education Technology*, *9*(7). https://doi.org/10.18178/ijiet.2019.9.7.1252

Alvarado, O., Heuer, H., Vanden Abeele, V., Breiter, A., & Verbert, K. (2020). Middle-aged video consumers' beliefs about algorithmic recommendations on YouTube. *Proceedings of the ACM on Human-Computer Interaction*, *4*(CSCW2), 1–24.

Anang, B. T., Bäckman, S., & Sipiläinen, T. (2020). Adoption and income effects of agricultural extension in northern Ghana. *Scientific African*, *7*, e00219.

Ani, A., & Baba, S. (2010). Utilization of selected electronic mass media as sources of agricultural information by farmers in Northern Taraba State, Nigeria. *Tropical Agricultural Research and Extension*, *12*(1), 17. https://doi.org/10.4038/tare.v12i1.1979

Antwi-Agyei, P., & Stringer, L. C. (2021a). Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from northeastern Ghana. *Climate Risk Management*, *32*, 100304.

Antwi-Agyei, P., & Stringer, L. C. (2021b). Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from northeastern Ghana. In *Climate Risk Management*, *32*. https://doi.org/10.1016/j.crm.2021.100304

Anwas, E. O. M., Sugiarti, Y., Permatasari, A. D., Warsihna, J., Anas, Z., Alhapip, L., Siswanto, H. W., & Rivalina, R. (2020). Social media usage for enhancing English language skill. *International Journal of Interactive Mobile Technologies*, *14*(7). https://doi.org/10.3991/IJIM.V14I07.11552

Aronowitz, S. V, Engel-Rebitzer, E., Dolan, A., Oyekanmi, K., Mandell, D., Meisel, Z., South, E., & Lowenstein, M. (2021). Telehealth for opioid use disorder treatment in low-barrier clinic settings: an exploration of clinician and staff perspectives. *Harm Reduction Journal*, *18*(1), 1–9.

Auxier, B., & Anderson, M. (2021). Social media use in 2021. *Pew Research Center*, *1*, 1–4.

Awuor, F.J., Opiyo, M.A., Obiero, K.O., Munguti, J. M., Abwao, J., Nyonje, B. M., Nevejan, N., & Stappen, G.V. (2021). Aquaculture extension service in Kenya: Farmers and extension officers' perspectives. *Journal of Agricultural Extension and Rural Development*, *13*(1), 14–22.

Bachhav, N. B. (2012). Information needs of the rural farmers: A study from Maharashtra, India: A survey. *Library Philosophy and Practice*, *2012*(1).

Banmeke, T.O.A., Eniola, O.C., Akeredolu-Ale, B.I., Kareem, R.F., & Hussain, L.A. (2021). Content of YouTube videos on cassava production and processing in Nigeria. *Journal of Agricultural Extension*, *25*(4).

Barrutia, L., Vega-Gutiérrez, J., & Santamarina-Albertos, A. (2022). Benefits, drawbacks, and challenges of social media use in dermatology: A systematic review. *Journal of Dermatological Treatment*, *May*. https://doi.org/10.1080/09546634.2022.2069661

Baumüller, H., Ikpi, U., Jumpah, E. T., Kamau, G., Kergna, A. O., Mose, L., Nientao, A., Omari, R., Phillip, D., & Salasya, B. (2023). Building digital bridges in African value chains: Exploring linkages between ICT use and social capital in agricultural marketing. *Journal of Rural Studies*, *100*, 103002.

Berends, J., Rich, K.M., Kaitibie, S., & Lyne, M.C. (2021). Ex-ante evaluation of interventions to upgrade pork value chains in Southern Myanmar. *Agricultural Systems*, *194*, 103265.

Bhattacharjee, S., & Raj, S. (2016). *Social media: Shaping the future of agricultural extension and advisory services 2016 acknowledgement*.

Blekking, J., Waldman, K., Tuholske, C., & Evans, T. (2020). Formal/informal employment and urban food security in Sub-Saharan Africa. *Applied Geography*, *114*, 102131.

Boateng, E.Y., & Abaye, D.A. (2019). A review of the logistic regression model with emphasis on medical research. *Journal of Data Analysis and Information Processing*, *7*(4), 190–207.

Bradshaw, S., & Howard, P. N. (2019). *The global disinformation order: 2019 global inventory of organised social media manipulation*.

Busungu, C., Gongwe, A., Naila, D. L., & Munema, L. (2019). Complementing extension officers in technology transfer and extension services: Understanding the influence of media as change agents in modern agriculture. *International Journal of Research*, *7*(6), 248–269. https://doi.org/10.29121/granthaalayah.v7.i6.2019.802

Caffaro, F., Cremasco, M.M., Roccato, M., & Cavallo, E. (2020). Drivers of farmers' intention to adopt technological innovations in Italy: The role of information sources, perceived usefulness, and perceived ease of use. *Journal of Rural Studies*, *76*, 264–271.

Cao, X., & Yu, L. (2019). Exploring the influence of excessive social media use at work: A three-dimension usage perspective. *International Journal of Information Management*, *46*, 83–92.

Carter, J., & Hollinsworth, D. (2022). Governing extension and extending governance for Pacific organic farming. *Geographical Research*, *60*(3), 498–510.

Casey, M., Meikle, A., Kerr, G., & Stevens, D. (2016). Social media-a disruptive opportunity for science and extension in agriculture? In *nzgajournal.org.nz* (Vol. 16, pp. 53–60).

Chander, M., Thakur, D., & Chander, M. (2018). Social media in agricultural extension: Benefits and challenges under Indian context Devesh. *AJAEES*, *27*(2), 1–8. https://doi.org/10.9734/AJAEES/2018/44086

Chander, M., Thakur, D., & Scientist, P. (2018). Use of social media in agricultural extension: Some evidences from India on farm trials and technology transfer on herbal medications for tick control. *International Journal of Science, Environment*, *7*(4), 1334–1346.

Chang, C.-W., & Lindner, J. R. (2017). *Taiwanese smallholder farmers' perceptions and barriers to adopting Facebook*. https://doi.org/10.5191/jiaee.2017.24304

Cheng, Y.-S. (2019). *Are social media bad for your employees? Effects of at-work break activities on recovery experiences, job satisfaction, and life satisfaction*. University of Missouri--Columbia.

Chuan, C. L., & Penyelidikan, J. (2006). Sample size estimation using Krejcie and Morgan and Cohen statistical power analysis: A comparison. *Jurnal Penyelidikan IPBL*, *7*(1), 78–86.

Cieslik, K., Barford, A., & Vira, B. (2022). Young people not in employment, education or training (NEET) in Sub-Saharan Africa: Sustainable development target 8.6 missed and reset. *Journal of Youth Studies*, *25*(8), 1126–1147.

Cinelli, M., De, G., Morales, F., Galeazzi, A., Quattrociocchi, W., & Starnini, M. (2021). *The echo chamber effect on social media*. https://doi.org/10.1073/pnas.2023301118/-/DCSupplemental.y

Cloete, P., Bahta, Y., Marunga, M., & Lombard, W. (2019). Perception and understanding of agricultural extension: Perspective of farmers and public agricultural extension in Thaba Nchu. *South African Journal for Agricultural Extension*, *47*(3), 14–31.

Dadaczynski, K., Okan, O., Messer, M., Leung, A. Y. M., Rosário, R., Darlington, E., & Rathmann, K. (2021). Digital health literacy and web-based information-seeking

behaviors of university students in Germany during the COVID-19 pandemic: Cross-sectional survey study. *Journal of Medical Internet Research*, *23*(1), e24097.

Das, S., Mahavidyalaya, S., & Siliguri, W. (2021). *Influence of social media on agricultural advisory service: Analytical study on the agricultural extension specialists of Uttar Banga Krishi Vishwavidyalaya, West Bengal*.

Das V, J., Sharma, S., & Kaushik, A. (2019). Views of Irish farmers on smart farming technologies: An observational study. *AgriEngineering*, *1*(2), 164–187.

David, C. (2020a). *Community, Crowdsourcing, and Commerce: WhatsApp groups for agriculture in Kenya*. Université d'Ottawa/University of Ottawa.

David, C. (2020b). *Community, crowdsourcing, and commerce: WhatsApp groups for agriculture in Kenya*. Université d'Ottawa/University of Ottawa.

Davis, K. E., Joseph, J., Barry, T., von Maltitz, L., van Niekerk, J., Ngomane, T., & Rasoanindrainy, A. (2021). *Global agricultural extension staff functional competencies*. Intl Food Policy Res Inst.

Dawadi, S., Shrestha, S., & Giri, R. A. (2021). Mixed-methods research: A discussion on its types, challenges, and criticisms. *Journal of Practical Studies in Education*, *2*(2), 25–36.

Declercq, L., Jamshidi, L., Fernandez Castilla, B., Moeyaert, M., Beretvas, S. N., Ferron, J. M., & Van den Noortgate, W. (2022). Multilevel meta-analysis of individual participant data of single-case experimental designs: One-stage versus two-stage methods. *Multivariate Behavioral Research*, *57*(2–3), 298–317.

Deodhar, O. R., & Mathur, J. (2019). Response to "using social media to support small group learning." *BMC Medical Education*, *19*(1), 4–5. https://doi.org/10.1186/s12909-019-1458-5

Devanand, I. I., & Kamala, I. M. (2019). Innovative extension approach for sustainable agricultural development: WhatsApp groups for farming solution. *Current Journal of Applied Science and Technology*, *37*(3), 1–8.

Diano, F., Sica, L. S., & Ponticorvo, M. (2023). Empower psychotherapy with mHealth apps: The design of “safer”, an emotion regulation spplication. *Information*, *14*(6), 308.

Dube, B. (2020). Rural online learning in the context of COVID 19 in South Africa: Evoking an inclusive education approach. *REMIE: Multidisciplinary Journal of Educational Research*, *10*(2), 135–157.

Fan, S., & Rue, C. (2020). The role of smallholder farms in a changing world. *The role of smallholder farms in food and nutrition security*, 13–28.

Farooq, M.S., Riaz, S., Abid, A., Abid, K., & Naeem, M.A. (2019). A survey on the role of IoT in agriculture for the implementation of smart farming. *Ieee Access*, *7*, 156237–156271.

Faxon, H. O. (2023). Small farmers, big tech: Agrarian commerce and knowledge on Myanmar Facebook. *Agriculture and Human Values*, 1–15.

Fernandes, J., Blache, D., Maloney, S. K., Martin, G.B., Venus, B., Walker, F.R., Head, B., & Tilbrook, A. (2019). Addressing animal welfare through collaborative stakeholder networks. *Agriculture*, *9*(6), 132.

Fidelugwuowo, U.B. (2021). Knowledge and skills for accessing agricultural information by rural farmers in South-East Nigeria. *IFLA Journal*, *47*(2), 119–128. https://doi.org/10.1177/0340035220951837

Garba, S., & Hasan, N. (2022). Exploring the use of WhatsApp in disseminating Covid-19 information among journalists in Zamfara, Nigeria. *Quantum Journal of Social Sciences and Humanities*, *3*(4), 35–47.

Getahun, A.A. (2020). Challenges and opportunities of information and communication technologies for dissemination of agricultural information in Ethiopia. *International Journal of Agricultural Extension*, *8*(1), 57–65. https://doi.org/10.33687/ijae.008.01.3069

Gray, M. C., Gemmiti, A., Ata, A., Jun, B., Johnson, P. K., Ricci, J. A., & Patel, A. (2020). Can you trust what you watch? An assessment of the quality of information in

aesthetic surgery videos on YouTube. *Plastic and Reconstructive Surgery*, *145*(2), 329e–336e.

Gustavsson, M., Frangoudes, K., Lindström, L., Burgos, M.C.Á., & de la Torre-Castro, M. (2021). Gender and Blue Justice in small-scale fisheries governance. *Marine Policy*, *133*, 104743.

Hansen, J., Jespersen, L., & Jensen, A. (2014). ICT and social media as drivers of multi-actor innovation in agriculture. *World Conference on Computers in Agriculture and Natural Resources*.

Hosmer Jr, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (Vol. 398). John Wiley & Sons.

Hruska, J., & Maresova, P. (2020). Use of social media platforms among adults in the United States-Behavior on social media. *Societies*, *10*(27), 1–14. https://doi.org/10.3390/soc10010027

Huang, S.-L., & Chang, C.-Y. (2020). Understanding how people select social networking services: Media trait, social influences and situational factors. *Information & Management*, *57*(6), 103323.

Hudders, L., De Jans, S., & De Veirman, M. (2021). The commercialization of social media stars: a literature review and conceptual framework on the strategic use of social media influencers. *International Journal of Advertising*, *40*(3), 327–375.

Hutto, C. J., Bell, C., Farmer, S., Fausset, C., Harley, L., Nguyen, J., & Fain, B. (2015). Social media gerontology: Understanding social media usage among older adults. *Web Intelligence and Agent Systems*, *13*(1), 69–87. https://doi.org/10.3233/WEB-150310

Ibrahim, C. W. I. R. Bt. C. W. (2018). Social media tools for informal language learning: A comprehensive theoretical framework. *Asian Social Science*, *14*(4). https://doi.org/10.5539/ass.v14n4p46

Inegbedion, H., Inegbedion, E., Asaleye, A., Obadiaru, E., Asamu, F., Baker, L. M., Alege, P. O., & Lokeswari, K. (2021). *Use of social media in the marketing of agricultural*

products and farmers' turnover in South-South Nigeria [version 1; peer review: 2 approved with reservations]. https://doi.org/10.12688/f1000research.26353.1

Isaya, E. L., Agunga, R., & Sanga, C. A. (2018). Sources of agricultural information for women farmers in Tanzania. *Information Development*, *34*(1). https://doi.org/10.1177/0266666916675016

Islam, M. R., Fagun, I. A., & Rishan, S. T. (2020). Role of social media in advancement of aquaculture in Bangladesh: Potentials and challenges. *Bangladesh Journal of Fisheries*, *32*(1), 207–212. https://doi.org/10.52168/bjf.2020.32.24

Jain, V. (2021). An overview of facebook. *Academicia: An International Multidisciplinary Research Journal*, *11*(12), 782–788.

Jia, C., & Zhang, J. (2022). How the popularity of short videos promotes regional endogeneity in Northwest China: A qualitative study. *Sustainability*, *14*(6), 3664.

Joshi, D., & Dhaliwal, R. K. (2019). Utilization of social media by farming community: A case from Punjab State. *Indian Journal of Extension Education*, *55*(1), 47–52.

Jost, C., Kyazze, F., Naab, J., Neelormi, S., Kinyangi, J., Zougmore, R., Aggarwal, P., Bhatta, G., Chaudhury, M., & Tapio-Bistrom, M.-L. (2016). Understanding gender dimensions of agriculture and climate change in smallholder farming communities. *Climate and Development*, *8*(2), 133–144.

Jouanjean, M.-A., Casalini, F., Wiseman, L., & Gray, E. (2020). *Issues around data governance in the digital transformation of agriculture: The farmers' perspective*.

Kaban, A. (2021). Views on the usage of social media tools in school-family communication. *International Journal of Technology in Education*. https://doi.org/10.46328/ijte.118

Kandpal, A. S., & Sharma, V. K. (2022). Short communication use of WhatsApp for development of farmers. *A Journal of Multidisciplinary Advance Research*, *11*(2), 132–135.

Kanjina, S. (2021a). Farmers' use of social media and its implications for agricultural extension: Evidence from Thailand. *Asian Journal of Agriculture and Rural*

Development, *11*(4), 302–310. https://doi.org/10.18488/JOURNAL.AJARD.2021.114.302.310

Kanjina, S. (2021b). Farmers' Use of social media and its Implications for Agricultural Extension: Evidence from Thailand. *Asian Journal of Agriculture and Rural Development*, *11*(4), 302–310. https://doi.org/10.18488/journal.ajard.2021.114.302.310

Kanjina, S. (2021c). Farmers' use of social media and its implications for agricultural extension: Evidence from Thailand. *Asian Journal of Agriculture and Rural Development*, *11*(4), 302–310. https://doi.org/10.18488/JOURNAL.AJARD.2021.114.302.310

Kapuscinski, P. (2017). *Improving smallholders' knowledge of agricultural practices and markets through innovative media platforms*.

Kelil, A., Girma, Y., & Hiruy, M. (2020). Access and use of agricultural Information in Africa: Conceptual review. *Information and Knowledge Management*, *10*(7), 1–5. https://doi.org/10.7176/ikm/10-7-01

Kesherwani, B., Rout, S., Padhy, D., & Ravichandran, S. (2022). Social media help farmers: For improving agriculture practices. *International Journal of Biology, Pharmacy and Allied Sciences*, *11*(1), 410–418.

Khan, M. L., & Idris, I. K. (2019). Recognise misinformation and verify before sharing: A reasoned action and information literacy perspective. *Behaviour & Information Technology*, *38*(12), 1194–1212.

Khan Tithi, T., Chakraborty, T. R., Akter, P., Islam, H., & Khan Sabah, A. (2021). Context, design and conveyance of information: ICT-enabled agricultural information services for rural women in Bangladesh. *AI & Society*, *36*, 277–287.

Khou, A., & Suresh, K.R. (2018). A study on the role of social media mobile applications and its impact on agricultural marketing in Puducherry region. *Journal of Management (JOM)*, *5*(6).

Kigatiira, K. K. (2019). *The effect of shared meaning between extension officers and farmers on the adoption of Irish potato farming innovations in Meru County, Kenya*. JKUAT-COHRED.

Kilonzi, J., Nyongesa, M., & Nganga, N. (2023). *Pesticides handling, risk management and estimation of exposure levels in potato farming under small scale production*.

Kimani, A. W. (2019). *Assessment of use of social media among smallholder farmers in Kiambu County*. UoN.

Kipkurgat, T., Onyiego, M., & Chemwaina, S. (2016). Impact of social media on agricultural extension in Kenya: A case of Kesses district. *International Journal of Agricultural Extension and Rural Development Studies*, *3*(1), 30–36.

Kircaburun, K., Alhabash, S., Tosuntaş, Ş.B., & Griffiths, M.D. (2018). Uses and gratifications of problematic social media use among university students: A simultaneous examination of the big five of personality traits, social media platforms, and social media use motives. *Int J Ment Health Addiction*, 526–546. https://doi.org/10.1007/s11469-018-9940-6

Kongnso, M., Kongla, N., & Ngala, K. (2020). Agricultural extension approaches and climate change communication within the Ndop Rice Sector, North West Region, Cameroon. *International Journal of Social, Political and Economic Research*, *7*(2), 125–141. https://doi.org/10.46291/ijospervol7iss2pp125-141

Kozlowska, I. (2018). Facebook and data privacy in the age of Cambridge Analytica. *The Henry M. Jackson School of International Studies*, 1.

Krell, N.T., Giroux, S.A., Guido, Z., Hannah, C., Lopus, S.E., Caylor, K.K., & Evans, T.P. (2021). Smallholder farmers' use of mobile phone services in central Kenya. *Climate and Development*, *13*(3), 215–227.

Kumar, A., Haryana, K., Ramadas, S., & Singh, S. (2018). *Modern extension strategies to disseminate technological innovations and interventions at farmers' fields*. *June 2020*.

Kumar, U., Werners, S., Roy, S., Ashraf, S., Hoang, L. P., Kumar Datta, D., & Ludwig, F. (2020). Role of information in farmers' response to weather and water related stresses in the lower Bengal Delta, Bangladesh. *Sustainability*, *12*(16), 6598.

Kumatongo, B., & Muzata, K. K. (2021). Research paradigms and designs with their application in education. *Journal of Lexicography and Terminology*, *5*(1), 16–32.

Kurten, S., Brimmel, N., Klein, K., & Hutter, K. (2022). Nature and extent of quantitative research in social work journals: A systematic review from 2016 to 2020. *The British Journal of Social Work*, *52*(4), 2008–2023.

Lacey-Barnacle, M., Robison, R., & Foulds, C. (2020). Energy justice in the developing world: A review of theoretical frameworks, key research themes and policy implications. *Energy for Sustainable Development*, *55*, 122–138.

Lahiff, E. P. (1997). *Agriculture and rural livelihoods in a South African 'homeland': A case study from Venda*. University of London, School of Oriental and African Studies (United Kingdom).

Lakshmi, K. B., & Babu, K. M. (2018). Extent of utilization of social media by extension functionaries in Southern India. *Indian Res. J. Ext. Edu*, *18*(3), 90–92.

Lall, S., Agarwal, M., & Sivakumar, R. (2020). A YouTube dataset with user-level usage data: Baseline characteristics and key insights. *ICC 2020-2020 IEEE International Conference on Communications (ICC)*, 1–7.

Lathiya, A., Choudary, K., & Rathod, A. (2015). Role of social media in agriculture. *International Journal of Commerce and Business Management*, *8*(2), 268–273. https://doi.org/10.15740/has/ijcbm/8.2/268-273

Latif, F., Iftikhar, M., & Shahzadi, A. (2020). Exploring the role of social media in dissemination of agricultural information and technologies among farmers in Pakistan: A diagnostic study of Sahiwal District. *J. Agric. Res*, *58*(2), 103–109.

Lee, C.E., Chern, H.H., & Azmir, D. A. (2023). WhatsApp use in a higher education learning environment: Perspective of students of a Malaysian Private University on academic performance and team effectiveness. *Education Sciences*, *13*(3), 244.

Lee, H., Wong, S. F., Oh, J., & Chang, Y. (2019). Information privacy concerns and demographic characteristics: Data from a Korean media panel survey. *Government Information Quarterly*, *36*(2), 294–303.

Leyrer-Jackson, J. M., & Wilson, A. K. (2018). The associations between social-media use and academic performance among undergraduate students in biology. *Journal of Biological Education*, *52*(2), 221–230. https://doi.org/10.1080/00219266.2017.1307246

Li, Z., Huang, Y., Yang, Y., & Lai, X. (2022). Can TikTok be a good way to extend the adoption of green control techniques? Evidence from rural China. *Asian Journal of Technology Innovation*, 1–18.

Litvinenko, V. S. (2020). Digital economy as a factor in the technological development of the mineral sector. *Natural Resources Research*, *29*(3), 1521–1541.

Liu, Y. (2010). Social media tools as a learning resource. *Journal of Educational Technology Development and Exchange*, *3*(1). https://doi.org/10.18785/jetde.0301.08

Lochner, H.L., Swenson, R.D., & Martinson, K.L. (2021). Audience engagement when disseminating livestock information through infographics on social media. *Natural Sciences Education*, *50*(2), e20074.

López-Morales, J.A., Martínez, J.A., & Skarmeta, A.F. (2020). Digital transformation of agriculture through the use of an interoperable platform. *Sensors*, *20*(4), 1153.

Malekani, A., & Mubofu, C. (2020). DigitalCommons @ University of Nebraska - Lincoln Agricultural information sources, channels and strategies for sharing agricultural research findings among farmers in Iringa district in Tanzania. *Library Philosophy and Practice*.

Malhan, I., & Rao, S. (2007). Impact of globalization and emerging information communication technologies on agricultural knowledge transfer to small farmers in India. *World Library & Information Congress: 73rd IFLA General Conference & Assembly*.

Mamgain, A., Joshi, U., & Chauhan, J. (2020). Impact of social media in enhancing agriculture extension. *Agriculture and Food: E-Newsletter*, *2*(9), 367–370.

Manca, S. (2020). Snapping, pinning, liking or texting: Investigating social media in higher education beyond Facebook. *The Internet and Higher Education*, *44*, 100707.

Mapiye, O., Makombe, G., Molotsi, A., Dzama, K., & Mapiye, C. (2021). Towards a revolutionized agricultural extension system for the sustainability of smallholder livestock production in developing countries: The potential role of ICTs. *Sustainability (Switzerland)*, *13*(11). https://doi.org/10.3390/su13115868

Marie, M., Yirga, F., Haile, M., & Tquabo, F. (2020). Farmers' choices and factors affecting adoption of climate change adaptation strategies: evidence from northwestern Ethiopia. *Heliyon*, *6*(4), e03867.

Martini, E., Paramita, E., & Roshetko, J.M. (2016). *Information channels for disseminating innovative agroforestry practices to villages in Southern Sulawesi, Indonesia* (224; Agroforestry and forestry in Sulawesi Series: Information channels for disseminating innovative Agroforestry practices to villages in Southern Sulawesi, Indonesia.).

Maulu, S., Hasimuna, O. J., Mutale, B., Mphande, J., & Siankwilimba, E. (2021). Enhancing the role of rural agricultural extension programs in poverty alleviation: A review. *Cogent Food & Agriculture*, *7*(1), 1886663.

Mavhunduse, F., & Holmner, M. (2019). Utilisation of mobile phones in accessing agricultural information by smallholder farmers in Dzindi Irrigation Scheme in South Africa. *African Journal of Library, Archives and Information Science*, *29*(1), 93–101.

Mbagwu, F.C., Benson, O. V., & Onuoha, C O. (2018). *Challenges of meeting information needs of rural farmers through internet-based services: Experiences from developing countries in Africa*.

Mbugua, M., Nzuma, J., & Muange, E. (2019). Social networks and ex post risk management among smallholder farmers in Kenya. *Development Studies Research*, *6*(1), 30–39.

Meena, M. S., & Singh, R. K. (2012). *ICT-enabled extension in agriculture sector: Opportunities and challenges in climate change situation*. 29–38.

Meisner, C., & Ledbetter, A. M. (2022). Participatory branding on social media: The affordances of live streaming for creative labor. *New Media & Society*, *24*(5), 1179–1195.

Menon, J.M.L., Ritskes-Hoitinga, M., Pound, P., & van Oort, E. (2021). The impact of conducting preclinical systematic reviews on researchers and their research: A mixed method case study. *PloS One*, *16*(12), e0260619.

Mills, J., Reed, M., Skaalsveen, K., & Ingram, J. (2019). The use of Twitter for knowledge exchange on sustainable soil management. *Soil Use and Management*, *35*(1), 195–203. https://doi.org/10.1111/sum.12485

Mirembe, D. P., Lubega, J. T., & Kibukamusoke, M. (2019). Leveraging social media in higher education: A case of universities in Uganda. *European Journal of Open, Distance and E-Learning*, *22*(1), 70–84. https://doi.org/10.2478/eurodl-2019-0005

Mishra, A., Singh, J., Singh, R., & Singh, K. (2022). *A comparative study on social media utilization pattern by farmers of different age groups*.

Misra, N. N., Dixit, Y., Al-Mallahi, A., Bhullar, M. S., Upadhyay, R., & Martynenko, A. (2020). IoT, big data, and artificial intelligence in agriculture and food industry. *IEEE Internet of Things Journal*, *9*(9), 6305–6324.

Msoffe, G., Chengula, A., Kipanyula, M. J., Mlozi, M.R.S., & Sanga, C.A. (2018). Poultry farmers' information needs and extension advices in Kilosa, Tanzania: Evidence from mobile-based extension, advisory and learning system (MEALS). *Library Philosophy and Practice*, *2018*(February).

Mtega, W. P. (2021). Communication channels for exchanging agricultural information among Tanzanian farmers: A meta-analysis. *IFLA Journal*, *47*(4), 570–579. https://doi.org/10.1177/03400352211023837

Mubofu, C., & Watson, M. A. (2020). Agricultural information sources, channels and strategies for sharing agricultural research findings among farmers in Iringa district in Tanzania. *Library Philosophy and Practice*, *2020*, 1–15.

Mulema, A., & Damtew, E. (2016). *Gender-based constraints and opportunities to agricultural intensification in Ethiopia: A systematic review*.

Muller, D. (2023). *The Local Government Handbook* (O. Main, Ed.; 13th ed.). Yes! Media.

Munthali, N., van Paassen, A., Leeuwis, C., Lie, R., van Lammeren, R., Aguilar-Gallegos, N., & Oppong-Mensah, B. (2021). Social media platforms, open communication and problem solving in the back-office of Ghanaian extension: A substantive, structural and relational analysis. *Agricultural Systems*, *190*. https://doi.org/10.1016/j.agsy.2021.103123

Muthuprasad, T., Aiswarya, S., Aditya, K. S., & Jha, G. K. (2021). Students' perception and preference for online education in India during COVID-19 pandemic. *Social Sciences & Humanities Open*, *3*(1), 100101.

Mwalupaso, G. E., Wang, S., Xu, Z., & Tian, X. (2019). Towards auspicious agricultural informatization—Implication of Farmers' behavioral intention apropos of mobile phone use in agriculture. *Sustainability*, *11*(22), 6282.

Naab, F. Z., Abubakari, Z., & Ahmed, A. (2019). The role of climate services in agricultural productivity in Ghana: The perspectives of farmers and institutions. *Climate Services*, *13*, 24–32.

Nain, M., Singh, R., & Mishra, J.R. (2019). Social networking of innovative farmers through WhatsApp messenger for learning exchange: A study of content sharing. *Indian Journal of Agricultural Sciences*, *89*(3), 556–558.

Naneetha, R. (2018). A new paradigm shift on how WhatsApp empower small business to develop customer relationship and it becomes an integral part of business. *Research Journal of Humanities and Social Sciences*, *9*(1), 119–124.

Narine, L. K., Harder, A., & Roberts, T. G. (2019). Farmers' intention to use text messaging for extension services in Trinidad. *The Journal of Agricultural Education and Extension*, *25*(4), 293–306.

Nazari, M., & Hasbullah, A. (2008). Farmers' approach and access to information and communication technology in the efficient …. *Editorial Advisory Board e*, *21*(1).

Ndimbwa, T., Mwantimwa, K., & Ndumbaro, F. (2021). Channels used to deliver agricultural information and knowledge to smallholder farmers. *IFLA Journal*, *47*(2), 153–167. https://doi.org/10.1177/0340035220951828

Ndimbwa, T., Ndumbaro, F., & Mwantimwa, K. (2019). Delivery mechanisms of agricultural information and knowledge to smallholder farmers in Tanzania: A meta-analysis study. *Salaam Library Journal*, *14*(2), 87–98.

Nedumaran, S., & Nandi, R. (2019). Agriculture extension system in India: A meta-analysis. *Research Journal of Agricultural Sciences*, *10*(3), 473–479.

Nie, P., Ma, W., & Sousa-Poza, A. (2021). The relationship between smartphone use and subjective well-being in rural China. *Electronic Commerce Research*, *21*, 983–1009.

Nkiaka, E., Taylor, A., Dougill, A. J., Antwi-Agyei, P., Fournier, N., Bosire, E. N., Konte, O., Lawal, K. A., Mutai, B., & Mwangi, E. (2019). Identifying user needs for weather and climate services to enhance resilience to climate shocks in Sub-Saharan Africa. *Environmental Research Letters*, *14*(12), 123003.

Nwakwuo, O. P., & Benson, O. V. (2021). Challenges and prospects of using of social media in disseminating agricultural information to farmers towards realization African Union Agenda 2063. *International Journal of Applied Technologies in Library and Information Management*, *7*(3), 5–38.

Nyajeka, P., & Duncombe, R. (2022). The use of mobile phones by women livestock keepers in Zimbabwe. *Proceedings of the 2022 International Conference on Information and Communication Technologies and Development*, 1–11.

Nyarko, D. A., & Kozári, J. (2021). Information and communication technologies (ICTs) usage among agricultural extension officers and its impact on extension delivery in Ghana. *Journal of the Saudi Society of Agricultural Sciences*, *20*(3), 164–172.

Odini, S. (2014). Access to and use of agricultural information by small scale women farmers in support of efforts to attain food security in Vihiga County, Kenya. *Journals.Co.Za*, *5*(2), 100–107.

Ogunnaike, M. G., Osinowo, O. H., & Olabode, J. O. (2021). Roles of social networks in adoption of climate-smart agricultural practices among rural households in Southern Nigeria. *Journal of Agripreneurship and Sustainable Development*, *4*(4), 223–234.

Okabe-Miyamoto, K., Folk, D., Lyubomirsky, S., & Dunn, E.W. (2021). Changes in social connection during COVID-19 social distancing: It's not (household) size that matters, it's who you're with. *Plos One*, *16*(1), e0245009.

Okoye, K., Hussein, H., Arrona-Palacios, A., Quintero, H.N., Ortega, L.O.P., Sanchez, A. L., Ortiz, E. A., Escamilla, J., & Hosseini, S. (2023). Impact of digital technologies upon teaching and learning in higher education in Latin America: An outlook on the reach, barriers, and bottlenecks. *Education and Information Technologies*, *28*(2), 2291–2360.

Oksa, R., Kaakinen, M., Savela, N., Ellonen, N., & Oksanen, A. (2021). *Professional social media usage: Work engagement perspective*. *23*(8), 2303–2326. https://doi.org/10.1177/1461444820921938

Oluyaire, B., S. B., A., G., L., Danbaki, C. A., O. O., S., C. O., A., A. F., A., L. G., L., A. A., A., & Bako, A. (2020). Factors influencing social media usage among farm youth in rural communities of Federal Capital Territory (FCT), Nigeria. *Advances in Social Sciences Research Journal*, *7*(4), 454–461. https://doi.org/10.14738/assrj.74.7748

Onwuegbuzie, A. J., & Collins, K. M. T. (2007). A typology of mixed methods sampling designs in social science research. *Qualitative Report*, *12*(2), 281–316.

Ortiz-Ospina, E., & Roser, M. (2023). The rise of social media. *Our World in Data*.

Otieno, W., Ochilo, W., Migiro, L., Jenner, W., & Kuhlmann, U. (2021). *Tools for pest and disease management by stakeholders: A case study on Plantwise*.

Paasonen, S. (2022). Experimentations in pandemic boredom. In *Methodologies of affective experimentation* (pp. 139–157). Springer.

Pandey, D. K., & Dubey, S. K. (2020). *Social media usage among agriculture collegian in North-Eastern India*. *56*(2), 26–30.

Pandit, J. C., & Miah, M. A. M. (2015). Farmers' access to ICT initiatives for agricultural information in Bangladesh. *Bangladesh Journal of Extension Education, 27*(1 & 2), 81–92.

Paoletti, J., Bisbey, T. M., Zajac, S., Waller, M. J., & Salas, E. (2021). Looking to the middle of the qualitative-quantitative spectrum for integrated mixed methods. *Small Group Research*, *52*(6), 641–675.

Patel, N., Dixit, A. K., & Singh, S. R. K. (2020). Effectiveness of WhatsApp messages regarding improved agricultural production technology. *Indian Journal of Extension Education*, *56*(1), 54–58.

Paudel, R., & Baral, P. (2018). Social media in agricultural extension. *Journal of Agricultural Extension*, *2*(2), 69–74. https://doi.org/10.22377/AEXTJ.V2I02.66

Pechrová, M., Lohr, V., & Havlíček, Z. (2015). Social media for organic products promotion. *Agris On-Line Papers in Economics and Informatics*, *7*(665-2016–45052), 41–50.

Peng, T., Lyndon, N., Hashim, K., & Aman, Z. (2021). The role of social media applications in palm oil extension services in Malaysia. *Akademika*, 145–156.

Quandt, A., Salerno, J.D., Neff, J.C., Baird, T.D., Herrick, J.E., McCabe, J.T., Xu, E., & Hartter, J. (2020). Mobile phone use is associated with higher smallholder agricultural productivity in Tanzania, East Africa. *PLoS One*, *15*(8), e0237337.

Rajkhowa, P., & Qaim, M. (2022). Mobile phones, off-farm employment and household income in rural India. *Journal of Agricultural Economics*, *73*(3), 789–805.

Rathje, S., Van Bavel, J. J., & Van Der Linden, S. (2021). Out-group animosity drives engagement on social media. *Proceedings of the National Academy of Sciences*, *118*(26), e2024292118.

Raza, M. H., Khan, G. A., Shahbaz, B., & Saleem, M. F. (2020). Effectiveness of information and communication technologies as information source among farmers in Pakistan. *Pakistan Journal of Agricultural Sciences*, *57*(1).

Reshi, I. A., & Sudha, T. (2023). Economic empowerment of women: A review of current research. *International Journal of Educational Review, Law and Social Sciences (IJERLAS)*, *3*(2), 601–605.

Rhoades, E., & Aue, K. (2010). Social agriculture: Adoption of social media by agricultural editors and broadcasters. *107th Annual Meeting and Conference of Southern Association of Agricultural Scientists*.

Riley, M., & Robertson, B. (2021). #farming365 – Exploring farmers' social media use and the (re)presentation of farming lives. *Journal of Rural Studies*, *87*. https://doi.org/10.1016/j.jrurstud.2021.08.028

Roberts, J. K., Pavlakis, A. E., & Richards, M. P. (2021). It's more complicated than it seems: Virtual qualitative research in the COVID-19 era. *International Journal of Qualitative Methods*, *20*, 16094069211002960.

Roche, S., Renaud, D., Genore, R., Bauman, C., Croyle, S., Barkema, H., Dubuc, J., Keefe, G., & Kelton, D. (2020). Communication preferences and social media engagement among Canadian dairy producers. *American Dairy Science Association*, *103*(12), 1228–12139. https://doi.org/10.3168/jds.2020-19039

Roh, M., & Park, K. (2019). Adoption of O2O food delivery services in South Korea: The moderating role of moral obligation in meal preparation. *International Journal of Information Management*, *47*, 262–273.

Rola-Rubzen, M. F., Paris, T., Hawkins, J., & Sapkota, B. (2020). Improving gender participation in agricultural technology adoption in Asia: from rhetoric to practical action. *Applied Economic Perspectives and Policy*, *42*(1), 113–125.

Rose, D. C., Chivers, C. A., de Boon, A., Schillings, J., Smith, R., Lishman, L., & Bliss, K. (2021). *Videos and podcasts as potential approaches for knowledge exchange with farmers: testing their potential role in ELM*.

Ruggiero, T. E. (2000). Uses and Gratifications Theory in the 21st Century. *Mass Communication and Society*, *3*(1), 3–37. https://doi.org/10.1207/S15327825MCS0301_02

Rust, N. A., Stankovics, P., Jarvis, R. M., Morris-Trainor, Z., de Vries, J. R., Ingram, J., Mills, J., Glikman, J. A., Parkinson, J., & Toth, Z. (2021). Have farmers had enough of experts? *Environmental Management*, 1–14.

Samal, I., Bhoi, T. K., Pradhan, A. K., & Mahanta, D. K. (2023). Plantix app: A success story of artificial intelligence in plant protection. *Van Sangyan*, 24.

Sandeep, G. P., Prashanth, P., Sreenivasulu, M., & Madavilata, A. (2022a). Constraints and suggestions for effective utilization of social media in agriculture- An analysis. *Biological Forum – An International Journal*, *14*(1), 1688–1692.

Sandeep, G. P., Prashanth, P., Sreenivasulu, M., & Madavilata, A. (2022b). View of effectiveness of agricultural information disseminated through social media. *Indian Journal of Extension Education*, *58*(2), 186–190.

Sandeep, G. P., Prashanth, P., Sreenivasulu, M., & Madhavilata, A. (2020). Social media in agriculture – A profile analysis. *International Journal of Current Microbiology and Applied Sciences*, *9*(7), 2727–2736. https://doi.org/10.20546/ijcmas.2020.907.322

Sani, L., Boadi, B., Oladokun, O., & Kalusopa, T. (2014). The generation and dissemination of agricultural information to farmers in Nigeria: A review. *Researchgate.Net*, *7*(2), 2319–2372.

Sari, N. U., Munajat, M., & Yunita, Y. (2022). Utilization of social media in agricultural extension activities in South Ogan Komering District. *AJARCDE (Asian Journal of Applied Research for Community Development and Empowerment)*, *6*(3), 24–28.

Schoemaker, E., Talhouk, R., Kamanu, C., McDonaugh, E., McDonaugh, C., Casey, E., Wills, A., Richardson, F., & Donner, J. (2022). Social agriculture: Examining the affordances of social media for agricultural practices. *ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies (COMPASS)*, 476–489. https://doi.org/10.1145/3530190.3534806

Sennuga, S. (2020). Impact of information and communication technologies (ICTS) on agricultural productivity among smallholder farmers: Evidence from Sub-Saharan African. *Researchgate.Net*, *7*(1), 27–43.

Sherpaw, A., Muhsenullah, I., & Farhad, sultanzoy. (2022). Impact of social media on agricultural extension in Afghanistan – A case of Ahmad Aba District. *International Journal for Research in Applied Sciences and Biotechnology*, *9*(2), 67–72. https://doi.org/10.31033/ijrasb.9.2.9

Sibanda, R. (2019). *Early childhood literacy practices in a multilingual township in Gauteng province of South Africa*. University of Johannesburg (South Africa).

Singh, G., Singh, P., Tiwari, D., & Singh, K. (2021). Role of social media in enhancing agricultural growth. *Indian Journal of Extension Education*, *57*(2), 69–72.

Sinpeng, A. (2021). Hashtag activism: social media and the# FreeYouth protests in Thailand. *Critical Asian Studies*, *53*(2), 192–205.

Sivakumar, S., Bijoshkumar, G., Rajasekharan, A., Panicker, V., Paramasivam, S., Manivasagam, V. S., & Manalil, S. (2022). Evaluating the expediency of smartphone applications for Indian farmers and other stakeholders. *AgriEngineering*, *4*(3), 656–673.

Skaalsveen, K., Ingram, J., & Urquhart, J. (2020). The role of farmers' social networks in the implementation of no-till farming practices. *Agricultural Systems*, *181*, 102824.

Skiba, D. (2017). Evaluation tools to appraise social media and mobile applications. *Informatics*, *4*(3). https://doi.org/10.3390/informatics4030032

Song, S., Zhao, Y. C., Yao, X., Ba, Z., & Zhu, Q. (2022). Serious information in hedonic social applications: Affordances, self-determination and health information adoption in TikTok. *Journal of Documentation*, *78*(4), 890–911.

Steinke, J., van Etten, J., Müller, A., Ortiz-Crespo, B., van de Gevel, J., Silvestri, S., & Priebe, J. (2021). Tapping the full potential of the digital revolution for agricultural extension: An emerging innovation agenda. *International Journal of Agricultural Sustainability*, *19*(5–6), 549–565.

Stellefson, M., Paige, S.R., Chaney, B.H., & Chaney, J.D. (2020). Evolving role of social media in health promotion: updated responsibilities for health education specialists. *International Journal of Environmental Research and Public Health*, *17*(4), 1153.

Subashini, K.K.P., & Fernando, S. (2018). Empowerment of farmers through ICT literacy. *2017 National Information Technology Conference, NITC 2017*, *2017-September*, 119–124. https://doi.org/10.1109/NITC.2017.8285663

Takahashi, K., Muraoka, R., & Otsuka, K. (2020). Technology adoption, impact, and extension in developing countries' agriculture: A review of the recent literature. *Agricultural Economics*, *51*(1), 31–45.

Talebian, S., Mohammadi, H. M., & Rezvanfar, A. (2014). Information and communication technology (ICT) in higher education: Advantages, disadvantages, conveniences and limitations of applying e-learning to agricultural students in Iran. *Procedia - Social and Behavioral Sciences*, *152*, 300–305. https://doi.org/10.1016/J.SBSPRO.2014.09.199

Tambade, L. R., Gonjari, P. A., & Singh, L. (2019). Analysis of YouTube use pattern among farmers for agro-advisory. *Indian Journal of Extension Education*, *55*(1), 53–55.

Tambo Id, J.A., Aliamo, C., Davis, T., Mugambi, I., Romney, D., Onyango, D.O., Kansiime, M., Alokit, C., & Byantwale, S.T. (2019). *The impact of ICT-enabled extension campaign on farmers' knowledge and management of fall armyworm in Uganda*. https://doi.org/10.1371/journal.pone.0220844

Tandon, A., Dhir, A., Talwar, S., Kaur, P., & Mäntymäki, M. (2021). Dark consequences of social media-induced fear of missing out (FoMO): Social media stalking, comparisons, and fatigue. *Technological Forecasting and Social Change*, *171*. https://doi.org/10.1016/J.TECHFORE.2021.120931

Tao, D., Ruth, T. K., Maxwell, J., & Feng, H. (2020). Social media use for farmers market communications in Illinois. *Journal of Extension*, *58*(6).

Thakur, D., & Chander, M. (2018). Use of social media in agricultural extension: Some evidences from India. *International Journal of Science, Environment and Technology*, *7*(4), 1334–1346. www.ijset.net

Thar, S. P., Ramilan, T., Farquharson, R.J., Pang, A., & Chen, D. (2021). An empirical analysis of the use of agricultural mobile applications among smallholder farmers in Myanmar. *The Electronic Journal of Information Systems in Developing Countries*, *87*(2), e12159.

Tire, M. (2006). *An evaluation of the information dissemination mechanisms* (Issue April).

Toivonen, T., Heikinheimo, V., Fink, C., Hausmann, A., Hiippala, T., Järv, O., Tenkanen, H., & Di Minin, E. (2019). Social media data for conservation science: A methodological overview. *Biological Conservation*, *233*, 298–315.

Tsai, H., Lee, Y.-P., & Tsai, W.-B. (2020). Assessing the negative determinants on the usage intention of social media. *Journal of Economics and Business*, *3*(4). https://doi.org/10.31014/aior.1992.03.04.286

Tulgar, A.T. (2019). WhatsApp as a tool for sustainable glocal linguistic, social and cultural interaction. *Turkish Online Journal of Distance Education*, *20*(3), 17–28.

Umbara, D. S., Sulistyowati, L., Noor, T. I., & Setiawan, I. (2021). Study of digital technology application in agribusiness extension in Tasikmalaya regency and city, West Java Province, Indonesia. *International Journal of Agricultural & Statistical Sciences*, *17*(2).

Varner, J. (2018). *Agriculture and social media*.

Vasumathi, P., & Arun, C. J. (2021). Young farmers' intention to use social media in marketing agro products: A conceptual framework. *Indian Journal of Economics and Business*, *20*(2).

Vayro, C., Brownlow, C., Ireland, M., & March, S. (2020). 'Farming is not just an occupation [but] a whole lifestyle': a qualitative examination of lifestyle and cultural factors affecting mental health help-seeking in Australian farmers. *Sociologia Ruralis*, *60*(1), 151–173.

Verma, V., & Rani, E. (2023). Role of social media in extension - A review. *International Journal of Humanities Social Science and Management (IJHSSM)*, *3*(3), 7–17.

Wang, G., Lu, Q., & Capareda, S.C. (2020). Social network and extension service in farmers' agricultural technology adoption efficiency. *Plos One*, *15*(7), e0235927.

Wang, J., Xu, Y., Zou, L., & Wang, Y. (2021). Does culture affect farmer willingness to transfer rural land? Evidence from Southern Fujian, China. *Land*, *10*(6), 594.

Wanyama, R., Mathenge, M., & Mbaka, Z. (2015). Agricultural information sources and their effect on farm productivity in Kenya. In *Egerton University* , 21(1), 1–5).

Wegenast, T., & Beck, J. (2020). Mining, rural livelihoods and food security: A disaggregated analysis of sub-Saharan Africa. *World Development*, *130*, 104921.

Wickman, A., Duysen, E., Cheyney, M., Pennington, W., Mazur, J., & Yoder, A. (2021). Development of an educational YouTube channel: A collaboration between US agricultural safety and health centers. *Journal of Agromedicine*, *26*(1), 75–84.

Wilmes, E., & Swenson, R. (2019). Engaging dairy farmers in safety messages: Values, moral norms, barriers, and implications for communication. *Journal of Applied Communications*, *103*(1).

Wiseman, L., Sanderson, J., Zhang, A., & Jakku, E. (2019). Farmers and their data: An examination of farmers' reluctance to share their data through the lens of the laws impacting smart farming. *NJAS-Wageningen Journal of Life Sciences*, *90*, 100301.

Wongnaa, C. A., & Babu, S. (2020). Building resilience to shocks of climate change in Ghana's cocoa production and its effect on productivity and incomes. *Technology in Society*, *62*, 101288.

Wu, B., & Liu, L. (2020). Social capital for rural revitalization in China: A critical evaluation on the government's new countryside programme in Chengdu. *Land Use Policy*, *91*, 104268.

Yee, A., Padovano, W.M., Fox, I.K., Hill, E.J.R., Rowe, A.G., Brunt, L.M., Moore, A.M., Snyder-Warwick, A.K., Kahn, L.C., & Wood, M.D. (2020). Video-based learning in surgery: Establishing surgeon engagement and utilization of variable-duration videos. *Annals of Surgery*, *272*(6), 1012–1019.

Yusuf, S.F.G., Popoola, O.O., & Yusuf, F.T.O. (2022). Harnessing the use of alternative media for South Africa's agricultural extension service delivery in the face of the COVID-19 global pandemic. *South African Journal of Agricultural Extension*, *50*(2), 137–155.

Zeweld, W., Van Huylenbroeck, G., Tesfay, G., Azadi, H., & Speelman, S. (2020). Sustainable agricultural practices, environmental risk mitigation and livelihood improvements: Empirical evidence from Northern Ethiopia. *Land Use Policy*, *95*, 103799.

Zhang, W., Chintagunta, P. K., & Kalwani, M. U. (2021). Social media, influencers, and adoption of an eco-friendly product: Field experiment evidence from rural China. *Journal of Marketing*, *85*(3), 10–27.

Zhang, Y., & Wang, L. (2016). Agricultural information dissemination using ICTs: A review and analysis of information dissemination models in China. *Elsevier*, *3*, 17–29.

Zhang, Z. (2021). Infrastructuralization of Tik Tok: Transformation, power relationships, and platformization of video entertainment in China. *Media, Culture & Society*, *43*(2), 219–236.

Zhao, Y., Zhang, T., Dasgupta, R. K., & Xia, R. (2023). Narrowing the age-based digital divide: Developing digital capability through social activities. *Information Systems Journal*, *33*(2), 268–298.

Ziegler, M., Wack, M., Ingutia, N., Muiruri, I., Njogu, N., Muriithi, K., Njoroge, W., Long, J., & Heimerl, K. (2020). Can phones build relationships? A case study of a Kenyan wildlife conservancy's community development. *Proceedings of the 3rd ACM SIGCAS Conference on Computing and Sustainable Societies*, 219–230.

Zimu-Biyela, N. (2021). Information needs of women subsistence farmers in the Dlangubo Village, South Africa. *Libri*, *71*(4), 361–373. https://doi.org/10.1515/libri-2020-0007

Zondo, W. N. S., & Ndoro, J. (2021). Social media use in sustainable water management practices among smallholder farmers: Mpumalanga, South. *PONTE International Journal of Science and Research*, *77*(8).

Zwane, E., & Kekana, E. (2014). The role of extension in agricultural cooperative development in Limpopo. *International Journal of Agricultural Extension*, *02*(02), 147–152.

APPENDIX A: Consent form

SCHOOL OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

Department: Agricultural Economics and Animal Production

Project: Incorporation of Social Media Use In Agricultural Information Dissemination By Extension Officers For Farmers In Limpopo Province

Dear participant

Kindly read the following statement carefully before signing or completing the questionnaire. This questionnaire is designed to address the objectives of the project mentioned above. It is to be completed by farmers with the help of the enumerators. The information provided will be used only for the purposes of this research and will be treated strictly confidentially, with no mention of names in the analysis. Please tick the appropriate boxes when necessary or fill in the blank spaces provided. There is no wrong or right answer to these questions. You are free to be or not to be part of this survey. You can withdraw from participating in this study anytime you feel like doing so. Your cooperation and participation in this study are highly appreciated.

CONSENT

I have read and understood the above information relating to the research.

Would you like to participate in this survey?	Yes	1	No	2

APPENDIX B: Social media use questionnaire.

Study Questionnaire

SCHOOL OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

Department: Agricultural Economics and Animal Production

Dear participant.

I am Patience Ramavhale, a PhD candidate from the University of Limpopo researching the use of social media for information dissemination. As part of my research, I am conducting a survey to understand how Farmers and Agric Officials use social media to disseminate information to their communities. Your participation in this survey will greatly contribute to our understanding of this topic and help inform future Extension programming.

General information

Enumerator's name	
Name of District Municipality	
Questionnaire number	
Date	

SECTION A: SOCIOECONOMIC INFORMATION

1. Gender of the farmer

Male	Female
1	2

2. Marital status of the farmer/extension officer (Allow only one answer)

Single	Married	Divorced	Widowed
1	2	3	4

3. Age of the farmer/extension officer in years.

4. The highest educational qualification of the household head? (Allow only one answer)

No formal education	Primary	Secondary	Tertiary	Abet
1	2	3	4	5

5. Number of people in the household (who have been living with you for the past three months? (Write only the number)

6. Sources of income? (Read the list and allow for more than one answer)

Salary	Farming	Pension	Grants
1	2	3	4

7. How much is the income of the farmer/extension officer? (Give an estimation)

<3000	3001-6000	6001-10000	>10001
1	2	3	4

8. What is your primary Language?

Sepedi	Tshivenḓa	Xitsonga	English	Other
1	2	3	4	5

SECTION B: The effectiveness of current social media platforms

1. Do you use social media platforms (WhatsApp, Facebook, Twitter, etc.)?

YES	No
1	2

2. Is the use of WhatsApp effective during information dissemination?

Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

2.1. Complete the following table regarding the effectiveness of WhatsApp. Where: *1 = Strongly Disagree, 2 Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree*

WhatsApp is effective for

Interacting	
Timely information	
Saving money	
Increasing productivity	
Networking	
Reliable information	
Valuable information	
Marketing	

3. Is the use of Facebook effective during information dissemination?

Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

3.1. Complete the following table regarding the effectiveness of Facebook. Where: *1 = Strongly Disagree, 2 Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree*

Facebook is effective for

Interacting	
Timely information	
Saving money	
Increasing productivity	
Networking	
Reliable information	
Valuable information	
Marketing	

4. Is the use of Instagram effective during information dissemination?

Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

4.1. Complete the following table regarding the effectiveness of Instagram. Where: *1 = Strongly Disagree, 2 Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree*

Instagram is effective for …

Interacting	
Timely information	
Saving money	
Increasing productivity	
Networking	
Reliable information	
Valuable information	
Marketing	

5. Is the use of TikTok effective during information dissemination?

Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

5.1. Complete the following table regarding the effectiveness of TikTok. Where: *1 = Strongly Disagree, 2 Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree*

TikTok is effective for

Interacting	
Timely information	
Saving money	
Increasing productivity	
Networking	
Reliable information	
Valuable information	
Marketing	

6. Is the use of Twitter effective during information dissemination?

Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

6.1. Complete the following table regarding the effectiveness of Twitter. Where: *1 = Strongly Disagree, 2 Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree*

Twitter is effective for

Interacting	
Timely information	
Saving money	
Increasing productivity	
Networking	
Reliable information	
Valuable information	
Marketing	

7. Is the use of Telegram effective during information dissemination?

Strongly Disagree	Disagree	Neutral	Agree	Strongly agree

1	2	3	4	5

7.1. Complete the following table regarding the effectiveness of Telegram. Where: *1 = Strongly Disagree, 2 Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree*

Telegram is effective for

Interacting	
Timely information	
Saving money	
Increasing productivity	
Networking	
Reliable information	
Valuable information	
Marketing	

SECTION C: The needs of using social media platforms

1. Do you have internet access in your area?

Yes	No
1	2

2. Do you have electricity?

Yes	No
1	2

3. What drives or encourages you to use social media? You can select more than one

I'm comfortable	1
Immediacy	2
Peer encouragement	3
Market information	4
Socialisation	5

Networking	6
Other	7

4. Which general factors hinder you from using social media? You can select more than one

Too many platforms to choose from	1
Social media are destructive	2
Technology is difficult to use	3
Fake news	4
Data is expensive	5

5. What would you like the department of agriculture to play in support of social media for information dissemination?

Provision of training	1
Assistance in the use of tools	2
Promotions and awareness of tools	3
Advocacy and redistribution	4
Curation and preservation of information	5

6. Do you have any reservations about the use of social media?

Privacy issues	1
Control of information issues	2
Blurring of personal boundaries	3
Other	4

7. Why do you use Social media?

Sourcing information	1
Keeping updated with the news	2
Sharing information	3
Collaboration	4
Writing posts	5
Keeping up with farming activities	6

SECTION D: Social media platforms used in agricultural information dissemination.

1. What are the social media platforms you use?

WhatsApp	1
Facebook	2
Instagram	3
TikTok	4
Twitter	5
Telegram	6
Other	7

2. How many social media platforms do you have accounts with?

One	1
Two	2
Three	3
Four	4
Five	5
More than five	6

3. How many times a day do you engage in social media?

Not everyday	1
Once a day	2
2-5 times/day	3
5-10 times/day	4
More than 10 times	5

4. How often do you post on social media?

Never	1
Monthly	2
Weekly	3
Daily	4
Hourly	5

5. When do you access social media? During…

Free time	1

At work	2
Occasions	3
Meal times	4

6. What do you use social media for?

Keep in touch with family	1
Event planning	2
Buying and selling	3
Inspiration	4
News	5
Dating	6
To meet new friends	7
To find employment	8
To browse	9

7. Has social media assisted you with agricultural information?

Yes	No
1	2

SECTION E: The perceptions and contributing factors of social media use

1. Complete the table below regarding the perceptions and contributing factors of social media platforms. Where: 1 = Strongly Disagree, 2 Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree

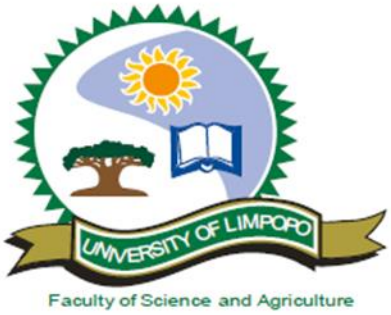
1. Using social media in agriculture helps improve the farming industry	
2. Using social media encourages participation and collaboration	
3. Social media increases farmers' interest in different agricultural sectors.	

4. Using social media makes agriculture more effective	
5. Using social media makes you productive	
6. There is a lack of social media accessibility in my area	
7. There is not enough time to spend on social media	
8. There is a lack of technical support for social media use	
9. I am confident in using social media for agricultural purposes.	
10. There is adequate support for social media use in my area.	
11. I have had adequate training on social media use.	

2. Why do you think social media should/should not be used in agricultural information dissemination? Write your views in the box below.

THANK YOU FOR YOUR TIME AND PARTICIPATION.

Interview for Extension officers



SCHOOL OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

Department: Agricultural Economics and Animal Production

Introduction.

The aim of my research is to develop a model for extension officers to use when incorporating social media for information dissemination in Limpopo Province. This interview is designed to gain in-depth knowledge of why and how social media is used for agricultural information dissemination.

Interview questions:

1. In what ways does social media benefit you?
2. Please describe your challenges regarding the use of social media. What can be done to reduce these challenges?
3. What let you to using social media? What were your expectations when you started? How is it going?
4. Do you think social media is taking agriculture in a different direction? How so? What have you observed?
5. Do you have any objections to the use of social media? Why is that so?

6. What are your general feelings about the use of social media? Is there anything you can change? Why is that so?
7. Does social media help you improve your daily farming skills? How so? Which skills are improved?
8. Does social media allow you access to credible and valuable information? On which platforms? Why not the others?
9. How important is it to develop a social-media-based information delivery mechanism for effective information dissemination of agricultural information in Limpopo? Why do you think so?
10. What are your common ways of disseminating information to the farmers? How long does it take you to reach all your farmers? How often do you visit one area?
11. Would you use Social Media in your workplace for information dissemination? Why?
12. Is there anything about social media that you would want to add or comment about?

THANK YOU FOR YOUR TIME AND PARTICIPATION.

APPENDIX C: Ethical clearance certificate.

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: 2022

PROJECT NUMBER: TREC/598/2022: PG

PROJECT:

Title:	Incorporation of social media use in agricultural information dissemination by extension officers for farmers in Limpopo Province
Researcher:	PM Ramavhale
Supervisor:	Prof. EM Zwane
Co-supervisor:	Prof. A Belete
School:	Agriculture and Environmental Sciences
Degree:	Doctor of Philosophy in Agriculture: Agricultural Extension

PROF D MAPOSA
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**

ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

Finding solutions for Africa

APPENDIX D: Permission to conduct study.

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
AGRICULTURE AND RURAL DEVELOPMENT

Ref: 12R
Enquiries: Dr T. Raphulu

06 February 2023

Ramavhale P.M
University of Limpopo

RE: APPLICATION TO CARRY OUT RESEARCH UNDER THE DEPARTMENT OF AGRICULTURE & RURAL DEVELOPMENT

1. Kindly take note that your request to conduct research titled "*INCORPORATION OF SOCIAL MEDIA USE IN AGRICULTURAL INFORMATION DISSEMINATION BY EXTENSION OFFICERS FOR FARMERS IN LIMPOPO PROVINCE*", has been granted. The permission to conduct research is valid from 13th February 2023 to 30th November 2023. Your permission entails interviewing Farmers and Extension Officers using a questionnaire, face to face.

2. You are required to contact the office of the Director: Agricultural Advisory Services in each district (Sekhukhune, Waterberg, Capricorn, Mopani and Vhembe) to brief them on the study, to request updated farmers database and the assistance.

3. The Department is prepared to embark on any activity that could assist our farmers to improve their communication, farming systems and production at large.

4. Kindly take note that you will be expected to hand over a copy of your final report to the Department for record purposes. You may also be invited to share your findings in the Departmental Research Forum.

5. Hoping that you will find this in order.

Kind regards.

06/02/2023

Dr. T. Raphulu
Chairperson: Research Committee

Date

67/69 Biccard Street, POLOKWANE, 0700, Private Bag X9487, Polokwane, 0700
Tel: (015) 294 3135 Fax: (015) 294 4512 Website: http://www.lda.gov.za

APPENDIX E: Editorial Letter.

UNIVERSITY OF LIMPOPO
TURFLOOP CAMPUS

Faculty: Humanities
School: Languages and Communication Studies
Department: Languages

Private Bag X1106
Sovenga
0727
Tel: +27 15 268 3564
Cell: 073 597 4602/076 4983 344/0605484820
E-Mail: moffat.sebola@ul.ac.za

19 October 2023

TO WHOM IT MAY CONCERN

This letter serves to certify that I have edited an earlier version of a thesis entitled: **"INCORPORATION OF SOCIAL MEDIA USE IN AGRICULTURAL INFORMATION DISSEMINATION BY EXTENSION OFFICERS FOR FARMERS IN LIMPOPO PROVINCE"** by **Ramavhale Manku Patience**. A version of the manuscript with the evidence of my editorial interventions has been sent to the author and is also available in my records.

I trust you will find the editing quality in order.

Best regards

Sebola, M

Dr MOFFAT SEBOLA