FARMER INFORMATION LITERACY AND AGRICULTURAL PRODUCTIVITY: A CASE OF RICE FARMERS IN KANO STATE, NIGERIA

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JUNE, 2024

DECLARATION

This Thesis is my original work and has not been submitted to another Institution for a Degree or other award.

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ABBREVIATIONS AND ACRONYMS

AGORA	Access to Global Online Research
AGRIS	Agricultural Science and Technology
CCSHAU	Chaudhary Charan Singh Haryana Agricultural University
CeRA	Consortium for E-Resources in Agriculture
FAO	Food and Agriculture Organization
GIS	Geographic Information Systems
HJBRDA	Hadejia Jama'are River Basin Development Authority
KAD	Kano Agricultural Development
KNARDA	Kano Agricultural and Rural Development Agency
KRP	Kano River Project
MIS	Management Information Systems
UN	United Nations
USDA	United States Department of Agriculture
USAID	United States Agency for International Development

DEDICATION

I dedicate this work to my mother for her encouragement and assistance in my pursuit of education at all levels.

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TABLE OF CONTENTS

DECLARATION ..... **II**
ABBREVIATIONS AND ACRONYMS ..... **III**
DEDICATION ..... **IV**
ACKNOWLEDGEMENTS ..... **V**
TABLE OF CONTENTS ..... **VI**
LIST OF TABLES ..... **IX**
LIST OF FIGURES ..... **X**
ABSTRACT ..... **XI**
CHAPTER ONE **1**
INTRODUCTION AND BACKGROUND TO THE STUDY **1**
1.1 Introduction 1
1.2 Background to the Study 1
1.5 Objectives of the Study 11
1.6 Research Questions 11
1.7 Assumptions 12
1.8 Limitations of the study 12
1.10 Significance of the study 14
1.12 Conceptual Framework 17
1.13 Operational definitions of key terms 18
CHAPTER TWO **20**
LITERATURE REVIEW **20**
2.1 Introduction 20
2.2 Rice Farmers' Information Needs 20
2.3 Agricultural Information Literacy Programs 30
2.4 Sources of Agricultural Information 36
2.4.1 Bibliographic Sources 39
2.4.2 Mass Media as Sources of Agricultural Information 46
2.4.3 Extension Services as Sources of Agricultural Information 59
2.4.4 Exhibitions and Agricultural Shows as Sources of Agricultural Information 64

2.4.5 Systems for Access and Dissemination of Agricultural Information 66
2.5 Farmers' Awareness of Agricultural Information Sources 78
2.6 Summary of Research Gap 86
CHAPTER THREE 88
RESEARCH DESIGN AND METHODOLOGY 88
3.1 Introduction 88
3.2 Research Design 88
3.2.1 Location of the Study 88
3.3 Target Population 90
3.4 Sampling techniques and sample size determination 90
3.4.1 Sampling Technique 91
3.4.2 Sample Size Determination 91
3.4.3 Sampling of Rice farmers at Local Government Areas 93
3.5 Research instruments 94
3.5.1 Pilot Testing 94
3.5.2 Validity Testing 95
3.5.3 Reliability Testing 96
3.6 Data Collection Methods 97
3.6.1 Ethical and Logistical Considerations 97
3.6.2 Data Collection Techniques 97
3.7 Data Analysis 96
CHAPTER FOUR 99
DATA PRESENTATION ANALYSIS AND DISCUSSION 99
4.1 Introduction 99
4.2 General and Demographic Information 99
4.2.1 Response Rate 99
4.2.2.1 Distribution based on Age of Respondents 101
4.2.2.2 Rice Farmers' Level of Education 102
4.2.2.3 Years of Experience in Rice Farming 104
4.3 Findings for Objectives 105

4.3.1 Information Needs for Rice Farming.....105
CHAPTER FIVE 138
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 138
5.1 Introduction..... 138
5.2 Summary 138
5.3 Conclusions..... 142
5.3.2 Awareness of Sources of Information 143
5.3.4 Farmer Information Literacy and Productivity.....145
5.4 Recommendations..... 146
REFERENCES..... 151
APPENDICES..... 173
Appendix I: Introductory Letter..... 173
Appendix II: Questionnaire for Rice Farmers..... 174
Appendix III: Research Approval from Graduate School..... 178
Appendix IV: Research Authorization from Graduate School..... 179
Appendix V: Research Clearance Certificate..... 180
Appendix VI: Research Authorization from Ministry for Local Government Kano, Nigeria..... 181

LIST OF TABLES

Table 3.1: Target Population.....90
Table 3.2: Krejcie and Morgan (1970), Table for Determining Sample Size from a Given Population.....92
Table 3.3: Sample Distribution per Local Government Area 93
Table 4.2 Comparative analysis of Rice Framers Information Needs in Kura, Garun-Mallam and Bunkure Local Governments.....109
Table 4.3 Comparative Analysis of Rice Framers Awareness about sources of Agricultural Information in Kura, Garun-Mallam, and Bunkure Local Governments.....118
Table 4.4 below illustrates comparison on the extent to which agricultural information sources are utilised in the three local government areas. 129
Table 4.4 Comparative Analysis Showing the Level of Utilisation of Agricultural Information Sources by Rice Farmers in Kura, Garun-Mallam, and Bunkure Local Governments. 129
Table 4.5: Correlation Matrix 133
Table 4.6 Cross-tabulation Chi-square of Farmers' Information Needs and Information Sources.....135

LIST OF FIGURES

Figure 1.1: Conceptual Framework 16
Figure 4.1: Response Rate 100
Figure 4.2: Distribution based on Age Group 101
Figure 4.3: Level of Education 103
Figure 4.4: Years in Rice Farming 104
Figure 4.5: Levels of Information Requirements of Rice Growers in Kura Local Government 106
Figure 4.6: Levels of Information Requirements of Rice Growerss in Garun Mallam Local Government 108
Figure 4.7 Levels of Information Requirements of Rice Growers in Bunkure Local Government Area 108
Figure 4.8: Awareness of the Sources of Agricultural Information in Kura Local Government 114
Figure 4.9: Awareness of the Sources of Agricultural Information in Garun Mallam Local Government 115
Figure 4.10: Awareness of the Sources of Agricultural Information in Bunkure Local Government 116
Figure 4.11: Level of Utilisation of Sources of Agricultural Information in Kura Local Government 126
Figure 4.12: Level of Utilisation of Sources of Agricultural Information in Garun Mallam Local Government 127
Figure 4.13: Level of Utilisation of Sources of Agricultural Information in Bunkure Local Government 128

ABSTRACT

Farmers must locate the finest agricultural information sources to make informed farming choices. Due to time and expense, rice farmers struggle to discover convenient information sources despite many. So, this research examined access and utilization of agricultural information by rice farmers in Kano State, Nigeria. The study's specific objectives were to determine rice farmers' information needs in Kano State, Nigeria, their awareness of agricultural information sources, their use of them, and the significant relationships between farmer information literacy, productivity increase, and information needs. The research study targeted 6,340 and 634 were selected using Krejcie and Morgan (1970) proportional sampling. The research collected data by questionnaire. Pilot tests ensured the instruments measured the desired goals. Farmers' demographic profiles were descriptively analysed using frequencies and percentages and shown in tables and graphs. The research found that rice producers require knowledge to make choices and boost crop output and profitability. Rice growers need current meteorological data to plan planting, harvesting, irrigation, and pest and disease management. Most Kano State rice farmers were aware of radio, television, internet, library, and information centres, among other agricultural knowledge sources, according to the survey. The research found a substantial positive correlation between information awareness and agricultural production ($r = 0.278$, $n = 634$, $p<1268$). The survey also revealed that most rice farmers had access to radio, television, agricultural extension agents, books, agricultural shows, newspapers, and magazines. Information and Communication Technologies were few, according to the report. The association between farmer information demands and agricultural information sources in the research region has a chi-square value of 23.57, higher than the tabulated 21.03 under 12 degrees of freedom highlighting the potential for variation in findings depending on the specific context or factors being examined. The research found that Kano State rice farmers need information literacy to increase output. Information literacy helps rice farmers in the area use new technology, make educated choices, and adopt best practises. The report proposes that Nigeria create and execute a comprehensive farmer information literacy programme in Kano State. This programme should teach rice farmers how to identify access, assess, and apply agricultural information to enhance farming practises.

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

This chapter provides an overview of Information Literacy (IL) and its impact on agricultural production. In addition, the comprehensive scope of this study includes the examination of the study's background, the identification of the issue statement, the formulation of research questions and purpose, the acknowledgment of limitations and delimitations, the consideration of assumptions, the development of a theoretical and conceptual framework, and the establishment of operational definitions for key words.

1.2 Background to the Study

Information literacy is the ability to identify one's information needs, actively seek out appropriate resources to meet those needs, and evaluate, analyse, integrate, and implement the acquired knowledge. Okediji, Moruf, and Bello (2020) define information literacy for farmers as a collection of skills that enable them to identify the need for information and then act accordingly. The concept of digital literacy extends beyond ordinary access to and utilisation of computers, the internet, and related technologies. It entails the ability and readiness to comprehend the profound significance and value of information, identify, evaluate, and select appropriate sources of information, and convert them into knowledge for strategic and effective application (Okediji, *et. al.;* 2020).

The significance of agricultural information literacy cannot be overstated for researchers and stakeholders in the agricultural industry, encompassing agricultural extension workers and farmers. This importance is evident across multiple farming stages, ranging from land

preparation and pest control to harvesting, food storage, credit facilities, and marketing (Kiplang'at 2019). Agricultural information literacy refers to the capacity of farmers to discern the level of information required, efficiently obtain the information that is accessible, and assess the information in order to achieve a certain farming objective (Eamin and Roknuzzaman 2017).

In the North American region, including the United States, Canada, and Mexico, a significant expanse of land is dedicated to agricultural activities, spanning thousands of hectares. Based on the National Agricultural Statistics Report (2019) published by the United States Department of Agriculture (USDA), it is revealed that a significant proportion of farmers, namely 73%, had computer access. Moreover, the report indicates that 75% of rice farmers are capable of using the internet, which is widely recognised as the primary and all-encompassing platform for accessing agricultural information. However, the importance of rice farmers having access to data on seed flow, moisture content, temperature, and weather patterns is becoming evident. This data may be obtained by remote sensors, which transmit information over the internet for farmers to conveniently access and analyse. When compared to other nations, the United States demonstrates a higher level of farmer information literacy, leading to increased productivity in subsistence crop cultivation, such as maize, sorghum, barley, and soybeans. Church, Haigh, Widhalm, de Jalon, Babin, Carlton, and Prokopy (2017) reported that the most notable maize yield observed since 2004 amounted to 160.4 per acre. Subsequently, wheat exhibited a yield of 43.2 bushels per acre, followed by soybeans with a yield of 42.5 bushels per acre. Nevertheless, it is apparent that there exists a discernible alteration in agricultural productivity due to the impact of climate change. The limited accessibility of weather-

related data has resulted in discontent among farmers in North America, leading to severe disruptions in their customary agricultural practises.

Rural institutions in certain countries have adopted computer-based Management Information System (MIS) and Geographic Information System (GIS). They are also building fundamental information programmes on research and extension subjects and a farm decision-making programme to increase productivity by making information freely accessible to farmers. Internet information distribution might transform agricultural services (Huang, Wang and Qiu 2019). Therefore, improved access to information has increased subsistence crop yields such as maize, cassava, sweet potatoes, Irish potatoes, tomatoes, peanuts, millet, and rice. Asia has grown to become the second-highest producer of maize, after the U.S. in North America, producing 257.1 million tons of maize. Asia dominates the world in rice, wheat, potatoes, and peanut production at 212.1, 131.4, 90.2, and 17.3 million tons respectively (Huang *et. al.;* 2019). However, the region's farm production is affected by a dearth of information on climate and weather patterns, affecting the overall farm productivity, whose quality and quantity rely primarily on the weather and climate changes.

The Brazilian Agricultural Research Corporation helps farmers with research-based information (Embrapa, 2022). Farmers in rural Brazil are using mobile apps, websites, and social media for timely, accurate, and location-specific information on crop management, pest control, weather forecasts, and market prices to make better decisions and boost productivity (Santos *et al.*, 2022). In Asia (China, India, and Pakistan), agricultural sectors have tremendously transformed since the 1970s due to successful technological innovation in subsistence farming. Agricultural information has traditionally been disseminated to

farmers by public extension agencies through formal and informal farmer training, radio and television presentations, leaflet distribution, field days, etc. In China, rice is a vital staple crop, cultivated on roughly 30.5 million hectares of land, with an estimated 200 million rice farmers participating in its production National Bureau of Statistics of China (2022). These farmers rely on various agricultural information sources, including traditional channels such as agricultural extension services, research institutions, and input suppliers (Huang *et. al.,* 2021).

The agricultural sector in Africa has considerable importance in the economic landscape of several countries throughout the continent, since a substantial section of the population depends on subsistence farming as their primary means of sustenance. Despite the overall improvement in information literacy levels and information systems, the continent has a lag in farmer information literacy. A significant proportion of African countries have yet to place emphasis on the distribution of agricultural knowledge and proficiency to rural areas, where around (70-80) % of the African populace resides. The potential hindrance to agricultural output in rural farming communities in Africa may arise from the scarcity of agricultural information and the lack of efficient knowledge transfer channels (Krell *et. al.,* 2020).

In Nigeria, research by Moruf (2020) on Agricultural Information Literacy Skills and Use of agricultural information by Farmers in Iwo Senatorial District of Osun State highlighted the need for appropriate and effective information dissemination among rice farmers in the state cannot be over-emphasized for improved productivity, especially for rural farmers. However, the agricultural sector in many developing nations, which is mostly centred on rural farmers, faces a deficiency in the effective transmission of pertinent information

across various media platforms, as well as a lack of practical experiential learning opportunities, adequate guidance, and overall awareness. According to their statement, a significant number of farmers residing in rural regions lack the necessary understanding of contemporary techniques that might enhance their agricultural practises, marketing approaches, and food preservation methods. Consequently, this knowledge gap has a financial impact on the general population, highlighting the need of information literacy.

Agriculture remains the hub of the Kano economy, with over 90% of its rural population engaged in crop production. A considerable proportion of the population derives their income from agriculture yet encounters numerous challenges: lack of crop varieties, deficit in terms of production that reduces market supply, use of traditional tools (Hoes, Matchets, Cutlasses), and reliance on unskilled labour, mainly household members (Osokoya, Alabi, and Fagbola, 2014).

Rice farmers worldwide, especially in less developed countries, often face a range of challenges that have significant implications for their livelihoods and economic well-being. Thapa and Joshi (2019) conducted a research to examine the impact of socioeconomic variables on the agricultural productivity of rice farmers in Nepal. The prevalence of traditional agricultural practises among a significant number of farmers, despite the nation's heavy reliance on rice agriculture, may mostly be ascribed to restricted availability of contemporary technology. The challenges are further intensified due to the constrained access to financial resources and educational prospects, leading to a decline in productivity and income. In contrast, a research conducted by Ochieng *et. al.,* (2020) in Kenya shown that the implementation of the System of Rice Intensification (SRI) among rice farmers resulted in noteworthy enhancements in agricultural production and economic benefits.

The System of Rice Intensification (SRI) encompasses alterations in rice production techniques, including the use of younger seedlings for transplanting, the application of organic fertilisers, and the deployment of improved water management strategies. The study's results revealed that the amount of information and training accessible to farmers had a substantial impact on their inclination to follow System of Rice Intensification (SRI) practises.

The use of broadcasting channels, such as television and radio, with the provision of extension services, significantly amplifies the efficacy of disseminating agricultural information to farmers. The aforementioned assertion is supported by the research conducted by Mekonnen *et. al.* (2020). The use of information and communication technology (ICT) in agriculture has become more significant. This includes the use of mobile phones and the internet, which have emerged as crucial tools for farmers to get up-to-date agricultural information. Through these technologies, farmers are able to receive real-time market information, weather predictions, and expert advice. Notwithstanding its inherent promise, the use of Information and Communication Technology (ICT) may encounter obstacles due to inadequate network coverage and limited digital literacy within the agricultural community (Tegene *et al.*, 2022). Another strength of current agricultural information sources is their ability to foster collaboration and knowledge sharing among farmers. Farmer-to-farmer networks, such as the Global Farmer Network (TATT, 2020), promote peer learning and knowledge exchange among farmers from different regions and countries. Through such networks, farmers can access insights and experiences from their peers, thereby facilitating the spread of innovative ideas and successful practices. Moreover, social media platforms and online discussion forums have become valuable

tools for farmers to connect with experts and fellow farmers, allowing them to ask questions, share experiences, and gain insights into various topics (Klerkx *et al.*, 2019).

The extent to which farmers embrace different information sources is subject to significant variation, influenced by variables such as geographical location, technological accessibility, and educational attainment. Studies have shown that the utilization of bibliographic sources among farmers was relatively low, particularly among small-scale farmers (Jara-Rojas *et al.*, 2019). This medium is attributed to limited literacy levels and lack of access to these resources (Bansal, Das, Joshi and Meena, 2022). Similarly, broadcasting media, such as radio and television, also saw varying use levels (Anyanwu and Udoh, 2022). While these sources can reach a wide audience and provide information in a more understandable format, their use may be limited in areas with poor signal coverage.

Radio and television remain crucial channels for the dissemination of agricultural information to producers, especially in rural areas with limited access to digital technologies. Radio programmes, similar to those supported by Farm Radio International (FRI, 2020), provide practical knowledge on a variety of topics, such as crop and livestock management, weather forecasts, and market information. Radio is an effective instrument for reaching large audiences due to its affordability, accessibility, and ability to surmount literacy barriers (Asenso-Okyere and Mekonnen, 2019). Similarly, television programmes such as Shamba Shape Up (Media, 2020) offer farmers visually compelling content, allowing them to learn through observation and demonstrations. These broadcasting sources are especially advantageous in regions with limited internet connectivity, ensuring that vital agricultural information is accessible to a variety of producers (Torero, 2020).

The Kano Agricultural and Development Agency (KNARDA) have adopted sustainable and cost-effective literacy programmes, which has benefited Kano State's agricultural development and production (Obayelu and Obayelu, 2020). Literacy initiatives are essential for improving farmers' knowledge and skills, with an emphasis on modern agricultural practises, climate change, and sustainable farming practises. By creating financially viable literacy projects, the association known as KNARDA has effectively addressed the problem of uneven knowledge distribution among farmers. These initiatives have increased farmers' access to cutting-edge knowledge and equipment while simultaneously enhancing their capacity for effective usage. As a result, there have been notable improvements in crop yields, agricultural productivity, and farmers' financial well-being (Obayelu and Obayelu, 2020). Additionally, KNARDA's effective implementation of sustainable literacy programmes has significantly aided in the development and promotion of sustainable agriculture practises. These behaviours are essential for protecting the environment and natural resources. Farmers who have received training in sustainable farming techniques are more likely to apply techniques that reduce greenhouse gas emissions, save water resources, and safeguard soil health (Ololade and Olagunju, 2017).

1.3 Statement of the Problem

The acquisition of agricultural information by farmers plays a pivotal role in the advancement of agricultural practises. Nigeria is rich in subsistence crops such as maize, beans and sorghum, but production has fallen in recent years, causing recurrent famine. Unrealized agricultural information abilities cause poor production and food insecurity, especially in Kano. Rice growers in Kano State, Nigeria, produce less despite the government efforts to raise rice farmers agricultural information literacy by providing agricultural extension service have failed due to poor communication, a library and information centre, extension agent, marketing expertise and resources (Wudil *et al.*, 2020). Despite the critical role of agricultural information in enhancing productivity and sustainability in rice production, access to and effective utilization of such information remain significant challenges for farmers in Kano State, Nigeria. Limited access to timely and relevant agricultural information, coupled with inadequate utilization of available resources, hinders the potential for maximizing rice yields and improving livelihoods in the region.

Several factors contribute to this problem. Firstly, there is a lack of adequate infrastructure and extension services in rural areas of Kano State, limiting farmers' access to essential agricultural information. Additionally, socio-economic disparities, including low literacy rates and limited technological literacy among farmers, further exacerbate the challenge of effectively utilizing available information.

Furthermore, the existing agricultural information dissemination channels may not be optimized to reach all segments of the farming population in Kano State. Traditional methods of information dissemination, such as extension services and agricultural fairs,

may not adequately cater to the needs of modern rice farmers or address emerging challenges, such as climate change and market dynamics.

Moreover, cultural and social factors may influence farmers' receptiveness to new agricultural practices and technologies, impacting their willingness to adopt and implement information received.

Therefore, understanding the barriers to access and utilization of agricultural information for rice production in Kano State is essential for devising targeted interventions to address these challenges effectively. By identifying the specific constraints faced by farmers and exploring opportunities for improvement, this study aims to contribute to the development of tailored strategies that can enhance agricultural information dissemination and utilization, ultimately fostering sustainable rice production and rural development in Kano State, Nigeria. The Kano State government's efforts to raise rice farmers' agricultural information literacy by providing agricultural extension services have failed due to poor communication, a library and information centre, extension agents, marketing expertise, and resources. The persistent reports of low agricultural production (yields) necessitated this study to investigate farmer information literacy and agricultural productivity among rice growers in Kano State, Nigeria, to investigate literacy issues contributing to agricultural information underutilization.

1.4 Purpose of the Study

The primary aim of this study was to explore the relationship between farmers' information literacy levels and agricultural output. Furthermore, it aimed to analyse the impact of information literacy on farmers' decision-making processes and their adoption of innovative farming practices. Additionally, this research aimed to identify effective strategies for improving access to and understanding of essential information that is crucial for enhancing agricultural productivity. Ultimately, the outcomes of this study will make a valuable contribution to the region's food security and socioeconomic advancement.

1.5 Objectives of the Study

i. To establish information needs of rice farmers in Kano State of Nigeria;
ii. To examine the level of rice farmers' awareness about the sources of agricultural information;
iii. To establish the level of utilization of agricultural information sources by rice farmers;
iv. To assess the relationship between farmer information literacy and productivity increase.
v. To identify the relationship between Farmers' information needs and Sources of Agricultural Information.

1.6 Research Questions

i. What information do farmers need to improve rice farming?
ii. Are farmers aware of the existing agricultural information sources?
iii. To what extend do farmers utilize agricultural information?

iv. What is the relationship between farmer information literacy and productivity increase?

v. Is there a relationship between Farmers' Information needs and Sources of Agricultural Information?

1.7 Assumptions

The research was predicated upon the following assumptions:

i. Rice Farmers understand the benefits information to Agricultural productivity in Kano State.

ii. Rice Farmers have limited Information literacy skills, including the ability to identify, evaluate, and apply information effectively.

iii. There is a relationship between Farmer Information Literacy and Productivity

iv. There is a relationship between Farmers' Information Needs and Agricultural Information Sources.

1.8 Limitations of the study

The presence of study constraints might be seen as a potential drawback in the research, and these constraints have the potential to impact the findings and conclusions drawn from the research. According to Ross and Bibler Zaidi (2019), there are several factors and events that emerge throughout a study that are outside the control of the researchers.

The researcher encountered limitations due to the fact that a significant portion of the study participants lacked the capacity to comprehend and react to the questions presented in the questionnaires. This phenomenon may be attributed to their limited comprehension and

proficiency in the English language. In order to address this limitation, the researcher undertook the task of translating the questionnaire into the local dialect.

Another limitation encountered was the reluctance shown by the participants in providing the necessary data for the research. The perception of the endeavour as lacking value stems from the failure to follow policies suggested by prior research conducted by the government. There exists a deficit in confidence about the extent to which research outcomes would effectively address and promote overall societal welfare. In order to address this difficulty, the community leaders and Agricultural Area Coordinators of each Local Government intervened prior to consenting to complete the surveys.

1.9 Delimitations of the study

However, delimitation pertains to the definitions and limitations that the researcher intends to establish as the limits of their study, in order to ensure that the aims and objectives of the study may be feasibly accomplished.

The primary objective of this study was to investigate the level of information literacy of Rice producers in Nigeria in relation to their agricultural performance. The study did not investigate other Nigerian commodities or regions. It did not investigate factors beyond information literacy that may influence agricultural performance, such as weather patterns, government policies, and socioeconomic factors. In addition, the research was limited to self-reported measures of information literacy and agricultural performance, as opposed to objective or direct observation.

1.10 Significance of the study

The results of this study provide possible implications and advantages for several stakeholders, such as farmers, agricultural policymakers, and other researchers. In addition, it is crucial to augment the expertise and comprehension of rice farmers regarding the need of efficiently utilising agricultural information. Moreover, it is essential to raise their awareness about many sources and methods of getting such information inside the agricultural sphere. Moreover, the outcomes of the study possess the capacity to provide substantial benefits to agricultural policymakers via enabling the development and execution of policies that are suitable for augmenting agricultural information literacy among rice farmers in the state. These actions are expected to have a substantial impact on agricultural productivity and make a considerable contribution towards the attainment of food security, which is a primary objective of the current administration.

This study may also benefit other researchers who intend to venture into similar studies within and outside the country by providing additional literature, which may provide a reasonable guide for the researchers regarding literature, methodology, and findings.

1.11 Theoretical Framework

The present study was grounded on Hester Meyer's (2016) "Building blocks information behavioural model." Meyer's model on information behaviour offers a thorough and systematic framework for examining the use of information by individuals in various contexts (Meyer, 2018). The manner in which humans discover, comprehend, and use knowledge is influenced by several factors such as sources, resources, channels, and methods (Meyer, 2000).

The first building block of the model encompasses various origins from which information emanates. These can be human experts, printed materials, online databases, or personal experiences. The credibility and relevance of sources significantly influence individuals' decisions about which information to trust and use (Julien and Given, 2003). The second building block represents individuals' tools and assets to access and manipulate information. These resources include tangible items like books and digital devices and cognitive capabilities such as memory and analytical skills (Tamir and Hughes, 2018). The availability and quality of resources can impact the efficiency of information-seeking processes (Case, 2012).

The third building block serves as a conduit through which information flows from sources to individuals. These channels encompass a spectrum of mediums, from traditional forms like face-to-face communication to modern platforms such as social media and online databases. The fourth building block constitutes the cognitive and behavioural activities of information-seeking and utilization. These processes encompass recognizing the need for information, actively searching for relevant sources, critically evaluating information for credibility and relevance and ultimately integrating or rejecting it.

This theory, has found significant adoption and application among researchers in information science. Scholars have embraced this model as a foundational framework for studying information-seeking behaviours, retrieval, and user interactions with information resources. For instance, Julien and Given (2003) highlight the utility of Meyer's model in structuring information behaviour research, enabling scholars to systematically investigate how individuals identify, seek, and evaluate information sources. By examining the

interplay between sources, resources, channels, and processes, researchers gain insights into the complex nature of information interactions.

Meyer’s model is a valuable framework for comprehending information behaviour. Its structured approach to analyzing the interactions between sources, resources, channels, and processes have enriched studies on user behaviors, information systems design, and the broader field of information science. Meyer's model provides a comprehensive lens through which scholars and practitioners can examine the intricate dynamics of information seeking.

This model, correlates with the current study’s objectives as it provides a conceptual framework for understanding how rice farmers in Kano State engage with information sources, utilize resources, navigate channels, and undergo cognitive and behavioural processes to enhance their agricultural practices and productivity. Meyer's model's relevance to this study lies in its ability to structure the analysis of farmer information behaviour. The sources component of the model aligns with the study's exploration of where farmers obtain agricultural information, whether from experts, printed materials, or digital platforms.

The resources section corresponds to the study's emphasis on the instruments and cognitive skills producers use to interpret and implement information for enhanced rice cultivation. The channels aspect is directly pertinent to investigating the communication channels and platforms through which farmers’ access and share agricultural knowledge. The processes component plays a vital role in understanding how farmers engage in the processing and application of acquired information, enabling them to make educated choices that have a direct influence on their agricultural production. This model allowed the researcher to delve

into the dynamic relationships between information sources, resources, channels, and processes, shedding light on the factors influencing farmers' information-seeking practices and how they ultimately impact their agricultural productivity in Kano State, Nigeria.

1.12 Conceptual Framework

The conceptual framework functions as a graphical depiction of the interrelationships of independent variables and dependent variables. This research examined the many factors that impact the information requirements of rice farmers, the extent of knowledge had by rice farmers about agricultural information sources, and the accessibility of agricultural information.

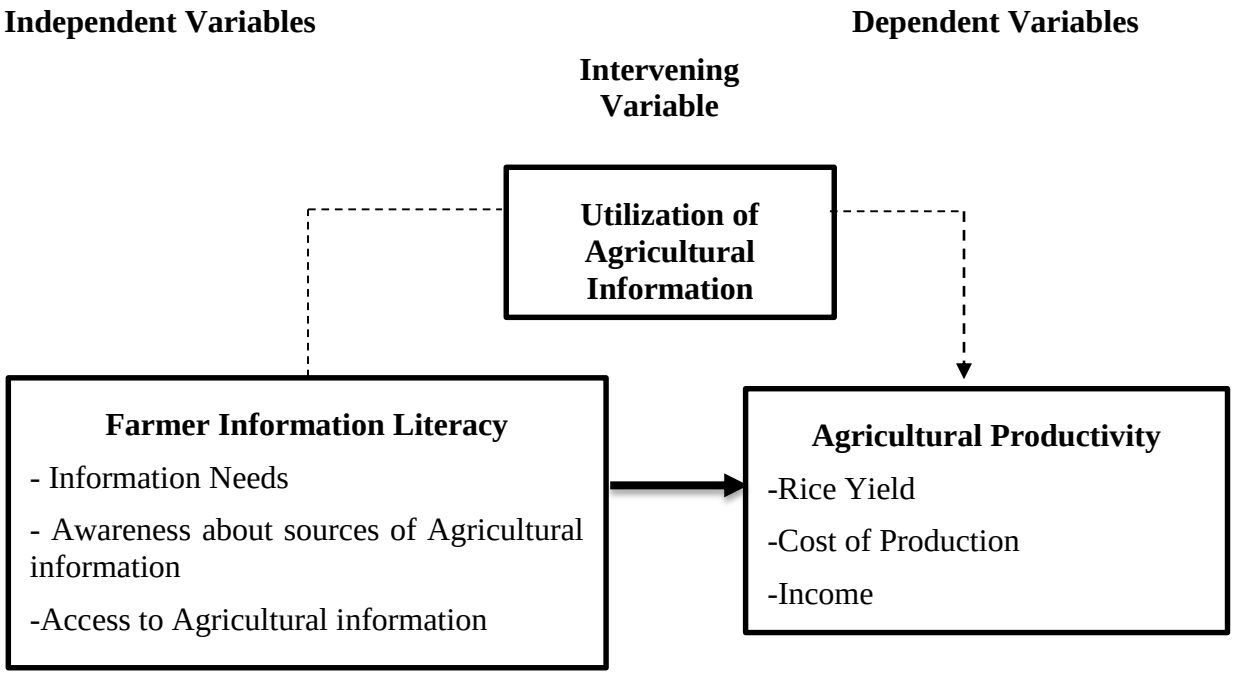

Figure 1.1: Conceptual Framework

Independent Variable The independent variable pertaining to Farmer Information Literacy included three distinct characteristics. The elements described above include the Information Needs, Awareness of Sources of Agricultural Information, and Access to

Agricultural Information. The selected independent variable has a notable link with increased output and subsequent profitability, therefore providing a valid rationale for its inclusion.

Intervening Variable The intervening variable of agricultural information utilisation among rice farmers has a mediating function in altering the association between Information Literacy and the enhancement of productivity.

Dependent Variable Productivity Increase in rice farming largely depended on Farmer Information Literacy using relevant information to improve farming methods.

1.13 Operational definitions of key terms

Information Literacy: The capacity to identify information needs, locate resources that meet those requirements, and then analyse, evaluate, synthesise, and communicate the acquired knowledge (Kumar, 2020).

Farmer Information Literacy: A collection of abilities that enable producers to recognise the need for information and retrieve, evaluate, and apply it effectively. This skill is essential for optimising their agricultural efforts. (Mashroofa and Senevirathne, 2014)

Agricultural Information: Agricultural information consists of a wide variety of data and communications pertaining to agricultural production operations carried out by producers. This includes agricultural cultivation and protection,

animal husbandry and administration, and the creation and preservation of ecological resources, among others. In addition, agricultural information encompasses the crucial aspect of selling agricultural products. (Zui and Li, 2021).

Agricultural Information Needs: Refer to the specific requirements for information that farmers, agricultural extension agents, researchers, and other stakeholders in the agricultural sector have to make informed decisions, solve problems, or enhance their knowledge base (Singh, Chana and Buyya, 2020).

Agricultural Information Sources: A person, thing, or place that provides, generates, or obtains agricultural information (Freeman and Qin, 2020).

Subsistence Farming: Subsistence farming refers to a method of agricultural practice whereby the primary objective is to sustain the farmer and their family, with little surplus available for commercial use or exchange. (Aragón, Oteiza, and Rud, 2021).

Agricultural Productivity: This metric determines how much agricultural output can be produced with inputs (Ortiz-Bobea, Ault, Carrillo, Chambers and Lobell, 2021).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a thorough examination of the existing body of literature pertaining to the subject of information literacy among farmers. The chapter provides a thorough examination of the existing empirical literature relevant to the topics being explored in the current study. This body of literature has identified deficiencies in the current research. This chapter provides a thorough analysis of the information requirements of farmers, their level of competence in agricultural information literacy, the wide range of sources they utilise for agricultural information, and their overall awareness and comprehension of the agricultural information available to them. The objective of this study was to conduct a complete evaluation and synthesis of pertinent prior research and empirical evidence pertaining to the matter and elements being examined in the present examination.

2.2 Rice Farmers' Information Needs

This chapter explores the many information requirements of producers as they negotiate the intricate terrain of contemporary agriculture. Acknowledging the significance of obtaining precise, up-to-date, and pertinent information for the purpose of making well-informed choices, this research delves into the several categories of information that are essential for farmers to augment their agricultural production and sustainability. From weather forecasts and market trends to pest management and soil fertility, understanding these information needs is essential for designing effective information dissemination

strategies and policies that empower farmers, improve their information literacy, ultimately, this will help to the expansion and development of the agricultural industry.

Chen, Rizwan, and Abbas (2022) examine how agricultural services affect Chinese agriculture production efficiency. The authors examine socialised agricultural service to demonstrate its importance. Chan *at al.* (2022) add to the literature on agricultural services and shed light on Chinese agricultural production efficiency by performing a thorough study. The Chinese government has created a socialised agriculture service system to help smallholder farmers modernise quickly in recent decades. The current framework enables farmers to incorporate modern agricultural practises in response to the growing need for food and fibre. This research examined how the system affected agricultural output efficiency. The current research picked Hubei, China, to achieve this goal. The analytical data was obtained from the Hubei Statistical Yearbook and Rural Statistical Yearbook. Data was collected from 2008 to 2019, ensuring a thorough evaluation of key factors. In this study, researchers used entropy to measure socialised and individual agriculture service acceptance. They also assessed manufacturing efficiency using data envelopment analysis (DEA). The researchers used these two methods to understand agricultural service uptake and output efficiency. This research used grey correlation and regression to assess agricultural service availability/uptake and production efficiency. Additionally, the research sought to uncover manufacturing efficiency aspects. The researchers used these analytical methods to better grasp these variables' complex relationships. This research shows a rise in agricultural socialised services. There has been significant expansion in the service levels of agricultural technology and financial security within the agriculture industry, therefore contributing to the advancement of agricultural development. These

services have grown fastest and attracted many users. The influence of science, technology, and material services on farmer efficiency has been studied in agricultural productivity. Numerous studies have examined how these variables affect agricultural output. A thorough literature review shows that science, technology, and material services are the most important variables in farmer production efficiency. This research suggests farmers are more interested in socialised agricultural services. The potential value-added advantages of an integrated system drive this interest. By implementing such a system, farmers have more overflow possibilities, which helps them attain self-sufficiency and food security. This research examines how information literacy might help rice farmers make educated choices and increase rice output. The researchers want to show how information literacy may benefit rice cultivation. This research examines literature and empirical data to provide light on information literacy's potential advantages to rice producers.

According to Hansen *at al.* (2019), via the synthesis and analysis of a diverse body of literature, the authors have identified a knowledge gap pertaining to the relationship between changing climate and its effects on agricultural practises. Climate services have the potential to effectively meet the unique adaptation requirements of African farmers on a significant scale. The objective of this review of literature is to examine the essential prerequisites for weather services to adequately meet the adaptive requirements of growers in sub-Saharan Africa, considering the difficulties presented by changing climates. The present analysis of methods aimed at improving farmer-centric practises is based on a prior research that found constraints in the capacity of both supply and demand factors, which hinder the progress of efficient weather services in Africa. Existing research shows a large gap between easily available knowledge and farmer needs. This disparity is connected to

the seasonal prediction convention and observational data use issues. Scalable improvements to generate local climatic data for agricultural decision-making are being implemented. Structured participatory communication helps farmers understand and relate complex climatic facts to their own experiences. This method helps them incorporate such data into agricultural management decisions. Strategies to carefully integrate communication channels have shown promise for rural climate services. Participatory procedures in agricultural advice systems and interactive broadcast media technologies are used. By combining these methods, stakeholders may successfully communicate climate information to rural communities, equipping them to adapt to changing weather.

This literature review examines how these integrated communication tactics might improve rural climate services. Several climate services co-production efforts have included farmers. These activities seek to improve farmer climate services and promote stakeholder communication. Despite these excellent attempts, farmers' use of information has sometimes been constrained. This literature review examines the problems and alternatives of meeting farmers' evolving needs. The project also examines how to aggregate and incorporate this useful knowledge into national climate service improvements. The available research shows that climate service supply and demand issues intensify each other and limit the successful satisfaction of farmers' needs throughout Africa. The study examined farmers’ need for information on climate conditions. It is also observed that, it is a mere review of previous studies without empirical evidence. The current research aimed to investigate the many components of information requirements among Rice Farmers.

Komarek, De Pinto, and Smith (2020) examined agricultural hazards. They illuminate agricultural hazards' known and unknown elements by assessing current information and finding gaps. Agriculture is complicated and dynamic, posing several dangers. Natural elements like weather, pests, and illnesses might pose these dangers. This literature review examines the five main agricultural hazards. It assesses the breadth and depth of research on these risks and how well they have concentrated on understanding risk implications and establishing mitigation solutions. This evaluation also examines whether the research has focused on particular risk categories or the many hazards farmers face and must manage. Contemporary paradigms and methods place a high value on risk, influencing risk management techniques and investment allocation in many countries. Farmers must handle many hazards simultaneously, highlighting their complex decision-making to protect their enterprises. Unexpected occurrences' severe repercussions highlight farmers' susceptibility to outside forces. The research methodically assessed 3283 peer-reviewed articles published between 1974 and 2019. These papers were chosen for their relevance to agricultural risk. Manufacturing, sales, organisational, personal, and economic risk are the main areas of risk evaluated. By searching this study's exhaustive investigation, relevant scientific publications were found. To address the issue thoroughly, databases and sources were carefully examined. After the literature search, strict eligibility criteria were used to find papers that satisfied the analytic requirements. This criterion ensured that only high-quality; relevant papers were kept for further review. This investigation searched across time scales, geographic areas, and study approaches without limits. The bulk, 66%, of the 3283 studies analysed in this review were based on production risk. Only 15% of these studies included various forms of risk, suggesting a low level of literature coverage. Only

18 researches have addressed all five risk categories. These studies have focused on farmers' views of each risk's relevance or conceptual features rather than quantitative analyses of the effect of exposure to all hazards on important agricultural metrics like yields or revenues. Farmers and politicians struggle to develop risk mitigation methods and regulations due to a lack of risk assessment. The study shows that experts are increasingly studying many risk factors. This move might provide farmers more ways to manage risk. Researchers study risk aspects to help farmers manage agricultural uncertainty. The study reviewed above focused more on risk associated with agriculture, whereas the focus of the present research regards to the examination of knowledge Literacy among rice farmers in Kano State, Nigeria.

Mgale and Yunxian (2020) conducted a study that investigated marketing efficiency and the determinants of marketing channel selection among rice farmers in rural Tanzania. The objective of this study is to conduct a complete analysis of the many factors that influence farmers' decision-making processes while selecting the most suitable selling channels for their rice produce. The significance of marketing efficiency within agricultural systems is of paramount importance, as it has a direct influence on the economic viability and long-term viability of farmers' livelihoods. Through the effective facilitation of connections between farmers and markets, marketing channels assume a critical function in guaranteeing equitable pricing for farmers' produce and enabling access to a broader consumer base. The determinants of marketing channel choice in the context of Mbeya region, Tanzania, a substantial body of evidence has been gathered to shed light on various aspects of the region's characteristics, dynamics, and socio-economic factors. The purpose of this literature review is to synthesise and assess the current corpus of research,

emphasising the expanding significance of rice production in terms of income generation and food security for small-scale producers across Tanzania's diverse regions. In an effort to increase rural incomes and alleviate destitution, the enhancement of rice producers' access to markets is crucial. This study aims to determine the optimal rice marketing channel and investigate the variables that influence the marketing channel choices of smallholder rice producers. This study suggests promoting concerted action by enhancing rural infrastructure, market information systems, and smallholder farmers' access to productive resources, responsible credit utilisation, and national farmer groups.

The study is related to the current study because of its focus on rice farming, and marketing which is one of the components of information needs of rice farmers. However, the present study has gone further to examine rice farmers' information literacy from a wider perspective which encompasses information needs, the level of knowledge of channels of agricultural knowledge and the use of these channels among various stakeholders in Nigeria.

The research conducted by Otekunrin, Momoh, and Ayinde in 2019 examined the extent of market engagement among small-scale farmers in Sub-Saharan Africa (SSA), with a particular emphasis on the cultivation of cash and food crops as well as animals. The aim of the writers is to provide awareness into the methodological techniques used in this particular location, examining their respective merits and limitations. Additionally, the research explores potential strategies for smallholder farmers to transition from subsistence farming to commercialised agriculture, thereby escaping the pervasive poverty that plagues rural SSA. This study examines various interventions aimed to improve smallholder farmers' and producers' groups' organisation, transaction costs, and access to productive

assets and innovative technology. . The objective is to explore strategies that can effectively stimulate profitable market participation among smallholders. This research highlights the importance of these interventions in facilitating sustainable agricultural growth and improving the lives of small scale farmers. Based on a comprehensive analysis of current research and academic literature, this review offers significant insights into the possible ramifications of these interventions and underscores the need for more inquiry in this domain. Overall, the findings underscore the importance of implementing targeted interventions to support smallholder farmers and facilitate their integration into profitable markets. The research reviewed above highlighted one of the very important components of the present study which is marketing, but farmers 'information literacy were not included, thereby indicating the need for further research.

Chen and Lu (2020) did research in Guangdong, China. It has been observed that a significant aspect that has been thoroughly examined is the socioeconomic attributes of farmers and its influence on their information requirements and avenues of access. The methodological foundation of the study is the collection and analysis of empirical data. This study collected a total of 4,006 questionnaires to investigate the intricate relationship between farmers' information needs and their access route preferences. In order to examine the data, correlation analysis, a common statistical technique, was employed. Typically, this technique is employed to evaluate the strength and direction of correlations between variables. Several characteristics, including educational attainment, income level, and farm size, have a significant impact on farmers' information needs and access methods, according to the study's findings. This study investigates a significant factor closely related to the present research: the influence of socioeconomic variables on information needs and

access routes. The researchers employed a comparable method, correlation analysis. However, the research has been unable to determine the various information needs of producers. In addition, the omission of the several methods via which agricultural information may be accessed was also observed. The research did not assess the extent to which agricultural information sources were utilised. Consequently, it is essential to acknowledge that the present study has addressed all of the aforementioned limitations of Chen and Lu's (2020) research.

In their investigation, Muhammad and Mumtaz (2013) assessed the information requirements of a representative sample of 84 Pakistani farmers. Face-to-face structured interviews were used to collect data for the study. Men between the ages of 25 and 65 who are presently engaged in agricultural activities are included in the study. The information requirements were centred on many factors, such as soil preparation, seed selection, crop maintenance, harvesting practises, and animal husbandry. The preponderance of their knowledge needs was met through interpersonal connections. According to the research, the function of mass media and printed materials as information sources is relatively limited. In order to acquire the necessary information, the producers encountered a number of obstacles, including limited access to timely information, low levels of educational attainment, and language barriers. Relevance derives from the study's emphasis on addressing the information requirements of producers, particularly within the agricultural industry. In contrast to the present investigation, which employs a quantitative approach to analyse the information needs of rice cultivators, the cited study employs a qualitative research approach.

Nwali, Lai-Solarin, Dyaji, and Nimzing (2022) evaluated the use of ICT by small-scale women producers in Gwagwalada Area Council, Abuja, Nigeria, to access agricultural information. This study investigated how small-scale women producers in the Gwagwalada Area Council of Abuja utilise ICT to acquire agricultural information. The researchers sampled using purposeful and random methods. The data was collected using surveys. The study comprised 100 randomly selected respondents from five of the ten political wards. The survey found that 98% of the studied area used GSM phones. With 88% and 83% use, radio and television were also popular ICTs. However, several participants reported difficulties accessing Zoom (59%), desktop PCs (56%), and laptops (48%). Numerous participants relied on cell phones (98%), the radio (78%), and *TELEVISION* (74%) as their primary sources of information. The report suggests raising small-scale female producers' awareness of the benefits of adopting Zoom and WhatsApp video conferencing. These technologies may facilitate virtual meetings, training, and information distribution, similar to face-to-face interactions. They also permit prompt responses to virtual meeting issues.

The study by Onyeneke, Umeh, and Onyeneke (2022) examined the use of climatic information services (CIS) among cereal producers in Ebonyi State, Nigeria. The researchers surveyed 405 producers and found that 89% actively searched for weather information, which was provided by agricultural extension staff, producers, and radio broadcasts. The study also found that 88% of producers used climate-related services to make agricultural decisions. Factors such as age, household size, marital status, farming experience, contact with income extension services, ownership of radios, *TELEVISION*s, mobile phones, market proximity, participation in workshops, climate events, and knowledge about climate change were considered. The study found that CIS use in

agricultural strategic planning increased the productivity of rice, maize, and cassava. However, the researchers suggested that agriculturists should have improved access to and utilization of CIS. The research omitted information needs regarding marketing, harvesting, storage, insect control, and seed varieties.

Based on the literature examined pertaining to the information requirements of rice farmers, the researchers primarily concentrated on several key areas. These areas encompassed climate conditions, agricultural risks, marketing information, marketing strategies, socio-economic factors as influential determinants of information needs, and the necessity for climate information services. It is important to acknowledge that there was no emphasis on addressing the knowledge requirements of rice growers, especially in Northern Nigeria. Insufficient investigation was conducted on the essential elements of information requirements for rice farmers, including land preparation, planting, pest management, fertiliser application, harvesting, storage, marketing, and credit/loan. This discovery implies the need for further exploration into the fundamental components of information needs among rice farmers, as stated in the primary objective of the present study.

2.3 Agricultural Information Literacy Programs

Anwar, Oliver, Frings-Hessami, Saha, and Sarker (2022) conducted an empirical study on information literacy among rural Bangladeshi female cultivators. The study focused on an ICT-based initiative aimed at empowering women in rural areas of Bangladesh. The qualitative data collected during a workshop on information literacy was used to analyze the participants' understanding of their information requirements and their familiarity with relevant sources. The study found that female participants demonstrated a fundamental

level of information literacy, but the digital environment presented challenges in assessing its credibility and relevance. The study also highlighted the cultural complexity of information literacy, as rural women's information behaviors were influenced by various social factors, including familial structures, community dynamics, and religious beliefs. The researchers focused on the ICT-based component of information literacy, excluding non-ICT-based components like agricultural extension services and farmers' organizations. The study included only female farmers, excluding male farmers. The research highlights the importance of understanding the cultural complexity of information literacy among rural women.

The increasing emission of greenhouse gases (GHG) has led to a decline in environmental elements and agricultural productivity, causing food scarcity. In developing countries, inefficient and environmentally damaging agricultural practices are prevalent due to economic and societal factors. Economic exclusion and lack of financial knowledge are significant obstacles to sustainable development. This was opined by Raza *et al.* (2023), in a study aimed to investigate the impact of financial inclusion and literacy on the long-term viability of agricultural operations. 220 farmers from the Central Punjab region of Pakistan were surveyed using an organized questionnaire. The research found that promoting financial inclusion and developing financial literacy can sustain the productivity of small-scale agricultural enterprises. Building trust in agricultural extension services is crucial for minimizing the impact of eight independent factors on the sustainable performance of farms. The influence of financial actors plays a crucial role in instilling trust in sustainable financial services within the agricultural sector. However, the researchers focused solely

on the effect of financial literacy and inclusion on agriculture growth and development, neglecting other significant contributors to agricultural advancement

Sang and Cheruiyot (2020) evaluated the information literacy and smallholder horticultural productivity of Kenyan highland farmers. Descriptive cross-sectional investigation. The data was obtained between January and April 2019. The Belgut Sub-county NALEP smallholder horticulturists were selectively questioned. 31 respondents were interviewed face-to-face at home using pre-tested semi-structured interview schedules and analysed using SPSS 2.0. Statisticians characterised the information sources of producers. Analyse attribute relationships using the gamma of Goodman and Kruskals and Somers. Most smallholder horticulture producers obtain agricultural information from government extension, commercial enterprises, NGOs/NPOs, mass media, and other farmers. As indicators of information literacy, farmers' formal education, organisational skills, accounting skills, and agricultural skills were moderately correlated with productivity and profitability, but inconsistent with horticultural produce quality. The Kenyan study was conducted with a limited sample of smallholder horticulture farmers, whereas the present study examined information literacy among 634 rice farmers.

Information sources are instrumental resources or media that provide the necessary information to individuals. Farmers obtained agricultural knowledge from diverse sources, including both printed and non-printed bibliographic resources. These sources included books, encyclopaedias, periodicals, electronic databases (such as AGRIS and AGORA), newspapers, library catalogues, and broadcast media such as radio and television. Mugwisi *et al.* (2016) have identified modern-day media channels such as WhatsApp, Facebook, corporation, and Instagram. According to Ajuwon and Odeku (2018), agricultural

information sources play a significant role in enhancing agricultural productivity. This is largely due to the fact that farmers are able to learn about new technology and agricultural techniques, allowing them to make informed decisions regarding planting and harvesting schedules, crop selection, and market opportunities. The role of agricultural information in facilitating farmers' access to diverse resources, such as bank facilities, seedlings, and methods for insect and disease management, is crucial. These resources have the potential to increase agricultural output and improve producers' standard of living.

According to Kilelo, Nowicki, Nguka, Olimba, Konyole, and Termote, (2023), Food insecurity effects 2 billion of the world's 7.96 billion inhabitants. Despite numerous investments in nutrition and agriculture, Kenya continues to struggle with food insecurity. This study examined farmers' participation in programmes, the relationship between agricultural and nutrition objectives, programme efficacy determinants, and policy effects on food security in order to identify the most influential programmes and stakeholders on food security. The descriptive cross-sectional study utilised numerous techniques for data acquisition. Focus group discussions and interviews with 30 critical informants provided researchers with qualitative data. According to the statistics, 75% of producers received vital initiatives. Pearson's chi-square test ($x(4, n=273)>=91.045$) indicates a statistically significant correlation between education and farmers' awareness of crucial agricultural programmes. The robust relationship is corroborated by the p-value of 0.000, which is less than 0.05. Food nutrition was less essential than profit in agricultural operations. Poor coordination between stakeholders results in unequal programme coverage and impedes the alignment of agricultural programmes with local nutrition needs. Despite the existence of food and agricultural policy, implementation and compliance are lacking. The presented

data indicates that 2.4% of funds are allocated to agriculture, which is less than a quarter of the international commitment of 10%. Lastly, land ownership restrictions limit the economic and nutritional requirements of small-scale producers. The survey revealed that 35.5% of respondents (n=136) possess less than 0.25 acres of land. Consequently, intelligent agriculture must be developed in order to increase yield on limited land by incorporating technology. To enhance food security through nutrition and agriculture, stakeholders must take policy initiatives, collaborate, and implement effective programme distribution mechanisms. Focusing on farmer participation, the study examined how agricultural information literacy initiatives and policies influence food security in Kenya. The research was conducted in Kenya, whereas the current study concentrates on the agricultural information literacy of rice producers in Nigeria.

Different African regions-initiated initiatives at various times. Nigeria benefited greatly from these agricultural initiatives. The Technical Centre for Agricultural and Rural Cooperation (CTA) was established in 1983 and has developed and provided services to improve access to agricultural development information and to strengthen the capacity of continents such as Africa, the Caribbean, and the Pacific (ACP) to produce, acquire, exchange, and use information in all areas of agriculture as highlighted by Olowu (2008).

The success of these programmes prompted the World Bank to finance rural farmers' agricultural processes, such as FADAMA III in Nigeria, which aims to reduce poverty through innovative farming techniques and develop a sustainable income for rural land-water resource users through capacity building, communication, and information support, small-scale community-owned infrastructure, and agricultural development programme (ADP). The report acknowledges the positive impact of FADAMA III initiatives on

enhancing information and communication channels within the farming community, which has led to significant improvements in farmers' knowledge, agricultural practices, and overall output. However, it also identifies significant opportunities for advancing the information literacy of producers. 2014; Sokoya, Alabi, and Fagbola.

The components of an agricultural information system include information-related processes, procedures, and activities. According to the Food and Agriculture Organization (FAO, 2018), systems serve as enablers and mediators by assisting farmers in decision-making and providing them with the necessary information for achieving sustainable agricultural and rural development. (Todaro, 2017) Subsistence agriculture is characterized by low productivity, risk, and uncertainty as it concentrates primarily on crop and livestock production for personal and domestic consumption. However, farmers sell less than fifty percent of their agricultural products due to the fact that their production scale is typically modest and associated with low market participation and high production for their own consumption (Bruntrup and Heltjens, 2018). In addition, Bruntrup and Heidhues (2018) argue that the expansion of subsistence farming has the potential to improve the food security of impoverished rural and urban families. In response to inflationary pressures, this is accomplished by minimizing food purchases.

In their 2015 study, Alcardo, *et al.* investigated novel technologies that could be utilized for the dissemination and exchange of agricultural knowledge and information in Tanzania. This study's research has effectively identified the current policies, initiatives, and programmes that have been implemented to increase agricultural production and ensure the long-term viability of smallholder agriculture. Among the established programmes are Kilimo Kwanza, Famogata, MKUKUTA, the subsidized farm inputs Programme, Southern

Block Agriculture Development, MKUZA, TASAF, the Tanzania Feed the Future Initiative, the Government of Tanzania Comprehensive Africa Agricultural Development Programme Compact, the Agricultural Sector Development Support Programme, and the USAID-Tanzania Agriculture Productivity Programme (Sanga *et al.*, 2013b; USAID, 2011).

The reviewed studies have produced significant findings regarding agricultural literacy initiatives, with a particular emphasis on programmes targeting the information literacy of female farmers, financial literacy policies and programmes, as well as the Technical Centre for Agricultural and Rural Cooperation (CTA) and FADAMA III. However, agricultural information literacy among rice producers in Nigeria has received insufficient scholarly attention, highlighting the need for additional research in this area.

2.4 Sources of Agricultural Information

The term "sources of agricultural information" refers to the various means by which anyone involved in agriculture, such as farmers, researchers, policymakers, and other stakeholders, can gain access to information about the field (Amiri-Zarandi, Hazrati, Yousefinaghani, Kaviani, and Dara, 2022). This study investigates the various agricultural information sources available to rice producers. The procurement of precise, timely, and relevant information is of the utmost importance for facilitating informed decision-making and enhancing agricultural productivity (Tanui and Wamae, 2022).

The authors of a study titled "The Access and Utilisation of Library and Internet Resources as Information Sources among Agricultural Academics and Extension Workers" noted the investigation of conventional sources, such as fellow farmers, community meetings, and

print materials, as well as modern channels, such as digital platforms, radio, television, and agricultural extension services, in order to provide a comprehensive overview of the information landscape. Fatokun, Salman, and Adanlawo (2002). Understanding the strengths and limitations of each information source is crucial for designing effective strategies that facilitate the dissemination of vital agricultural knowledge, thereby empowering rice farmers to adopt innovative practises and increase productivity and sustainability.

Wanyama, Mathenge, and Simba's (2016) study on "Agricultural Information Sources and Their Impact on Farm Productivity in Kenya" explores the role of various agricultural information sources in influencing farm production. They highlight the importance of farmers' access to agricultural knowledge, which is crucial for enhancing production and fostering economic growth. Agriculture extension services are essential for sustainable agriculture and can increase agricultural output. In Kenya, agriculture extension has transformed subsistence cultivation into a profitable enterprise, promoting family nutritional security, economic expansion, and poverty reduction. The government has always provided extension assistance to farmers, but recent development has created a pluralistic structure with multiple information sources. The study examines the agricultural extension service providers in Kenya and their influence on agricultural production. It reveals three significant knowledge sources: state institutions, for-profit corporations, and non-profit organizations. These service providers play a vital role in the dissemination of specialized knowledge and information to specific target audiences. However, only 21% of the sampled producers used these services, with public extension services becoming the most popular option. The study suggests that increasing investment in extension services

and enhancing cooperation between public and private entities could improve the efficiency and quality of these services.

Getahun (2020) investigated the numerous obstacles and prospective benefits associated with the use of information and communication technology (ICT) for agricultural information dissemination in Ethiopia. Modern secondary data sources, such as the Central Statistical Agency and agricultural ICT 4 Ag academic publications, were utilised for data collection, analysis, and evaluation. Agriculture in Ethiopia has been slower to adopt ICT than government, health, and education. Ethiopia features several agricultural ICT services and applications despite its immaturity. Existing research indicates that farmers are capable of creating, sharing, storing, analysing, interpreting, and protecting agricultural information and knowledge through extensive use of information and communication technologies (ICTs) such as mobile phones, websites, social media platforms, and other internet-based services. Only ICT-based agricultural extension systems are capable of disseminating agricultural information and knowledge. Nearly 65,000 agricultural extension employees are employed in Ethiopia. Existing extension procedures are costly and ineffective, limiting their viability. Consequently, agricultural extension policy and practise must prioritise ICT-based extension systems. Only information and communication technology (ICT)-based extension systems that distribute agricultural information were the focus of this study. The study's conclusions were drawn primarily from secondary data sources. The primary purpose of this study was to conduct an exhaustive investigation of the various agricultural information sources available to rice producers in Kano State, Nigeria.

China, Zhang, Wang, and Duan (2016) examined how ICTs can spread agricultural knowledge. The research examined Chinese agricultural information distribution strategies. This research examined Chinese ICT-based information distribution models. It shared expertise and experiences on using developing ICTs to educate farmers and rural communities about agriculture. The overarching goal was to achieve productivity while ensuring sustainability across economic, social, and environmental dimensions. This research examined and evaluated China's agricultural information distribution systems' developmental stages and techniques for creating and implementing agricultural information services. Seven ICT-based information delivery methods were found and studied. The findings of this research may help academics and professionals create ICT-based information dissemination platforms. China's experience utilising emerging ICTs to distribute agricultural information and transfer expertise was used to help other developing countries learn and implement productive techniques. ICTs are costly and farmers are poor, therefore overusing them for agricultural information in Nigeria may not be wise. Furthermore, in order to effectively increase the productivity of Rice Farmers in the Nigerian state of Kano, it is necessary to provide them with access to a variety of credible agricultural information sources. This would allow for the dissemination of accurate, expeditious, and sufficient information regarding agriculture, thereby facilitating their agricultural practises.

2.4.1 Bibliographic Sources

Agricultural information ensures that rice farmers employ best practices for increased productivity. The agricultural sector is constantly evolving with innovations and findings that can significantly affect the output and quality of rice production. Access to

bibliographic sources for this information is essential for farmers to keep abreast with these changes. Traditional sources such as textbooks, research papers, and farming journals have long been the foundation of knowledge for rice farmers.

The purpose of this study is to conduct a comprehensive literature review on the digitalization of the agricultural sector, particularly within the context of Agriculture 4.0. The aim is to identify and analyse bibliographic sources that provide relevant agricultural information. The term "agricultural literature" refers to a compilation of papers and databases that include information on published works pertaining to the field of agriculture. These sources can include bibliographies, indexes, abstracts, and databases that provide information on various types of agricultural literature, including books, journals, conference proceedings, reports, and theses (Abbasi, Martinez and Ahmad, 2022). These sources help researchers, policymakers, and other stakeholders to identify and access relevant information on agricultural topics. They can be accessed through libraries, online databases, and specialized search engines. They are a valuable tool for conducting literature reviews and staying up-to-date on the latest research and trends in agriculture (Abbasi, Martinez and Ahmad, 2022).

The study titled "The Significance of Grey Literature in Assessing the Efficacy of Digital Health and Health and Welfare Technology: An Important Source to Consider" examines the function of grey literature in assessing the effectiveness of digital health and health and welfare technology, it was stated that bibliographic sources of information are often organized and searchable, making it easier for users to find relevant publications on specific topics (Landerdahl *et al.*, 2022). For example, some bibliographic sources may allow users to search by keyword, author, title, or subject area, helping them to locate

relevant publications quickly. Bibliographic sources are generally considered reliable sources of information, as they are often compiled and maintained by reputable organizations and institutions (Nahotko, 2022). They ensure that the publications included in bibliographic sources have undergone some level of review or evaluation and are of a certain standard. They provide access to a wide range of published literature on agriculture. This category includes books, journals, reports, conference proceedings, and dissertations that cover a broad spectrum of topics within the discipline of agriculture. This includes, but is not limited to, agriculture production, animal management, agricultural economics, and agricultural policy (Nahotko, 2022).

Moreover, bibliographic sources often provide detailed information about the content of each publication. This information assists farmers, researchers, and other stakeholders in identifying and selecting pertinent publications for their research or informational requirements. The findings of this study indicate that farmers, particularly those engaged in small-scale agriculture, utilise bibliographic sources to a low degree (Jara-Rojas *et al.*, 2019). This phenomenon may be linked to many variables, including restricted literacy levels and inadequate access to these resources.

In their 2022 study titled "Farmer's Awareness and Use of Different ICT Tools," Bansal, Das, Joshi, and Meena claim that books and periodicals provide consistent and conspicuous coverage of particular issues. They are essential for motivating the public to change attitudes, increase awareness, develop knowledge and skills, and gain an understanding of various topics, such as agriculture. Therefore, books and journals play a crucial role in the dissemination of agricultural knowledge.

Parmar, Soni, Kuwornu, and Salin (2019) conducted a study on the access of farmers to agricultural information in Rajasthan, India. The majority of ICT applications are only accessible in English, and only a small percentage of rural farmers have formal education. The study surveyed 133 farmers, with 71 reporting using ICT and 62 not. The results showed a significant relationship between farmers' access to production and marketing information and their user type. Producers had greater access to information from ICT sources than from non-ICT sources. Multiple regression analyses showed a positive correlation between farmers' access to marketing and production information and the proportion of information obtained via ICT sources. Non-ICT sources had a significant negative impact on producers' access to information. The study suggests that providing comprehensive education and training programs for farmers, particularly female farmers, can accelerate their access to relevant information. However, the research locale and respondents differ, so further research is needed to examine Rice Farmers' Information Literacy and Productivity.

Aldosari, Al Shunaifi, Ullah, Muddassir, and Noor, (2019) examined farmers' ICT use in Khyber Pakhtunkhwa, Northern Pakistan. Agriculture drives growth in Pakistan, as in other emerging countries, according to the study. This research investigated the perspectives of the agricultural community on electronic media and the association between demographic variables and their utilisation of television and radio in the region of Khyber Pakhtunkhwa (KPK), Pakistan. The researchers used a random sampling technique to pick a total of 183 individuals for their study. The data was analysed using both a Chi-square test and descriptive statistics. The survey found that most participants agreed mobile devices and the internet could provide agricultural information. This idea was strongly opposed by

1.6% and 5.5% of respondents. Many participants were unsure whether an agricultural helpline could provide agricultural expertise. The claim was highly supported by 14.2% of respondents. Respondents' radio and *TELEVISION* use was significantly correlated with their age. Conversely, respondents' education levels were strongly and statistically significantly correlated with radio broadcast knowledge use. Between respondents' usage of *TELEVISION* and radio for information and their experience in agriculture, there was no statistically significant correlation. According to the findings, extension professionals must to actively encourage and educate farmers to use electronic media, such as television, radio, helplines, the internet, and mobile devices. These portals may give current knowledge on advanced agriculture production methods. This study demonstrates its relevance to contemporary research by using appropriate instruments for data collecting and employing effective techniques of analysis. In contrast, there are variations in both geographical location and the individuals surveyed. The research did not include rice growers in their analysis.

The 2022 study "Agriculture 5.0: A novel strategic management approach for enhancing cost reduction and energy efficiency in the agricultural industry" by Ragazou *et al.* examines the impact of Agriculture 5.0 on farmers' economic well-being during the pandemic and the adoption of energy-efficient practices. The research used bibliometric analysis with the R programming language and analyzed 2,000 scholarly publications from Scopus. The study found that incorporating emerging technologies and alternative energy sources into Agriculture 5.0 could offer economically feasible approaches for financial resources, weather data access, remote agricultural activity management, and sustainable energy solutions. The study also highlighted the potential of renewable energy, the Internet

of Things, and emission control in achieving sustainable agriculture. The study is a literature review, focusing on agricultural information sources in Kano state, Nigeria.

2.4.1.1 The Agricultural Information Services (AGRIS) 1974 was the year in which the Food and Agricultural Organisation (FAO) created the Agricultural Information Services (AGRIS) database. The platform serves as a comprehensive compilation of bibliographic references that have been systematically catalogued by the Food and Agriculture Organisation (FAO) and its affiliated research institutions from numerous countries. AGRIS was founded with the intention of meeting the information requirements of developing nations in a variety of disciplines, including agricultural research, food production, agricultural economics, rural development, natural resources, and the environment. The system gathers information from a worldwide network of agricultural information centres. In addition, it assists developing countries in establishing and operating agricultural information systems. The primary objective of this initiative is to reduce the occurrence of redundant tasks and enhance the effectiveness of specialised information services. Agricultural research entails the application of scientific concepts and methods to the field of agriculture, with the goal of developing novel technologies that increase agricultural productivity while protecting natural resources and the environment. The result is an increase in both food production and revenue generation.

2.4.1.2 The Essential Electronic Agricultural Library (TEEAL), The Essential Electronic Agricultural Library (TEEAL) is a digital library that provides access to over 500 indexed agricultural journals across various disciplines, including agronomy, animal science, fisheries, forestry, and veterinary science. It was created in collaboration between Cornell University's Albert Mann Library and the Rockefeller Foundation, and is accessible via

CD-ROM and internet platforms. The library is financed by international organizations like the CTA, the Rockefeller Foundation, and the Food and Agricultural Organisation (FAO), as well as donor agencies. TEEAL is a valuable resource for researchers, policymakers, and stakeholders working in low-resource settings, particularly in developing nations. Studies have shown that TEEAL has facilitated the dissemination of modern agricultural research and scientific knowledge to Kenyan farmers, leading to improvements in crop productivity and financial returns. In Ethiopia, TEEAL positively impacted the agricultural research capacity of researchers and extension employees, as well as the livelihoods of smallholder farmers.

In Bangladesh, TEEAL played a crucial role in meeting the information requirements of farmers and researchers, particularly in regions where access to conventional library resources is restricted. It has increased agricultural output, reduced production costs, and enhanced the welfare of Bangladeshi producers.

2.4.1.3. Access to Global Online Research in Agriculture (AGORA) The AGORA Portal is a platform that provides access to scientific articles, bibliographic databases, and other agriculture-related Internet resources. It was created by the Food and Agricultural Organization (FAO), the World Health Organization (WHO), prominent scientific publishers, and Cornell University's Manual Library. The portal supports various disciplines within the sphere of science and social sciences, including environmental sciences, food policy, and agricultural economics. The availability of global online agricultural research is crucial for providing producers with accurate and up-to-date information on agricultural practices, innovations, and research. With a projected global population of 9.7 billion by 2050, it is necessary to increase food production by at least

70% to meet the rising demand. To ensure the sustainability of the food supply, producers will need to adopt novel and improved agricultural methods, technologies, and commodities.

The increased availability of internet-based research resources in agriculture has increased the pace and efficiency of information dissemination, enabling the swift adoption of new technologies and practices. This has facilitated farmers in remaining informed about the most recent research and advancements, promoting the use of sustainable agricultural practices. Bibliographic sources containing agricultural information have a distinct variety, focusing on specific topics such as soil health, crop yields, pest control, and farming technologies. This wealth and specificity facilitate a more streamlined and targeted environment for agricultural research, but can hinder the flow of cross-disciplinary insights and the integration of other fields of study.

2.4.2 Mass Media as Sources of Agricultural Information

The expression "mass media" refers to technologies designed to swiftly disseminate information to a large audience. It functions as the primary mode of communication for the majority of the general population. The most popular forms of mass media are newspapers, magazines, radio, and television. The media is frequently the primary source of information about political, social, entertainment, and agricultural issues for the general public.

2.4.2.1 Television as a Source of Agricultural Information

Television is a valuable medium for disseminating agricultural information, offering a variety of programming that aims to educate farmers and other relevant parties on many

aspects of agriculture, such as optimal methods, emerging technology, and related topics (Achichi, Sennuga, Osho-Lagunju, and Alabuja, 2023).

According to a Nigerian study titled "Effect of Farmers' Socioeconomic Characteristics on Access to Agricultural Information in Gwagwalada Area Council, Abuja," television is a major source of agricultural information for farmers. However, the level of audience reach for the content is subject to significant fluctuations due to a variety of factors (Achichi, Sennuga, Osho-Lagunju, and Alabuja, 2023). Viewership of agricultural programmes and channels, which focus on farming practises, technology, and market trends, is predominantly affected by variables such as literacy rate, access to electricity, and television ownership. In contrast to urban and semi-urban farmers, who have greater accessibility and consequently higher viewing rates, the situation in rural and remote areas, where the majority of Nigerian farmers reside, is typically different. According to Achichi *et al.* (2023), the use of television to disseminate agricultural information is limited by a variety of factors, including but not limited to rural settings, unreliable electricity supply, low literacy rates, and the prohibitive cost of television sets.

The programme content of television as a medium for disseminating agricultural information has the potential to serve as a valuable resource for farmers, researchers, policymakers, and other relevant individuals. This medium provides access to relevant and current information that can facilitate the improvement of agricultural practises and contribute to the industry's long-term viability. According to a study conducted by the Nigerian Communications Commission (NCC) in 2019, approximately 48.7 million Nigerian households own a television set, making television the most popular medium for accessing information. This finding suggests that television has the potential to serve as a

viable medium for disseminating agricultural knowledge to farmers and other pertinent stakeholders in the Nigerian agricultural industry. In addition, a 2017 survey conducted by the African Farming Network revealed that television has become a prominent and preferred medium for smallholder farmers in Nigeria to access agricultural information. Almost 49% of respondents cited television as their principal source of information in this domain, according to the study.

A study by Olanrewaju, Ola, and Ifeduba, titled Monitoring Television Articles in the Nigerian Context, was conducted in 2023. It has been argued that television has become an indispensable part of human existence, superseding the limited visual content of periodicals and the audio content of radio. Currently, people are seeking audio-visual experiences that are exclusive to traditional television media. This study examines the research conducted by Nigerian and international academicians on the impact of television on various facets and domains of human existence. This study aimed to investigate the numerous research areas that academicians have examined in relation to social sectors and television. This study's methodology is the Systematic Review Method. The analysis reveals that the majority of scholarly attention has been focused on television, governance, political affairs, and the growth of communities. The study suggests that academicians should diversify their focus and investigate many topics such as television, climate change, culture, business, and the economics.

Numerous research projects in Pakistan have examined the function of the media in agricultural information dissemination. Shahid *et al.* (2007) examined the role of print media in disseminating vital information and discovered that farmers in the Tando Allahyar region of the Hyderabad district found television to be the second most effective medium.

In their study, Lodhi and Khan (2012) examined the effectiveness of television as a medium for agricultural information dissemination. The researchers examined three districts in the province of Punjab, namely Faisalabad, Sheikhupura, and Rahimyarkhan, and discovered comparable results to support their observations. In their study, Khan *et al.* (2013) determined that the media has a substantial impact on agronomic and plant preservation practises in the Faisalabad region. In their study conducted in the province of Sindh, Chhachhar *et al.* (2012) found that farmers frequently watch television. The researchers designated television as a viable medium for disseminating vital agricultural information. Memon *et al.* (2014) investigated the influence of mass media in the Baluchistan region of Jaffarabad. The device in question was demonstrated to be highly effective in addressing agricultural challenges within the farming community; however, there are numerous other resources available to rice producers that the current study endeavours to investigate.

Some television programmes that benefit rice producers include cultivation best practises. According to Donkoh *et al.* (2019), agriculture-related television programmes can provide information on the best techniques for cultivating rice, including land preparation, planting methods, and fertiliser application. In addition, they discuss pest and disease management as well as methods for increasing yield and productivity. In addition, rice producers benefit from television programmes that provide market data, including current market prices, demand trends, and marketing strategies (Tong *et al.*, 2020). This helps producers determine when and where to sell their grains.

In addition, television programmes provide information about government policies and programmes associated with rice cultivation (Antwi-Agyei and Stringer, 2021). They provide information on available subsidies, grants, and financing for rice producers, as well

as updates on new policies and initiatives to promote rice agriculture in the state. Additionally, agricultural television programmes cover innovations and technologies that benefit rice producers. They include information on novel seed varieties, irrigation systems, and farm equipment that can assist producers in increasing yields and decreasing expenses.

A number of scholars are questioning the importance of media in conveying agricultural information on the grounds that mass media, particularly television, lacks the interactive elements necessary for effective communication and the practical component required for understanding equipment. Kakade (2013) conducted a study in which it was discovered that farmers favoured the demonstration method and discussion as efficient means of acquiring agricultural knowledge. In addition to television, Khatam *et al.* (2013) discovered that farmers accessed agricultural information from a variety of other media platforms.

Moreover, studies have demonstrated that despite the fact that television programmes on agriculture information can be a valuable resource for farmers, they may encounter some difficulties when relying on this information. Not all farmers have access to televisions or reliable electricity to view television programmes (Raza *et al.*, 2020). This may limit the ability of individuals to obtain vital agricultural information through this particular medium. The quality and precision of the information provided on television programmes may vary. Thus, producers may lack the knowledge to evaluate the credibility of the presented information, which can lead to misinformation and confusion (Shamrat, Asaduzzaman, Ghosh, Sultan, and Tasnim, 2020). Thirdly, *TELEVISION* programmes may be disseminated in a language that some farmers do not understand, or farmers may have

low levels of literacy, making it difficult for them to comprehend complex agricultural concepts presented on television (Wahyuningtyas, Kusuma, Febrianita, and Achmad, 2021). Moreover, television programmes may not always be pertinent to farmers' local circumstances. Agricultural practises and obstacles can vary by region, and some of the information presented on television may not be applicable or effective in the local environment.

Mtega, W. P. (2018) examined how farmers in Morogoro, Tanzania, utilise radio and television for agricultural information in Tanzania. This study investigates the selection criteria for agricultural information exchange channels. This study identifies the communication channels utilised by Tanzanian farmers and analyses the factors that influence their selection for agricultural information exchange. The purpose of meta-analysis is to identify, appraise, and evaluate relevant studies. According to the data, radio, cellular phones, television, newspapers, other farmers, agricultural extension agents, and agricultural extension agents were the primary sources of agricultural knowledge. Moreover, the selection of communication channels is influenced by other factors such as the accessibility and cost associated with these channels, the extent of network coverage they provide, and the availability of resources and facilities required for their use. The process of identifying the target audience, evaluating communication features, and selecting appropriate communication channels highlights the need to improve agricultural information accessibility. Before disseminating agricultural information, providers should have a thorough comprehension of communication strategies. The study's objectives have been effectively attained.

It is widely acknowledged that radio and television broadcasts have a significant reach in Tanzania, particularly in rural areas. Certain radio stations may only broadcast in semi-urban and rural areas of the country (Tanzania Communication Regulatory Authority (TCRA), 2017; Ngowi *et al.*, 2016; Ngowi and Mwakalobo, 2017; Ngowi *et al.*, 2016).

Several television programmes in Kenya provide agricultural information to producers. Some television programmes that provide farmers in Kenya with agricultural information include Shamba Shape Up, a popular *TELEVISION* programme in Kenya that provides farmers with practical advice on farming practises, including livestock and cereal cultivation (Kenya National Farmers' Federation, 2017). In addition, specialists provide advice on soil management, seed selection, and insect control. The other programme is 'Kilimo Biashara,' a television programme that focuses on agribusiness and offers producers advice on how to operate successful agricultural enterprises (Agricultural Sector Development Support Programme, 2018). Marketing, finance, and production are a few of the topics covered on this programme.

In addition, Smart Harvest is an N*TELEVISION* Kenya programme that educates producers on modern agricultural techniques, such as the use of technology and innovation to increase yields and decrease costs. The Organic Farmer - This programme offers information on organic agricultural techniques, such as crop rotation, natural insect control, and soil management (ASDSP, 2018). KTN producers *TELEVISION* are a programme that educates producers on a variety of agricultural topics, such as livestock, agriculture, and agribusiness.

Numerous television programmes offer agricultural advice to rice farmers in Nigeria. A television programme called 'Rice and Beans' offers producers advice on rice cultivation,

irrigation, insect control, and harvesting (Agricultural Research Council of Nigeria, 2020). National Agricultural Extension, Research, and Liaison Services (2019). "AgroNation" is a television show that offers rice producers advice on soil preparation, crop selection, and post-harvest management. The television programme 'Agric Today' promotes modern agricultural techniques, including the technological cultivation of rice. The programme comprises professionals who provide yield and expense reduction guidance.

"Farm and Fortune" covers agriculture, specifically rice cultivation. Marketing, financing, and production are some of the topics covered on the show. Farmers learn how to successfully administer paddy plantations. Lastly, 'Green*TELEVISION*' promotes rice cultivation and sustainable agriculture (NAERLS, 2020). The programme provides producers with guidance on organic agriculture, soil preservation, and water management.

2.4.2.2 Radio as a source of Agricultural information

In their recent study, Ndimbwa, Mwantimwa, and Ndumbaro, (2021) examined the various channels used to disseminate agricultural knowledge and information to smallholder farmers. This study's objective was to assess the efficacy of various communication channels used to disseminate agricultural knowledge and expertise to small-scale producers in Tanzania. A descriptive cross-sectional method was utilised to collect data from 321 respondents. Quantitative and qualitative methodologies were employed in the data collection process. Statistical Product and Service Solutions (SPSS) version 21 was used to analyse the questionnaire data, whereas the interview data was subjected to thematic analysis. The findings suggest that the lack of timely and pertinent agricultural knowledge and expertise, which is not effectively communicated in an appropriate format, presents a significant barrier to the efforts of smallholder farmers to increase production. Consequently, subsistence producers rely primarily on informal channels. In addition to informal channels, farmer associations and demonstration sites are increasingly recognised as important channels for the dissemination and acquisition of agricultural knowledge and abilities. To accomplish a significant increase in agricultural production, it is essential to aggressively pursue measures designed to improve the dissemination of agricultural knowledge and expertise. The results indicate that radio played an important role in the dissemination of agricultural knowledge and abilities. Other significant sources of agricultural information germane to rice cultivators in Kano state, Nigeria are omitted from the research.

Jat, Punjabi, and Bhinda (2021) assert that radio assumes great significance in rural regions with limited access to other information sources. According to Jat *et al.* (2021), the use of

indigenous languages in radio programmes makes them accessible to a broad range of farmers regardless of their literacy level. Agricultural radio programmes cover a broad range of topics, including soil preparation, crop cultivation, insect and disease management, market intelligence, and weather forecasts. These programmes feature specialists from a variety of fields, including agronomy, veterinary medicine, and economics. According to Silvestri, Richard, Edward, Dharmesh, and Dannie (2021), the authors provide farmers with valuable advice and perspectives that enable them to make informed decisions regarding their agricultural activities.

The study "The Impact of Farmers' Socioeconomic Characteristics on Agricultural Information Accessibility in Gwagwalada Area Council, Abuja" explores the relationship between farmers' socioeconomic characteristics and their access to agricultural information. The research, conducted by Achichi, Sennuga, Osho-Lagunju, and Alabuja, primarily focuses on local producers, with a sample size of 120 respondents. The study found that 42.5% of farmers were married individuals aged 36-50, living in homes with 11-20 members. A significant percentage of producers claimed an annual income between N100,000 and N500,000. Farmers were well-versed in various aspects of agricultural practices, including fertiliser application, land preparation techniques, crop variety selection, appropriate fertiliser application rates, effective pest and disease management strategies, market information access, and proper storage and processing. However, a small number of producers had a thorough understanding of climate change, irrigation techniques, and agricultural equipment. Primary sources of information included radio, interpersonal networks, agricultural organizations, and television. The study suggests that

the government should reduce energy and internet connectivity costs to create a favourable environment for producers to access these services.

In Nigeria, many communication means are used to provide agricultural information to producers in accordance with the country's agricultural strategy. The agricultural sector uses a variety of communication media, including farm periodicals, brochures, newsletters, newspapers, pamphlets, radio, and television (Dare, 2019).

According to Anyanwu and Udoh (2022), radio in Nigeria has become the dominant form of public communication. Radio broadcasts have been observed to be timely and capable of effectively disseminating information to audiences regardless of their geographical location, provided they possess a receiver fuelled by an acceptable energy source. Radio communication is not hindered by the absence of infrastructure such as roads, electricity, and water. Similarly, the presence of difficult geographical features, great distances, time constraints, and socio-political conditions does not hinder the effectiveness of radio communication. The author also noted that illiteracy does not impede the transmission of radio communications because messages can be transmitted in the language understood by the audience. A further advantage of radio broadcasting is its locational flexibility, as it can be generated in a variety of locations using a tape recorder (Nwuzor, 2020). Due to the numerous advantages of radio, a significant number of governments place a strong emphasis on using it as the primary medium for communicating with producers.

Farmers can learn about new technologies, agricultural techniques, and best practises that can increase their yields and profitability through radio broadcasts (Silvestri *et al.*, 2021). Additionally, they can receive updates on policy changes, new regulations, and market trends that may affect their agricultural operations. According to Silvestri *et al.* (2021),

farmers can effectively communicate their experiences, engage in the exchange of ideas, and mutually benefit from shared knowledge through radio programmes. This peer-to-peer learning can help producers develop a sense of community and mutual support.

The agricultural extension offer ratio is limited by rice cultivators in many developing countries, including Tanzania (Daniel, 2013; CUTS International, 2011). Due to the use of satellites and antennas for broadcasting, radio stations are able to simultaneously reach a larger audience than agricultural extension services (Wahab, 2015). Moreover, the transition from analogue to digital radio broadcasts has increased radio frequency accessibility and coverage (Wahab, 2015). Radio has consistently served as a convenient and advantageous medium for educating a significant portion of the population, particularly nomads. Nevertheless, the nation has yet to fully actualize its potential as a result of a multiplicity of challenges. The primary obstacles include the issue of frequency allocation, the National Policy on Education's limited provisions for distance education, insufficient financial resources, and the government's monopoly over broadcasting (Creed and Perraton, 2001).

Alhassan, Mohammed, and Ibrahim (2002) report that radio programmes in Kano, Nigeria are broadcast in Hausa, the local language, thereby assuring inclusivity for a heterogeneous group of rice cultivators regardless of their level of literacy. The radio programmes cover a broad variety of topics related to rice cultivation, providing farmers with practical advice and insightful perspectives designed to increase their crop yields and financial gains. The radio programmes aimed at rice producers in Kano State cover a variety of topics, including but not limited to soil preparation, crop selection, irrigation methods, pest and disease management, and post-harvest handling (Tanko, Kang and Islam, 2019). The programmes

feature specialists in a variety of fields, including agronomy, irrigation, and rice processing. In order to assist producers in maximising crop yield and minimising costs, they offer advice on the most effective techniques and emergent technologies.

In addition to conveying technical details, radio programmes also serve as a source of market information for rice producers in Kano, including updates on both local and international rice prices as well as market trends (Mohammed and Ibrahim, 2021). This information has the potential to aid producers in making well-informed decisions regarding the optimal timing and pricing for selling their products, thereby enhancing their overall profitability. Utilising radio programmes in Kano State for rice farmers could provide a platform for knowledge exchange, allowing farmers to share their practical experiences and gain valuable insights from one another. According to Mohammed and Ibrahim (2021), radio programmes can facilitate the formation of a communal atmosphere and promote cooperation among rice producers by providing a forum for communication and information sharing.

Broadly, mass media entities exert a crucial influence in disseminating agricultural information, aiding producers in implementing enhanced practises and making well-informed choices. However, the effectiveness of these communication channels can vary significantly based on a variety of factors. Despite the fact that these mass media platforms offer a variety of channels for communicating agricultural insights, deviations from the ideal situation are evident. These deviations are a result of the observation that certain studies have omitted a detailed examination of how mass media channels affect rice cultivation, particularly in terms of providing vital information. A thorough understanding of these influencing factors and the customization of media strategies for rice producers in

Kano State are crucial endeavours. Such efforts have the potential to optimise the efficacy of these communication channels, thereby augmenting their capacity to disseminate crucial agricultural information to the rice farming community.

2.4.3 Extension Services as Sources of Agricultural Information

Agricultural extension services act as a bridge between research institutions and the farming community. In many regions, these services distribute bulletins and fact sheets and organize field days or training programs to impart knowledge to rice farmers. They are often seen as a trusted source of information as they provide localized, practical solutions to farming challenges. Despite the availability of numerous bibliographic sources, the actual utilization by rice farmers varies significantly. Factors such as age, literacy, internet access, and trust significantly determine farmers' preferred sources.

Antwi-Agyei and Stringer (2021) conducted extensive research on the efficacy of agricultural extension services in promoting farmer adaptation to climate change in Ghana's North-eastern Region. The purpose of the study was to examine the impact of social media on mental health and to investigate how extension agents can assist smallholder farmers in adapting to the dangers and consequences of climate change.

The focus of this study is the paucity of research on the enhancement of agricultural extension agents' abilities to assist smallholder farmers in mitigating climate-related risks. The purpose of this study is to improve our understanding of agricultural extension services and their effectiveness in mitigating the effects of climate change on subsistence farming in Ghana.

The study also investigates the information sources used by agricultural extension agents in the Upper East region of Ghana in an effort to comprehend the diverse channels they use to access pertinent information regarding their agricultural practises and dissemination of knowledge. The study also identifies the primary obstacles that impede the effective implementation of adaptation efforts to climate change.

The research employs a mixed methods methodology, including regional stakeholder workshops, expert interviews, and questionnaires administered to a sample of 32 agricultural extension agents in the north eastern region of Ghana. This exhaustive strategy aims to collect disparate perspectives and ideas from numerous stakeholders in the region.

The first study discovered that radios and televisions are the primary sources of climatic information for agricultural extension agents in the Upper East region. The study also identified the need for capacity development, including the improvement of technical skills, communication abilities, knowledge expansion, and agricultural interventions that are climate-smart. It also highlighted the need for field demonstration and project monitoring and evaluation expertise.

The literature review emphasises on the primary obstacles agricultural extension agents confront when disseminating climate change knowledge. These include inadequate transportation resources, material scarcity, high agent-to-farmer ratios, and inadequate funding allocation. The literature review also emphasises the reluctance of farmers to embrace change and the complexity of land tenure systems, both of which impede investment opportunities.

The proposal calls for periodic seminars to enhance the knowledge and skills of agricultural extension agents regarding the use of information and communication technology (ICT) for extension services. These seminars must emphasise the significance of audio-visual integration. Regular assessments and evaluations of capacity development requirements are also essential to ensure that extension agents have the necessary skills and knowledge to carry out their responsibilities effectively. This procedure improves their capacity to meet the demands and requirements of paddy producers.

Agrarian extension services seek to provide farmers, their businesses, and other market participants with information, data, and innovations. However, these services are constrained by a lack of resources such as training, programme financing, and ICTs, which hinders the staff's ability to remain current and execute new extension programme activities effectively.

A study in the Sudanese state of Gezira examined the role of extension personnel in providing agricultural services to small-scale producers. The data compiled from a sample of 36 extension officers revealed that 80 percent had not received formal training and 81 percent had established positive interactions with farmers. 75% of the accumulated data came from the research centres, which served as the primary source of information for inputs and technical packages.

Extension services play an important role in disseminating agricultural knowledge, providing producers with a comprehensive array of evidence-based information regarding various aspects of farming, such as crop management, insect and disease control, soil fertility, and livestock care. They frequently provide agricultural practitioners with training

and technical support, as well as access to input suppliers, financing facilities, and other support services that facilitate the implementation of novel practises and technologies.

Numerous studies have demonstrated that extension services have a significant impact on agricultural output and rural community prosperity. Wale and Mkuna (2023) examined smallholder farmers' satisfaction with the quality of agricultural information provided to them and their preferences for a diversity of information sources. The study analysed data collected from 458 smallholder irrigation producers participating in four irrigation initiatives in KwaZulu-Natal.

Singh *et al.* (2017) discovered that the provision of extension services in India had a positive impact on the adoption of improved dairy farming practises, resulting in higher milk yields and higher incomes for farmers. Through knowledge and training on sustainable practises, extension services may also play a significant role in promoting sustainable agriculture, mitigating environmental impacts, and enhancing resilience to climate change and other adversities.

Norton and Alwang (2020) conducted a study that examines the changes observed in agricultural extension programmes and their potential effects on farmers' adoption of novel practises. The authors assert that agricultural extension initiatives have undergone significant transformations over the past four decades. Which elements have changed, and what are the underlying causes of these modifications? How much have these changes affected the adoption of technology in the agricultural community? In the context of developing nations, it is crucial to consider the potential changes that policymakers and extension agencies may implement. There have been significant structural changes in the agricultural industry, which have been accompanied by the use of innovative agricultural

technology. These changes have occurred concurrently with the restricted allocation of public funds, efforts to distribute government responsibilities, and the proliferation of information and communication technology (ICT). Consequently, there has been an increase in pluralistic extension and consultancy services that combine public and private funding and execution methods for extension operations. Increasingly, the significance of farmer groups and virtual networks in the dissemination of technology is acknowledged, presenting extension services with the opportunity to capitalise on these networks by employing the most advanced information and communication technology (ICT) strategies.

Nyarko and Kozári (2021) examined the adoption and influence of information and communication technologies (ICTs) among agricultural extension officers in Ghana. The researchers emphasised the growing global significance of ICTs in the agricultural sector. The acknowledged implications of this nascent revolution on the efficacy and productivity of agricultural extension services in the agricultural sector have garnered significant attention. To validate these conclusions, however, it is essential to conduct an empirical investigation among industry users. Therefore, the main objective of this study is to assess the use of Information and Communication Technologies (ICT) among agricultural extension workers and its influence on the provision of extension services. The researchers used a basic random sampling technique to select 153 field extension employees as their sample. To obtain information from the participants, a standardised questionnaire was distributed. The acquired data were evaluated using the version 22 of the IBM SPSS Statistics software. The findings of this study indicate that agricultural extension employees utilise information and communication technology (ICT) primarily for personal

communication purposes, rather than for extension-related tasks. It has been suggested that agricultural extension services should provide extensive training in information and communication technology (ICT) to their agricultural extension staff. This training aims to facilitate the seamless incorporation of ICT into the delivery of extended advisory services.

Extension employees play a vital role in disseminating valuable information regarding market trends, pricing, and marketing techniques to enable producers to make informed decisions regarding the optimal time and place to sell agricultural products. In addition, extension agents play a crucial role in the dissemination of information regarding climate-smart agricultural techniques, such as sustainable land management, conservation agriculture, and the use of climate-resilient crop varieties. This information is intended to aid producers in adapting to climate change's effects.

In conclusion, the existing body of literature emphasises the fundamental significance of extension services in fostering the link between agricultural research and its practical application. These services serve as intermediaries for providing producers with customised advice, training, and information. According to the prevalent standard, these services are easily accessible, geographically concentrated, and meticulously tailored to the specific needs of producers. Nonetheless, it is essential to recognise that rice cultivation in Nigeria's Kano State varies. Specifically, previous research has neglected to investigate the impact of various information sources on rice producers in this region

2.4.4 Exhibitions and Agricultural Shows as Sources of Agricultural Information

Agricultural exhibitions and shows are public events that demonstrate equipment, animals, sports, and recreation related to agriculture and animal husbandry (Oxford Advanced

Learners Dictionary, 2009) and are largely commercial. They are also known as fairs. In other words, the terms agricultural fairs, exhibitions, and shows are interchangeable (Wikipedia, 2013), while Roberts (2011) believes that certain agricultural displays are referred to as expositions or exhibitions.

An agricultural show is an effective communication approach to transmitting information to specific individuals or groups of individuals (Mbata and Iwueke, 2007). Agricultural exhibitions will continue to be of significance in Africa, particularly in ex-British colonies such as Nigeria, Kenya, Zimbabwe, Ghana, South Africa, and the Benin Republic (Robertson, 2011).

According to the Federal Government of Nigeria (2002), many attempts to organize national agricultural fairs have been made since the Federal Ministry of Agriculture was formed in 1965. These attempts include "The Fifth National Agric-business Exhibition 2000," which came after an eight (8) year gap of no-shows between 1992 and 1999.

In conclusion, it is apparent based on the existing body of research that Agricultural exhibits facilitate direct interaction between farmers and manufacturers, suppliers, as well as specialists. Farmers learn practical insights that significantly benefit their farming activities by attending workshops and demonstrations. However, these exhibitions are sometimes not easily accessible to everyone. Farmers residing in distant or countryside regions have significant financial and temporal obstacles while attempting to participate in the shows. Furthermore, the content is sometimes more tailored to large-scale farming, leaving small-scale farmers with limited applicable knowledge. Agricultural shows, on the other hand, are often more localized and grander in their presentation. They include competitions, displays of livestock, and various farming technologies. These shows

generally appeal to a broader audience, including the general public, and often include cultural and entertainment aspects. The challenge lies in making these platforms more inclusive and relevant to all farmers, regardless of their size or location. While they offer substantial opportunities for learning and exposure, they deviate from the ideal situation, such as accessibility and relevancy.

2.4.5 Systems for Access and Dissemination of Agricultural Information

The acquisition of knowledge and information is essential for small-scale agricultural producers to make well-informed decisions. Muriithii *et al.;* (2009) identified the accessibility, efficacy, and affordability of agricultural information as the most significant barriers to increasing agricultural output among small-scale producers. Nonetheless, these obstacles can be overcome through the application of innovative strategies that integrate information and communication technologies (ICTs) into agricultural information dissemination. The range of modern technology includes cell phones, the internet, and social media platforms, among others.

2.4.5.1 Mobile platforms for disseminating agricultural information

Multiple societal domains, such as education, commerce, industry, and agriculture, have been permeated by the ubiquitous integration of information and communication technology (ICT), specifically mobile phones. The use of mobile phones for communication has increased dramatically in recent years, establishing itself as the prevalent method of communication among numerous information and communication technologies (ICTs) of the present day.

According to the recent statistical data, approximately 62.9% of the world's population has a mobile phone, totalling 4.68 billion people (Statista, 2019). The use of cell phones has facilitated communication among farmers at multiple levels, ranging from local interactions to administrative exchanges, in regards to agricultural commerce, information dissemination, procurement and sale of inputs, and farm produce (Ogutu *et al.*, 2014). The aforementioned development has led to a decrease in transportation costs and an increase in the productivity of agricultural cooperatives located in rural areas.

Muddassir *et al.* (2016) and Noor *et al.* (2016) report a significant disparity between the current yields and the prospective yields of various commodities in the agricultural sectors of many developing nations. Numerous research projects conducted in developing nations, such as Pakistan, Tanzania, Ethiopia, and Nigeria, have cast light on a variety of impediments related to the current information deficit. One of the most significant obstacles identified is the limited adoption of modern agricultural technology, which can be attributed to farmers' limited access to information about innovative farming techniques. This issue was investigated in a study titled "Efficiency of using smart-mobile phones in accessing agricultural information by smallholder farmers in North Kordofan, Sudan" conducted by Ahmad *et al.* (2016).

Perera, Sivashankar, and Mahaliyanaarachchi (2021) carried out a study titled "Mobile phone-based agricultural information for farming decisions: evidence from upcountry vegetable farmers in Sri Lanka." Researchers found that the use of mobile-based information services in agriculture yields benefits for a variety of stakeholders and resources. These technologies are effective at disseminating agricultural data, thereby improving resource management and supervision.

This study examines the use of mobile phones by rural vegetable growers in Sri Lanka for agricultural information sharing. Despite the increasing availability of mobile phones, the majority of farmers use them for personal communication, according to the poll. Farmers' limited access to agricultural information may be attributable to their insufficient knowledge and attitudes regarding mobile phone-based information technology. According to producers who utilise these services, they can maximise the use of resources to foster agricultural expansion. Utilising agricultural information effectively improves the management of resources, thereby increasing the financial advantages of producers and mitigating their negative impact on the environment. This is the first study to analyse the propensity of Sri Lankan farmers to spend money on mobile phone-based information.

In regions characterised by difficulties in establishing communication with rural farmers, the use of Information and Communication Technologies (ICTs), particularly mobile cell phones, offers a promising opportunity for the timely dissemination of relevant information regarding weather patterns, market dynamics, agricultural resources, and research discoveries to these agricultural practitioners. The provision of such information has the potential to significantly increase agricultural productivity for farmers and empower them to make informed farm management decisions in the face of unpredictability in the climate. Mobile technologies have been viewed as a viable method for enhancing communication with farmers, particularly in remote and difficult-to-reach locations.

The mobile technology sector in Somalia is essential to the development of information and communication technology (ICT), as approximately 70% of the population actively uses mobile money services. The purpose of this study was to evaluate the viability of disseminating agricultural advisory information to producers in the Afgooye district via

mobile. The research found that factors such as age, literacy level, and income sources unrelated to agriculture influenced vegetable producers' adoption of cell phones. Farmers who legally owned land and had income sources were more likely to own or obtain a smartphone than those who leased land or participated in cooperative agricultural arrangements. In the Afgooye region, the optimal use of devices is hindered by obstacles such as human security concerns and limited internet connectivity.

The primary finding of this research indicates that smartphones have the potential to be used as a tool for disseminating information within the study region. To improve their effectiveness, it is essential, however, to resolve both internal and external issues. A significant number of producers expressed urgent concerns regarding security and the availability of trustworthy information sources. Somalia is currently engaged in post-conflict reconstruction and, as a result, faces ongoing threats to its peace and security from a variety of external factors.

2.4.5.2 Social Media as platforms for exchange of agricultural information

A study by Kesherwani, Padhy, padhy, and chandran (2022) examines the function of social media in enhancing agricultural practises among farmers. Platforms such as YouTube, Facebook, Twitter, WhatsApp, Instagram, and LinkedIn facilitate the transmission of information, the development of relationships, and participation. These platforms facilitate the exchange of data and facts and provide producers with avenues for expressing their expertise and technological advancements. Historically, producers had difficulty gaining access to specialised personnel.

Social media platforms facilitate interaction, the acquisition of knowledge, and the dissemination of agricultural techniques with the goal of enhancing quality, fertility, and productivity. WhatsApp is a popular messaging platform, but YouTube and Facebook are favoured for the creation and management of websites. Focusing on information dissemination, educational resources, entertainment content, and awareness campaigns, this study examines the potential impact of social media on the operations of farmers. Agriculture marketing is progressively engaging the use of social media platforms such as blogs, microblogs, pages, and groups, according to Balkrishna and Deshmukh (2017). Using structured questionnaires and in-depth interviews, this study sought to provide a comprehensive description of the experiences and practises of farmers who utilise social media platforms.

The results of the study indicate that utilising social media platforms for agricultural marketing is advantageous. Utilising this technology results in increased information management efficiency and cost-effectiveness for producers. Facebook is predominantly a platform for the creation and administration of profiles and pages. YouTube videos are frequently regarded as the primary source for application-related information. WhatsApp is a widely utilised social networking application that facilitates group communication and interaction. Numerous governing bodies and institutions use social media, blogs, and online communities to gather information and address a variety of issues. Implementing social media for marketing objectives presented obstacles. Social media e-commerce platforms for the purchase and sale of agricultural products have limited credibility.

White, Meyers, Doerfert, and Irlbeck (2014) examine the use of social media by agriculturalists in the context of agricultural marketing in their study. The investigation

employed a qualitative research methodology, which included in-depth interviews with four distinct populations. The study found that individuals utilise social media to combat negative messages about agricultural production, manage their social media presence, and reconcile their responsibilities. Farmers were optimistic about using social media for their enterprises and the agricultural community, according to the results of the survey.

ICT has substantially transformed the dissemination of agricultural information. It has developed numerous tools and platforms that enable producers to access real-time data, connect with specialists, and share their experiences. In an optimal scenario, ICT provides timely, accurate, and customised information, enhancing the decision-making abilities and overall productivity of producers. In general, agricultural studies, however, the literature reveals significant deviations from this optimal condition.

Research reveals that deviations from the ideal arise due to specific studies not centring on rice farming but rather encompassing agriculture. These deviations are reflected in findings that underscore limited access to ICT in rural or remote locales, primarily due to infrastructural deficiencies. Moreover, not all farmers have the requisite literacy or technical competence to harness these tools effectively. The reliability and calibre of disseminated information also demonstrate fluctuations, potentially leading to misinformation. Furthermore, the initial financial outlay associated with adopting ICT solutions proves to be a prohibitive barrier for small-scale farmers.

2.4.6 Systems for Disseminating Agricultural Information

Zhang, Wang, and Duan (2016) conducted a comprehensive study on the dissemination of agricultural information in China, concentrating on the use of Information and

Communication Technologies (ICTs). The purpose of the study was to provide a comprehensive evaluation of various ICT-based strategies used in China for the dissemination of agricultural information. The objective of this study was to facilitate the exchange of information and experiences regarding the use of emerging ICTs for disseminating agricultural information to farmers and rural communities. Focusing on increasing production and improving economic, social, and environmental sustainability, the primary objective was to improve agricultural sector efficiency and promote sustainable development.

The study identified seven distinct ICT-based models for information distribution that serve as conceptual frameworks for the efficient dissemination of knowledge in a variety of contexts. The findings of this study offer a distinct path for the advancement of future information dissemination systems to academics and professionals in the ICT industry, providing valuable insights. The research contributes to the current body of knowledge by emphasising the significance of ICT-based systems in information distribution and by providing a comprehensive understanding of China's use of developing ICTs to disseminate agricultural information and facilitate knowledge transfer.

In their research, Büyükbay and Gündüz (2013) found a strong correlation between the use of computers and the Internet and the socioeconomic characteristics of individuals. It has been suggested that internet access be provided to agricultural researchers in order to increase their utility and contributions to the advancement of agriculture.

In a study conducted by Patel and Patel (2013), the objective was to evaluate the use of cloud computing in rural India to facilitate agricultural development. The prospective advantages of cloud computing technology in the agricultural industry and its related

services have been proposed. This finding is consistent with the research conducted by Büyükbay and Gündüz (2013), who stressed the importance of providing farmers with extensive training and establishing a robust ICT infrastructure in order to facilitate the efficient use of computer and internet technologies for information dissemination in rural areas. In addition, they emphasised the importance of information and communication technology (ICT) applications in promoting agricultural development in the rural regions of Turkey's Tokat Province. However, a significant limitation of the study is the insufficient representation of internet and computer utilisation, as only 30 percent of the total 184 questionnaires collected were devoted to this specific domain.

Agriculture is widely acknowledged as the primary generator of economic growth and stability in the majority of African countries, and it plays a vital role in their social and economic development (Munyua and Adera, 2009; Bhalekar *et al.*, 2015).

Electronic agriculture, also known as e-agriculture, is an emerging field that aims to improve agricultural and agrarian development through the use of information and communication technology (ICT) advancements. In e-agriculture, the integration of the User Interface and Knowledge Management System facilitates the dissemination of vital information. Several systems, including the Decision Support System (DSS), Management Information System (MIS), and Expert System (ES), are utilised to accomplish this (Behera *et al.*, 2015; Bhalekar *et al.*, 2015). According to Verdouw *et al.* (2015), an Enterprise Resource Planning (ERP) system is a standardised software bundle that incorporates diverse organisational operations capabilities into a single system.

The study by Oyewole *et al.* (2013) investigates the role and contributions of information and communication technologies (ICTs) in the development of agriculture in the Ibadan

North West area council of Nigeria. The survey included carefully crafted questions and a random sample of fifty participants. Using techniques such as frequency counts, percentages, and the Pearson Product Moment Correlation, the collected data was analysed. Approximately 58 percent of participants had used information and communication technology (ICT) for between one and five years, according to the findings. In addition, the research disclosed a significant correlation between information and communication technology (ICT) and agricultural advancements.

Agriculture Information System (AIS) is defined by Singh *et al.* (2015b) as a computerised information system that contains the necessary interconnected data to assist producers in information management and policy decision-making. Radios, televisions, mobile phones, computers, tablets, and networking systems, as well as hardware and software components, were among the ICT devices used to improve agricultural practises (Munyua and Adera, 2009; Pande and Deshmukh, 2015).

According to Yimer (2015) and Munyua and Adera (2009), radio is widely used to educate people on agricultural topics, such as innovations in farming practises, efficient production management, and market updates. This finding indicates that farmers, particularly those living in rural areas, may benefit from radio communication in the absence of sophisticated technological resources. Internet and web-based applications are widely used in the agricultural industry to exchange and disseminate information, as well as to facilitate the sale of products and services.

The research conducted by Ramli *et al.* (2015) revealed that information and communication technology (ICT) has the potential to effectively mitigate a number of obstacles that impede the development of agricultural businesses. Inadequate marketing

connections, ineffective information management, subpar production, declining revenue, and a lack of variety are some of these obstacles. Singh *et al.* (2015a) highlighted the significance of using Information and Communication Technology (ICT) in the agricultural sector via the distribution of agricultural information systems to producers at various levels. Nonetheless, a significant limitation of this study is that its sources do not adhere to the globally acknowledged standard format.

Githinji, Mwangi, and Bebe (2014) evaluated the effectiveness of using short messaging service (SMS) to distribute weather information to Kenyan farmers. The study utilised a cross-sectional research design to investigate the efficacy of SMS in disseminating information and enhancing the decision-making processes of producers.

Moreover, Mamta, Tiwari, and Singh (2015) evaluated the effectiveness of radio-based agricultural extension services within the context of India. The research revealed that radio-based extension services effectively reached a large number of farmers, resulting in increased knowledge acquisition and adoption of novel technologies.

Abdullahi, Dahiru, Musa, and Abdullahi (2018) conducted a study in Nigeria to evaluate the effectiveness of community-based extension services in the state of Kano. Farmers' knowledge and adoption of innovative agricultural technologies increased as a result of the implementation of community-based extension services, according to the study's findings.

In a separate study conducted by Pemsl, Waibel, and Ortmann (2016), the effectiveness of e-extension services in Vietnam was evaluated. Using a descriptive survey methodology, the study found that e-extension services effectively reached out to farmers and improved their comprehension and use of innovative technology.

The dissemination of agricultural knowledge, including to rice producers, relies on bibliographic sources as a foundational instrument. These sources usually include research papers, journals, and manuals providing in-depth analysis and recommendations for various agricultural methods and technologies (Spielman *et al.*, 2019). These scholarly publications typically contain the most recent research findings, which can be invaluable for enhancing crop yield and agricultural practises. The majority of rice producers, particularly those in developing countries, have limited access to such publications due to financial constraints or availability issues.

Additionally, newspapers, radio, and television serve as dissemination channels for agricultural information. According to Evenson and Gollin (2020), these platforms can effectively disseminate weather forecasts, market trends, and innovative methods to a broad audience. Although this platform has a large audience, the provided content is frequently not tailored to the specific needs of rice producers, resulting in a lack of relevant and practical advice. In addition, the media tends to emphasise broad agricultural trends rather than the particular difficulties and opportunities in rice cultivation

Historically, extension services have played a pivotal role in facilitating the transmission of knowledge from research to practical application. (Davis *et al.*, 2019) These services frequently provide hands-on training and consultation to rice producers, directly enhancing their skills and practises. Nevertheless, the efficacy of extension services can differ greatly contingent on the availability of resources, outreach, and local infrastructure. Rice producers in remote areas often confront difficulties accessing these valuable services, contributing to a divide in knowledge and application of modern agricultural techniques.

Farmers can interact with experts, observe demonstrations, and learn about the newest technologies and products at exhibitions and agricultural displays (Anderson *et al.*, 2020). These exhibitions can provide rice producers with useful information about new rice varieties, equipment, and insect control techniques. However, these showcases are typically held in urban or central locations, making it difficult for small-scale or rural rice producers to attend due to financial and logistical constraints.

The importance of Information and Communication Technology (ICT) in agriculture has increased significantly, allowing for novel methods of information distribution. ICT has revolutionised how rice farmers access information, from mobile applications that provide real-time weather forecasts to online forums where farmers can share their experiences (Binswanger-Mkhize *et al.*, 2019). Nevertheless, the digital divide persists, limiting access to these technologies to those who can afford them and who are digitally literate.

Systems for disseminating agricultural information can be intricate and multi-tiered, frequently incorporating a combination of the sources discussed previously. In optimal circumstances, these systems are designed to complement one another, ensuring that rice cultivators receive expeditious, pertinent, and actionable information from multiple channels (Evenson and Goltin, 2020).

However, voids in the system frequently exist, predominantly as a result of resource constraints, unequal access to technology, and implementation restrictions. Rice producers face significant obstacles in gaining access to and making effective use of diverse agricultural information sources. Financial constraints, geographical isolation, and technological obstacles can hinder their ability to utilise these valuable information channels. Therefore, it is essential to employ a comprehensive strategy that includes policy

interventions, infrastructural improvements, and community engagement in order to address these challenges (Davis *et al.*, 2019; Anderson *et al.*, 2020).

The literature review has shown that systems for disseminating agricultural information encompass various methods, platforms, and technologies designed to deliver vital information to farmers, stakeholders, and others involved in the agriculture sector. Conventionally, these systems should offer accurate, timely, and relevant information through accessible channels, whether through traditional means like community meetings or modern technologies like mobile apps. However, deviations from this ideal standard have been shown to exist. Accessibility is a significant issue; while urban or well-connected areas may benefit from many information sources, rural or remote regions might suffer from limited access. The one-size-fits-all approach of some dissemination systems may not cater to the specific needs, language, or cultural context of different farming communities. The lack of integration between different information sources can lead to inconsistencies or contradictions in the advice provided. Furthermore, small-scale farmers might not have the resources or literacy levels to access or utilize complex technological platforms.

2.5 Farmers' Awareness of Agricultural Information Sources

This section provides a summary of the existing literature on farmers' cognizance of the diverse agricultural information sources available to them. (Jato *et al.*, 2019) This factor plays a crucial role in determining the extent to which producers can access and utilise such information to increase their productivity. The study examines farmers' awareness of traditional sources such as fellow farmers, community meetings, and printed materials, as well as contemporary channels such as digital platforms, radio, and agricultural extension

services (Kabir *et al.*, 2020). By understanding the factors influencing farmers' awareness of these information sources, researchers can identify potential knowledge gaps and develop strategies to improve access to and disseminate vital agricultural knowledge, thereby promoting informed decision-making and sustainable farming practises (Oladimeji *et al.*, 2020).

Caffaro *et al.* (2020) investigate the factors that influence technological innovation among Italian farmers. In West African agricultural innovation systems, the adoption of agricultural knowledge and technologies is predominantly influenced by perceived utility and ease of use, according to the research. 499 household leaders from rice centres in Benin, Côte d'Ivoire, Niger, Nigeria, and Togo participated in the survey. The study suggests policy measures to facilitate farmers' access to formal and informal knowledge sources, capital, social support, and information and communication technologies. The research emphasises the need to consider both external and internal factors when implementing inclusive technology in developing nations with low levels of literacy. The study also emphasises farmers' inadequacy in identifying their information needs, allocating resources, analysing and implementing the knowledge obtained from various agricultural information sources.

Nikam, Ashok, and Pal (2022) evaluated the information needs, accessibility, and effects on producers in several cotton-producing regions of the Indian state of Maharashtra. Utilising data from a home survey of 644 cotton producers, the research objectives were accomplished. Two districts within the state of Maharashtra, India, were chosen to represent distinct production situations and were sampled using multistage sampling techniques. The Probit model was used to determine the factors that influence the

accessibility of information from particular sources. Using the Inverse Probability Weighted Regression Adjustment (IPWRA) technique, the impact of information availability was analysed. The research revealed that producers from the two distinct regions had slight differences in their information needs. In the Jalgaon district, where cotton production is highly dependent on irrigation, producers who accessed at least one authoritative source of information saw a significant increase in both cotton yield and output value per unit area. After conducting a comprehensive analysis of each formal knowledge source, it was determined that their respective levels of effect are variable. In addition, the study revealed that the availability of information from public sources and mass media had a substantial effect on the cotton manufacturing process. The results of this study indicate a dearth of awareness and insufficient utilisation of important agricultural information sources.

Deressa, Hassan, Ringler, Alemu, and Yesuf (2008) discovered that the majority of rural farmers in Ethiopia and East Africa were oblivious of agricultural information sources. In contrast to this study's findings, other studies, such as those conducted by the BBC World Service Trust (2010), Jonge (2010), and Mertz *et al.* (2008), discovered that African farmers were aware of agricultural information sources.

Kiconco, Stevens, Akankwasa, and Kubiriba (2022) investigated the correlation between the sharing of agricultural information and the deliverance of services within social networks among participants in Uganda's banana value chain. The study employed an exploratory case study design, with focus group discussions and key informant interviews serving as the primary data collection techniques. The data was analysed using Social Network Analysis (SNA) to identify the key individuals accountable for facilitating the

dissemination of information and provision of services across the banana value chain. The results of the study indicate that farmer associations and regulatory bodies played a significant role in facilitating the exchange of information and the provision of services. However, their primary function was that of information and service consumers rather than influencers. The network density results (0.256–0.283) indicate a low level of cohesion among the participants, indicating that less than 30% of the potential connections are utilised for the exchange of information and provision of services. The current study drew attention to the low levels of information literacy exhibited by farmers in certain regions of East Africa.

Literature reviewed supports the need to investigate farmer information literacy and agricultural productivity among paddy producers in Nigeria's Kano state. Bisto (2012) defines information sources as receptacles for knowledge or data that serve a variety of consumer groups. Isaya, Agunga, and Sanga (2018) analysed agricultural information sources for producers in developing countries, with an emphasis on rural areas. They identified bibliographic sources such as books, periodicals, and electronic databases, mass media channels such as television, extension services, and ICT, especially smartphones. Furthermore, social media platforms such as YouTube, WhatsApp, and Facebook contributed to the dissemination of agricultural information. Exhibits, agricultural shows, seminars, workshops, and training programmes were to be analysed, along with cooperative groups, print media, pamphlets, libraries, public addresses, written documents, visual representations, and artistic creations.

In a study conducted by Abbas, Muhammad, Nabi, and Kashif (2003), an assessment was made on the information sources used by producers and their degree of knowledge

pertinent to the adoption of sugarcane production technology. The study included a cohort of 180 participants who were sugarcane cultivators living in the Faisalabad region. Based on the data at hand, a substantial majority of large-scale farmers, ranging from 52.50 to 84.80 percent, exhibited knowledge of the proposed sugarcane production method and subsequently implemented it. The dissemination of information about sugarcane production technique among a significant proportion of small-scale farmers, often exceeding 70%, mostly stems from their fellow farmers within the agricultural community, as well as from those who exhibit creative and forward-thinking approaches. A comparable percentage, namely 20% or more, acquired information through the Agriculture Department's Extension Wing and Research Institutes. Additionally, a range of 10% to 20% gained information from mass media sources such as radio, television, and printed materials.

Due to the research's narrow concentration on sugarcane production, little is known about farmers' cognizance of agricultural information pertinent to food production and food security in general. To address this lacuna, the present study capitalized on the reduced sample size, which represents a subset of the population, to investigate the extent of farmers' cognizance regarding available agricultural information sources for rice farmers. 634 farmers were selected from three local government areas in the Nigerian state of Kano.

According to the findings of Kielbasa *et al.* (2018), farmers demonstrated a comprehensive comprehension of the importance of agricultural information and recognized the need to identify dependable sources from which to obtain the required information. In spite of the significance of agricultural information knowledge and comprehension, research results on farmer awareness in the African context vary.

Deressa, Hassan, Ringler, Alemu, and Yesuf (2008) and Orindi and Murray (2005) conducted research revealing that rural farmer in Ethiopia and East Africa frequently lacked knowledge of available agricultural information sources. In contrast to the findings of the present study, previous research conducted by the BBC World Service Trust (2010), Jonge (2010), and Mertz *et al.* (2008) demonstrated that farmers in a number of African countries were aware of agricultural information sources.

Moon, Miah, and Berg (2016) conducted a study in Bangladesh to evaluate growers' comprehension of the efficient transmission of agricultural information using ICT-mediated extension services. From a population of 700 farmers, 100 were selected to participate in face-to-face interviews and focus group discussions to acquire data. 68% of producers had a moderate level of knowledge, while 26% had a high level of cognizance, according to the study. Only 6% exhibited a limited level of comprehension. Challenges confronted by farmers include insufficient services provided by field extension agents, frequent power disruptions, a shortage of competent personnel, inadequate training facilities, and inadequate supervision and monitoring of field extension initiatives. The purpose of this research is to expand on extant data and literature regarding the knowledge of rice producers in rural areas regarding various information sources.

Farmers' awareness of available agricultural information sources is crucial for adopting modern farming techniques, optimizing yields, and managing risks (Colussi, Morgan, Schnitkey and Padula, 2022). This is particularly important for rice farmers, given the crop's susceptibility to various environmental factors like weather conditions, pests, and diseases (Labarthe and Laurent, 2019). The degree of awareness among rice farmers may exhibit significant variation, contingent upon characteristics such as geographical location,

educational background, and resource accessibility, despite the abundance of knowledge accessible via research publications, extension services, and digital platforms.

The status of farmers' awareness is a function of multiple variables, including education, proximity to urban centres, and the quality of local extension services (Javaid, Haleem, Khan and Suman, 2023). For instance, rice farmers in developed countries or those near research institutions will likely be better informed due to more efficient extension services and easier access to academic resources (Sulaiman and Davis, 2020). Conversely, those in remote or underdeveloped regions might be less aware of the best farming practices, relying primarily on traditional knowledge and peer advice.

One significant challenge for raising awareness among rice farmers about these various agricultural information sources is the diversity of the farming population. Some farmers may have limited literacy skills or speak languages not widely represented in academic or extension materials (Labarthe and Laurent, 2019). Language barriers and low levels of formal education can make it difficult for these farmers to benefit from written resources, scientific publications, or even digital platforms.

Another challenge lies in the disconnect between research institutions and actual farming practices. While a great deal of agricultural research is conducted annually, not all of it reaches the farmers for whom it is most relevant (Sulaiman and Davis, 2020). Even when rice farmers are aware of research publications or educational resources, they may find these materials too technical or not directly applicable to their circumstances.

The role of extension services in this context cannot be overstated, but here, there are challenges. These services are dependent not only on the quality of the information

provided, but also on the level of trust between extension officers and rice producers (Labarthe and Laurent, 2019). Rice farmers may likely learn new techniques or use new resources if they are introduced by individuals or organizations they trust. However, this trust takes time to build and requires consistent, reliable support—something that is not always available.

Moreover, although digital platforms offer enormous potential for raising awareness about agricultural information, not all rice farmers have equal access to these platforms. Even among those who do, digital literacy levels can vary significantly, affecting how much these farmers can benefit from online resources (Sulaiman and Davis, 2020). This technological divide is another challenge to raising awareness among rice farmers about available agricultural information sources.

In summary, while various agricultural information sources could benefit rice farmers, awareness of these resources is uneven and faces several challenges. These include geographic and economic disparities, language and literacy barriers, and limitations in the effectiveness and reach of extension services. Efforts to bridge these gaps must be multi-pronged and culturally sensitive, requiring collaboration between governments, NGOs, and local communities (Labarthe and Laurent, 2019; Sulaiman and Davis, 2020).

The literature examined underscores the pivotal role of farmers' awareness regarding agricultural information sources. This awareness is critical in enabling informed decision-making and adopting modern farming practices. Ideally, farmers should comprehensively understand the spectrum of available sources. This understanding would empower them to tap into various information streams, including extension services, mass media, exhibitions, and technology platforms among others. However, the reality deviates from

this anticipated ideal, particularly when considering studies focused on agriculture as a whole rather than specific to rice farming.

The aforementioned disparity becomes evident when analyzing instances in which inadequate education and awareness initiatives are ineffective, resulting in a dearth of knowledge among farmers about the presence of important resources. This lack of awareness, in turn, curtails their ability to leverage new techniques and technologies. Cultural and linguistic barriers compound this situation, particularly within diverse or remote communities. Additionally, instances arise where misinformation and unfounded rumour outshine trustworthy sources, resulting in decisions that fall short of optimal.

It is, therefore, unmistakably evident that while a diverse array of agricultural information sources exists, challenges tied to education, cultural dynamics, and information authenticity create constraints that impede farmers' awareness. As a result, their potential to fully harness the available wealth of knowledge remains compromised. This insight is particularly relevant when assessing studies that have not specifically honed in on the nuances of rice farming, contributing to the observed deviations from the standard.

2.6 Summary of Research Gap

This research examines information literacy among rice farmers, concentrating on their familiarity with diverse agricultural information sources. Despite the availability of diverse information, obstacles such as education, cultural dynamics, and authenticity hinder farmers' awareness, limiting their ability to fully utilize the available knowledge. This is particularly relevant when assessing studies that have not specifically focused on rice farming nuances, contributing to deviations from the standard.

The study reveals that farmers' information needs are influenced by individual characteristics, social factors, and family dynamics. Farmers require a wide range of knowledge and abilities to effectively carry out their agricultural activities, including training, healthcare, scientific advancements, disease prevention, dietary nutrition, techniques for soil preparation, seed selection, crop maintenance, harvesting methods, and animal husbandry. These areas are crucial for the rural labor force engaged in agricultural pursuits. However, research primarily focuses on generalizing the population and sample to include mechanized farmers, agricultural professionals, women farmers, and farmers specialising in specific crops, rather than addressing the unique agricultural information requirements of rice farmers.

In addition, various sources of information for farmers have been identified, including books, mass media, ICT tools, and social media platforms. Despite identifying these sources, the existing research does not fully delve into the specific sources preferred by smallholder rice farmers or consider their unique demographic profiles.

According to the studied literature, agriculture is a key economic component in many African nations, and e-agricultural technology can spread crucial information. Existing studies does not explain how rural rice farmers use these improvements. The preceding review shows that most research did not concentrate on rice farmer information literacy and agricultural performance. Many of these studies don't focus on rice cultivation. Their generalised perspective of agriculture leaves rice farmers' unique information requirements and preferences unmet. This research examined rice farmers' information literacy and agricultural performance in Kano State, Nigeria, to fill such gaps.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter provides a thorough analysis of the research design and methodology utilised in the current investigation. It includes the research design, study location, target population, sampling techniques and sample size, data collection instrument, pretesting or pilot study, instrument validity and reliability, data collection techniques, data analysis methods, and logistical considerations.

3.2 Research Design

The purpose of the study was to investigate the level of information literacy among producers and its impact on agricultural production. The research employed a descriptive methodology. The model is a method for studying and explaining social processes. A comprehensive research approach includes a detailed description of a phenomenon, as well as its classification, quantification, and the development of statistical frameworks to explain the observed phenomena (Creswell, 2013). The researcher's chosen methodology facilitated the examination and discussion of the information needs of rice producers in Kano State, Nigeria. In addition, it allowed for an evaluation of the extent to which rice farmers in the region are aware of agricultural information sources, their access to such sources, and the relationships between farmers' information literacy and productivity.

3.2.1 Location of the Study

The study was carried in Kano State, more precisely at the Kano River Irrigation Scheme. Kano State is situated in northern Nigeria and has long been recognised as Nigeria's food

basket (Anugwa and Agwu, 2019). It has a population of approximately nine million people (National Population Commission, 2006). The yearly growth rate is expected to be 2.27 percent (Raimi *et al.*, 2020), bringing the number of residents to 13,897,103 persons in 2020.

The Kano River Irrigation Scheme was constructed as one of the ground-breaking projects by the Federal Government of Nigeria in 1970 (Ahmad, 2018). The Scheme is a large-scale, capital-intensive irrigation project in the state that would cover 58,000 acres and raise food production and productivity, increase recipients' income, create job opportunities, and eliminate food insecurity. The Kano River Irrigation Scheme serves the local governments of Kura, Bunkure, and Garun Mallam (Wudil, A.H. *et al.*, 2023). Rice cultivation under irrigation is prevalent in these areas due to the vast number of rice farmers (Yusuf, Abdu, and Ibrahim, 2022).

Rice farmers were selected expressly for the research since rice accounts for more than 70% of planted land. Rice is a significant food source in Nigeria, widely consumed in all regions and social classes (Wudil *et al.*, 2021). Additionally, the government's prohibition on rice imports, intended to enhance domestic production, has contributed to its economic value. According to existing data, Nigerians consumed more over seven million metric tons of rice in 2020. (Ihedioha *et al.*, 2021).

According to Kamai *et al.* (2020), rice intake is rapidly expanding in Nigeria as a result of shift in consumer choices toward it, increased in population, financial resources, and rapid urbanization. Rice is the most valued food crop in the world, feeding more than half of the population of the world, mainly in India, China, and many other African and Asian countries (Nandi *et al.*, 2012).

3.3 Target Population

This section offers a summary of the study's chosen target population. The research included 6340 smallholder rice farmers from Kano State's Kura, Garun-Mallam, and Bunkure Local Government Areas. This sample was gathered from the registered membership records of rice farmers' associations in the respective agricultural wards, as provided by the Kano Agricultural and Rural Development Agency. To a visual representation, please refer to Table 3.1 presented below:

Table 3.1: Target Population

Local Government	Wards	Number of Registered Rice Farmers
Kura	Karfi	650
	Kura	840
	Bugau	280
	Kosawa	590
	Kanwa	476
Garun-Mallam	Mudawa	274
	Chiromawa	337
	Yadakwari	196
	Kadawa	207
	Garun Babba	287
Bunkure	Bunkure	724
	Lautaye	323
	Gafan	404
	Turba	209
	Barkum	543
	Total	**6340**

Source: Kano Agricultural and Rural Development Agency (KNARDA), 2022

3.4 Sampling techniques and sample size determination

3.4.1 Sampling Technique

Sampling methods are the procedures used to select a subset of a population that is representative of the entire population. (Etikan *et al.*, 2016) The primary purpose of these processes is to conduct research and derive conclusions about the entire population. This study employed a multistage sampling strategy to account for the stratification of rice producers. The first phase consisted of the deliberate selection of three Local Government Areas (LGAs) within the project area, which served as the first stratum. The next phase of the sampling procedure was conducted at the ward level. The research employed a thorough selection procedure to identify a total of fifteen agricultural districts with exceptional rice production and a substantial number of registered rice producers. Specifically, five districts were chosen from each of the designated Local Government Areas. In the third phase of the research, respondents were chosen from various ward levels to facilitate data capture.

3.4.2 Sample Size Determination

The determination of the sample size was conducted using Krejcie and Morgan's (1970) Sample Size Determination Table, with the aim of achieving an accuracy of ±5% and a confidence level of 95%. According to the above information, in order to achieve a ±5% precision with a 95% confidence level, a sample size of 364 individuals should be selected from a population of 6,340. The sample size for this research was determined proportionally due to the unequal distribution of rice farmers throughout the wards in each

Local Government, following the approved method by Krejcie and Morgan, shown on table 3.2:

Table 3.2: Krejcie and Morgan (1970), Table for Determining Sample Size from a Given Population

Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

Source: Krejcie and Morgan, 1970

The sample size determination formula by Krejcie and Morgan was as follows**:** $\frac{N \times S}{TP}$

The letter **N** means the population of Rice Farmers in each Local Government Area.

The letter **S** means total sample size = 364

While the letter **TP** means target Population = 6,340.

3.4.3 Sampling of Rice farmers at Local Government Areas

The researchers used a straightforward random selection method to choose the participants from different wards, aiming to achieve a representative sample size at the governmental level. The allocation of samples among the three Local Government Areas was calculated and shown in Table 3.2 as follows:

Kura Local Government: $\frac{2,836 \times 634}{6340} = 284$

Garun-Mallam Local Government: $\frac{1,301 \times 634}{6340} = 130$

Bunkure Local Government: $\frac{2,203 \times 634}{6340} = 220$

Table 3.3: Sample Distribution per Local Government Area

s/n	Names of Local Government Areas	Population of rice farmers (*N*)	Sample size (*n*)
1	Kura	2,836	284
2	Garun- Mallam	1,301	130
3	Bunkure	2,203	220
Total		**6,340**	**634**

Source: Field Data, 2022.

3.5 Research instruments

The following subsection presents a brief description of the research instruments utilised in this study's data collection. The researchers used primary data collection techniques in order to gather data for this investigation. The objective of this activity is to collect primary information pertinent to the investigated topic. The purpose of the carefully constructed questionnaire was to collect information about the socioeconomic background of the participants. These include age, duration and scope of practise, and educational background. Additionally, the questionnaire has been developed to gather data on farmers' information requirements, their awareness of agricultural information sources, their utilisation of agricultural information, the correlation between farmers' information literacy and productivity enhancement, and the association between farmers' information needs and agricultural sources. A questionnaire is a methodological approach in quantitative research that facilitates the collection of answers from a substantial number of participants in order to address particular research concerns.

3.5.1 Pilot Testing

The process of conducting a pilot test is of great significance in the field of research, as it allows researchers to assess and improve their research instruments, methodology, and data collection procedures before initiating the main study (Leon, Davis, and Kraemer, 2019). Researchers have the ability to identify potential problems or difficulties by conducting a small-scale preliminary test that involves just a portion of the intended audience. Potential challenges that may arise in survey research include a range of factors, such as unclearly

formulated questions, inappropriate response scales, or logistical obstacles (Creswell and Creswell, 2020). Incorporating these considerations during the pilot testing phase enhances the integrity, reliability, and overall quality of the study results. Hertzog (2020) asserts that the appropriate allocation of time and resources is ensured in the first inquiry.

The pilot research was conducted inside the Dawakin-kudu Local Government Area. The pilot research was carried out with a sample size of 63, which constituted 10% of the whole population. According to Connelly (2008), previous academic studies indicate that an optimal pilot research should include a sample size that is around 10% of the projected selected participants for the larger main study.

3.5.2 Validity Testing

Tanner (2018) defined validity as instrument's ability to measure what it is intended to find out. The returned questionnaires were analysed to check the level of completion to test the validity of the questionnaires, and a 70% similarity index was realized. The tool's configuration determined face validity, which included font size and instrument language relevance. The questionnaires were given to the supervisors for the purpose of assessing and assigning ratings to each of them according to the study objectives. The supervisor meticulously formatted the questionnaire to include key issues and provided appropriate guidance to the researcher.

3.5.3 Reliability Testing

The research used Cronbach's alpha to assess the reliability of questionnaire questions. Reliability refers to the consistency of a questionnaire when administered to respondents on two separate occasions. A Cronbach alpha value of 0.7 or above indicates dependable items in the questionnaire. A preliminary test was conducted in Madobi Local Government Area, Kano, Nigeria, using 80 questionnaires among rice growers. The results showed an overall Cronbach Alpha coefficient of 0.769, indicating the instrument's reliability.

3.6 Data Analysis

This study's data were collected utilising a questionnaire to meet its goals. Assessing rice farmers' knowledge of agricultural information sources is crucial to determining their information needs. Quantitative data from respondents were analysed using descriptive statistics to ascertain the extent of agricultural knowledge sources usage among rice growers in Kano state. This allowed the researcher to accomplish goals one, two, and three. The investigator used descriptive statistics to identify, organise, and summarise data to implicitly construct a measurement distribution (Mugenda and Mugenda, 1999). However, quantifiable data were collected by questionnaire and examined using Pearson correlation (by variant) to determine the association between farmer information literacy and production. Additionally, chi-square analysis examined the association between farmers' information demands and agricultural information sources. Data were checked, cleaned, and analysed using SPSS version 21. The statistical analysis was presented in tables, figures, and graphs.

3.7 Data Collection Methods

This section gives a description of the study's gathering of data technique. The researcher travelled to specific Local Government Areas (LGAs) to establish a tangible presence and duly inform the authorities of the study's objectives. In addition, these visits served to establish a schedule for data collection. With the assistance of a research assistant, the prepared questionnaires were distributed to respondents in their respective locations. The experiment was conducted over a period of six weeks, with the researcher allocating two weeks to each of the three designated local government regions in order to establish a comprehensive relationship with the participants. To obtain a high response rate, a self-administered questionnaire was chosen. This was made possible by the researcher's ability to interact with respondents, provide translations in the local language, and persuade them personally prior to survey completion.

3.7.1 Data Collection Techniques

Rice farmers were the main focus. Rice Farmers were identified based on their Associations' registered membership, which was made available at the Local Government Secretariats. The researcher went to the study sites as frequently as possible to ensure that the questionnaires were distributed and returned.

3.7.2 Ethical and Logistical Considerations

Appropriate ethical considerations were implemented in order to uphold ethical standards and safeguard the privacy and anonymity of participants. Prior to beginning data collection, the Graduate School of Kenyatta University granted the requisite sanction (see Appendix III). The researchers obtained permission from the Ministry of Local Government in the state of Kano to conduct their investigation in the designated Local Government Areas (see Appendix VI). In addition, the Kano Agricultural and Rural Development Agency (KNARDA) authorised the study to facilitate the researcher's engagement with and data collection from local rice producers (see Appendix V). To maintain the confidentiality of data collection, an anonymous questionnaire was used, and participants were given explicit assurances of confidentiality.

CHAPTER FOUR

RESULTS PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

The chapter commences with an introduction to the response rate, followed by a subsequent discussion on demographic information. The subsequent sections are organised based on the objectives and address the informational needs of rice farmers in Kano State, Nigeria, as well as their level of comprehension regarding agricultural information sources. This study investigates the issue of access to agricultural information among rice farmers in Kano State. It examines the relationship between farmers' information literacy and their production output, as well as the association between their information needs and the sources of agricultural information they utilise. The responses provided by the participants were analysed and subsequently presented using Descriptive Statistics and Correlational analysis.

4.2 General and Demographic Information

4.2.1 Response Rate

Response rate, often referred to as participation level or reply rate, is a metric used in research to measure the proportion of individuals who have provided answers to a research tool, such as a questionnaire or interview schedule, divided by the total number of individuals in the sample. Typically, it is represented as a percentage (Booker, Austin, and Balasubramanian, 2021). Booker *et al.* argue that a high response rate is crucial to guarantee the study's results appropriately represent the broader population sample.

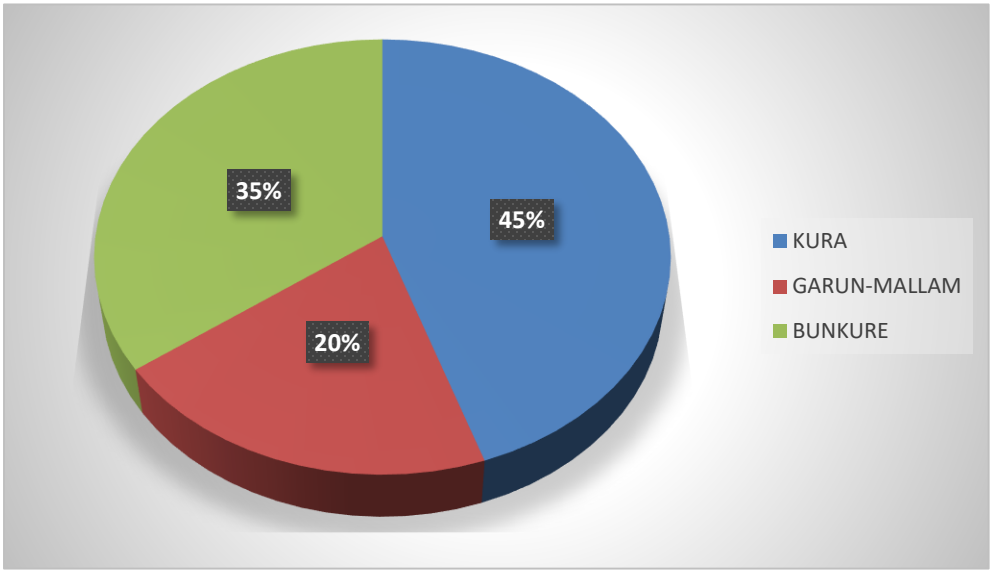

Figure 4.1 Response Rate

Source: Field data, 2022.

The response rate is shown in Figure 4.1 above. 634 questionnaires were sent to respondents drawn from Kano State's three Local Government Areas. Out of 634 questionnaire samples sent to respondents, 590 (93%) were completed and returned properly. However, just 44 of the questionnaires, or 7%, were not recovered by the researcher. The American Association for Public Opinion Research (AAPOR, 2016) deemed this return rate acceptable, citing 60% as an acceptable minimum response rate for published research.

4.2.2 Demographic Data

Social variables of the subjects provide information about study participants who voluntarily participated in research and are necessary for determining whether the subjects in a study are a representative sample of the target population for the purpose of assessing farmer information literacy and agricultural productivity.

Chen and Lu (2020) discovered that socioeconomic characteristics of farmers, such as level of education, age, and years of experience, play a significant role in determining farmers' information needs and access channels. This section provides data on the age, education level, and years of experience of rice producers.

4.2.2.1 Distribution Based on Age of Respondents

Age influences rice farming participation and output. Brown, Daigneault, and Dawson (2019) discovered that elderly farmers take less risk, experiment less, and are less impacted by society. Older farmers adopt technology less. He found that involving younger farmers in farming enhances management and the agricultural business. Some nations, notably in Africa, consider 15-64-year-olds productive or working-age (URT, 2013). The researcher used descriptive statistics to quantify respondents' ages from the questionnaire. To determine respondents' ages, analysis was done. This will help identify the capabilities of rice farmers in identifying information need, using various sources, and applying the knowledge in their agricultural practices in the research region. See figure 4.2 below.

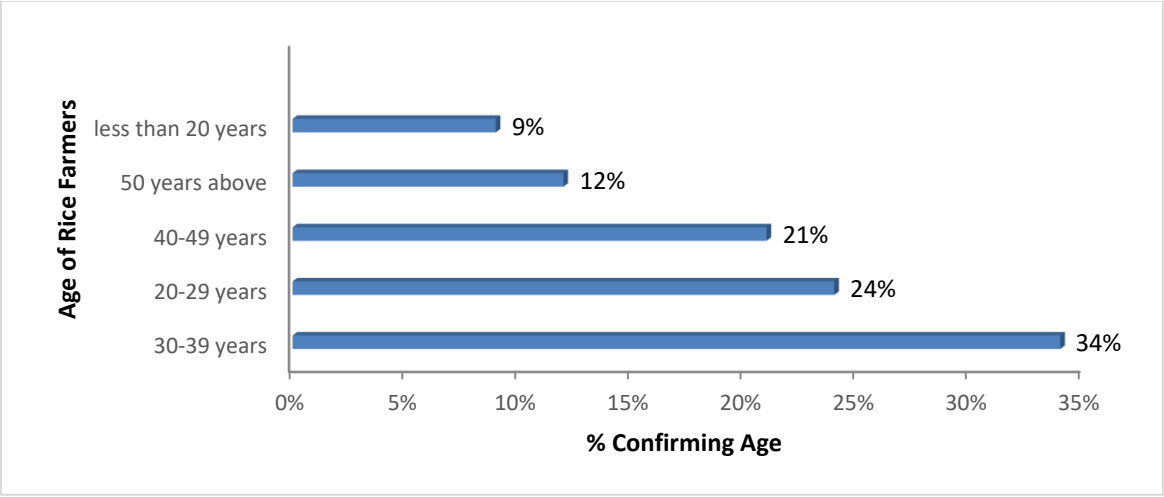

Figure 4.2 Distribution Based on Age Group

Source: Field Data, 2022.

The result presented in figure 4.2 showed (34%) participants were within ages of 30-39 years, then (24%) respondents who were between the ages of 20-29 years, (21%) respondents were between the ages of 40-49 years, and farmers 50 years and older made up 12% of the respondents, while (9%) of the respondents were younger than 20 years of age. The findings suggest that all ages were characterised in this study, indicating that there was no bias in the selection of participants. The research has produced a diverse and exhaustive sample of rice producers. Inclusion of all age groups in the study yields more accurate results and reduces the likelihood of age-related biases that may influence the findings. Suppose, for instance, that only elderly producers are included in the study. In such a case, the results may be skewed towards traditional agricultural practices, while excluding newer producers may result in the omission of innovative methods. The range of ages between 30-39 years is significant in terms of the producers' experience, expertise, and output. This age range represents a period of optimum productivity for rice producers or a time when they encounter unique obstacles. This discovery is consistent with Brown, Daigneault, and Dawson's (2019) and also the study by Mittal, and Mehar, (2016).

4.2.2.2 Rice Farmers' Level of Education

According to Aina *et al.* (1999) the level of education has a significant impact on the learning of new knowledge information, and skills necessary to strengthen rice farmers' information literacy and production. The aggregate data from the respondents was analysed using descriptive statistics and displayed in a bar chart. Figure 4.3 provides an illustration.

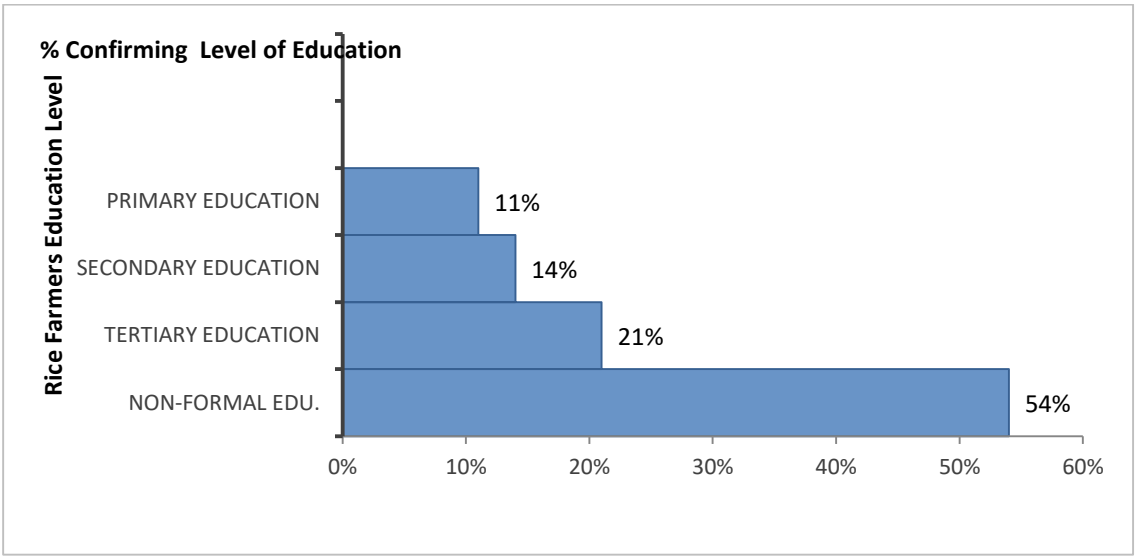

Figure 4.3: Level of Education **Source:** Field Data, 2022.

The result presented in figure 4.3 showed that majority of the respondents 54%, had a non-formal, this was followed by 21% of respondents with a higher education degree, 14% with a secondary school diploma, and 11% with a primary school diploma. The findings of this study implied that the majority of rice producers in the research regions lack higher education. The lack of higher education have significant effects on a person's ability to identify information needs, undertake source inquiries, utilise accessible resources, and implement acquired knowledge in the real world as opined by Iskandar, Amanah, Hubeis, and Sadono (2020). The finding of my study is in line with Aina et. al. (1999) who found that the level of education has a significant impact on the acquisition of information, comprehension, evaluation, and adoption of new agricultural practises. Knowledge and experience provide producers with techniques that accelerate their society's development. The study is also in consistence with Iskandar, Amanah, Hubeis, and Sadono (2020) found that the education level of producers had a significant and beneficial impact on their information literacy. Empirical research indicates that farmers with a higher educational attainment possess a greater capacity to assimilate novel knowledge compared to those

with a lower educational attainment. As a result, they will adjust to the progress in information technology and make more active use of agricultural information. Farmers who possess a considerable level of knowledge, especially those who have obtained a college degree, exhibit more openness towards the use of information technology.

4.2.2.3 Years of Experience in Rice Farming

According to Anigbogu *et al.* (2015) identified years of farming experience is enhancing information literacy of farmers and it is also a measure indicator of agricultural production, which was anticipated to have a positive effect on agricultural production. Consequently, agricultural experience is assessed in terms of years in the industry. Respondent data was analysed using descriptive statistics and displayed using a bar chart. Figure 4.4 is shown below.

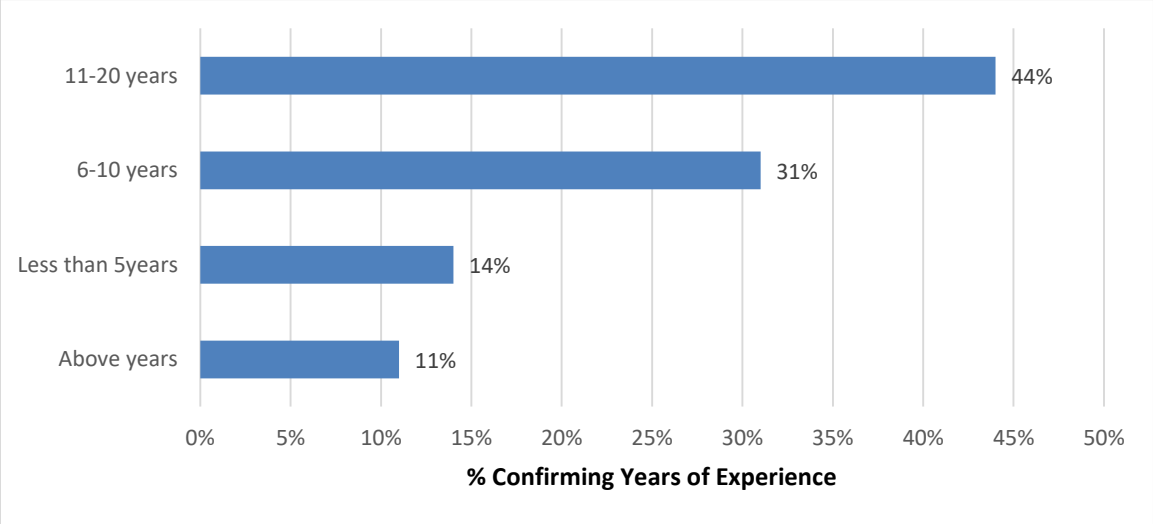

Figure 4.4: Years in Rice Farming

Source: Field Data, 2022.

The result as presented in Figure 4.4 indicated that, 259 respondents (44%) have 11-20 years of practice in rice cultivation, while 185 respondents (31%) have fewer than 6-10 years of experience. The remaining 4% of the 80 respondents have less than five years of

practice in rice cultivation. The 66 respondents with more than 20 years of experience as rice producers represent 11% of the total. This suggests that the majority of rice producers in Kano State have acquired pertinent knowledge and skills through years of experience and on-the-job training, which could affect their ability to access and utilise information. This study's findings corroborate Lin *et al.;* (2023) study which asserted that the number of years of experience had a notable positive moderating influence on the relationship between effort expectations and the inclination to enhance information literacy. Anigbogu *et al.;* (2015) also stated that farmer experience level had been identified as a measure indicator of information literacy, which was anticipated to have an influence on agricultural production. Lin *et al.* (2023) found that the number of years of experience had a notable positive moderating influence on the relationship between effort expectations and the inclination to enhance information literacy.

4.3 Findings for Objectives

This part summarises the results via the use of charts, which allows readers to visually and comprehensively analyse the data. This section offers significant insights into the distribution of data, measures of central tendency, and variability. These insights serve as a fundamental basis for doing additional analysis and interpreting the research results within the framework of our study goals.

4.3.1 Information Needs for Rice Farming

The study's first objective was to determine the informational needs of rice producers in Kano State, Nigeria. To make informed decisions and boost crop yield and profitability, rice producers require various types of information. To make informed decisions regarding

planting and harvesting times, irrigation schedules, and pest and disease management, rice producers need current meteorological information. Information on government agricultural policies and programmes, such as subsidies, loans, and crop insurance, is essential for rice producers to gain access to resources and support that will increase their production and profitability. This part aims to identify the information necessary for rice production, in accordance with the primary goal of the research, which is to assess the information needs of rice growers in Kano State, Nigeria.

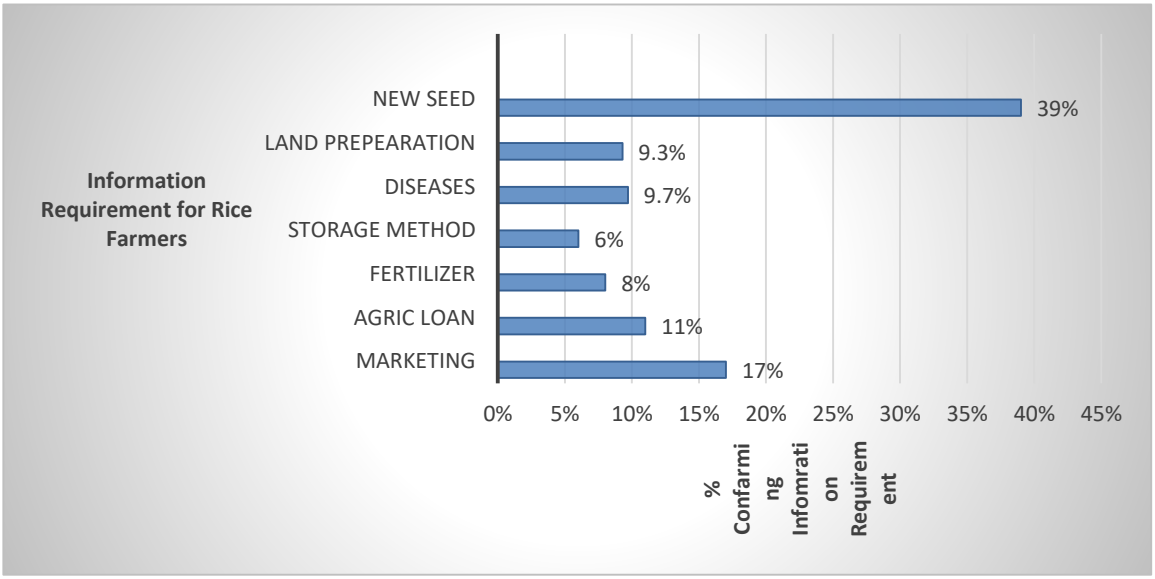

Figure 4.5: Levels of Information Requirements of Rice Growers in Kura Local Government

Source: Field Data, 2022.

The result presented in Figure 4.5 provides a summary of the information requirements of rice producers in Kura Local Government. 39% of respondents indicated a predilection for learning about novel rice seed varieties/seeds. Following this was a request for marketing information, which comprised 17% of the responses. In addition, 11% of respondents desired information pertaining to agricultural credit/loan, while 9.7% desired information pertaining to maladies and insect control. In addition to land preparation (9.3%), fertiliser usage (8.8%), and storage methods (6%), producers expressed a need for additional information regarding land preparation (9.3%), fertiliser usage (8.8%), and storage methods (6%). The categories of information requirements for rice producers in Kura Local Government have proven to be diverse. A total of 284 questionnaires were distributed, but only 264 (representing 93% of the questionnaires) were returned.

In the Garun Mallam Local Government Area, a total of 130 questionnaires were disseminated by the researcher, in accordance with the determined sample size for the respondents in that specific region. Ninety-two percent of the total sample, or 120 questionnaires, were collected, analysed, and presented in figure 4.6.

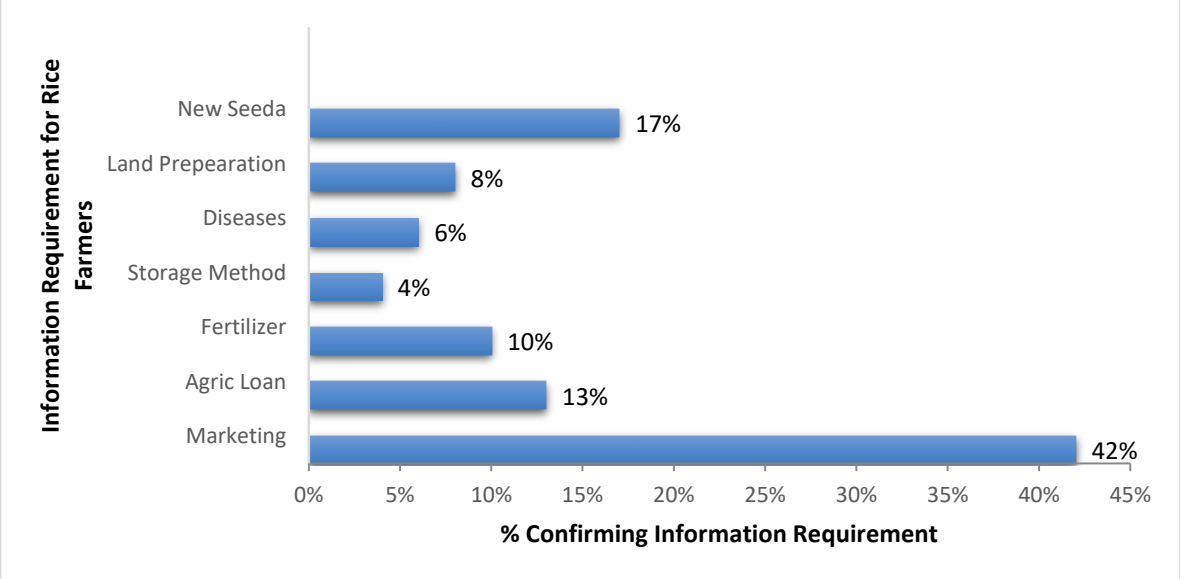

Figure 4.6: Levels of Information Requirements of Rice Growers in Garun Mallam Local Government
Source: Field Data, 2022**.**

The results presented in Figure 4.6 revealed that the most of respondents (42%) prepared marketing information, followed by novel seed variety information with 17%. Other topics included credit/loan information (13%), fertiliser use (10%), land preparation (8%), pest and disease control (6%), and storage (4%).

The local government area of Bunkure has distinctive characteristics. There were a total of 220 questionnaires distributed to 330 participants. Nonetheless, 206 questionnaires were effectively filled out and returned to the researcher. To provide a visual illustration, please refer to figure 4.7 below, which provides a comprehensive overview of the varying degrees of information requirements among Bunkure Local Government rice producers.

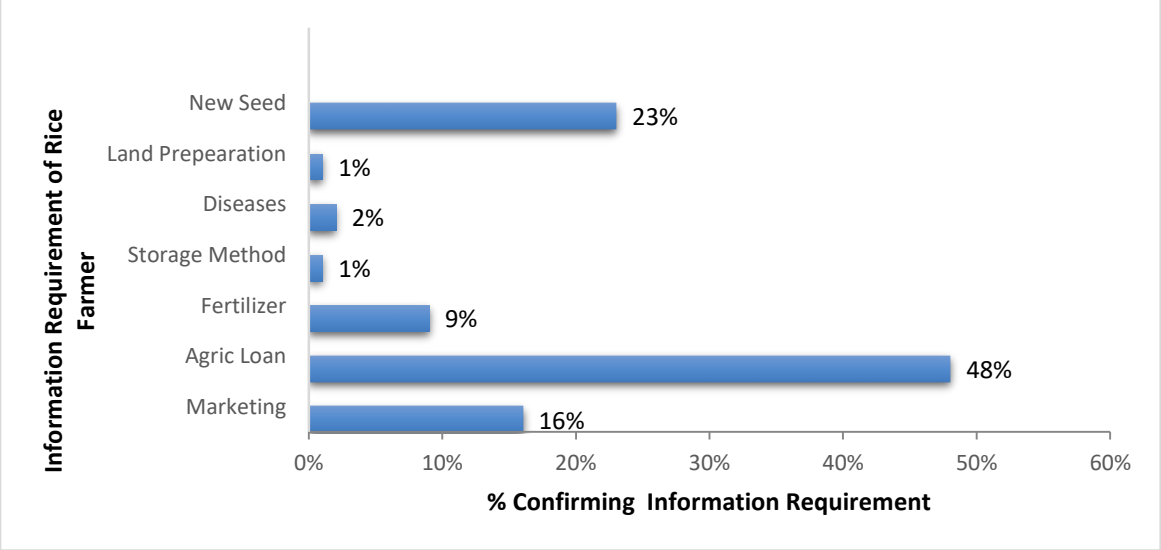

Figure 4.7: Levels of Information Requirements of Rice Growers in Bunkure Local Government Area

Source: Field Data, 2022.

Rice cultivators in Bunkure Local Government have inherent information requirements, as shown in Figure 4.7 revealed that, 48% of respondents prepare information on credit/loan, followed by 22% who prepare information on novel seed varieties. The remainder included

data on marketing at 16%, fertiliser use at 9%, pest and disease control at 2%, storage at 1%, and land preparation at 1%.

Moreover, the study also presented comparative table to elucidate further the areas of interest of each local government area concerning the information requirements of rice producers. The finding of this study collaborated with the finding works of Madhavan, (2017) noted that a paucity of agricultural information has been identified as the most potent deterrent to cultivators across the entire spectrum of the agricultural system. Access to precise and sufficient information is crucial for increasing agricultural production and productivity in the current environment, where agriculture is increasingly information-focused. Information guides the decisions in farm management. The finding is also in line with Muhammad and Mumtaz (2013) whose find out in their study that, farmer information needs have centred on many factors, such as soil preparation, seed selection, crop maintenance, harvesting practises, and animal husbandry. These requirements if frankly harnessed, would improve farmer information literacy and by extension the overall agricultural productivity.

Table 4.2 Comparative analysis of Rice Framers Information Needs in Kura, Garun-Mallam and Bunkure Local Governments

	KURA		**GARUN- MALLAM**		**BUNKURE**	
Needs Category	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
Marketing	46	17%	50	42%	32	16%
credit/loan	30	11%	16	13%	98	48%
Fertilizers	21	8%	12	10%	18	9%
Pest control	25	9.7%	7	6%	5	2%
Storage	16	6%	5	4%	3	1%
land preparation	24	9.8%	10	8%	3	1%
Seeds	102	39%	20	17%	42	23%

Source: Field Data, 2022.

The results presented Table 4.2 illustrated the distribution of various "Needs Categories" across three distinct regions: Kura, Garun-Mallam, and Bunkure, along with the corresponding percentages of each category's frequency within these areas.

In the category of "Marketing," Kura accounts for 46 instances, which is approximately 17% of the total representation, while Garun-Mallam stands out with 50 instances, constituting a substantial 42% of the total Meanwhile, Bunkure has 32 instances of marketing needs, making up 16% of the total count in that area. The "Credit/Loan" category revealed that Kura has 30 instances, representing approximately 11% of the total, while Garun-Mallam reports 16 instances, making up around 13% of the total count. Bunkure demonstrates a significantly higher demand for credit and loans with 98 instances, accounting for an impressive 48% of the total within that region. For "Fertilizers," Kura reports 21 instances, representing 8% of the total, while Garun-Mallam has 12 instances, comprising 10% of the total. Bunkure, with 18 instances, accounts for 9% of the total for this category.

In terms of "Pest Control," Kura indicated 25 instances, which is approximately 9.7% of the total count, whereas Garun-Mallam reported 7 instances, constituting approximately 6% of the total. Bunkure registered 5 instances, making up about 2% of the total for this category. Regarding "Storage" needs, Kura has 16 instances, which represents 6% of the total, while Garun-Mallam has 5 instances, accounting for 4% of the total. Bunkure reported 3 instances, making up 1% of the total for this category. The results presented in Table 4.2 "Seeds" category shows that Kura has a substantial 102 instances, representing 39% of the total for this need. Garun-Mallam reported 20 instances, accounting for

approximately 17% of the total, while Bunkure demonstrates 42 instances, making up around 23% of the total for this category. In the "Land Preparation" category, Kura recorded 24 instances, which accounts for around 9.8% of the total. Garun-Mallam reported 10 instances, making up approximately 8% of the total, and Bunkure indicated 3 instances, representing about 1% of the total in this category.

This implies that pests and diseases pose a threat to rice cultivation in the state of Kano; therefore, producers are interested in obtaining early and accurate information on these pests and diseases in order to control them as soon as possible. Rice crops in the state of Kano are susceptible to a variety of parasites and diseases that have the potential to substantially reduce yields and quality. Farmers may lack the insight or abilities required to identify, prevent, and effectively manage these pests and diseases.

This suggests that many rice farmers in Kano State may not have access to the necessary resources, such as pesticides and equipment, to effectively control pests and diseases. As a result, they are interested in learning about alternative methods of pest and disease control that do not require a substantial financial investment. It is also essential to note that parasites and diseases can cause substantial crop damage, resulting in a loss of income for producers. By learning how to effectively control pests and diseases, producers can reduce the risk of crop injury and safeguard their livelihoods.

According to the findings, rice producers in Kano State do not have access to formal education or information on modern agricultural techniques. Consequently, they may lack the necessary knowledge and skills for appropriate land preparation. This also indicates that some rice producers in the state of Kano continue to rely on traditional farming methods that may not be suitable for contemporary rice cultivation. Inappropriate land

preparation techniques may be among these practises, resulting in low crop production. Some rice farmers in Kano State may lack access to essential resources, such as fertiliser, irrigation systems, and agricultural equipment, which can hinder their ability to prepare their land for rice cultivation.

Due their preference of high-yielding seeds, rice producers in Kano State are interested in information about new varieties of seeds. New rice seed varieties are frequently bred to generate greater crop yields than their predecessors. By sowing new varieties, farmers can increase their crop yields, thereby increasing their profitability. By sowing disease-resistant seed varieties, producers can minimise crop losses caused by diseases and parasites that can impact rice crops. In addition, new rice seed varieties are frequently developed to accommodate altering climate conditions, such as higher temperatures and an increase in the severity of adverse weather conditions. Farmers may better prepare for and reduce the impact of changing climates on their crops by sowing climate-adapted seed types.

The primary aim the investigation conducted by Muhammad and Mumtaz (2013) was to ascertain the information requirements of 84 farmers in Pakistan. The findings of the present study align with those of their previous research. Direct organised interviews were employed as the primary method of data collection, targeting a sample of male individuals aged 25 to 65 who were actively involved in agricultural activities. Various areas, such as soil preparation, seed selection, crop maintenance, harvesting techniques, and animal husbandry, necessitated the acquisition of knowledge. The resemblance between the outcomes of the two studies can be attributed to the utilisation of variables that assessed the farmers' informational needs.

Consistent with Soyemi's (2014) research, which identified production, post-planting, sales, promotional, and policy-related information, the outcomes are as expected. At every stage of the agricultural production cycle, information must therefore be communicated and exchanged. A lack of information exacerbates the vulnerabilities of farmers; therefore, rural farmers must have access to information that is beneficial to their livelihoods. In a similar vein, Zhang (2012) argued that it is necessary to distinguish the information needs of farmers from a vast multitude of information demands based on the characteristics of various information resources and information services. This position is consistent with the present investigation's findings. The results also support the findings of Huang and Zhang (2011). According to them, rural farmers in developing nations seek agricultural information on crop management, pest control, and cultivation primarily.

4.3.2 Awareness about the Sources of Agricultural Information

This section has examined and offered an analysis of the degree of knowledge among rice farmers on their sources of agricultural information in Kano state, Nigeria. This aligns with the second purpose of the study. The method of data collection process employed a structured questionnaire, and subsequent data cleaning, coding, and analysis was conducted and displayed in charts. Data was captured through the evaluation of the Rice Framers level of knowledge of different sources of agricultural information and was analysed using descriptive statistics. The findings were then organised and reported separately for each study region, namely Kura, Garun Mallam, and Bunkure Local Government Areas.

In Kura Local Government Area, a total of 284 questionnaires were provided by the researcher. Out of them, 264 questionnaires were successfully filled and returned,

accounting for a response rate of 93%. Figure 4.8 presents a comprehensive examination of the degree of knowledge among rice farmers in Kura Local Government about the sources of agricultural information.

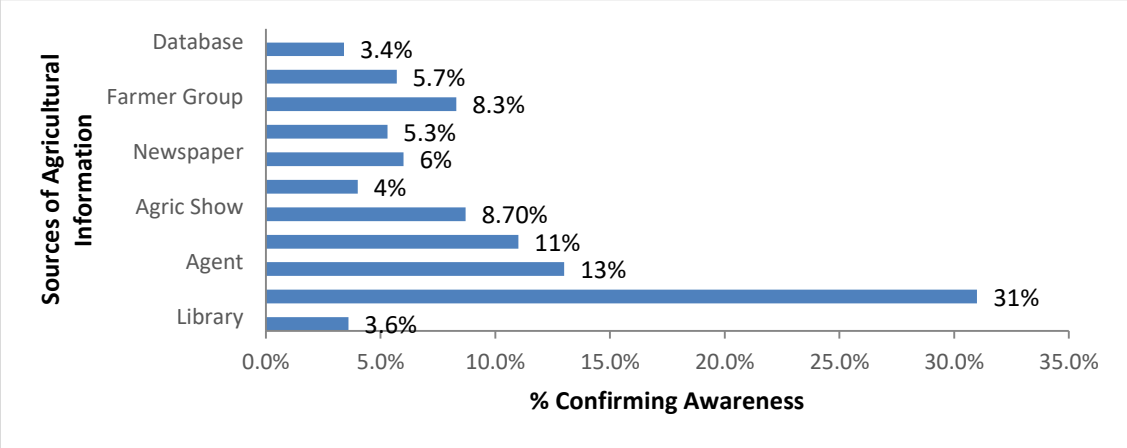

Figure 4.8: Awareness of the Sources of Agricultural Information in Kura Local Government

Source: Field Data, 2022.

According to the results shown in figure 4.8, radio emerges as the primary channel for accessing agricultural information, accounting for 31% of the total. Multiple sources have been discovered at various levels. A variety of information channels are utilised by individuals in the agricultural sector. These channels consist of agricultural agents (13%), farmer associations (11%), agricultural shows (8.7%), farmers groups (8.3%), newspapers (6%), Facebook (5.7%), internet (5.3%), Television (4%), library (3.6%), and agricultural databases (3.4%).

Nevertheless, the results of this research contradict the findings of Chikwendu, Ubi, and Onyibe (1996), who discovered that radio, did not serve as a significant source of agricultural information for the farmers studied in Borno State, Nigeria. It is important to acknowledge that radio has inherent limitations when it comes to delivering agricultural information. Due of its monologic character, the presenter has few opportunities for contact

with the farmers. Sums of 130 questionnaires were shared in Garun Mallam Local Government, in accordance with the predetermined sample size for the respondents in the region. A total of 120 questionnaires were collected, examined, and subsequently shown in figure 4.9.

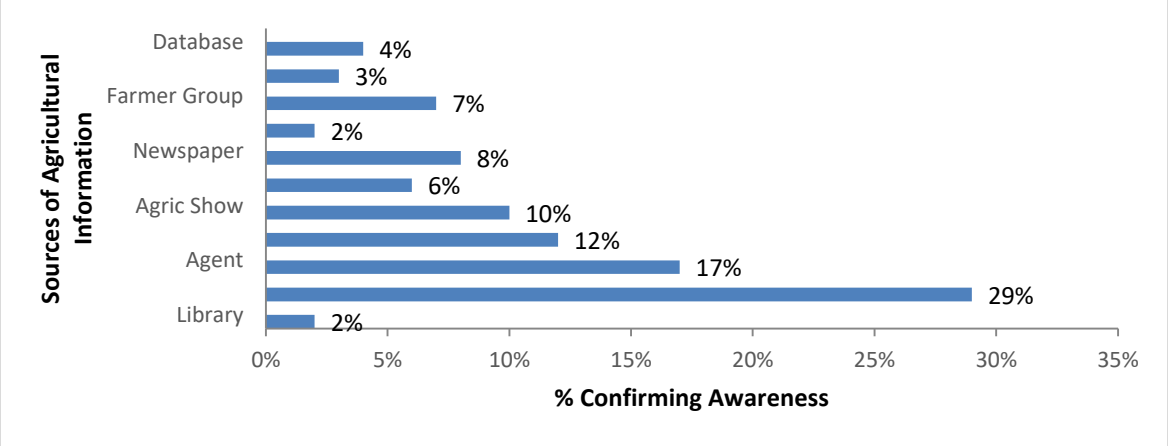

Figure 4.9: Awareness of the Sources of Agricultural Information in Garun Mallam Local Government

Source: Field Data. 2022.

The result as presented in Figure 4.9 reveals that, 29% of respondents in Garun Mallam indicate that radio is their primary source of interest for agricultural information. The remainder includes 17% agricultural agents, 12% farmer associations, 10% agricultural events, 8% newspapers, 7% farmer organisations, 6% television, and 4% agricultural databases, Internet 2%, Facebook 3%, and the library 2%.

This aligns with the results of prior research conducted by Monu (1993) and Ikejimba and Alabi (2017). The farmers' affinity for radio is unsurprising, given that a significant number of them admitted to having the Imo State ADP's battery-free radios, which were used to broadcast agricultural information to them. The literature widely recognises the efficacy of radio as a means of delivering agricultural information to farmers.

The researcher analysed and presented the levels of knowledge regarding agricultural information sources. For example, see table 4.8 below.

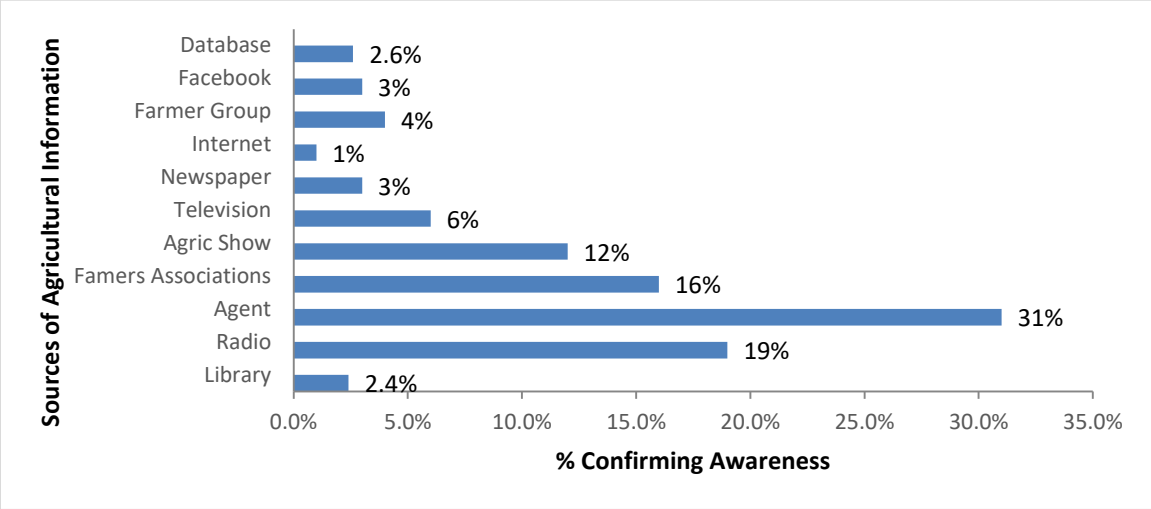

Figure 4.910 Awareness of the Sources of Agricultural Information in Bunkure Local Government

Source: Field Data, 2022.

The results on awareness about rice farmers' sources of agricultural information in Bunkure have produced various levels of awareness. Agricultural extension agents 31%, radio 19%, farmer association 16%, agricultural show 12%, Television 6%, farmers groups 4%, newspaper 3%. This outcome aligns with the discovery made by Patel (1983) and the perspective shared by Ozowa (1995), that Nigerian farmers consider the extension agent to be the most reliable source of information and guidance. This research highlights the significance of the extension agent in the process of transferring agricultural knowledge.

Furthermore, the study also presented comparative table to elucidate further the awareness on various sources of agricultural information of each local government area.

Opara, U., N., (2008), said that knowledge and information are fundamental components for enhancing agricultural output and productivity. Data is an essential asset in the

functioning and administration of the agriculture business. Efficient dissemination of agricultural information necessitates understanding the requirements of farmers and devising optimal methods to transmit the information they seek. The farmer's success or failure may be determined by their ability to get accurate and timely information in the appropriate format and from reliable sources.

According to Hossain (1998), the conveyance of agricultural knowledge plays a crucial role in facilitating transformation within the farming community. Hence, agricultural research findings provide a crucial repository of information that need to be accessible to farmers via channels that align with their preferences. Therefore, it is necessary to identify the many sources of information and information services used in order to determine the significance of these sources and services, as well as the preference and priority given to different kinds of sources and services. In addition, he stated that agricultural information can be obtained from various sources such as extension agents, age grades, fellow farmers, information and communication technologies, radio, television, community leaders, friends and relatives, farm demonstrations and agricultural shows, farmers' cooperatives, and bibliographic sources.

According to Labarthe and Laurent, (2019) the level of awareness of sources of agricultural information among rice farmers may exhibit significant variation, contingent upon characteristics such as geographical location, educational background, and resource accessibility, extension services, and digital platforms. These variables contribute in improving farmer information literacy.

Table 4.3 Comparative Analysis of Rice Framers Awareness about sources of Agricultural Information in Kura, Garun-Mallam, and Bunkure Local Governments

	KURA		GARUN-MALLAM		BUNKURE	
Awareness Category	**Frequency**	**P**	**Frequency**	**P**	**Frequency**	**P**
Library	10	3.6%	3	2%	5	2.4%
Radio	82	31%	36	29%	40	19%
Extension Agents	35	13%	21	17%	63	31%
Farmer Asso.	28	11%	15	12%	32	16%
Agricultural show	22	8.7%	12	10%	25	12%
Television	13	4%	8	6%	12	6%
Newspaper/Magazines	16	6%	10	3%	6	3%
The Internet	14	5.3%	3	2%	3	1%
Farmer Groups	21	8.3%	9	7%	9	4%
Facebook	15	5.7%	4	3%	6	3%
Agricultural Databases	9	3.4%	5	4%	5	2.6%

Source: Field Data, 2022.

The results presented Table 4.3 revealed the "Awareness Category" in three distinct regions: Kura, Garun-Mallam, and Bunkure. It offers insights into the frequency and the corresponding percentages of each category's representation in these regions. In the category of "Library," Kura reported 10 instances, which accounts for 3.6% of the total awareness category in that region. In Garun-Mallam, there are 3 instances, representing 2% of the total, while Bunkure has 5 instances, making up 2.4% of the total for this category.

"Radio" emerges as a popular source of awareness across the regions. In Kura, there are 82 instances, making up a significant 31% of the total awareness category. Garun-Mallam reported 36 instances, representing 29% of the total, and Bunkure has 40 instances, comprising 19% of the total in this category. "Extension Agents" are another notable source of awareness. In Kura, there are 35 instances, accounting for 13% of the total awareness category. Garun-Mallam has 21 instances, representing 17% of the total, while Bunkure reported 63 instances, making up a substantial 31% of the total in this category.

"Farmer Associations" are also influential in disseminating information. In Kura, there are 28 instances, comprising 11% of the total awareness category. Garun-Mallam reported 15 instances, representing 12% of the total, and Bunkure has 32 instances, making up 16% of the total for this category. "Agricultural Shows" play a role in raising awareness, with Kura reporting 22 instances, accounting for 8.7% of the total awareness category. Garun-Mallam has 12 instances, representing 10% of the total, and Bunkure reported 25 instances, making up 12% of the total in this category.

"Television" is a source of awareness, with Kura reporting 13 instances, representing 4% of the total awareness category. In Garun-Mallam, there are 8 instances, accounting for 6% of the total, and Bunkure has 12 instances, making up 6% of the total for this category. "Newspapers/Magazines" are also influential, with Kura reporting 16 instances, comprising 6% of the total awareness category. Garun-Mallam has 10 instances, representing 3% of the total, and Bunkure reports 6 instances, making up 3% of the total in this category.

"The Internet" is a relatively modern source of awareness, with Kura reporting 14 instances, accounting for 5.3% of the total awareness category. In Garun-Mallam, there are

3 instances, representing 2% of the total, and Bunkure has 3 instances, making up 1% of the total for this category. "Farmer Groups" are influential in Kura, with 21 instances, comprising 8.3% of the total awareness category. In Garun-Mallam, there are 9 instances, accounting for 7% of the total, and Bunkure has 9 instances, making up 4% of the total in this category.

"Facebook" is a modern platform for awareness, with Kura reporting 15 instances, representing 5.7% of the total awareness category. In Garun-Mallam, there are 4 instances, accounting for 3% of the total, and Bunkure has 6 instances, making up 3% of the total for this category. "Agricultural Databases" provide awareness, with Kura reporting 9 instances, which accounts for 3.4% of the total awareness category. Garun-Mallam has 5 instances, representing 4% of the total, and Bunkure reported 5 instances, making up 2.6% of the total in this category.

This result indicates that the majority of rice producers in the state of Kano are cognizant of the unlimited availability of agricultural information sources. Modern and effective cultivation techniques, new seed varieties, and other agricultural information can be discovered in libraries. Without access to information on modern farming techniques and new seed varieties, producers may continue to rely on less effective traditional farming methods. This can result in decreased crop yields, profitability, and output. If farmers are oblivious of these resources, they may lose out on valuable information that could assist them in enhancing their agricultural techniques. An increased comprehension of radio as a provider of agricultural knowledge can have substantial effects on agricultural development and agricultural production. Specifically in rural regions where access to other sources of knowledge may be constrained, radio can be an effective means of

disseminating information to farmers about new technologies, practises, and market opportunities. If farmers are aware that radio can provide agricultural information, they may be more likely to listen to agricultural programming and utilise the information provided.

Farmers and all other stakeholders involved in agricultural development must recognise Extension personnel as providers of agricultural knowledge. Agricultural extension agents are essential for disseminating information about new technologies, practises, and market opportunities to producers as well as providing training and assistance. This also suggests that when the majority of farmers are unaware of or do not trust agricultural extension agents as a source of information, they may be less likely to seek out their services, which could result in missed opportunities to learn about new technologies and practises, as well as lower productivity and incomes.

According to the findings, many paddy farmers in Kano State are unaware of farmers' associations as a source of agricultural information. They will likely be deprived of vital information about new technologies, practises, and market opportunities that could increase their productivity and income. Associations of farmers can provide a forum for farmers to congregate, share knowledge and experiences, and advocate for their collective interests. However, if the majority of rice farmers are oblivious of these organisations, this could reduce opportunities for collective action and farmers' influence in decision-making processes. It is essential to educate rice farmers in Kano State about the benefits of farmers' associations as a source of agricultural information, assistance, and collaboration. This can be achieved through targeted outreach and communication campaigns and by enhancing the capacity and visibility of regional farmer associations.

In addition, a significant number of rice cultivators in Kano State own an information-sharing platform. Agricultural exhibitions provide a venue for farmers, researchers, and other agricultural industry stakeholders to congregate, share knowledge and expertise, and showcase innovative technologies and methods. If farmers are aware of these events, they will be able to attend and learn about the most recent innovations and practises in agriculture. In addition, rice producers in Kano State who are aware that agricultural events serve as a source of information may be more likely to adopt new technologies and practises. Farmers who attend agricultural festivals are exposed to new practises and technologies that can increase their productivity and income, and they may be more likely to implement them on their farms.

Television is an effective tool for disseminating information to vast audiences. Imagine that more rice producers are aware of it as a source of agricultural information. They would then have greater access to information regarding new technologies, practises, and market opportunities. Farmers have access to specialist knowledge and the experiences of other farmers through agricultural television programming. This enables producers to discover new techniques and best practises and to exchange their experiences and knowledge.

In addition, rice farmers in Kano, have access to useful agricultural information. Thus, they can gain knowledge of new agricultural techniques, enhanced crop management practises, and other suggestions that can increase their yields and profits. Farmers can increase their productivity, reduce their environmental impact, and increase their income with increased knowledge and skills. Newspapers and periodicals provide information on market prices, demand, and trends, allowing rice farmers to make informed judgements about which crops to cultivate and where to sell them. Awareness of newspapers and periodicals as a source

of agricultural information can have a positive effect on the livelihoods of rice cultivators in Kano State and contribute to the sustainable development of the agricultural sector.

It must be stated that rice cultivators in the state of Kano do not have Internet access and, as a result, are not exposed to important agricultural information on the Internet. Due to the increasing significance of the internet in agriculture, farmers who are oblivious of it may not have access to the most recent agricultural technologies and innovations that can help them increase their productivity and efficiency. Internet has become an indispensable source of information for all types of information-seeking individuals. Farmers with limited knowledge of online agricultural information resources may struggle to obtain current research results, optimal techniques, and market trends.

Thus, the majority of rice cultivators in the region have joined farmers' organisations. When the majority of rice farmers recognise farmer groups as a source of agricultural information, they will likely have access to valuable resources and knowledge that will help them improve their farming practises and increase their crop yields. Through farmer associations, farmers can learn from one another and exchange experiences. Farmers who recognise farmer associations as a source of agricultural knowledge are more likely to have access to a broader range of agricultural knowledge and expertise. Additionally, farmer societies can help producers negotiate for higher commodity prices and access to credit and other resources. This can boost their profits and reduce their financial risks.

Moreover, the majority of rice farmers in the state of Kano are not Facebook users and are therefore unable to access agricultural information through the platform. The fact that few rice farmers recognise Facebook as a source of agricultural information suggests that the overwhelming majority of farmers may not be able to utilise the vast amount of information

and resources available on this platform. Rice producers' unfamiliarity with Facebook as a source of agricultural information can hinder their productivity, competitiveness, and access to markets. It is crucial to increase awareness of this resource in order to aid farmers in enhancing their agricultural practises and attaining sustainable development.

4.3.3 Utilisation of Sources of Agricultural Information by Rice Farmers

Adetimehin, Okunlola, and Owolabi (2018) emphasised that improving the production and productivity of the Nigerian agricultural sector could be achieved by increasing farmers' access to and efficient utilisation of agricultural information. This can be done by identifying and addressing the issues that hinder the access to and utilisation of agricultural information.

The widespread use of diverse information technology resources in Agricultural Development Programmes throughout different parts of the nation has been well recognised. The available capabilities include a range of communication tools such as radio, television, mobile phone, projector, media van, telephone, geographical information system (GIS), print media, and internet access.

Nevertheless, the crucial factor may not just lie in the mere presence of these facilities, but rather in their accessibility to the change agents and, more specifically, to the farmers. Equally important understands the farmers' inclination towards using information and communication technology in their agricultural practises (Arokoyo 2007). Information is an essential element in the implementation of farming and serves as the foundation for extended service. The advent of information and communication technologies (ICTs) has made information crucial in our modern culture. Information, in its narrowest technical

meaning, refers to a structured series of symbols that are used to record or communicate a message.

Agricultural information, as described by Agbamu (2006), encompasses both published and unpublished knowledge across all areas of agriculture. He categorised agricultural information into four distinct classifications: technical, commercial, socio-cultural, and legal information. The utilisation of agricultural information is crucial for the holistic advancement of agriculture, aiming to enhance the livelihoods of farmers. The attainment of agricultural information goals is unlikely if farmers lack access to information (Olawoye, 1996). Disseminating agricultural information to farmers fosters knowledge on the use of technological advancements.

Rice producers must use agricultural information sources to increase yields, productivity, and market access. Agricultural extension services provide producers with information on best practises, novel technologies, and market opportunities. Typically, government agencies or non-governmental organisations (NGOs) provide these services. Farmers can gain access to shared resources, market intelligence, and training programmes through farmer organisations such as cooperatives and associations. These organisations can also serve as a forum for producers to share their expertise and insights. This section is primarily designed and organised to investigate how rice producers utilise agricultural information sources. This presentation is based on objective three of the study, which investigated rice producers' access to agricultural information in Kano state. Kano's Kura, Garun Mallam, and Bunkure Local Government Areas were surveyed for information. Quantitative analysis was used to ascertain the extent to which respondents utilised agricultural information sources. Using descriptive statistics, the responses were summarised and

presented in charts. The reports were organised by Kura, Garun Mallam, and Bunkure Local Government Areas.

In Kura Local Government Area, 284 questionnaires were distributed to the study's sample of respondents. Only 264 questionnaires were collected, analysed, and illustrated in figure 4.11 below.

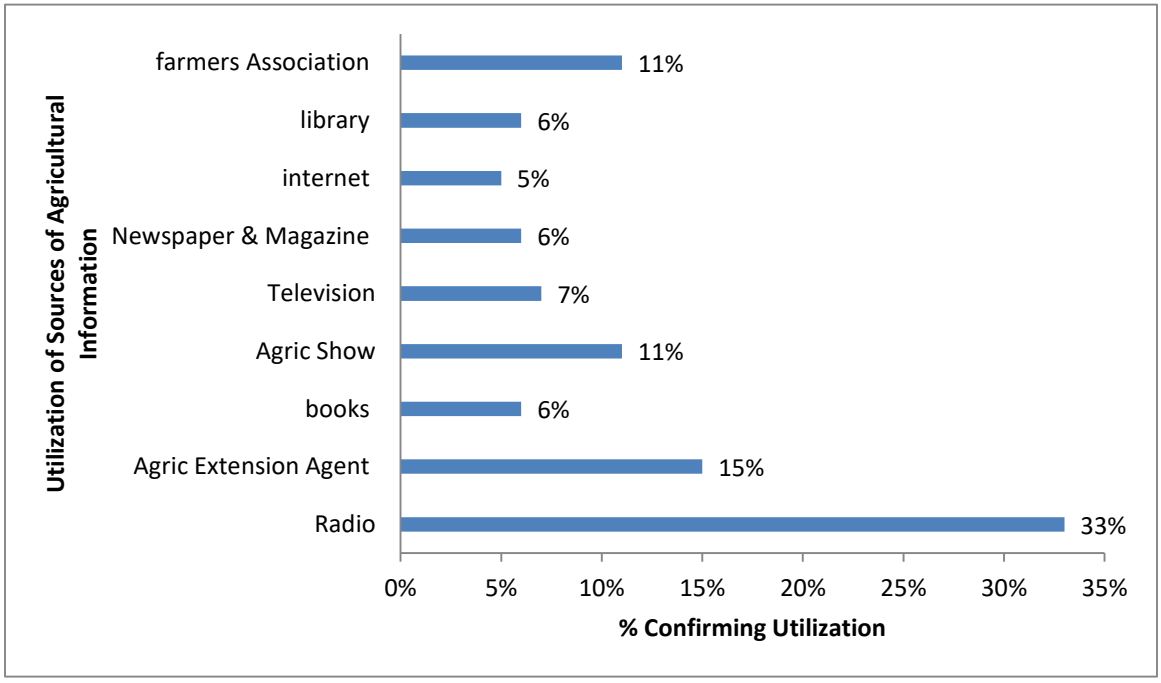

Figure 4.11 Level of Utilisation of Sources of Agricultural Information in Kura Local Government

Source: Field Data, 2022.

The results revealed that most respondents preferred radio at 33%, agricultural agent at 15%, agricultural show at 11%, and farmer association at 11%. Other sources utilized by the respondents included television 7%, literature 6%, library 6%, periodicals 6% and internet 5%. The reliance on Radio as a preferred source will adversely affect Farmers in their quest for reliable, current and up to date agricultural information that could enhance their production. The findings of this study are consistent with Salik, Tanwir, Saboor,

Akram, Anjum, Mehdi, and Asghar, (2021), who discovered that a large proportion of farmers in Pakistan indicated that radio communication is moderately beneficial for obtaining information related to soil preparation, crop varieties, appropriate fertilisers, optimal sowing time, and advancements in agricultural techniques such as drip irrigation, tunnel farming, and hydroponic agriculture.

In Garun Mallam Local Government Area, 130 questionnaires were disseminated, and only 120, representing 92%, were returned. The collected information were analyzed and displayed in figure 4.12 below.

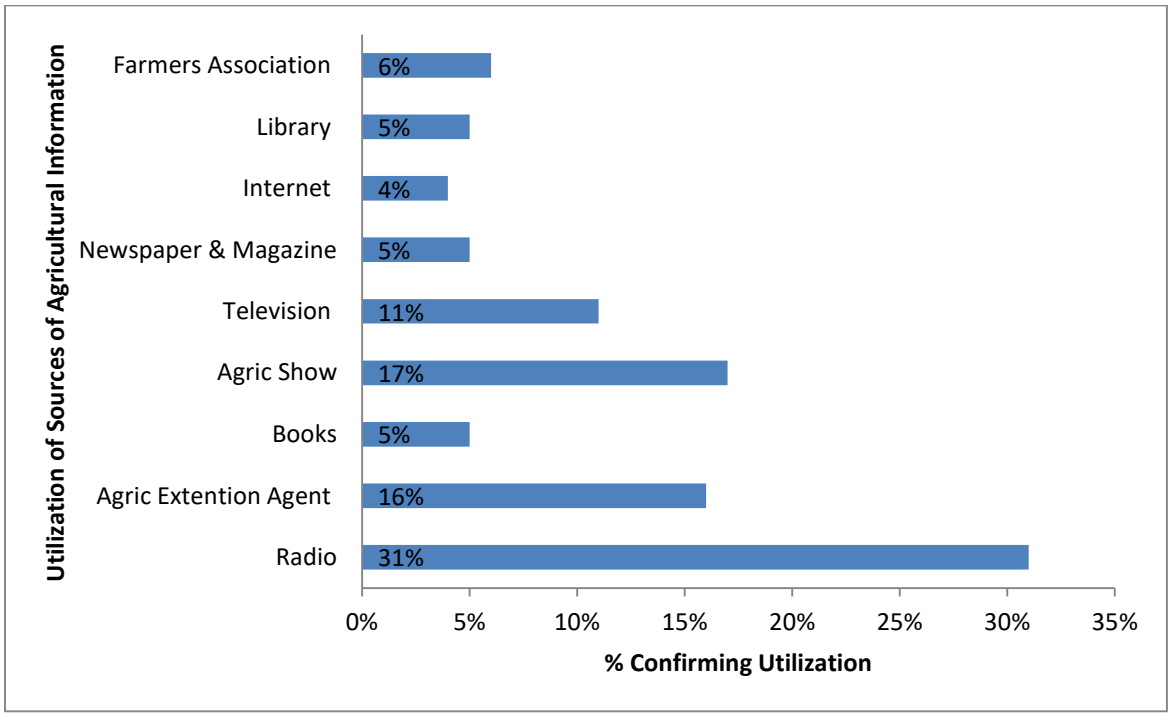

Figure 4.12 Level of Utilisation of Sources of Agricultural Information in Garun Mallam Local Government

Source: Field Data, 2022

The results indicated that radio sources are preferably used at 31%, agricultural agents at 16%, agricultural shows at 17%, and farmer associations at 6%. Others included television

11%, books 5%, library 5%, newspaper 5% and internet 4%. This result indicates Farmers inability to seriously explore other sources of agricultural information, and further indicate their lack of expertise in information literacy.

The distribution of two hundred twenty questionnaires in the Bunkure Local Government Area. A total of 206 were returned. The researcher analysed and presented the levels of knowledge regarding agricultural information sources. See figure 4.13 for illustration.

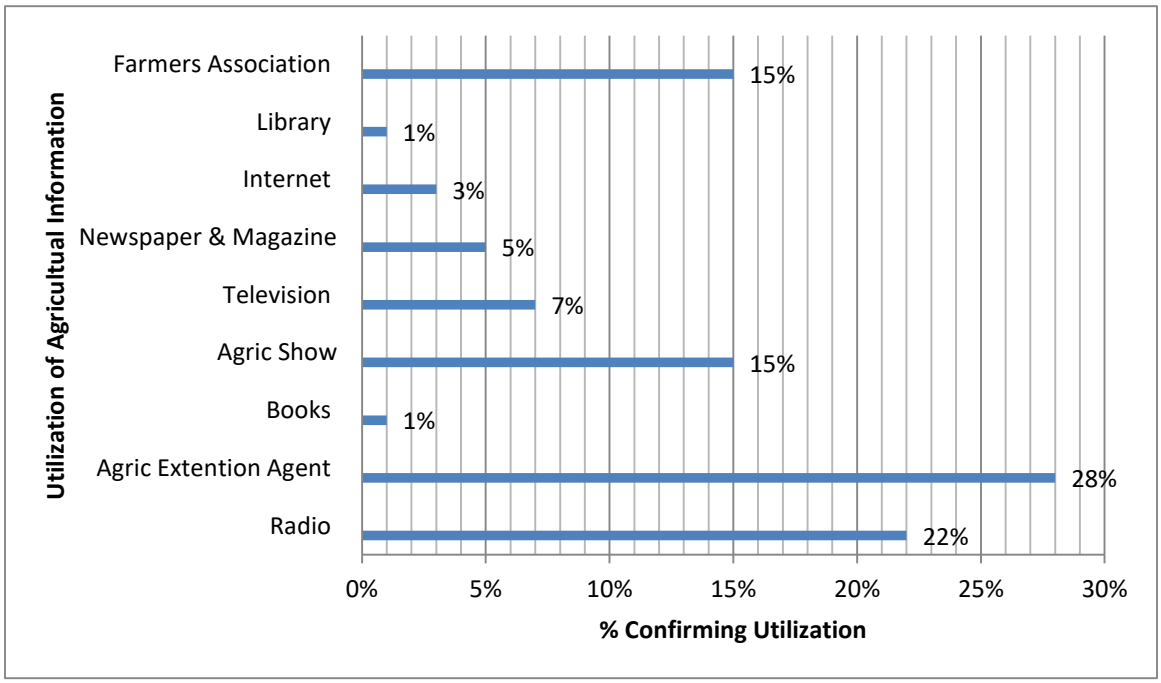

Figure 4.13 Level of Utilisation of Sources of Agricultural Information in Bunkure Local Government

Source: Field Data, 2022

The result presented in Figure 4.13 revealed that, agricultural extension agents was found to be the highest at 28%, followed by radio at 22%, agricultural events at 18%, and farmer associations at 15%. Other sources included 7% television, 5% newspapers, 3% internet, 1% literature, and 1% libraries. This outcome aligns with the discovery made by Ozowa

(2010) that Nigerian farmers consider the extension agent to be the most reliable source of information and guidance.

Table 4.4 below illustrates comparison on the extent to which agricultural information sources are utilised in the three local government areas.

Table 4.4 Comparative Analysis Showing the Level of Utilisation of Agricultural Information Sources by Rice Farmers in Kura, Garun-Mallam, and Bunkure Local Governments.

	KURA		GARUN-MALLAM		BUNKURE	
Utilization Category	**Frequency**	**P**	**Frequency**	**P**	**Frequency**	**P**
Radio	87	33%	34	31%	43	22%
Extension Agents	40	15%	18	16%	58	28%
Books	16	6%	5	5%	3	1%
Agricultural show	30	11%	19	17%	36	18%
Television	18	7%	12	11%	14	7%
Newspapers/Magazines	15	6%	16	5%	10	5%
The Internet	12	5%	4	4%	8	3%
Library	16	6%	5	5%	4	1%
Farmers Assoc.	30	11%	7	6%	30	15%

Source: Field Data, 2022.

The result presented in Table 4.4 provides insights into the utilization of various information sources in three different regions: Kura, Garun-Mallam, and Bunkure. It highlighted the frequency and the corresponding percentages of each utilization category within these regions. "Radio" emerges as a significant source of information utilization in all three regions. In Kura, there are 87 instances, accounting for 33% of the total utilization

category. Garun-Mallam reported 34 instances, representing 31% of the total, while Bunkure has 43 instances, making up 22% of the total in this category.

"Extension Agents" are another prominent source of information. In Kura, there are 40 instances, comprising 15% of the total utilization category. Garun-Mallam reports 18 instances, accounting for 16% of the total, and Bunkure has 58 instances, making up 28% of the total in this category. "Books" are a source of information utilization, with Kura reporting 16 instances, representing 6% of the total utilization category. In Garun-Mallam, there are 5 instances, making up 5% of the total, and Bunkure reported 3 instances, accounting for 1% of the total for this category.

"Agricultural Shows" also play a role in information utilization. In Kura, there are 30 instances, accounting for 11% of the total utilization category. Garun-Mallam has 19 instances, representing 17% of the total, and Bunkure reported 36 instances, making up 18% of the total in this category. "Television" is a source of information utilization, with Kura reporting 18 instances, comprising 7% of the total utilization category. In Garun-Mallam, there are 12 instances, accounting for 11% of the total, and Bunkure has 14 instances, making up 7% of the total for this category.

"Newspapers/Magazines" are influential in information utilization, with Kura reporting 15 instances, representing 6% of the total utilization category. Garun-Mallam has 16 instances, accounting for 5% of the total, and Bunkure reports 10 instances, making up 5% of the total in this category. "The Internet" serves as a modern source of information utilization, with Kura reporting 12 instances, accounting for 5% of the total utilization category. In Garun-Mallam, there are 4 instances, making up 4% of the total, and Bunkure has 8 instances, representing 3% of the total for this category.

"Library" is a source of information utilization, with Kura reporting 16 instances, comprising 6% of the total utilization category. In Garun-Mallam, there are 5 instances, making up 5% of the total, and Bunkure has 4 instances, accounting for 1% of the total for this category. "Farmers Associations" play a role in information utilization. In Kura, there are 30 instances, accounting for 11% of the total utilization category. Garun-Mallam reports 7 instances, representing 6% of the total, and Bunkure has 30 instances, making up 15% of the total in this category.

This data revealed the diverse sources through which people in these regions access and utilize information. It provides valuable insights into the preferred channels for information consumption, which can be instrumental in tailoring educational and outreach efforts to effectively disseminate agricultural knowledge and information in these areas.

This also indicates that radio is a popular and effective means of disseminating agricultural information to the agricultural community. Radio can reach remote and rural communities that may not have access to other media. Access to radio as a source of agricultural information improves the productivity, competitiveness, and market access of rice producers. Consequently, it is crucial to continue investing in radio programmes that provide producers with high-quality agricultural information and to ensure that this information reaches those who need it the most. However, a significant portion of the agricultural community may lack access to knowledge and resources that could help them improve farming practises and increase yields. Agricultural literature can provide comprehensive information on particular agricultural practises, such as soil management, insect control, and crop rotation. Without these resources, producers may miss out on vital data that could improve their agricultural practises. In addition, agriculture publications can educate producers on a range of topics, from basic agricultural techniques to more advanced methods. Without access to these resources, farmers may miss out on opportunities to increase their skills and knowledge, leaving them less equipped to manage their properties and adapt to new challenges.

The study finding of the study collaborated with Ali, Hamad, Abdallh, and Elagab (2020), who examined the role of extension officers in the provision of agricultural services to small-scale producers in the Gezira State of Sudan, concur with these findings. Using a field survey and structured questionnaires, information was gathered from 36 extension officers selected via quota sampling. The Statistical Package for the Social Sciences (SPSS) was utilised for data analysis employing descriptive statistics, correlation, and regression analysis. 81% of respondents reported having outstanding direct contact with producers.

4.4 Correlations Analysis to show the Relationship between Rice Farmer Information Literacy and Agricultural Productivity.

This study provides empirical evidence regarding the relationship between producers' information literacy and agricultural output.

Table 4.5: Correlation Matrix

		Agricultural Productivity	Information Awareness
Agricultural Productivity	Pearson Correlation	1.000	.278**
	Sig. (2-tailed)		
Information Awareness	Pearson Correlation	.278**	1.000
	Sig. (2-tailed)	0.000	

****** Correlation is significant at the 0.01 level (2-tailed).
Source: Field Data, 2022

Information awareness was associated with agricultural productivity at 0.01 (2-tailed) (r = 0.278, n =634, p=1268). This indicates that producers with greater information knowledge are probably more productive.

The correlation matrix illustrates the relationships between Agricultural Productivity, Information Awareness, and Information Access using Pearson correlation coefficients and significance levels. The correlation between Agricultural Productivity and Information Awareness is 0.278, indicating a weak to moderate positive relationship, which is statistically significant with a p-value of 0.000. This suggests that as Information Awareness increases, Agricultural Productivity tends to increase slightly. Similarly, the correlation between Agricultural Productivity and Information Access is 0.175, also showing a weak positive relationship that is statistically significant with a p-value of 0.000. This indicates that greater Information Access is associated with a slight increase in Agricultural Productivity. The strongest correlation in the matrix is between Information

Awareness and Information Access, with a coefficient of 0.892, indicating a very strong positive relationship, and is statistically significant with a p-value of 0.000. This strong correlation suggests that higher levels of Information Access are strongly associated with higher levels of Information Awareness. Overall, these findings highlight that while both Information Awareness and Information Access positively impact Agricultural Productivity, they are most strongly correlated with each other.

Farmers with higher levels of information literacy are more likely to have access to and be able to effectively utilise data regarding new technologies, best practises, and market trends. This information will help them optimise their agricultural practises, reduce pollution, and increase yields. Additionally, producers with a higher level of information literacy are more likely to make efficient and effective decisions. They can more accurately assess the potential benefits and risks of various courses of action and make more informed decisions that meet their specific needs.

The study is in collaboration with Oyewole *et. al.;* (2013), who investigated the role and contributions of information and communication technologies in the development of agriculture in the Ibadan North West area council of Nigeria. The survey included well-structured questionnaires and a random sample of fifty respondents, with data analysis using frequency counts, percentages, and Pearson Product Moment Correlation. According to the findings, approximately 58% of respondents have utilised ICT for one to five years. In addition, the study discovered a significant relationship between ICT and agricultural progress.

The study conducted in 2013 by Büyükbay and Gündüz, found a strong correlation between computer and internet use and a person's socioeconomic characteristics. It was suggested

that agricultural researchers should have Internet access to increase their contribution to agricultural development and their usefulness.

4.5: Chi-square Computation on the Relationship between Information Needs and Sources of Agricultural Information.

This section describes the connection between Framer information needs and agricultural information sources. The concept of Agricultural information requirements refers to a farmer's desire or need for particular information in order to achieve a particular goal or carry out a particular activity. This phenomenon occurs when there is a gap between the producers' current knowledge or available resources and the knowledge required to accomplish their intended goals successfully (Wahab, 2015). Cross tabulation Chi-square was utilised to analyse the data in order to investigate the relationship between farmer information needs and agricultural information sources. Refer to the illustration on table 4.6 below.

Table 4.6 Cross-tabulation Chi-square of Farmers' Information Needs and Information Sources

	Value	**Df**	**Asymp. Sig (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	.487[a]	1	.485		
Continuity Correction[b]	.216	1	.642		
Likelihood Ratio	.487	1	.485		
Fisher's Exact Test				.642	.321
Linear-by-Linear Association	.481	1	.488		
N of Valid cases	80				
Chi-sq cal	23.57	12			
Chi-sq tab @ Sig. level (ά) = 0.05	21.03				

Source: Field Data, 2022. Cell chi-square = 23.57 df = 12, T-cal_23.57> 21.03

The empirical analysis of the relationship between farmer information needs and agricultural information sources in the study area revealed a chi-square value of 23.57, which is greater than the chi-square value of 21.03 under 12 degrees of freedom. This implies that there is a significant correlation between farmer information literacy and the quantity/volume of output produced. The result further indicated a variety of statistical tests used to assess the relationship between farmers' information needs and agricultural information sources. Each test provides insight into whether there is a significant association between these two variables.

Firstly, the Pearson Chi-Square test shows a value of 0.487 with 1 degree of freedom, and an asymptotic significance (2-sided) of 0.485. This p-value is well above the typical threshold of 0.05, indicating that we do not have sufficient evidence to reject the null hypothesis. In other words, the data does not support a significant relationship between farmers' information needs and agricultural information sources. Similarly, the Continuity Correction, which is applied to the Pearson Chi-Square test to reduce bias in 2x2 tables, has a value of 0.216 and a p-value of 0.642. This higher p-value again suggests that there is no statistically significant association between the variables in question. The consistency of these results reinforces the initial conclusion drawn from the Pearson Chi-Square test.

The Likelihood Ratio Chi-Square test, another method for testing the association between categorical variables, mirrors the findings of the Pearson Chi-Square test with an identical value of 0.487 and a p-value of 0.485. This further corroborates the lack of a significant relationship between the variables. Fisher’s Exact Test, which is particularly useful for small sample sizes or when expected frequencies are low, provides exact significance values of 0.642 (2-sided) and 0.321 (1-sided). Both values are greater than 0.05, providing

additional evidence that there is no significant association between farmers' information needs and agricultural information sources.

The Linear-by-Linear Association test, which measures the strength and direction of a linear relationship between two ordinal variables, also supports these findings. With a value of 0.481 and a p-value of 0.488, it indicates no significant linear association. A total of 80 valid cases were included in this analysis, which provides a reasonable sample size for these tests. However, the overall lack of significant results suggests that the sample size is not a limiting factor in detecting an association if one existed. Interestingly, a separate Chi-Square test with 12 degrees of freedom yields a calculated value of 23.57, which is greater than the critical value of 21.03 at the 0.05 significance level. This indicates a significant relationship for this different set of data or variables. This discrepancy highlights that while the main analysis shows no significant relationship, other datasets or variables might reveal significant associations.

In summary, the various tests conducted in the primary analysis consistently indicate no significant association between farmers' information needs and agricultural information sources. The finding of this study is in line with Umar, (2015) who affirmed that there is a significant relation between farmers' literacy level and the quantity/volume of output in study conducted on the effect of credit utilization by ground nut oil processors in Funakaye and Gombe local government areas in Gombe State, Nigeria.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section provides an overview of the chapter's content and its relevance to the research endeavour. This chapter provides a summary and interpretation of the research findings in light of the research questions. The chapter also includes recommendations for practise, policy, and future research, as well as conclusions based on the study's findings.

5.2 Summary

In this section, the outcomes of the previous chapters are summarised. Evaluations were conducted on the information literacy and agricultural performance of rice cultivators in Kano State, Nigeria. In accordance with the objectives, the results were organised and presented so as to address the information requirements of rice producers in Kano State, Nigeria, and their familiarity with agricultural information sources. It also addressed how rice farmers in the state of Kano utilise agricultural information sources, the relationship between farmer information requirements and sources, and the link between farmer information literacy and production. Utilising correlational, descriptive, and Chi-square statistics, subject responses were analysed and reported.

Rice producers in Kano state have diverse information needs, with novel rice seed varieties being the most important. Marketing and agricultural credit/loan are less prevalent, followed by diseases and pest management, land preparation, fertiliser use, and storage. In the Bunkure Local Government, credit/loan information is most sought after. Radio is the most important source of agricultural news for 31% of the Kura Local Government. Other

sources include agricultural agencies, farmer associations, agricultural events, farmer organizations, periodicals, Facebook, the internet, television, library, and 3.4 agricultural databases. In Garun Mallam Local Government, radio is the main source of agricultural information, followed by radio, agricultural agents, farmer associations, agricultural shows, television, farmer organizations, Facebook, agricultural databases, libraries, and the internet.

The study reveals that the majority of Kura LGA respondents use radio, agricultural agents, exhibitions, and farmer organizations for marketing, with other sources including television, literature, library, periodicals, and the internet. It also found a positive association between information awareness and agricultural production, suggesting that producers with higher literacy are more productive.

In addition, 90.3% of rice producers in Kano State had access to radio agricultural information, while 9.7% did not. According to the research, radio is a popular and effective method for sharing agricultural information with producers. Radio can reach rural and isolated populations when no other medium can. Enhanced access to agricultural information via radio broadcasting may potentially enhance the productivity, competitiveness, and market accessibility for rice growers.

The survey also revealed that 84.3% of rice producers had access to informational agricultural extension agents. The research discovered that rice producers in Kano State have easy access to agricultural extension agents. In an effort to better their practises and yields, agricultural extension agents may provide farmers with information on cutting-edge technology, standard procedures, and other advancements. Farmers can determine what

commodities to plant and when to sell them based on market demand, pricing, and other market data provided by agricultural extension agents.

Based on the findings of the study, it was observed that a significant proportion of rice growers, namely 80.1%, faced a lack of availability to agricultural literature. This implies that a considerable segment of the agricultural populace in Kano State lacks access to pertinent knowledge and resources that have the potential to enhance their farming methods and productivity.

The survey revealed that 44.6% of Kano State rice producers attended agricultural exhibits for informational purposes, gaining knowledge to increase yield. These festivals showcase new innovations and tools, helping producers improve their practices. Despite restrictions, 58.2% of producers sourced agricultural information from television, with many broadcasts in local languages facilitating access to information.

The majority of rice producers in Kano State (62.4%) lacked access to newspapers and periodicals for agricultural information. Rice producers in the state of Kano have limited access to newspapers and periodicals for agricultural information, indicating that the dissemination of information should be enhanced. This may involve developing internet platforms, radio programmes, or print distribution channels in rural areas.

The majority of paddy growers in Kano State (65.5%) do not use the internet for agricultural information, indicating a need for improved internet infrastructure and cost-effective services. Additionally, 80.5% of farmers lack access to agricultural libraries and information centers, suggesting a potential scarcity of resources like books. This suggests that farmers' access to these resources may be restricted or limited, especially in rural areas

where access to books is limited. Therefore, enhancing internet infrastructure and providing more cost-effective services are crucial for improving agricultural information access.

The survey revealed that 64.3% of rice producers in Kano State did not have access to farmer groups for agricultural knowledge. Without access to farmers' organisations, rice farmers in Kano State may miss out on opportunities to improve farming practises, increase yields, and network with other farmers and agricultural professionals.

The study found a slight positive correlation between access to agricultural knowledge and rice output among farmers in Kano State, Nigeria. However, the strength of the connection is low, suggesting that the relationship is not accidental and may apply to all rice growers. The existing connection is insufficient, indicating the need for further investigation to identify factors contributing to productivity.

Rice producers are aware of diverse information sources. Most rice producers are aware of various agricultural information sources; consequently, they have access to diverse information. With access to a variety of agricultural data, rice farmers can make informed cultivation decisions. Farmers may utilise weather forecasts to plant or harvest crops, as well as market information to determine what to cultivate and how much to produce.

Most producers in Kano State, particularly paddy producers, struggle with ICT usage, indicating the need for alternative methods of agricultural knowledge. Extension specialists provide advice, and nearly half of producers can evaluate agricultural facts, while 27.2% struggle with high-quality information and 24.7% are uncertain. This suggests they can make informed decisions about crop management and market trends.

The majority of rice producers in Kano State (61.2%) are proficient in communication and data analysis, indicating their ability to obtain accurate agricultural information. Additionally, 45.3% of producers are capable of evaluating and applying data effectively, indicating their ability to make better agricultural decisions.

60% of rice growers have access to agricultural information via internet platforms, enhancing their decision-making abilities. 47.5% of farmers can communicate and retrieve information via mobile phones, while 33.3% lack this ability and 19.2% express uncertainty over their capacity.

The study found a significant positive correlation between farmer information literacy and agricultural production performance in Kano State. Higher literacy levels lead to better access to new technologies, best practices, and market trends, improving agriculture, reducing waste, and increasing yields. Farmers with higher literacy make more intelligent decisions.

5.3 Conclusions

In this concluding section, the study summarises and synthesises the key findings regarding farmer information literacy and agricultural productivity, focusing specifically on rice producers in Kano State, Nigeria-West Africa. This section also discusses the implications of these findings for the development of effective information dissemination strategies and the improvement of rice grower literacy in the region. The conclusions have been presented in accordance with the aim of the research.

5.3.1 Information Needs of Rice Farmers

Rice producers in Kano State need valuable information to improve agricultural practices and output. Rice prices vary based on weather, demand, and supply, so they need to sell effectively to maximize profits. Marketing knowledge helps them attract new customers. Financial resources are crucial for meeting production goals, especially when purchasing agricultural supplies on credit. Farmers also need to know which fertilisers yield the highest yields and the least expensive ones.

The research shows that many rice farmers in Kano State face resource constraints, including limited access to pesticides and equipment, which hinders effective pest management. They are interested in cost-effective alternatives like proper stowage to maximize income, wait for improved market conditions, and meet market requirements for quality and quantity.

Several rice growers in Kano State use outdated methods that may no longer provide desired results. Inadequate land preparation may lead to low agricultural production. In addition, modern rice seed variants often yield more than traditional kinds. Introducing new seed kinds enhances agricultural output and financial gains. Novel rice seed cultivars exhibit enhanced resistance to illnesses and parasites, thereby mitigating crop losses for growers.

5.3.2 Awareness of Sources of Information

The survey shows that a significant number of rice farmers are knowledgeable about various agricultural information sources. To optimize productivity and income, it's crucial for producers to have comprehensive knowledge on reliable sources. Governments and

other stakeholders should ensure accurate and relevant information is provided, enhancing the quality of life for rice producers and contributing to the agricultural sector's growth.

Accurate and timely agricultural information can boost rice producers' productivity and profitability by addressing factors like seed varieties, soil fertility, pest management, and irrigation. This knowledge allows producers to make informed decisions about timing, location, and quantity of sales. Rice farmers can access information through various channels, but they must have the necessary skills to effectively use and acquire information.

The poll indicates that rice farmers with agricultural expertise can utilize extension services, research institutions, and input providers. Extension services provide technical assistance and advanced teaching in rice cultivation, while research organizations develop innovative cultivars with enhanced resistance to pests and diseases. Input suppliers offer high-quality fertilizers, seeds, and pesticides.

The Nigerian economy heavily relies on agriculture, particularly rice cultivation in Kano State. To increase output and profitability, rice producers need access to various information sources, monitor market prices, and coordinate harvest times with high demand periods. They can also benefit from government input subsidies and loans. This strategic approach maximizes earnings and maximizes the economy's potential.

5.3.3 Agricultural Information Access

The research shows that farmers in Kano State are utilizing radio for agricultural information dissemination, which can reach rural and isolated populations. This increased access to information can improve productivity, competitiveness, and market access for rice growers. Agricultural extension agents provide farmers with information on new

technologies, best practices, and yield-enhancing innovations. However, a significant portion of the agricultural population is missing out on resources to enhance their practices and yields. Agriculture publications cover topics like soil management, insect control, and crop rotation. Television is also a significant source of agricultural information, with many broadcasts in local languages.

Rice farmers in Kano face challenges in accessing agricultural information, requiring coordination between government, development partners, and stakeholders. Access to extension services, technology, input suppliers, and market information is crucial for informed decision-making, enhancing agricultural practices, and increasing yields and profits. The absence of extension services, which provide modern advice on rice production, is a significant issue, potentially leading to a decline in yield.

Nigeria's paddy producers in Kano State face challenges due to limited access to technology, including mobile phones, online information, and digital platforms. Low suppliers of agricultural inputs and market information also hinder their ability to access necessary resources, leading to reduced prices or loss of products. This highlights the need for improved technology and digital platforms in the region.

5.3.4 Farmer Information Literacy and Productivity

The study found a strong correlation between farmer information literacy and output. Farmers with information literacy improve their practices by learning new techniques, pest and disease management, and soil management, increasing yields and reducing production costs. They also use superior crops, fertilizers, and market data for optimal pricing.

Research shows that rice producers in Kano State, Nigeria, lack information literacy, leading to less productive practices and limited access to vital information. To improve their skills, assistance and training should be provided to access and utilize agricultural information, benefiting paddy growers and the Nigerian agricultural economy.

The empirical analysis of the relationship between farmer information needs and agricultural information sources in the study area revealed a chi-square value of 23.57, which is greater than the chi-square value of 21.03 under 12 degrees of freedom.

5.4 Recommendations

This section contains recommendations based on the study's findings and conclusions. Based on the investigation's findings and conclusions, the following recommendations are made:

i. Producers should be involved in the assessment of their information requirements, identifying their needs, obstacles, and possibilities, to ensure that the assessment accurately reflects their actual information needs.

ii. The government and stakeholders in Kano State should adopt a participatory approach to engage rice producers, identifying their information needs and developing tailored solutions to ensure agricultural practitioners have access to relevant and valuable information.

iii. Kano rice producers should be educated on available agricultural information sources, including the Internet, extension services, and mobile applications, to enhance their agricultural practices and access and utilize these resources effectively.

iv. Enhancing extension services is crucial for providing producers with accurate information. Strengthening these services among rice cultivators in Kano State involves increasing the number of workers, improving skills and resources, and establishing effective communication channels.

v. Collaborate with local educational institutions or agricultural extension services to provide targeted training and resources.

vi. Develop tailored informational materials and training sessions that cater to the specific needs and challenges faced by farmers at different stages of their careers.

vii. Allocate resources to recruit and train additional extension agents who can provide personalized support and guidance to small-scale rice producers, facilitating knowledge transfer and adoption of best practices, such as in Kura.

viii. Capitalize on the popularity and effectiveness of radio as a means of disseminating agricultural information by investing in high-quality radio programs tailored to the specific needs and preferences of rice farmers in the Kura, Garun-Mallam, and Bunkure regions.

5.4.1 Policy Recommendations

The potential improvement of farmer information literacy and agricultural production performance among rice farmers in Kano State might be achieved by the coordinated and sustained implementation of the policy ideas outlined. This would ultimately result in the desired outcome.

i. The government of Nigeria should develop and implement a comprehensive information literacy programme for Kano's farmers. This programme should

include instruction on how to effectively recognize find, assess, and utilize agricultural data to improve farming practices.

ii. The Nigerian agricultural industry must improve the accessibility and effectiveness of extension services by increasing the number of employees through recruitment and training, and ensuring adequate resources like transportation, machinery, and communication tools.

iii. The government should create and distribute localized agricultural information to Kano State rice producers, ensuring it is relevant and beneficial, tailored to the local context.

iv. The Nigerian government must enhance the access of rice producers in Kano State to technology and digital platforms, such as mobile phones and laptops, to improve their information literacy and agricultural output.

v. Policies strengthening peasant organizations are crucial for farmers to access information, agricultural inputs, and markets, facilitated by training, capacity building, and resource provision.

vi. The government should boost research and development expenditures in agriculture to discover innovative techniques for increasing rice production in Kano State, while also developing environmental and natural resource-protective agricultural policies.

vii. In Kano State, rice farmers should enhance their exposure to local and international markets to boost income and increase output. Monitoring and evaluating policies to improve information literacy and agricultural output will help identify areas for development and refine them for optimal results.

viii. Facilitate knowledge-sharing networks and platforms where farmers can exchange experiences, innovations, and best practices to enhance agricultural productivity and resilience.

5.4.2 Recommendations for Further Research

This study aimed to evaluate the correlation between data awareness among rice producers in Kano State, Nigeria, and their agricultural output, suggesting further research on the influence of different information sources on farmers' information literacy and agricultural production.

In addition, it is crucial to conduct comparative research in order to evaluate the level of farmer information literacy and agricultural productivity performance among farmers in the state of Kano who cultivate a variety of commodities. This study seeks to determine the similarities and differences between the variables influencing producers' information literacy and productivity across different crop types. This study suggests conducting additional research into the effect of climate change on producers' information literacy and agricultural output. This study seeks to identify strategies that rice farmers in Kano State could employ to mitigate the effects of climate change and increase agricultural productivity.

In addition, it is suggested that future research efforts examine the impact of gender on farmers' information literacy and agricultural production outcomes in the context of rice cultivation in Kano State. This study seeks to ascertain effective approaches for mitigating gender gaps and nurturing gender equality within the agriculture industry in the specified geographical area. Additional research should be conducted to investigate the effects of

policy interventions as an intervening factor in enhancing farmers' information literacy and their agricultural production outcomes, focusing on rice farmers in Kano State. This will facilitate the identification of effective policy interventions and the acquisition of valuable insights for formulating and implementing future policies.

REFERENCES

Abbas, M., Muhammad, S., Nabi, I. and Kashif, M. (2003). Farmers' information sources, their awareness and adoption of recommended sugarcane production technologies in the central Punjab. *Pakistan Journal of Agricultural Sciences*, 40(3-4). 202-206.

Abbasi, R., Martinez, P., and Ahmad, R. (2022). The digitization of agricultural industry–a systematic literature review on agriculture 4.0. *Smart Agricultural Technology*, 100042.

Abdullahi, A. I., Dahiru, B. D., Musa, U., and Abdullahi, A. M. (2018). Effectiveness of community-based extension services in Kano State, Nigeria. *International Journal of Agricultural Extension, 6*(1), 39-45.

Achichi, C., Sennuga, S. O., Osho-Lagunju, B., and Alabuja, F. O. (2023). Effect of Farmers' Socioeconomic Characteristics on Access to Agricultural Information in Gwagwalada Area Council, Abuja. *Discoveries in Agriculture and Food Sciences*, *10*(5), 28-47.

Adebayo, O. O., Shehu, H., and Idris, N. A. (2020). Assessment of rice farmers' access to agricultural information in Kano State, Nigeria. Journal of Agricultural Extension, 24(1), 87-98.

Adekunle, A. A., Alabi, O. Y., Ogunjimi, S. I., and Adesoji, O. M. (2019). Effect of irrigation methods on rice yield in Nigeria. *Journal of Agricultural Extension and Rural Development*, *11*(5), 77-84.

Ademola, A., and Olatokun, W. (2018). Agricultural Information Sources and Literacy of Fruit Farmers: A Qualitative Enquiry. *Available at SSRN 3123707*.

Adenkule, A. A. (2004). *Agricultural information dissemination: An audience survey in Kano State*. IITA.

Adesiji, G. B., Ogunjimi, S. I., and Agboola, R. S. (2020). Adoption of integrated pest management practices in rice production in Kwara State, Nigeria. *Journal of Agriculture and Ecology Research International*, *22*(8), 1-9.

Adhiguru, P., Birthal, P. S., and Kumar, B. G. (2009). Strengthening pluralistic agricultural information delivery systems in India. *Agricultural Economics Research Review*, *22*(347- 2016-16740), 71-80.

Adhikari, B., Bhattarai, B., and Sapkota, T. B. (2020). Impacts of Climate-Smart Agriculture on the Livelihood of Farmers in the Mid-Hills of Nepal. Climate, 8(11), 132.

Adio, E. O., Abu, Y., Yusuf, S. K., and Nansoh, S. (2016). Use of agricultural information sources and services by farmers for improve productivity in Kwara State. *Library Philosophy and Practice (e-journal), 1456*.

Ahmad, M. T., Haie, N., Yen, H., and Tuqan, N. A. S. (2018). Efficiency of a water use system: the case of Kano River irrigation project, Nigeria. *International Journal of Civil Engineering.* 16, 929–939. doi: 10.1007/s40999-017-0235-2

Ahmed, M. (2018). Accessibility and Utilization of Agricultural Information: The Role of Communication Media in the Delivery of Information to Farmers in Nigeria. In *Information and Knowledge Management* (Vol. 8, No. 10).

Aina, L. O. (2007). Globalisation and small-scale farming in Africa: What role for information centres. In *World Library and Information congress: 73rd IFLA general conference and council* (pp. 1-8).

Aina, L. O. and Dulle, F. W. (1999). The information needs of small scale dairy farmers in Tanzania. International Association of Agricultural Information Specialists (IAALD) Quarterly Bulletin 44(3–4): 173–176

Ajuwon, G. A., and Odeku, E. L. (2018). Module One Information Sources Ibadan. *African Journals,* 5(1), 87 – 93

Alcardo, A., B., Edvin, J., K., Camilius S., Ayubu, S., Joseph, P. and George, K. (2015). New technologies for disseminating and communicating agriculture knowledge and information: challenges for agricultural research institutes in Tanzania. *The Electronic Journal of Information Systems in Developing Countries*. 70(2) 1-22

Aldosari, F., Al Shunaifi, M. S., Ullah, M. A., Muddassir, M., and Noor, M. A. (2019). Farmers' perceptions regarding the use of information and communication technology (ICT) in Khyber Pakhtunkhwa, Northern Pakistan. *Journal of the Saudi Society of Agricultural Sciences*, *18*(2), 211-217.

Alhassan, Y. K., Mohammed, Z., and Ibrahim, H. M. (2021). Accessing agricultural information by rural farmers through mobile phones in Karaye Local Government Area of Kano State, Nigeria. *Journal of Information and Communication Technology Development and Applied Research*, *3*, 50-60.

Ali, A., Adekola, A. A., Awoyemi, O. A., and Onumah, E. E. (2020). Effects of seed selection and management practices on rice productivity in Nigeria. *Journal of Agribusiness in Developing and Emerging Economies*, *10*(2), 189-204.

Ali, J., Ishaq, M., Shahzad, M. A., and Khan, A. A. (2019). Factors affecting the use of information sources by rice farmers in Punjab, Pakistan. *Information Development*, 35(3), 452-458.

Aliber, M., and Hart, T. G. (2009). Should subsistence agriculture be supported as a strategy to address rural food insecurity? *Agrekon*, *48*(4), 434-458.

Amir Khatam, A. K., Sher Muhammad, S. M., Siddiqui, B. N., Hassan, M. Z. Y., Ijaz Ashraf, I. A., Khan, M. Z., and Aijaz Kuharoo, A. K. (2013). Communication of agricultural information through group contact methods in Pakistan.

Amiri-Zarandi, M., Hazrati Fard, M., Yousefinaghani, S., Kaviani, M., and Dara, R. (2022).A platform approach to smart farm information processing. *Agriculture*, *12*(6), 838.

Anigbogu, T. U., Abbas, O. E. and Okoli, I. M. (2015). Socioeconomic Factors Influencing Agricultural Production among Cooperative Farmers in Anambra State, Nigeria. *International Journal of Academic Research in Economics and Management Science*, Vol. 4, No. 3 ISSN: 2226-3624.

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

Anugwa, I. Q., and Agwu, A. E. (2019). Research Article Perceived Causes of Household Food Insecurity and Policy Implications for Food Production in Kano State, Nigeria.

Anwar, M., Oliver, G., Frings-Hessami, V., Saha, M., and Sarker, A. (2022). Collective aspects of information literacy in developing countries: a Bangladeshi case. *Journal of Documentation*.

Anyanwu, B., and Udoh, G. N. (2022). The Effectiveness of Mass Media in Agricultural Extension and Development. *African Journal of Agricultural Science and Food Research*, *3*(1), 25-36.

Aragón, F. M., Oteiza, F., and Rud, J. P. (2021). Climate change and agriculture: Subsistence farmers' response to extreme heat. *American Economic Journal: Economic Policy*, *13*(1), 1-35.

Asenso-Okyere, K., and Mekonnen, D. A. (2019). The Importance of ICTs in the Provision of Information for Improving Agricultural Productivity and Rural Incomes in Africa. United Nations Development Programme. Retrieved from https://www.undp.org/content/dam/rba/docs/Working%20Papers/ICT%20Agriculture%20Paper%20Series.pdf

Balkrishna, B. B., and Deshmukh, A. A. (2017). A study on role of social media in agriculture marketing and its scope. *International Journal of Management, IT and Engineering*, *7*(4), 416-423.

Bansal, V., Das, L., Joshi, V., and Meena, S. C. (2022). Farmer's Awareness and Use of Different ICT Tools. *Asian Journal of Agricultural Extension, Economics and Sociology*, *40*(10), 156-165.

Behera, B.S., Das, T.K., Jishnu, K.J., Behera, R.A., Behera, A.C. and Jena, S., 2015. E-Governance Mediated Agriculture for Sustainable Life in India. *Procedia Computer Science*, 48, pp.623-629.

Benard, R., Dulle, F. and Ngalapa, H. (2014). 'Assessment of information needs of rice farmers in Tanzania; A case study of Kilombero District, Morogoro', Library Philosophy and Practice (e-journal), (paper 1071): pp1–34. [http:// digitalcommons.unl.edu/cgi/viewcontent.cgi?article=2666andcontext= libphilprac]

Bhalekar, P., Ingle, S., and Pathak, K. (2015). The study of some ICT projects in agriculture for rural development of India. *Asian Journal of Computer Science and Information Technology*, *5*(1), 5-7.

Breivik, P. S. and Gee, G. E. (2016). *Information Literacy: Revolution in the Library.* New York: American Council on Education, Macmillan Publishing Company

Brodny, J., and Tutak, M. (2022). Analysing the level of digitalization among the enterprises of the European Union member states and their impact on economic growth. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(2), 70.

Brown, P., Daigneault, A., and Dawson, J. (2019). Age, values, farming objectives, past management decisions, and future intentions in New Zealand agriculture. *Journal of environmental management*, *231*, 110-120.

Bruce, C. (2011). Information literacy programs and research: An international review. The Australian Library Journal, 60 (4), 326-333. Doi:10.1080/00049670.2011.10722652

Brüntrup, M., and Heidhues, F. (2002). *Subsistence agriculture in development: Its role in processes of structural change*. Grauer.

Bryman, A. (2020). Social research methods (6th ed.). Oxford University Press.

Budd, J. M., and Lloyd, A. (2014). Theoretical foundations for information literacy: A plan for action. *Proceedings of the American Society for Information Science and Technology*, *51*(1), 1-5.

Büyükbay, E. O. and Gündüz, O., 2013. An investigation on computer and internet use for agricultural development in rural areas: A case study for Tokat Province sin Turkey. *African Journal of Biotechnology*, 10(56), pp. 11879-11886.

Caffaro, F., Cremasco, M. M., Roccato, M., and 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.

Caffaro, F., Cremasco, M. M., Roccato, M., and 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.

Chemtob, C., Roitblat, H. L., Hamada, R. S., Carlson, J. G., and Twentyman, C. T. (1988). A cognitive action theory of post-traumatic stress disorder. *Journal of anxiety disorders*, *2*(3), 253-275.

Chen, T., Rizwan, M., and Abbas, A. (2022). Exploring the role of agricultural services in production efficiency in Chinese agriculture: A case of the socialized agricultural service system. *Land*, *11*(3), 347.

Chen, Y., and Lu, Y. (2020). Factors influencing the information needs and information access channels of farmers: An empirical study in Guangdong, China. *Journal of Information Science*, *46*(1), 3-22.

Chhachhar, A. R., Hassan, M. S., Omar, S. Z., and Soomro, B. (2012). The role of television in dissemination of agriculture information among farmers. *Journal of Applied Environmental and Biological Sciences*, *2*(11), 586-591.

Chipeta, S., Christoplos, I., and Katz, E. (2008). Common Framework on Market-Oriented Agricultural Advisory Services. Lindau, Switzerland: Neuchâtel Group. (www. neuchatelinitiative.net / English/ documents/ CF on Market - Oriented Agricultural Advisory Servicessmall.pdf)

Church, S. P., Haigh, T., Widhalm, M., de Jalon, S. G., Babin, N., Carlton, J. S. and ProkopyL. S. (2017). Agricultural trade publications and the 2012 Midwestern US drought: A missed opportunity for climate risk communication. *Climate Risk Management*, *15*, 45-51

Coleman, J. S. (1986). Social theory, social research, and a theory of action. *American journal of Sociology*, *91*(6), 1309-1335.

Communication of agricultural information through group contact methods in Pakistan. *Pak. J. Agric. Res*. 26: 245-253.

CONAB. (2022). Acompanhamento da Safra Brasileira de Grãos 2019/2020. Companhia Nacional de Abastecimento. Retrieved from https://www.conab.gov.br/info-agro/safras/graos/boletim-da-safra-de-graos

Connelly, L. M. (2008). Pilot studies. *Medsurg Nursing*, 17(6), 411-2.

Creed, C. and Perraton, H. (2001). Distance Education in the E-9 Countries: The Development and Future of Distance Education Programmes in the *Nine High-Population Countries. France: UNESCO.*

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Daniel, E., and Elifadhili, D. (2013). Assessment of agricultural extension services in Tanzania. A case study of Kyela, Songea Rural, and Morogoro Rural Districts. *Internship Report in Plant Sciences. Crops Systems Analysis Group. Wageningen University and Research Centers (WUR).*

Danjuma, N. U., Agir, H. M., Zubairu, E., and Agya, A. (2021). Role of Radio Agricultural Programmes on farmers' education: A case study of Radio Benue, Makurdi, Benue State. *Journal of Agricultural Economics, Environment and Social Sciences, 7*(2), 152-160.

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

Daudu, S., Chado, S. S., and Igbashal, A. A. (2009). Agricultural information sources utilized by farmers in Benue State, Nigeria. *Publication Agriculture and Technology*, *5*(1), 39-48

Debastiani, L. (2021). A Extensão Rural no Brasil. In Anais do Congresso Brasileiro de Extensão Rural (Vol. 1, No. 1, pp. 1-6). Universidade Federal de Santa Maria.

Deressa, T. T., Hassan, R. M., Ringler, C., Alemu, T., and Yesuf, M. (2009). Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global environmental change*, *19*(2), 248-255.

Dong, L. (2021). Toward resilient agriculture value chains: challenges and opportunities. *Production and Operations Management*, *30*(3), 666-675.

Donkoh, S. A., Azumah, S. B., and Awuni, J. A. (2019). Adoption of improved agricultural technologies among rice farmers in Ghana: A multivariate probit approach. *Ghana Journal of Development Studies*, *16*(1), 46-67.

Dos Santos, E. A., Da Cunha, D. A., dos Santos, J. B., and Zanúncio, J. C. (2021). Agricultural vulnerability to climate change in the Rio das Contas Basin, Brazil. *International Journal of Environmental Science and Technology*, 1-12.

Dower,M (2009). Subsistence and Semi-subsistence farming in Europe: a challenge to EU and National Policies. Retrieved from www.forum-synergies.eu

Düştegör, D. (2020). An analysis of agricultural information literacy levels of small farmers: a case study of Turkey. *Information Development*, 36(1), 34-42.

Eamin, A. K., and Roknuzzaman, A. (2017). Agricultural Information Literacy of Farmers in the Northern Region of Bangladesh. *Journal of information and knowledge management*, 2(6), 45 – 56

Echezona, R. I., and Ugwuanyi, C. F. (2010). African university libraries and internet connectivity: Challenges and the way forward. *Library philosophy and practice*, *3*(9), 1-13.

Embrapa. (2022). Embrapa Arroz e Feijão. Empresa Brasileira de Pesquisa Agropecuária. Retrieved from https://www.embrapa.br/arroz-e-feijao

Etikan, I., Musa, S. A., and Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, *5*(1), 1-4.

F.A.O. (2018). *Agricultural Knowledge and Information Systems for Rural Development* (AKIS/RD). Strategic Vision and Guiding Principles

FAO. (2019). e-Agriculture. Food and Agriculture Organization of the United Nations. Retrieved from https://www.fao.org/e-agriculture/

Fatokun, K., Salman, A., and Adanlawo, E. F. (2022). The Access and use of Library and Internet as Information Source by Agricultural Academics and Extension Workers within King Cetshwayo District Municipality of Kwazulu-Natal Province, South Africa. *Library Philosophy and Practice (ejournal)*, *6865*.

Finger, R., Swinton, S. M., El Benni, N., and Walter, A. (2019). Precision farming at the nexus of agricultural production and the environment. *Annual Review of Resource Economics*, *11*, 313-335.

Food and Agriculture Organization of the United Nations (2017). Gender, FAO programmes- crops.[http://www.fao.org/gender/gender-home/genderprogramme/gender crops/en/].

Freeman, K., and Qin, H. (2020). The role of information and interaction processes in the adoption of agriculture inputs in Uganda. *Agronomy*, *10*(2), 202.

FRI. (2020). Farm Radio International. Retrieved from https://www.farmradio.org/

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.

Ghobadpour, A., Monsalve, G., Cardenas, A., and Mousazadeh, H. (2022). Off-road electric vehicles and autonomous robots in agricultural sector: trends, challenges, and opportunities. *Vehicles*, *4*(3), 843-864.

Githinji, J., Mwangi, M., and Bebe, B. (2014). The effectiveness of mobile phone-based agricultural extension services among smallholder farmers in Southern Kenya. *Journal of Agricultural Extension and Rural Development*, 6(7), 198-211.

Gohain, H. K. (2017). Importance of information literacy in agricultural productivity: a case study of farmers of Jorhat district of Assam. *TRANS Asian Journal of Marketing and Management Research (TAJMMR)*, *6*(8), 71-82.

Goodwin, B. K., and Mishra, A. K. (2004). Farming Efficiency and the Determinants of Multiple Job Holding by Farm Operators. *American Journal of Agricultural Economics*, *86*(3), 722-729. https://doi.org/10.2307/3697812

Gravetter, F. J., and Wallnau, L. B. (2016). Essentials of statistics for the behavioral sciences (9th ed.). Cengage Learning.

Gunton, L., Bruce, C. S., and Stoodley, I. (2012). Experiencing religious information literacy: Informed learning in church communities. *Australian Library Journal*, 61 (2), 119–132.

Hambati, H. M., and Jamali, H. R. (2019). Agricultural information literacy of smallholder farmers in Tanzania: A case study. *Information Development*, 35(3), 372-384.

Hansen, J. W., Vaughan, C., Kagabo, D. M., Dinku, T., Carr, E. R., Körner, J., and Zougmoré, R. B. (2019). Climate services can support african farmers' context-specific adaptation needs at scale. *Frontiers in Sustainable Food Systems*, *3*, 21.

Hertel, T. W., and Lobell, D. B. (2014). Agricultural adaptation to climate change in rich and poor countries: Current modeling practice and potential for empirical contributions. *Energy Economics*, *46*, 562-575.

Hertzog, M. A. (2020). Considerations in determining sample size for pilot studies. *Research in Nursing and Health*, 33(2), 180-191.

Hicks, A. and Lloyd, A. (2016). It takes a community to build a framework: Information literacy within intercultural settings. Journal of Information Science, 42 (3), 334–343. Doi. 10.1177/0165551516630219

Huang, J., Wang, X., & Qiu, H. (2012). Small-scale farmers in China in the face of modernisation and globalisation. *IIED/HIVOS, London/The Hague*.

Huang, J., Yang, J., Msangi, S., Rozelle, S., and Weersink, A. (2022). Biofuel development, food security, and the use of marginal land in China. Journal of Environmental Management, 231, 1113-1123.

Ibrahim, H., Jing, Z., Abdu, I., Sanusi, M., and Bala Sanda, N. (2018). An Assessment of Agricultural Marketing Information System among Farmers Associations in Kano State, Nigeria. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems*, 3(2), 75-80.

Idiku, F. O., Ntui, O. E., Iyamah, D. A., Abu, L. E., and Ochang, D. O. (2022). Library Use for Agricultural Research by Undergraduate Students of the Faculty of Agriculture, Forestry and Wildlife Resources Management, University Of Calabar, Nigeria.

Ifeanyi-obi, C. C., Wigwe, C. C., Adesope, O. M., and Obafemi, A. (2023). Traditional Perceptions of Climate Change Phenomenon Influencing Adaptation Decisions among Women Crop Farmers in Southern Nigeria. *Journal of Agricultural Extension*, *27*(2), 15-27.

Isaya, E., L., Agunga, R. and Sanga, C., A. (2018). Sources of agricultural information for women farmers in Tanzania. *Information Development.* 34(1) 77–89

Iskandar, E., Amanah, S., Hubeis, A. V. S., and Sadono, D. (2020). Factors affecting internet literacy of smallholder cocoa farmers in aceh, Indonesia. *International Journal of Advanced Science and Technology*, *29*, 4074-4084.

Jara-Rojas, R., Bravo-Ureta, B. E., and Díaz, J. (2019). Adoption of water conservation practices: A socioeconomic analysis of small-scale farmers in Central Chile. Land Use Policy, 82, 568-577.

Jat, J. R., Punjabi, N. K., and Bhinda, R. (2021). Use of ICTs by tribal farmers for obtaining agricultural information in southern Rajasthan. *Indian Journal of Extension Education*, *57*(3), 16-19.

Jato, M. J., Onu, F. M., and Musa, G. A. (2019). Factors influencing awareness and use of information sources by smallholder rice farmers in Niger State, Nigeria. *Library Philosophy and Practice*, 32(2) 1-13.

Jimale, A. (2020). Can Smartphones be used as an information delivery tool in post-conflict context?.

Jones, D. E. (1990). Sources of agricultural information.

Joyce Lyimo-Macha and Ntengua Mdoe (2002). Gender and Rural Poverty in Tanzania: Case of Selected Villages in Morogoro Rural and Kilosa Districts. LADDER Working Paper No. 18,1-19.

Kano Agricultural and Rural Development Authority (KNARDA, 2019). Farm Families. KNARDA, Kano State, Nigeria.

Kanyamuka, J. S., Jumbe, C. B., Ricker-Gilbert, J., Edriss, A. K., and Mhango, W. G. (2020). Determinants of ISFM technology adoption and Disadoption among smallholder maize farmers in Central Malawi. Climate Impacts on Agricultural and Natural Resource Sustainability in Africa, 449-469.

Kelly, S. (2022). Intercultural Communication in Agriculture Libraries: A Case Study in Ethiopia. *Library Philosophy and Practice*.

Kesherwani, B., Rout, S., Padhy, D., and Ravichandran, S. (2022). Social Media Help Farmers: For Improving Agriculture Practices.

Khan, G. A., Muhammad, S., Chaudhry, K. M., and Khan, M. A. (2010). Present status and future preferences of electronic media as agricultural information sources by the farmers. *Pakistani Journal of Agricultural Sciences*, *47*(2), 166-172.

Khan, G.A., S. Muhammad, K.M. Chaudhary and M.A. Khan. (2013). Information regarding agronomic practices and plant protection measures obtained by the farmers through electronic media. *Journal of Animal and Plant Sciences.* 23:647-650.

Khan, N. A., Shah, A. A., Tariq, M. A. U. R., Chowdhury, A., and Khanal, U. (2022). Impact of Farmers' Climate Risk Perception and Socio-Economic Attributes on Their Choice of ICT-Based Agricultural Information Services: Empirical Evidence from Pakistan. *Sustainability*, *14*(16), 10196.

Kiełbasa, B., Pietrzak, S., Ulén, B., Drangert, J. O., and Tonderski, K. (2018). Sustainable agriculture: The study on farmers' perception and practices regarding nutrient management and limiting losses. *Journal of Water and Land Development*, (36).

Kilelo, E. S., Nowicki, M., Nguka, G., Olimba, L. A., Konyole, S. O., and Termote, C. (2023). Food security's broken link: The misalignment of stakeholder priorities in agriculture and nutrition in Vihiga County, Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, *23*(8), 24222-24247.

Kipkoech, A. K., Kipkoech, S., and Bett, H. K. (2019). Socio-economic determinants of farmers' choice of rice production technologies in Kenya. *Journal of Agricultural Science*, 11(14), 1-11.

Kiplang'at, J. (2019). An analysis of the opportunities for information technology in improving access, transfer and the use of agricultural information in the rural areas of Kenya. *Library Management*, 20(2), 63 – 75

Kiptot, E., Franzel, S., Nang'ole, E., and Karanja, G. (2019). Impact of a Participatory Approach to Improve Smallholder Dairy Production in Kenya: The Dairy Farmer Field School. In C. A. R. Bautista (Ed.), Transforming Mountain Forestry (pp. 327-339). Routledge.

Klerkx, L., Jakku, E., and Labarthe, P. (2019). A review of social science on digital agriculture, smart farming, and agriculture 4.0: New contributions and a future research agenda. NJAS – Wageningen. *Journal of Life Sciences*, 90-91, 100315.

Komarek, A. M., De Pinto, A., and Smith, V. H. (2020). A review of types of risks in agriculture: What we know and what we need to know. *Agricultural Systems*, *178*, 102738.

Kountios, G., Konstantinidis, C., and Antoniadis, I. (2023). Can the Adoption of ICT and Advisory Services Be Considered as a Tool of Competitive Advantage in Agricultural Holdings? A Literature Review. *Agronomy*, *13*(2), 530.

Krell, N. T. Giroux, S. A. Guido, Z. Hannah, C. Lopus, S. E. Caylor, K. K., and Evans, T. P. (2020): Smallholder farmers' use of mobile phone services in central Kenya, Climate and Development, DOI: 10.1080/17565529.2020.1748847

Krell, N. T., Giroux, S. A., Guido, Z., Hannah, C., Lopus, S. E., Caylor, K. K., and Evans, T. P. (2021). Smallholder farmers' use of mobile phone services in central Kenya. *Climate and Development*, *13*(3), 215-227.

Kumar, D. E. E. P. A. K., and Devi, J. Y. O. T. I. (2020). Farmers' perspective on agricultural information literacy: A case study of Jind District, India. *Library Philosophy and Practice*, 18 (2), 1-16.

Landerdahl Stridsberg, S., Richardson, M. X., Redekop, K., Ehn, M., and Wamala Andersson, S. (2022). Gray literature in evaluating effectiveness in digital health and health and welfare technology: a source worth considering. *Journal of Medical Internet Research*, *24*(3), e29307.

Lathiya, A., Rathod, A., and Choudhary, K. (2015). Role of social media in agriculture. *International Journal of Commerce and Business Management*, *8*(2), 268-273.

Leon, A. C., Davis, L. L., and Kraemer, H. C. (2019). The role and interpretation of pilot studies in clinical research. *Journal of Psychiatric Research*, 45(5), 626-629.

Li, H., Li, W., Li, W., Shi, Y., and Xu, Q. (2020). Digital agriculture in China: Current status, challenges, and future directions. NJAS – Wageningen. *Journal of Life Sciences,* 92-93, 100349.

Lin, D., Fu, B., Xie, K., Zheng, W., Chang, L., and Lin, J. (2023). Research on the Influencing Factors and Countermeasures of Moderate Scale Operation of Tea Farmers' Digital Literacy Improvement Behavior Under the Background of Digital Intelligence Empowerment.

Lloyd, A. (2010). Information literacy landscapes: Information literacy in education, workplace and everyday contexts. Oxford: Chandos. Retrieved from: https://books.google.co.in/books?id=zEeANwAACAAJ

Lloyd, A. (2017). Information literacy and literacies of information: A mid-range theory and model. *Journal of Information Literacy*, *11*(1).

Lloyd, A., Kennan, M. A., Thompson, K. M., and Qayyum, A. (2013). Connecting with new information landscapes: Information literacy practices of refugees. Journal of

Documentation, 69 (1), 121 – 144. Retrieved from http://dx.doi.org/10.1108/00220411311295351

Lobell, D. B., *et al.* (2014). *Greater sensitivity to drought accompanies maize yield increase in the US Midwest*. Science, 344(6183), 516-519.

Madhavan, S. R. U. T. H. Y. (2017). Agriculture Information Needs of Farmers: An Overview. *International Journal of Science and Research (IJASR)*, *7*(6), 209-216.

Mamta, B., Tiwari, R., and Singh, S. K. (2015). An assessment of radio-based agricultural extension services in India. *Agricultural Extension Review*, 27(1), 1-14.

Marie, M., Yirga, F., Haile, M., and Tquabo, F. (2020). Farmers' choices and factors affecting adoption of climate change adaptation strategies: evidence from northwestern Ethiopia. *Heliyon*, *6*(4).

Mashroofa, M.M. and Senevirathne, W. (2014). Influence of information literacy skills in accessing agricultural information with special reference to Paddy Farmers of Ampara District, Sri Lanka. *Paper presented at IFLA Conference in Lyon, July 21 – 25, 2014.*

Mediae. (2020). Shamba Shape Up. Retrieved from https://www.shambashapeup.com/

Mekonnen, D. A., Gerber, N., and Matz, J. A. (2018). Gendered social networks, agricultural innovations, and farm productivity in Ethiopia. *World Development*, *105*, 321-335.

Memon, I., Panhwar, K. N., Chandio, R. A., Bhutto, A. L., and Khooharo, A. A. (2014). Role of mass media in dissemination of agricultural technology among the farmers of Jaffarabad district of Balochistan. *Journal of Basic & Applied Sciences*, *10*, 525.

Meyer, H. (2000). The building blocks of information behaviour. *Journal of Information Science*, 26(4), 256-267.

Meyer, H. W. (2018). Understanding the building blocks of information behaviour: a practical perspective. *Innovation: journal of appropriate librarianship and information work in Southern Africa*, *2018*(56), 24-50.

Meyer, H. W. J. (2020). Supporting information access and the information needs of agricultural researchers and extension workers in South Africa. *Journal of Agricultural and Food Information*, *21*(3), 179-192.

Mgale, Y. J., and Yunxian, Y. (2020). Marketing efficiency and determinants of marketing channel choice by rice farmers in rural Tanzania: Evidence from Mbeya region, Tanzania. *Australian Journal of Agricultural and Resource Economics*, *64*(4), 1239-1259.

Mhishi, M., Mudekwe, M., and Makaka, G. (2019). Determinants of agricultural information literacy among smallholder farmers in Zimbabwe. *Information Development,* 35(4), 615-625.

Mittal, S., and Mehar, M. (2016). Socio-economic factors affecting adoption of modern information and communication technology by farmers in India: Analysis using multivariate probit model. *The Journal of Agricultural Education and Extension*, *22*(2), 199-212.

Moguluwa, S. C., Odugbesan, J. A., Rjoub, H., and Iloka, C. B. (2021). Cost and competitiveness of agricultural produce in Nigeria: impact on exportation. *Custos E Agronegocio online*, *17*(2), 64-86.

Moon, S., J., Miah, A., M., and Berg, T. (2016). Farmer's awareness on effective delivery of farm information through ICT mediated extension service in Bangladesh. *European Scientific Journal* 12(21) 9-17

Moruf, H. A. (2020). Agricultural information literacy skills and information use by farmers in Iwo Senatorial District of Osun State, Nigeria. *ATBU Journal of Science, Technology and Education*, *8*(3), 69-76.

Moruf, H.A. (2020). Library services in the face of emerging knowledge society: Importance of information literacy. First Annual National Conference of Faculty of Education, Bayero University Kano (12-15th, January, 2020)

Mtega, W. P. (2018). The usage of radio and television as agricultural knowledge sources: The case of farmers in Morogoro region of Tanzania.

Mugenda, O.M and Mugenda. A.G (1999). Research methods. quantitative and qualitative approaches. Nairobi, Kenya: ACTS Press.

Mugwisi, T., Mapara, M., and Chikonzo, A. (2020). Information Seeking Behaviour of Agricultural Extension Officers in Zimbabwe. *Journal of Agricultural and Food Information, 21*(1-2), 61-74.

Mugwisi, T., Ocholla, D., and Mostert, J. (2016). Is indigenous knowledge accessed and used by agricultural researchers and extension workers in Zimbabwe? *Innovation: journal of appropriate librarianship and information work in Southern Africa*, 2012(44), 101-125.

Munyua, H. and Adera, E., 2009. Emerging ICTs and their potential in revitalzing small-scale agriculture. *Agricultural information worldwide*, *2*(1), pp.3-9.

Mushi, G. E., Di Marzo Serugendo, G., and Burgi, P. Y. (2022). Digital technology and services for sustainable agriculture in Tanzania: a literature review. *Sustainability*, *14*(4), 2415.

Mustapha, M., Kamaruddin, R. B., and Dewi, S. (2018). Factors affecting rural farming households' food security status in Kano, Nigeria. *International Journal of Management Research and Reviews, 8*(9), 1

Naab, F. Z., Abubakari, Z., and Ahmed, A. (2019). The role of climate services in agricultural productivity in Ghana: The perspectives of farmers and institutions. *Climate Services, 13,* 24-32.

NAFIS. (2020). National Farmers Information Service. Retrieved from http://www.nafis.go.ke/

Nahotko, M. (2022). Knowledge Organization Affordances in a Faceted Online Public Access Catalog (OPAC). *Cataloging and Classification Quarterly*, *60*(1), 86-111.

Nakasone, E., Torero, M., and Minten, B. (2020). The power of information: The ICT revolution in agricultural development. Annual Review of Resource Economics, 12, 281-300.

NATESC. (2022). National Agricultural Technology Extension Service Center. Retrieved from http://www.natesc.org.cn/

National Bureau of Statistics of China. (2022). China Statistical Yearbook 2020. Retrieved from http://www.stats.gov.cn/tjsj/ndsj/2020/indexeh.htm

Naveed, M. A., and Anwar, M. A. (2013). Agricultural information needs of Pakistani farmers. *Malaysian Journal of Library and Information Science*, *18*(3), 13-23.

Ndimbwa, T., Mwantimwa, K., and Ndumbaro, F. (2021). Channels used to deliver agricultural information and knowledge to smallholder farmers. *IFLA journal*, *47*(2), 153-167.

Nikam, V., Ashok, A., and Pal, S. (2022). Farmers' information needs, access and its impact: Evidence from different cotton producing regions in the Maharashtra state of India. *Agricultural Systems*, *196,* 103317.

Norton, G. W., and Alwang, J. (2020). Changes in agricultural extension and implications for farmer adoption of new practices. *Applied Economic Perspectives and Policy, 42*(1), 8-20.

Norton, G. W., and Alwang, J. (2020). Changes in agricultural extension and implications for farmer adoption of new practices. *Applied Economic Perspectives and Policy, 42*(1), 8-20.

Nwali, P. N., Lai-Solarin, W. I., Dyaji, L., and Nimzing, M. M. (2022). Evaluation of small–Scale Women Farmers' Utilization of ICT in Accessing Agricultural Information in Gwagwalada Area Council, Abuja, Nigeria. *Science and Technology*, *3*(2), 8-15.

Nyarko, D. A., and 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.

Obayelu, A. E., and Obayelu, O. A. (Eds.). (2020). *Developing Sustainable Food Systems, Policies, and Securities*. IGI Global.

Obi, E., Anyanwu, C., and Ogbonna, M. (2018). Effectiveness of farmer field schools in improving rice farmers' knowledge and adoption of best management practices in Anambra State, Nigeria. African *Journal of Agricultural Research, 13*(3), 78-84.

Ochieng, J., Kirimi, L., and Mathenge, M. (2020). Effects of climate-smart agricultural practices on household welfare of smallholder farmers in Kenya. Climate and Development, 12(5), 471-482.

Oduol, J. B., *et al.* (2018). The impact of extension services on adoption of improved maize varieties and productivity: evidence from Kenya. *Journal of Development and Agricultural Economics, 10*(7), 201-211.

Ogalleh, S., Vogl, C., Eitzinger, J., and Hauser, M. (2012). Local perceptions and responses to climate change and variability: The case of Laikipia district, Kenya. *Sustainability*, 4(12), 3302–3325. https://doi.org/10. 3390/su4123302

Okediji Oyekanmi G., Moruf Hawwau A., and Bello Hakeemat S. (2020). Agricultural Information Literacy Skills and Information Use by Farmers in Iwo Senatorial District of Osun State, Nigeria. *Journal of Science Technology and Education* 8(3)

Okezie, C. A., Nwachukwu, I. N., and Okoye, B. C. (2018). Market information and profitability of rice production in Ebonyi State, Nigeria. *Journal of Agriculture and Ecology Research International, 17*(3), 1-9.

Oladimeji, Y. U., Olorunfemi, F. B., and Okunnu, M. A. (2020). Awareness, access, and use of information and communication technology among arable crop farmers in Kwara State, Nigeria. Journal of Agricultural and Food Information, 21(1), 22-38.

Olajide, S. O. (2018). Meaning and purpose of Rural Economics" Elements of Rural Economics. Ibadan, University Press Publishing House, Ibadan, Nigeria

Olanrewaju, M. M., Ola, O. I., and Ifeduba, E. (2023). Tracking Television Articles within the Nigerian Context: A Systematic Review. *Sapientia Global Journal of Arts, Humanities and Development Studies*, *6*(1).

Olawepo, R.A., and Ibrahim, A.B., (2019). Rural Farmer benefit from Agricultural Modernisation in Kano River Project, Kano, Nigeria. *Journal of Agricultural and Environmental Sciences,* 2 (1), 39-54.

Ololade, R. A., and Olagunju, F. I. (2017). Determinants of access to credit among rural farmers in Oyo State, Nigeria. *Global Journal of Science Frontier Research Agriculture and Veterinary Sciences,* 13(2), 16-22.

Onyancha, O. B. (2020). Trends and patterns in the scholarly output on agricultural information and knowledge in Africa: a bibliometric study. *South African Journal of Libraries and Information Science, 86*(1), 1-12.

Onyeneke, C. J., Umeh, G. N., and Onyeneke, R. U. (2022). Impact of climate information services on crop yield in Ebonyi state, Nigeria. *Climate, 11*(1), 7.

Opara, U. N. (2008). Agricultural information sources used by farmers in Imo State, Nigeria. *Information Development*, *24*(4), 289-295.

Ortiz-Bobea, A., Ault, T. R., Carrillo, C. M., Chambers, R. G., and Lobell, D. B. (2021). Anthropogenic climate change has slowed global agricultural productivity growth. *Nature Climate Change*, *11*(4), 306-312.

Osokoya, A. A., Alabi, A. O., and Fagbola, B. O. (2014). Farmers information literacy and awareness towards agricultural produce and food security: FADAMA III programs in Osun state Nigeria.

Osokoya, A. A., Alabi, A. O., and Fagbola, B. O. (2014). Farmers information literacy and awareness towards agricultural produce and food security: FADAMA III programs in Osun state Nigeria

Otekunrin, O. A., Momoh, S., and Ayinde, I. A. (2019). Smallholder farmers' market participation: concepts and methodological approach from Sub-Saharan Africa. *Current Agriculture Research Journal*, *7*(2), 139.

Oxford Advanced Learner's dictionary. (2nd-9th ed.). (1963-2015). Oxford: Oxford University Press.

Pakistan Bureau of Statistics. (2020). Agriculture Statistics of Pakistan 2019-2020. Retrieved from http://www.pbs.gov.pk/content/agriculture-statistics-pakistan-2019-20

Pande, N. and Deshmukh, P., 2015. ICT: A Path towards Rural Empowerment through Telecommunication, E- governance, and E- agriculture. IBMRD'S Journal of Management and Research,4(2), pp.47-54.

PARC. (2020). Pakistan Agricultural Research Council. Retrieved from http://www.parc.gov.pk/

Parmar, I. S., Soni, P., Kuwornu, J. K., and Salin, K. R. (2019). Evaluating farmers' access to agricultural information: Evidence from Semi-arid region of Rajasthan State, India. *Agriculture*, *9*(3), 60.

Patil, A., Lunge, H., and Kulkarni, R. (2020). AgriApp: A Mobile Application for Agricultural Information Sharing. International Journal of Computer Applications, 174(1), 23-29.

Pemsl, D. E., Waibel, H., and Ortmann, G. F. (2016). *Evaluating the effectiveness of e-extension in Vietnam.*

Perera, G. D., Sivashankar, P., and Mahaliyanaarachchi, R. P. (2021). Mobile phone-based agricultural information for farming decisions: evidence from up country vegetable farmers in Sri Lanka. *International Journal of Agriculture Innovation, Technology and Globalisation*, *2*(4), 300-317.

Peterman, A., Behrman, J. and Quisumbing, A. (2011). A Review of Empirical Evidence on Gender Differences in Non-Land Agricultural Inputs, Technology, and Services in Developing Countries. ESA Working Paper No. 11-11. Food and Agriculture Organization of the United Nations. [http://www.fao.org/ docrep/013/am316e/am316e00.pdf].

Phiri, A., Chipeta, G. T., and Chawinga, W. D. (2019). Information needs and barriers of rural smallholder farmers in developing countries: A case study of rural smallholder farmers in Malawi. *Information Development*, *35*(3), 421-434

Poisvert, C., Curie, F., and Moatar, F. (2017). Annual agricultural N surplus in France over a 70-year period. *Nutrient cycling in agroecosystems*, *107*(1), 63-78.

Ragazou, K., Garefalakis, A., Zafeiriou, E., and Passas, I. (2022). Agriculture 5.0: A new strategic management mode for a cut cost and an energy efficient agriculture sector. *Energies*, *15*(9), 3113.

Rahim M. S, (2008). Kompetensi dan Amalan Pendidikan Pengembangan (Concept and Practice of Extension Education). Buletin Pengembangan (Extension Bullutin), Bil. 1, Universiti PutraMalaysia.

Rahim M. S, (2010). Empowering of Agricultural Extensionists through Knowledge and Skill of the Extension Profession

Raimi, M. O., Muhammadu, I. H., Udensi, L. O., and Akpojubaro, E. H. (2020). Assessment of safety practices and farmers behaviors adopted when handling pesticides in rural Kano State, Nigeria. Arts Humanit. Open Access J. 4, 191–201. doi: 10.15406/ahoaj.2020.04.00170

Ramli, S.A., Samah, B.A., Hassan, M.S., Omar, S.Z., Bolong, J. and Shaffri, H.A.M., 2015. Potential Benefits of ICT for Youth Agro-based Entrepreneurs in Malaysia. *Journal of Applied Sciences,* 15(3), p.411.

Raza, A., Tong, G., Erokhin, V., Bobryshev, A., Chaykovskaya, L., and Malinovskaya, N. (2023). Sustaining Performance of Wheat–Rice Farms in Pakistan: The Effects of Financial Literacy and Financial Inclusion. *Sustainability*, *15*(9), 7045.

Raza, M. H., Khan, G. A., Shahbaz, B., and Saleem, M. F. (2020). Effectiveness of information and communication technologies as information source among farmers in Pakistan. *Pakistan Journal of Agricultural Sciences*, *57*(1).

Riaz, M. (2010). The role of the private sector in agricultural extension in Pakistan. *Rural Development News*, *1*(2010), 15-22.

Röling, N. G. (2018). *Extension Science. Information System in Agricultural Development*, Cambridge University Press, Cambridge.

Ross, P. T., and Bibler Zaidi, N. L. (2019). Limited by our limitations. *Perspectives on medical education*, *8*, 261-264.

Sang, N. C., and Cheruiyot, J. K. (2020). Farmers' Information Literacy and Productivity Performance of Smallholder Horticulture in a Highland Zone, Kenya. *Journal of Scientific Research and Reports*, 89-99.

Sanga, C., Tumbo, S. and Mlozi, M. (2013b) System Design and ICT Adoption in Agricultural. Agricultural Extension Services Delivery in Tanzania, Chapter 15. In Technology Development and Platform Enhancements for Successful Global E-Government Design, edited by Bwalya, K.J. 282–306. Hershey, PA: IGI Global.

Santos, D., Peres, F., Campos, M., Ribeiro, M. L., and Oliveira, A. (2020). The use of digital technologies by farmers in Brazil. In ICT adoption and application in the Brazilian agroindustry (pp. 1-14). Springer, Cham.

Shamrat, F. M. J. M., Asaduzzaman, M., Ghosh, P., Sultan, M. D., and Tasnim, Z. (2020). A web based application for agriculture:"Smart Farming System. *International Journal of Emerging Trends in Engineering Research*, *8*(06).

Shokeen, A. (2022). Agricultural Information Literacy among the Farmers: A Case Study of Ambala District, India. *Journal of Indian Library Association*, *57*(2), 172-180.

Silvestri, S., Richard, M., Edward, B., Dharmesh, G., and Dannie, R. (2021). Going digital in agriculture: How radio and SMS can scale-up smallholder participation in legume-based sustainable agricultural intensification practices and technologies in Tanzania. *International Journal of Agricultural Sustainability*, *19*(5-6), 583-594.

Singh, K. M., Kumar, A., and Singh, R. K. P., 2015a. Role of Information and Communication Technologies in Indian Agriculture: An Overview. *Available at SSRN 2570710*.

Singh, N. and Singh, N. (2014). Educating for information literacy: assessing Indian agricultural science graduates' knowledge and information skills. *Library*

Philosophy and Practice (e-journal). Paper 1102. Retrieved November 3, 2014 from http://digitalcommon.unl.edu/libphilprac/1102

Singh, R., *et al.* (2017). Impact of dairy extension services on milk yield and net returns: evidence from a quasi-experimental study in Bihar, India. *Journal of Dairy Science, 100*(8), 6436-6446.

Singh, S., Chana, I., and Buyya, R. (2020). Agri-Info: cloud based autonomic system for delivering agriculture as a service. *Internet of Things*, *9*, 100131.

Singh, V., Sankhwar, S. and Pandey, D., (2015b). The Role of Information Communication Technology (ICT) in Agriculture. *Global Journal of Multidisciplinary Studies,* 3(4).

Sokoya, A. A., Alabi, A. O., and Fagbola, B. O. (2014). Farmers information literacy and awareness towards agricultural produce and food security: FADAMA III programs in Osun state Nigeria.

Sokoya, A.A., Alabi, A.O. and Fagbola, B.O. (2014). Farmers' information literacy and awareness towards agricultural produce and food security: FADAMA III programs in Osun state, Nigeria. *Paper presented at IFLA Conference in Lyon, July 21 – 25, 2014.*

Stockdale, E. A., Lampkin, N. H., Hovi, M., Keatinge, R., Lennartsson, E. K. M., Macdonald, D. W., and Watson, C. A. (2001). Agronomic and environmental implications of organic farming systems, 261-327.

Suleiman, H. A., Dauda, D. E., and Muhammad, L. A. (2019). Soil fertility management practices and rice yield in Nigeria. *Journal of Agricultural Extension and Rural Development, 11*(3), 48-55.

Suleiman, R. A., Ibrahim, H., and Bashir, M. (2019). Agricultural extension needs of rice farmers in Kano State, Nigeria. Journal of Agricultural Extension, 23(3), 132-144.

Sulewski, P., and Gołaś, M. (2019). Environmental awareness of farmers and farms' characteristics. *Zagadnienia Ekonomiki Rolnej/Problems of Agricultural Economics,* (4).

Supian, S., and Ismail, N. (2022). Mapping in the Topic of Mathematical Model in Paddy Agricultural Insurance Based on Bibliometric Analysis: A Systematic Review Approach. *Computation*, *10*(4), 50.

Swanson, B. E. and Rajalahti, R. (2010). Strengthening Agricultural Extension and Advisory Systems: Procedures for Assessing, Transforming and Evaluating Extension Systems. World Bank, Washington, D.C. pp.187.

Swanson, B. E., and Rajalahti, R. (2010). Strengthening agricultural extension and advisory systems: Procedures for Assessing, Transforming, and Evaluating

Extension Systems - Agriculture and Rural Development Department World Bank – Washington

Taherdoost, H. (2016). Sampling methods in research methodology; how to choose a sampling technique for research. *International Journal of Academic Research in Management,* 5(2), 18-27.

Tanko, Y., Kang, C. Y., and Islam, R. (2019). Data screening and preliminary analysis on the impact of rural infrastructure on rice productivity in Kano State, Nigeria. *Journal of Economic Information, 6*(2), 4-11.

Tanti, P. C., Jena, P. R., and Aryal, J. P. (2022). Role of institutional factors in climate-smart technology adoption in agriculture: Evidence from an Eastern Indian state. *Environmental Challenges, 7*, 100498.

Tanui, G., and Wamae, P. (2022). Utilization of Agricultural Information by Poultry Farmers in Enhancing Productivity: The Case of Menengai West, Nakuru County, Kenya. *International Journal of Current Aspects*, *6*, 1-99.

Tanui, G., and Wamae, P. (2022). Utilization of Agricultural Information by Poultry Farmers in Enhancing Productivity: The Case of Menengai West, Nakuru County, Kenya. *International Journal of Current Aspects*, *6*, 1-99.

TATT. (2020). Global Farmer Network. Truth About Trade and Technology. Retrieved from https://globalfarmernetwork.org/

Tegene, T., Wims, P., Gebeyehu, D. G., and Melkato, T. A. (2022). Farmers' Access to and Utilization of Mass Media Channels for Communicating Agricultural Information in Southern Ethiopia. *International Journal of Agricultural Science, Research and Technology in Extension and Education Systems (IJASRT in EES), 12*(4), 189-202.

Thapa, G.B., and Joshi, G.R. (2019). Socioeconomic factors influencing the adoption of modern rice varieties in Nepal. *Journal of Crop Improvement*, 33(4), 505-522.

Todaro, M. P. (2017). *Development economics* (6th ed). New York: Longman.

Tong, S., Luo, X., and Xu, B. (2020). Personalized mobile marketing strategies. *Journal of the Academy of Marketing Science*, *48*, 64-78.

Torero, M. (2020). Digital Technologies for Agricultural and Rural Development in the Global South. CAB International.

United Republic of Tanzania (URT), (2007). Morogoro region socio-economic profile. [http://www.tanzania.go.tz/regions/MOROGORO.pdf].

United States Department of Agriculture (2019). USDA's National Agricultural statistics report

Uzoh, I. M., Igwe, C. A., Okebalama, C. B., and Babalola, O. O. (2019). Legume-maize rotation effect on maize productivity and soil fertility parameters under selected agronomic practices in a sandy loam soil. *Scientific reports*, *9*(1), 8539.

Verdouw, C.N., Robbemond, R.M. and Wolfert, J., 2015. ERP in agriculture: Lessons learned from the Dutch Horticulture. *Computers and Electronics in Agriculture*, 114, pp.125-133.

Wahyuningtyas, D., Kusuma, A., Febrianita, R., and Achmad, Z. A. (2021). Local language programs in cultural radios to maintain Indonesian national identity. *Etnosia: Jurnal Etnografi Indonesia*, 47-65.

Walder, P., and Kantelhardt, J. (2018). The environmental behaviour of farmers–capturing the diversity of perspectives with a Q methodological approach. *Ecological Economics*, *143*, 55-63.

Wale, E., and Mkuna, E. (2023). Smallholder satisfaction with the quality of agricultural information, and their preferences among the sources: Empirical evidence from KwaZulu-Natal, South Africa. *Journal of Agriculture and Food Research*, *14*, 100715.

Wanyama, R., Mathenge, M. W., and Simba, Z. (2016). Agricultural information sources and their effect on farm productivity in Kenya.

White, D., Meyers, C., Doerfert, D., and Irlbeck, E. (2014). Exploring agriculturalists' use of social media for agricultural marketing. *Journal of Applied Communications*, *98*(4), 72-86.

Wudil, A. H., Ali, A., Aderinoye-Abdulwahab, S., Raza, H. A., Mehmood, H. Z., and Sannoh, A. B. (2023). Determinants of food security in Nigeria: Empirical evidence from beneficiaries and non-beneficiaries rice farmers of the Kano River Irrigation Project. *Frontiers in Sustainable Food Systems*, *7*, 999932.

Wudil, A. H., Ali, A., Hassan, S., and Mushtaq, K. (2021). Exploratory factor analysis of the perceived constraints affecting rice farmers of kano river irrigation (KRIP) kano state, Nigeria. *International Journal of Agricultural Extension*, *9*(3), 485-492.

Yahuza, B. S. (2018). Viability of Muzara'ah Contract on Agro-financing in Alleviating Rural Poverty in Kano State, Nigeria. *Al-Muzara'ah*, *6*(2), 91-102.

Yimer, M., 2015. The Role of ICT for Good Governance and Agricultural Development in Ethiopia: Local Evidence from Southern Ethiopia. *International Journal of Political Science and Development*, *3*(1), pp.30-39.

Yunusa, M., Lawan, M. K., and Sanni, S. (2019). Access and use of information and communication technology (ICT) among extension agents and farmers in Kano State, Nigeria. *Journal of Agricultural Extension*, 23(1), 154-168.

Yusuf, M., Abdu, Z., Ilu, I. Y., and Ibrahim, A. A. (2022). Socioeconomic Factors Influencing Smallholder Irrigated Rice Farmers Participation in Contract Farming in Kano River Irrigation Project, Kano State, Nigeria. *Nigeria Agricultural Journal*, *53*(3), 99-103.

Zhang, Y., Wang, L., and Duan, Y. (2016). Agricultural information dissemination using ICTs: A review and analysis of information dissemination models in China. *Information processing in agriculture*, *3*(1), 17-29.

Zhu, L., and Li, F. (2021). Agricultural data sharing and sustainable development of ecosystem based on block chain. *Journal of Cleaner Production*, *315*, 127869.

APPENDICES

Appendix I: Introductory Letter

Aliyu Haidar Abubakar
Nigeria Police Academy,
PMB 3474, Kano
Nigeria

To……

COMPLETION OF QUESTIONNAIRE

I am a PhD student in the Department of Information Science, Kenyatta University, Kenya. Conducting a research on "Farmer Information Literacy and Agricultural Productivity Performance: A Case of Rice Farmers in Kano State, Nigeria." The aim of this questionnaire is purely for Academic Purposes. The findings from the research will be of benefit to you as it will educate you on the importance of optimum utilization of agricultural information which will surely impact on your productivity, improve on your level of awareness on sources and access to agricultural information, in order to enhance your knowledge and skills in Rice Farming. Additionally, it will greatly benefit Agricultural policy makers in re-structuring and adopting mechanisms suitable enough to improve agricultural information literacy among rice farmers in Kano state. You are chosen as a respondent, based on your involvement in rice farming in Kano State, Nigeria.

I would be grateful if you could spare 5-10 minutes to fill out this questionnaire. Please respond to the questions to the best of your knowledge and as honest as possible. Your identity will be treated with uttermost confidentiality that it deserves.

If you have any further enquiries or concerns, please you can contact me directly through:

aliyuhydar@gmail.com or Phone +2348036691590.

Thank you for your anticipated cooperation.

Yours faithfully,

Aliyu Haidar Abubakar

Appendix II: Questionnaire for Rice Farmers

SECTION A: Farmer Personal Details

Please respond by ticking against your preferred response for questions with options. For questions that require suggestions or comments, please use the provided spaces.

1. Gender: a. Male ( ) b. Female ( )

Age: a. Less than 20 years ( ) b. 20 - 29 years ( ) c. 30 - 39 years ( )

d. 40 - 49 years ( ) e. 50 years and above ( )

2. Marital Status: a. Married ( ) b. Single ( ) c. Widow ( ) d. Divorced ( ) e. Widower ( )
3. Educational Background: a) Non formal education ( ) b) Quranic education ( ) c) Adult education ( ) d. Primary education ( ) e. Secondary education ( ) f. Tertiary/University education ( )
4. For how long have you been into rice Farming?
   Less than 5 years ( )

   6-10 years ( )

   11-20 years ( )

   20 years and above ( )

5. Languages Spoken: Hausa ( ) English ( )
6. Apart from Farming what other occupation do you engage in?
   a. Civil Servant ( ) b. Accounting ( ) c. Teacher ( ) d. others (specify) …….

SECTION B: Information needed for Rice Framing

Which of the following information do you need more?

i.	Information on marketing	Yes ( )	No ( )
ii.	Information on agricultural credit/loan	Yes ( )	No ( )
iii.	Information on how to use fertilizers	Yes ( )	No ( )
iv.	Information on diseases and pest control	Yes ( )	No ( )

v. Information on storage method Yes ( ) No ( )

vi. Information on land preparation Yes ( ) No ( )

vii. Information on new seeds/ Varieties of rice seeds Yes ( ) No ( )

viii. Others (Specify) …….

SECTION C: Awareness about the Sources of Agricultural Information

Which of the following sources of agricultural information are you aware of?

i.	Library	Aware ( )	Not Aware ( )
ii.	Radio	Aware ( )	Not aware ( )
iii.	Agricultural extension Agents	Aware ( )	Not aware ( )
iv.	Farmer Associations	Aware ( )	Not aware ( )
v.	Agricultural show	Aware ( )	Not aware ( )
vi.	Television	Aware ( )	Not aware ( )
vii.	New papers and magazines	Aware ( )	Not aware ( )
viii.	The Internet	Aware ( )	Not aware ( )
ix.	Farmer Groups	Aware ( )	Not aware ( )
x.	Facebook	Aware ( )	Not aware ( )
xi.	Agricultural related Databases	Aware ( )	Not aware ( )

SECTION D: Access to agricultural information by Rice Farmers

Which among these Sources of Agricultural Information do you have Access to?

i.	Radio	Yes ( )	No ( )
ii.	Agricultural extension Agents	Yes ( )	No ( )
iii.	Books	Yes ( )	No ( )
iv.	Agricultural show	Yes ( )	No ( )
v.	Television	Yes ( )	No ( )
vi.	New papers and magazines	Yes ( )	No ( )
vii.	The Internet	Yes ( )	No ( )
viii.	Library and Information Centre	Yes ( )	No ( )
ix.	Farmer Associations	Yes ( )	No ( )

x. Others (Specify) ……..……..…….

In all the sources you used to access agricultural information, which one do you consider more important?.....

SECTION E: Information Literacy Skills

Tick from the choices below what you can do:

i. Able to identify various sources of information?
Yes ( ) No ( )

ii. Able to use information and communication technologies Yes ( ) No ( )

iii. Able to evaluate quality agricultural information Yes ( ) No ( )

iv. Able to communicate effectively in seeking and sourcing for information. Yes ( ) No ( )

v. Able to Evaluate and use information effectively.
Yes ( ) No ( )

vi. Able to access agricultural information from the internet. Yes ( ) No ( )

vii. Able to use mobile phones to communicate and retrieve agricultural information.

Yes ( ) No ( )

viii. Able to use the Library to access Agricultural information. Yes ( ) No ( )

SECTION F: Agricultural Productivity

Fill in the quantity of Rice harvested in the last 6 years

YEAR	**NO. OF BAGS OF RICE HARVESTED**	**NO. OF KILOGRAMS HARVESTED**
2016		
2017		

2018		
2019		
2020		
2021		

Thank you for your time.

Appendix III: Research Approval from Graduate School

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 11th March, 2022

REF: E83F/28263/18

TO: Mr. Aliyu H. Abubakar
C/o Department of Library & Information Science
KENYATTA UNIVERSITY

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the Graduate School Board at its meeting 2nd March, 2022 approved your Ph.D. Research Proposal entitled "Farmer Information Literacy and Productivity Performance: A Case of Rice Farmers in Kano State, Nigeria".

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking and Progress Report Forms. The Forms are available at the University's Website under Graduate School webpage downloads.

By copy of this letter, the Registrar (Academic) is hereby requested to grant you substantive registration for your Ph.D. studies.

Thank you.

KENYATTA UNIVERSITY OFFICE OF DEAN 11 MAR 2022

JOHN M. ODONGI
FOR: DEAN, GRADUATE SCHOOL

c.c. Chairman, Department of Library & Information Science
Registrar (Academic) Att; Mr. Richard Chweya

Supervisors:

1. Dr. Peter Wamae
   C/o Department of Library & Information Science
   KENYATTA UNIVERSITY

2. Dr. Harriet Kamau
   C/o Department of Library & Information Science
   KENYATTA UNIVERSITY

JMO/cao

Appendix IV: Research Authorization from Graduate School

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: E83F/28263/18

Date: 11th March, 2022

The Director General,
National Commission for Science, Technology & Innovation,
P.O. Box 30623-00100,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MR.ALIYU A. HAIDAR- REG. NO. E83F/28263/18

I write to introduce Mr. Abubakar who is a Postgraduate Student of this University. He is registered for a Ph.D. degree programme in the **Department of Library & Information Science in the School of Education.**

Mr. Abubakar intends to conduct research for Ph.D. thesis entitled, **"Farmer Information Literacy and Productivity Performance: A Case of Rice Farmers in Kano State, Nigeria".**

Any assistance given will be highly appreciated.

Yours faithfully,

PROF. ELISHIBA KIMANI
DEAN, GRADUATE SCHOOL

JMO/cao

Appendix V: Research Clearance Certificate

KANO STATE AGRICULTURAL AND RURAL DEVELOPMENT AUTHORITY

Address: Hadejia Road Kawo 700213 Kano

RESEARCH CLEARANCE CERTIFICATE

KNARDA/3/2022/03004

PROJECT TITLE: Farmer Information Literacy and Agricultural Productivity: A Case of Rice Farmers in Kano State, Nigeria

Researcher: Aliyu Haidar Abubakar

Department of Information Science,

Kenyata University, Kenya.

Date Considered: 12/4/2022

Decision of the Committee: Approval has been granted

Chairman: Alhaji Abdullahi Yahuza MNI

Appendix VI: Research Authorization from Ministry for Local Government Kano, Nigeria

MINISTRY FOR LOCAL GOVERNMENT KANO STATE, NIGERIA

Address: Audu Bako Secteriat - Zaria road Kano

Ref No. MFLG KN/ P/19/87098/28111 Date: 15th April, 2022

Aliyu Haidar Abubakar
Department of Information Science,
Kenyatta University
P.O. Box 43844 - 00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on **"Farmer Information Literac y and Agricultural Productivity: A Case of Rice Farmers in Kano State, Nigeria"** I am pleased to inform you that you have been authorized to unde rtake the research in Kura, Bunkure and Garun Malam Local Government Areas.

You are advised to report to the respective Local Government Secretariats before embarking on the research for proper documentation. Kindly note that you shall deposit a copy of the r esearch to the Ministry upon completion of your study.

Aliyu Abdulkadir Bichi
For: Hon. Commissioner For Local Government

C opy to:

Chairman Kura Local Government Area
Chairman Bunkure Local Government Area
Chairman Garun Malam Local Government Area