

KNOWLEDGE SHARING PRACTICES AMONG RICE FARMERS IN THE EASTERN
REGION OF GHANA

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DECLARATION

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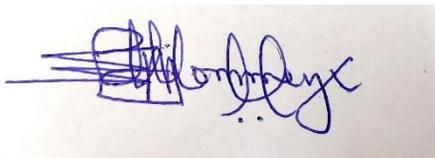
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KNOWLEDGE SHARING PRACTICES AMONG RICE FARMERS IN THE EASTERN REGION OF GHANA

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I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.



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DEDICATION

This research is dedicated to my parents, brothers, sisters, Kate, Andy, Belinda, Naa Jasmine, Cynthia, Eunice, Marilyn, Stella, Phemy, Marian, Beedear, Francis and friends for their wonderful moral, spiritual and financial support throughout my education.

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ABSTRACT

There is problematic flow of Knowledge among rice farmers in Ghana, which constitutes one of the critical challenges that is face in rice production in country. Effective knowledge sharing, therefore, offers great potential for addressing the challenges of rice production in Ghana. The current study explores the knowledge sharing practices among rice farmers in the Eastern Region of Ghana in order to develop strategies to enhance knowledge sharing. The study was underpinned by the pragmatic paradigm where concurrent triangulation mixed-method design was used for the study. Data was gathered with survey and interviews. A total sample of 110 was used; involving 101 survey respondents and 9 interview participants. The survey data was analyse descriptively using Statistical Package for the Social Sciences (SPSS), version 26. The interview finding was analysed using thematic analysis. Findings revealed informal and elementary knowledge sharing practices among the rice farmers, which are mostly face-to-face. The study suggests coherent and structured strategy for knowledge sharing. It established that a successful implementation of knowledge sharing would depend on identifying and linking knowledge sharing enablers to tools and technologies. The proposed strategies would not only improve knowledge sharing among rice farmers in Ghana and add to the body of knowledge. The findings of the study may also be adopted by rice farming communities in other African countries whose rice farming context is similar to the context in Ghana.

Keywords: Knowledge, knowledge management, knowledge sharing, knowledge sharing types, knowledge sharing practices, knowledge sharing tools and technologies, Knowledge sharing benefits, knowledge sharing inhibitors, rice, rice farming, agriculture, Ghana.

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LIST OF ABBREVIATIONS AND ACRONYMS

AAR - After Action Review

AK - Agriculture Knowledge

APQC - American Productivity and Quality Centre

CBT - Computer-Based Training

CC - Climate Change

CD-ROM - Compact Disk Read Only Memory

CF - Conceptual Framework

CIC - Community Information Centre

CMQF - Conceptual Model Quality Framework

CoP - Communities of Practice

CSF - Critical Success Factors

CSOs - Civil Society Organizations

DIK - Data Information Knowledge

DVD - Digital Video Disk

E-learning - Electronic Learning

E-Mail - Electronic Mail

FAO - Food and Agriculture Organisations

FB - Facebook

FFS - Farmer Field Schools

GDP - Gross Domestic Product

ICRAF - International Centre for Research in Agroforestry

ICT - Information and Communication Technology

IPCC - International Panel of Climate Change

IT - Information Technology

KFL - Kpong Farms Limited

KARI - Kenya Agricultural Research Institute

KEFRI - Kenya Forestry Research Institute

KM - Knowledge Management

KMS - Knowledge Management Systems

KS - Knowledge Sharing

KT - Knowledge Transfer

LMIC - Low-and Middle-Income Countries

LL - Lessons Learned

LPP - Legitimate Peripheral Participation

MAB - Multi-Author-Blog

MCOP - Mobile Communities of Practice

ML - Mobile Learning

MoE - Ministry of Education

MoFA - Ministry of Food and Agriculture

NGO - Non-Governmental Organisations

NRDS - National Rice Development Strategy

PPP - Public and Private Partnership

RCT – Randomised Controlled Trial

SECI - Socialisation, Externalisation, Combination and Internalisation

SDG - Sustainable Development Goals

SET - Social Exchange Theory

SMS - Short Messaging Services

SPSS - Statistical Package for the Social Sciences

TF - Theoretical Framework

TRA - Theory Reasoned Action

TTM - Technology Transfer Model

UK - United Kingdom

UN - United Nations

UNISA - University of South Africa

UG - University of Ghana

VCOP – Virtual Communities of Practice

VRA - Volta River Authority

WAC - World Agroforestry Centre

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Knowledge sharing has become critical in pursuit of sustainable agriculture. Sustainable farming practices offer opportunity for improving the livelihoods of individuals, households and communities involved in agriculture, especially smallholder farmers in sub-Saharan African countries (Qureshi et al., 2017:18; Wijitdechakul, 2018:11). Poor agricultural practices, for instance reduce the quantity and quality of food produced (Donkor, Matthews & Ogundeji, 2018:152). For instance, poor fertilizer application and poor weed control reduce rice yield. In Africa, rice is seen as one of the most widely consumed food commodities, which can be harnessed for addressing food insecurity on the continent (Nimoh, Tham-Agyekum & Nyarko, 2012:37). Poor rice farming practices are having a severe adverse effect on the quality and quantity of rice produced, due to the limited sharing of knowledge on rice farming (Donkor et al., 2018:155). Effective knowledge sharing ensures that farmers get access to relevant and timely knowledge to improve their farming practices.

Knowledge sharing is one of the processes of knowledge management, which scholars envisage as critical to agriculture (Kamarudin, Aziz, Zaini & Ariff, 2015:114). Knowledge management is defined as processes that are structured to ensure knowledge is acquired, stored and flows to the right individuals at the right time to create efficiency and value (Patii et al., 2017:881). Knowledge sharing defined the process by which knowledge is shared among a group of people for goal attainment (Meijer et al., 2015:49; Patii et al., 2017:881). Knowledge sharing has been linked to extreme poverty alleviation and reducing inequality and social injustice (Qureshi et al., 2017:12). It provides social and economic opportunities and therefore serves as a pathway out of poverty and social exclusion (Qureshi et al., 2017:20).

Ortolani et al (2017:22) were of the view that knowledge sharing is linked to sustainable agricultural practices. Critical knowledge among rice farmers is needed to be able to circumvent the devastating impacts of global climate change. For example, Ortolani et al. (2017:22) and Tariq et al., (2018:75) have reported increasing numbers of farmers who share knowledge on climate change and food security. Effective knowledge sharing has thus become critical for farmers as climate change has had and continues to have a catastrophic impact on human settlements and livelihoods (Clappison, Cranston, Rowley & Lloyd-Laney, 2013:56). Thus, adaptability to climate change is seen as a case of risk management aimed at securing food, water, timber and other means of subsistence (Balaji, Meera & Dixit, 2007:7). Studies by Chen et al. (2015:1433), Feng and Xue (2014:11), García, Galeon and Palaoag (2018:32), Ortolani et al. (2017:22), Tariq et al. (2018:75) and Wood, Blair, Gray, Kemp, Kenyon, Morris and Sewell (2014:74) also provide insight into the potential of knowledge-sharing activities among farmers that can affect climate change.

Tariq et al. (2018:75) for instance opine that, with the current rate of climate change and how it threatens global food safety, there is the need to encourage knowledge dissemination about food crops and environmentally friendly agricultural practices. Knowledge sharing, therefore, provides a pathway to addressing food insecurity, especially in low- and middle-income countries (LMICs) (Wijitdechakul, 2018:4). Within the context of rice farming, sustainable agriculture requires that rice farming activities become both economically viable and environmentally sustainable (Wijitdechakul, 2018:6). The drive towards sustainable rice farming practices is, therefore, to encourage rice farmers to adopt efficient and environmentally-friendly practices that help increase rice production, improve the quality of rice yield and also safeguard the quality of the natural environment simultaneously.

This is based on the realization that, currently, there are environmentally unsustainable rice farming activities in many African countries because knowledge flow on rice farming practices is limited. The limited flow of knowledge on improving rice farming practices was found to be negatively impacting the quality and quantity of rice production in these

countries (Meijer, Catacutan, Ajayi, Sileshi & Nieuwenhuis, 2015:43). When sufficient pool of knowledge has been gathered, there needs to be effective and efficient ways of sharing the knowledge in order to make the knowledge beneficial. Effective knowledge sharing, therefore, constitutes a critical pathway to bringing innovation and modernization into rice farming in developing countries (Laforge & McLachlan, 2018:258) The basic goal of knowledge sharing among farmers is to leverage the available knowledge that may help rice farmers to carry out their tasks more efficiently and effectively. When rice farmers engage in efficient knowledge sharing practices, it helps new and improved rice farming knowledge to spread easily among rice farming communities to aid adoption of global best rice farming practices (Moglia et al., 2018:86). Conversely, problematic knowledge sharing practices impede the flow of improved rice farming knowledge and therefore become counterproductive to sustainable rice farming and productivity (Laforge & McLachlan, 2018:258).

In African countries where rice farming was less mechanized knowledge sharing among rice farmers constitutes a critical pathway for boosting rice production (Mashavave, Mapfumo, Mtambanengwe, Gwandu & Siziba, 2013:6). This is especially so because there is increasing emphasis on farmer-led extensions in improving agricultural practices and productivity, especially in rural areas (Kiptot, Franzel, Hebinck & Richards, 2016:169). The efficiency of such farmer-led extensions depends on efficient knowledge sharing practices among farmers. In rice farming, knowledge sharing is considered important because, as knowledge is shared, other farmers benefit from it and this ensures high productivity on farms (Quinn et al., 1996:277). This is critical in the sense that effective knowledge sharing among rice farmers brings efficiency in farming activities and increases productivity. Sharing knowledge in the right way includes knowing the types of knowledge to share, following the right knowledge sharing activities, using the right technology and knowledge sharing tools. Understanding the potential enabling and inhibitory factors for knowledge sharing would help to develop the right strategies to improve knowledge sharing among rice farmers.

The agricultural sector in Ghana contributes between 35-40% of Ghana's Gross Domestic Product (GDP) and provides livelihoods for an estimated 57% of the total labour force

(Cadger, Quaicoo, Dawoe & Isaac, 2016:32). The agricultural sector, in general, is dominated by smallholder farmers mainly in rural areas. Rice is one of the most important crops in Ghana's agricultural landscape. This is because rice has been identified as fundamental to addressing the food security challenges in Ghana due to its high preference among the majority of the population (Cadger et al., 2016:34). The rice sector plays a crucial role in Ghana's national economy (Nimoh et al., 2012:39). The reason for this is due to increased dietary shifts from traditional Ghanaian foods (such as fufu, kenkey, and gari) to rice foods, particularly in urban areas. Rice is currently the second most important staple food in Ghana, after maize, and its consumption is forecast to continue to rise as a result of population growth, urbanization and the associated change in dietary patterns and habits (Cadger et al., 2016:33). Rice has permeated the socio-cultural fabric of Ghana's food space, being more common than any of Ghana's traditional foods (Nimoh et al., 2012:37). Rice is eaten by all Ghana ethnic groups and tops the list of foods served in various cultural activities including funeral ceremonies, marriage ceremonies, ceremonies to be named and social gatherings.

Despite, the critical importance of rice farming, rice yield has been slowing down, especially among smallholder farmers in developing countries like Ghana (Moglia et al., 2018:85). For instance, the average rice yields potential is 10t/ha; however, the global average rice yield has hovered around 7-8 t/ha, with average yield from developing countries hovering around 4-5t/ha (Moglia et al., 2018:86). In Ghana, for instance, rice production has not paralleled the growing preference for rice meals, necessitating importation from other countries to augment rice consumption (Tinsley, 2009:14). Part of the problems contributing to low rice yield, especially in developing countries, include lack of technology and efficient knowledge sharing practices in particular and knowledge management in general among smallholder farmers (Tariq et al., 2018:73).

The literature on knowledge sharing broadly focus on formal organizational settings. The few studies in the agricultural settings in general and rice farming in particular, come from high income countries. In Ghana for instance, there are no studies on how knowledge is shared among rice farmers. Knowledge sharing can help to improve rice production by

improving farming practices, developing collaboration and innovation among rice farmers and preventing loss of critical know-how in rice farming (Tariq et al., 2018:73). The current study, therefore, focuses on understanding knowledge sharing in rice farming communities in Ghana, drawing on two theories, the Socialisation, Externalisation, Combination and Internalisation (SECI) model by Nonaka (1991:6) and social exchange theory (SET) by Homans (1958) as a framework.

1.1.1 Contextual setting

Ghana, until 2018 was administratively, divided into ten (10) Regions which are; Brong Ahafo, Ashanti, Central, Greater Accra, Eastern, Northern, Upper East, Upper West, Volta and Western Regions. Ghana now has 16 Regions. In 2019, the number of administrative Regions increased from 10 to 16 following a successful presentation of the Constitutional Instruments (CI) on the creation of the six new Regions. The six additional Regions are Oti, Western North, North East, Ahafo, Savannah and Bono East Regions.

However, in terms of terrestrial ecosystems Ghana is mainly divided into six ecological zones. These include Guinea savannah, Sudan savannah, Coastal savanna, Forest or savannah transitional zone, Deciduous forest zone and the Rain forest zone. Each of these ecological zones has peculiar climatic conditions and geographic features which make them suitable for certain kinds of agricultural activities.

Rice is produced in all sixteen (16) Regions of Ghana but mainly localized within four ecological climatic zones; interior savannah zone, semi-deciduous forest zone, coastal savannah zone and the high rain forest zone (Cadger et al., 2016:33). Rice production in Ghana follows two ecosystems which are rain-fed drylands and rain-fed lowlands (Nimoh et al., 2012:36). Using the two ecosystems, rice production is dominated by the following three regions; Eastern Region, Northern Region and Ashanti Region (Cadger et al., 2016:35).

Among the three regions where rice is predominantly produced in Ghana, the current study was conducted in the Eastern Region of Ghana. The Eastern Region was selected

for the study because it is of the top producer of rice in Ghana. Rice farmers in this region are estimated to contribute more than half of all rice produced in Ghana for local consumption (Donkor et al., 2018:157). The Eastern Region shares regional boundaries with Ashanti, Greater Accra, Western and Volta regions. Its capital is Koforidua. Farming is the main economic activity in the region, with rice production occurring in the rural communities in the region. Rice production in the Eastern region is dominated by three rice farming communities– Akuse, Asutsuare and Kpong.

Rice farming in Akuse and Asutsuare are dominated by smallholder farmers in rural and under-resourced communities. Their farming activities, therefore, become mainly subsistence in scale due to several challenges such as lack of machinery to use for farming (Tinsley, 2009:6). Rice farming in Kpong, however, is dominated by the Kpong Farms Limited, which was incorporated in 1982 as a wholly agricultural commercial venture, engaged in mechanized rice production.

1.2 Statement of the problem

Knowledge sharing is an important part of rice farming. Knowledge sharing among rice farmers ensures access to timely and relevant knowledge on best practices in improving rice productivity (Wijitdechakul, 2018:4). Knowledge sharing is even more critical in countries where the mechanization of agriculture still evolves (Qureshi et al., 2017:12). In many rice farming communities in Africa, knowledge sharing among rice farmers constitutes a critical pathway for boosting rice production, ensuring collaboration and preserving critical know-how ((Mashavave, Mapfumo, Mtambanengwe, Gwandu & Siziba 2013:6). Farmer-led extensions are increasingly focused on improving agricultural practices and productivity in especially rural areas (Kiptot, Franzel, Hebinck & Richards 2016:169).

However, rice farmers in Ghana, face severe challenges in their rice production. The challenges include pest infestation, less quality of rice grains and difficulties in proper fertilizers application (Tinsley 2009:7). These challenges faced by rice farmers have been attributed, to the fact that there are limited knowledge sharing on best rice farming

practices, even in rice farming communities where usable knowledge exists (Tsinigo & Behrman, 2017:49). The challenges of knowledge sharing practices among rice farmers, is a crucial factor accounting for the low rice productivity in Ghana (Donkor et al., 2018:155). The limited knowledge sharing impedes the productivity of rice, undermines collaboration among rice farmers and preservation of critical know-how in rice farming in Ghana (Nimoh et al., 2012:36). For instance, several attempts by the Ministry of Agriculture to bring innovation into rice farming in Ghana were unsuccessful due to limited understanding of knowledge flow among smallholder farmers in Ghana (Tsinigo & Behrman, 2017:49).

The persisting challenges of knowledge sharing shows that knowledge sharing has been under-researched in Ghana. The problematic nature of knowledge sharing among the rice farmers creates the conditions for loss of critical know-how, prevent collaboration and reduces productivity. This study aims to explore knowledge sharing practices among rice farmers and how it affects their rice farming production. However, the study sought, find out the challenges faced by rice farmers in knowledge sharing practices, and offer pragmatic strategies to improve knowledge sharing in rice farming communities.

1.3 Purpose of the study

The main purpose of the study was to provide comprehensive context of knowledge sharing practices among rice farmers in the Eastern Region of Ghana, to inform the development of strategies to enhance knowledge sharing among the rice farmers.

1.3.1 Objectives of the study

The specific objectives of the study were to:

1. Investigate the different types of knowledge shared among the rice farmers in the Eastern Region of Ghana
2. Explore the knowledge sharing practices among rice farmers in the Eastern Region of Ghana
3. Identify the technologies used for knowledge sharing among the rice farmers
4. Examine the benefits of knowledge sharing practices among rice farmers
5. Examine factors that inhibit knowledge sharing among rice farmers

6. Establish the different enablers to knowledge sharing among rice farmers
7. Develop strategies to enhance knowledge sharing practices among rice farmers in the Eastern Region of Ghana

1.4 Research questions

Based on the objectives of the study, the following research questions were addressed:

1. What are the different types of knowledge shared among rice farmers in the Eastern Region of Ghana?
2. What are knowledge sharing practices used among rice farmers in the Eastern Region of Ghana?
3. Which technologies are used for knowledge sharing among the rice farmers?
4. What are the benefits of knowledge sharing practices among the rice farmers?
5. What are the factors that inhibit knowledge sharing among rice farmers?
6. What are the different enablers to knowledge sharing among rice farmers?
7. What are the strategies to enhance knowledge sharing practices among rice farmers in the Eastern Region of Ghana?

1.5 Significance of the study

The study empirically establishes the context of knowledge sharing practices among rice farmers in Ghana. The current study was noteworthy and timely, considering Ghana's rice farmers' barriers to knowledge sharing. From these assertions, the study provided strategies to curb these barriers faced by rice farmers in the knowledge sharing process. Again, the study would benefit curriculum experts in information studies when making changes in the curriculum. The results of the study would help them to understand the challenges facing the implementation of knowledge sharing and development of a good curriculum which could cater for it.

This study, therefore, develops strategies that help enhance knowledge sharing among the rice farmers. The proposed strategies would help rice farmers to leverage both traditional and technological knowledge on rice farming to improve their rice farming

practices to boost productivity. The strategies are useful to other stakeholders of rice farming such as Non-Governmental Organisations (NGOs) and civil society organizations (CSOs) involved in rice production advocacy in Ghana, and other African countries.

The study would also enrich the literature available on the variables being studied on rice farmers. This would allow future researchers to have similar research reference materials on knowledge sharing among rice farmers. In other words, the findings of this study would serve as related literature for future researchers investigating issues related to knowledge sharing practices among rice farmers. Also, the study would also add to the existing sources of literature on knowledge sharing in agriculture (Adamides and Stylianou 2013, Feng and Xue 2014, Gava et al. 2017, Meijer, Catacutan, Ajayi, Sileshi and Nieuwenhuis, 2015, Mtega and Ngoepe 2019).

The research further serves as a useful source of literature to researchers, students, farmers and other policy review stakeholders and curriculum experts or planners. The study would be of tremendous benefit for researchers and students as it can provide them with relevant information on benefit, barriers and strategies to enhance knowledge sharing. Farmers would be able to have rudimentary knowledge regarding knowledge sharing and how it enhances the modern approach to farming. The research would influence stakeholder and support curriculum experts by making changes to the curriculum reform in agricultural studies.

This study also contributes to knowledge management. However, the study would conceptualise how the rice farmers acquire and handle informational resources that impact on their rice farming activities, both directly and indirectly. In a way, this study adds to the body of knowledge in the field of information and knowledge management by educating readers on the flow of knowledge to the right people at the right time so they can act more efficiently and effectively to share and use knowledge to create value. Mtega and Ngoepe (2019) argue that there is a need for more empirical studies in rice farming communities so that findings from different context could contribute to developed models to guide knowledge sharing among farmers. From a theoretical perspective, the study builds on the SECI and SET to establish a strategy for knowledge sharing among rice

farmers. The empirical findings on benefits (performance improvement); technology (software tools and knowledge repositories) and strategies enhance knowledge sharing among farmers.

1.6 Originality of the study

The thesis aimed to investigate knowledge sharing practices among rice farmers in the Eastern Region of Ghana using an empirical approach. The study is original in terms of the new ideas it generates to develop a strategy that helps enhance knowledge sharing among rice farmers in the Eastern Region of Ghana. The study has provided new solution to knowledge sharing by developing a transformative sustainable approach to improving knowledge sharing practices. The new transformative sustainable approach helps the performance of the team which improved knowledge sharing among rice farmers. This helps the rice farmers to enhanced creativity, better problem solving and improvement in the decision-making process.

The rice farmers can consider more options due to knowledge sharing. Farmers can learn from the experience of other farmers or team members. By this way, knowledge was used within the team in a better way, which leads to an improvement in the decision-making process (Mahmood, Hussan, Sarfraz, Abdullah, & Basheer 2016:13; Hussain, Sallehuddin, Shamsudin, & Jabarullah, 2018:17). The problem faced by the farmers can easily be solved by the knowledge sharing because the problem can be better understood, more alternatives to solve the problem can be explored, and the issues causing the problem can be found out earlier. Several studies have supported the argument that transformative sustainable approach improved knowledge sharing (Jamshed & Majeed 2018:34).

The strategic intervention identifies what can be accomplished in the short term and the long term. The strategy also identifies what was achievable at the community level and what was beyond the abilities of rice farming communities, which needs to be addressed at the structural level. For instance, while the leadership, culture and strategy in knowledge sharing can be accomplished at the community level, technological

infrastructure, architecture and functionality needed to improve knowledge sharing are structural.

The study also provides new solution to existing knowledge sharing problem by identifying three strategic levels of improving knowledge sharing; vertical top-down (extension officers to rice farmers), vertical bottom-up (farmers to extension officers), and horizontal interpersonal (among rice farmers). With these strategies, the study contributes a modern approach to improving knowledge sharing in rice farming communities, which require concerted and coordinated partnerships and alliances between rice farming communities, government institutions, CSOs, NGOs and researchers.

The study also applies new methodology innovation to knowledge sharing research among rice farmers. The current study used a mixed-method approach to addresses knowledge sharing concerns among rice farmers was original to this study. Most of the research on knowledge sharing has used mainly qualitative methods and, in a few cases, quantitative methods. However, both qualitative and quantitative approaches were used to understand deeper meaning on knowledge sharing farmers through triangulative means.

1.7 Scope

The scope of the current study encompassed knowledge sharing practices and rice farming practices and productivity of rice farmers in the Eastern Region of Ghana. It was limited specifically to rice farmers in Kpong Farms, Akuse and Asutsuare. These rice farming communities constitutes are among the topmost rice producing communities in Ghana, and yet face several challenges in their knowledge sharing practices (Tinsley 2009:11). The scope covered types of knowledge shared, knowledge sharing practices, technologies for knowledge sharing, benefits, inhibitors and enablers, as well as ways of improving of knowledge sharing among the rice farmers. For in-depth analysis, the philosophical foundation of the study was pragmatic paradigm, where concurrent triangulation design was used to understand knowledge sharing practices among rice farmers. The concurrent triangulation design allows the researcher to attain and examine

both the quantitative and qualitative data and then compare or combine them simultaneously.

1.8 Limitations

Studies of all kinds have their own inherent limitations. A lot of problems were encountered in conducting this study. As the study seeks to investigate the knowledge sharing practices among rice farmers in the Eastern Region of Ghana, the researcher had to travel to and from rice growing communities in the Eastern Region. This was a tiresome task but lifelong interesting adventure. The adoption of questionnaire and interview guide with the respondents was not easy because of their scattered nature and busy schedules in their farms. Given that the researcher collected data from different participants, the threat to the confidentiality and anonymity of the participants' information was higher, taking into account the number selected for the interviews. The researcher agreed to exclude any comments / quotations that might reveal the identity of any of the participants from the study.

The results may not be completely generalisable to knowledge sharing practices among rice framers in other regions of Ghana in the making of policy for rice farmers in Ghana due to the geographical conditions prevailing in the Eastern Region of Ghana. Furthermore, editing, sorting and coding of the recovered questionnaire distributed were equally a cumbersome task that the researcher had to contend with. Similarly, the transcription of the recorded interview and its coding into appropriate thematic areas to meet the demand of the study was a challenge due to the diverse views presented by the subjects.

Merriam (2009:67) draws the attention of researchers to potential bias that may occur during data collection, construction and analysis. Attempts were made in this analysis to ensure that the data collected was bias-free. First, before their execution, both the questionnaire and the interviews were piloted. Second, different approach was used to collect data. These ensured triangulation of the data, eliminating any potential bias.

1.9 Ethical considerations

High ethical standards were followed in all the stages of conducting the study. Ethics are very critical aspects of research because they ensure that research participants are protected in all the stages of the research process (Plonsky, 2017:58). According to Patten and Newhart (2017:68), research ethics help in protecting participants, developing trust with them, promoting the integrity of the research process, guarding against misconduct and helping gain public confidence. All researchers are advised to adhere to some professional ethical codes and regulations while undertaking research. The hallmark of ethical concerns in research includes seeking ethical approval, informed consent, autonomy, ensuring privacy and confidentiality, and avoiding inducement for participation (Nardi, 2018:39).

All these ethical concerns were duly adhered to in the current study. In terms of ethical approval, ethical clearance was first sought from the UNISA Ethics Board of the University of South Africa (see Appendix D) for the study before carrying it out. In terms of informed consent, permission was first sought from all the stakeholders relevant to the study before data collection began. In terms of autonomy, the respondents and participants were given all the necessary knowledge about the study needed to decide to participate or not. This implied that each person was given the respect, time, and opportunity necessary to make his or her own decisions.

The informed consent process involved properly informing the respondents about everything to do with the study: procedure, objectives, risks and benefits - as a basis for consenting or not consenting to participate. An informed consent form was then given to those who agreed to be part of the study, to sign (or verbally obtained where necessary) before being included in the study. In terms of privacy and confidentiality, the researcher made sure the data collected was managed in such a way that the identities of the respondents were protected at all times and that no knowledge could be directly traced or associated with any individual respondent. With this, no names or codes traceable to the individual respondents were used. They were also made to understand that they had the right to refuse to participate or withdraw from the study at any time. None of them was

forced, coerced or financially induced to participate in the research. There were no monetary incentives given to them as well.

1.10 Definition of terms

Knowledge management (KM)

Knowledge management is explained as applying structured processes in helping the timely flow of knowledge to the right individuals so they can act more efficiently and effectively to create value (American Productivity and Quality Centre [APQC], 2018:11). In this study, knowledge management was conceptualized as how the rice farmers acquire and handle knowledge resources that impact on their rice farming activities, both directly and indirectly.

Knowledge sharing

American Productivity and Quality Centre (APQC, 2018:11) defines knowledge sharing as the exchange of knowledge between individuals. Knowledge sharing may be formal or informal as well as in-person or virtual. Knowledge sharing is defined as activities of transferring or disseminating knowledge from one person, group or organisation to another (Kaewchur & Phusavat, 2013:181). In the current study knowledge sharing was conceptualized as the practices involved in how critical information resources are communicated or exchanged among the rice farmers and other stakeholders involved in rice farming in the Region.

Knowledge sharing practices

Tahlelo (2016:34) agreed that knowledge sharing practices are all the activities that are intended to improve the internal flow and use of knowledge within a team in an organisation. Knowledge sharing practices help improve organisational performance and achieve the mission. Further, knowledge sharing practices have the potential to improve customer services, bring new products to the market and, above all, reduce the cost of business operations in general.

Expertise location

APQC (2018:7) refers to expertise location as tools and approaches used to surface experts and knowledgeable people in the workforce. It often involves the creation of searchable online employee profiles. However, approaches may incorporate centralized “ask the expert” services, communities of practice, collaboration applications, blogs, microblogs, and tools that analyse real-time data on employees’ contributions and behaviours to dynamically generate expertise recommendations.

Tacit knowledge

Tacit knowledge is conceptualized as the practical and action-oriented knowledge acquired from everyday lived experiences, habits and practices that are usually drawn upon for making every day intuitive decisions (Tahlelo, 2016:34).

Explicit knowledge

Explicit knowledge is conceptualized as the type of knowledge that is formally communicated in the form of written down documents or contextually agreed rules of conduct that facilitate processes and operations among groups or within organisations (Biconne, 2014:125).

Climate change

Climate change is defined by the International Panel of Climate Change (IPCC) (2011:12) as any change in climate over time, whether as a result of human activity or of the natural variability

Food security

The Food and Agricultural Organization of the United Nations (2008:12) defines food security as a situation where all people have (physical, social, and economic) access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life.

1.11 Organisation of the study

The study is organised into six different chapters (Chapters 1 – 6).

Chapter one introduces the topic of the research and explains the need for the study. It is based on the general background of the study, problem statement, purpose of the study, aim and specific objectives, significance of the study, scope and limitations of the study, originality of the study, ethical considerations and definition of terms and description of chapters.

Chapter two presents the review of the literature of all the major concepts and the models that form the foundation of knowledge sharing among rice farms in the Eastern Region of Ghana as identified in the study.

Chapter three presents the research methodology of the study. It describes the philosophical bedrock of the study, research design, population, sample size and sampling technique, sources of data, data collection instruments, method of data analysis and presentation.

Chapters four presents data analysis and results of the study. It presents the sociodemographic profiles of the participants. After that, it presents results and findings for each of the objectives and their respective research questions. Chapter five presents a discussion of the results and findings to be obtained in the study. Chapter six presents the summary, conclusion and recommendations of the study.

1.12 Chapter summary

The researcher provided an introduction and discussion on the background to the study of knowledge sharing practices among rice farmers in the Eastern Region of Ghana, highlighting the significance, objectives, purpose and research questions of the study. The researcher provided also detailed discussions on the significance of ethical considerations scope, limitations and originality of the study. Explanation and definitions of terms have further expatiated. In the presentation, every effort was made to ensure

clarity in all sections of this chapter. The next chapter describes how past and recent literature converges on the view that Knowledge sharing practices play a crucial role in enhancing rice farmers performance on the farms.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter presents a critical review of the theoretical framework that informs the study and the relevant literature to situate the study within the context of knowledge sharing practices in general and within the agricultural sector and rice farming in particular. A literature review is defined as a discussion of published knowledge in a particular subject or research area (Hart, 2018:4). A literature review usually has an organisational pattern and combines both summary and synthesis. It plays a significant role in scientific research endeavour, and it has been explained to be both a process and a product (Ridley, 2012:2). As a process, a literature review is defined as the systematic processes involved in searching for scholarly works within a research area (Ridley, 2012:3). As a product, a literature review is defined as the final report or draft put together after critically reviewing scholarly works (Hart, 2018:4). The literature review provides an extensive reference to related research within the field of study, where connections are made within and among sources of knowledge (Ridley, 2012:3). Fundamentally, the literature review shapes the entire study process including serving as a framework for interpreting research data and discussing research findings (Hart, 2018:7).

There are different levels of literature review depending on the degree levels being pursued (Ridley, 2012:4). For a Doctor of Philosophy (PhD), Ridley (2012:5) argues that a literature review involves an analytical synthesis of scholarly works, encompassing all known literature on the research topic. It involves a “high level of conceptual thinking within and across theories” (Ridley, 2012:5). In this sense, there is the need for both summative and formative evaluation of relevant previous empirical and scholarly works on the problem under study (Hart, 2018:12; Ridley, 2012:5). There is also the need for depth and breadth of discussion within the context of the philosophical underpinning of the study in ways that relate to the problem under investigation (Hart, 2018:10).

In this chapter, previous research works are critically reviewed, analysed and synthesized to provide a broader context of knowledge sharing. The discussions in the chapter are organized as follows:

- Rice, rice farming and agricultural sector
- Concepts and theories of knowledge sharing
- Concept of knowledge sharing practices in rice farming
- Related studies on the concept of knowledge sharing in rice farming
- Related studies on the concept of knowledge sharing in other agricultural products
- Theoretical framework
- Conceptual framework
- Synthesis of the literature review
- Summary of the chapter

The outline of the literature review is provided on Figure 2.1 which shows the map of the key issues covered in the literature chapter. The map found in Figure 2.2 shows the theory linked to each of the objectives in the study. Creswell (2012:14) is of the view that a literature map is a figure or drawing that displays the research literature (e.g. studies, essays, books, chapters, and summaries) on a topic. Creswell further expatriated that this visual rendering helps see overlaps in knowledge or major topics in the literature and determines how a proposed study adds to or extends the prevailing literature rather than duplicates past studies. In a way, a literature review map was developed to outline how the objectives of the study are linked to the theoretical framework that buttresses this study. To map the ideas, arguments, opinions and concepts from a body of literature is an important part of the review of the literature.

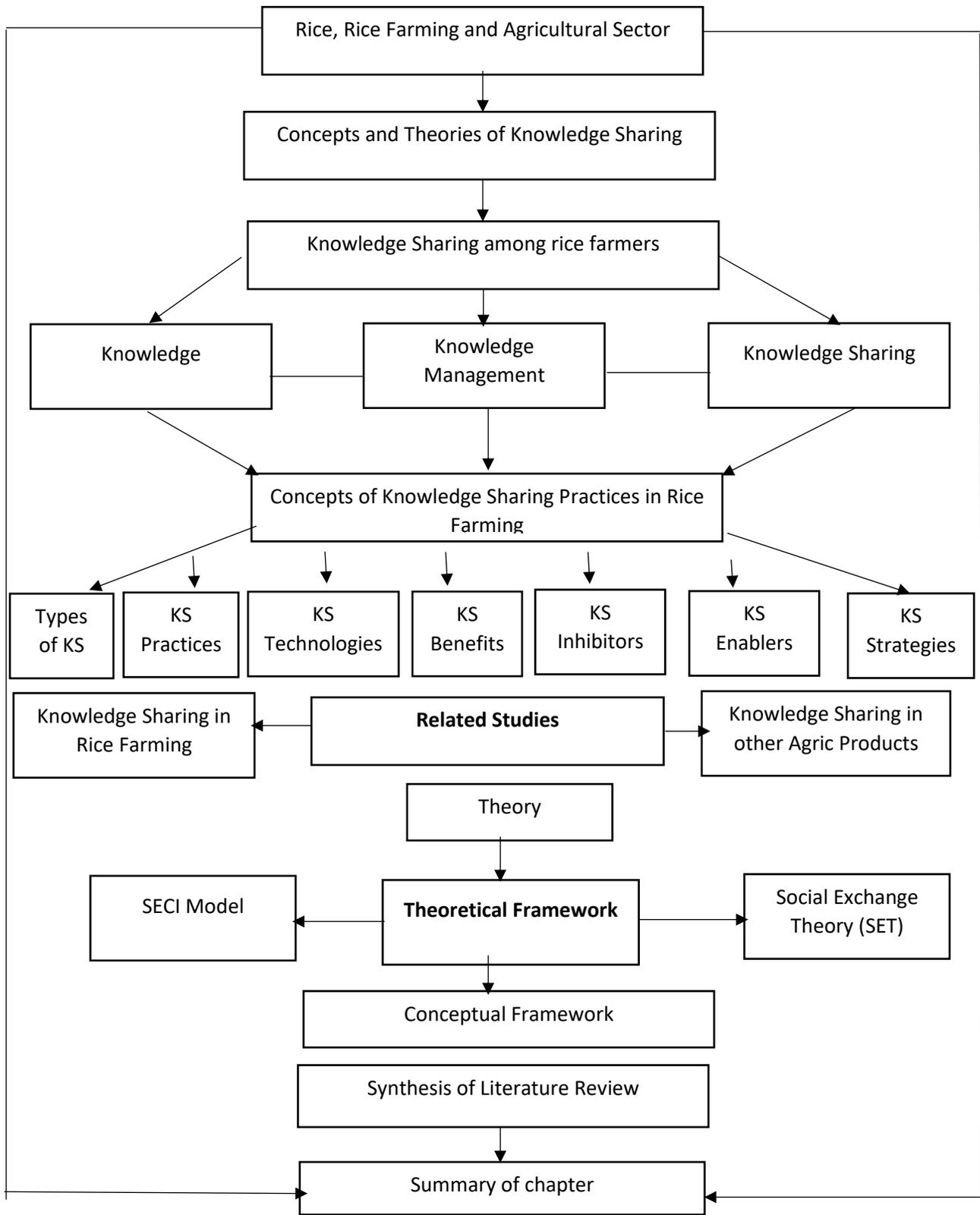


Figure 2.1: Literature review map
 Source: Researcher's construct (2019)

2.2 Rice farming and agricultural sector

This section situates rice and rice farming within the agricultural sector and within the context of knowledge sharing, and specifically explains why knowledge sharing is important to rice farmers in Ghana. The concepts discussed here are rice and rice farming, and rice and rice farming in Ghana. Rice is normally grown as an annual plant, although there is evidence to suggest that in tropical areas rice can survive as a perennial, producing ratoon crop for even up to 30 years (Nimoh et al., 2012:37). Rice cultivation is usually well-suited in countries and regions where there is low labour cost and high rainfall. This is because rice cultivation is argued to be one of the most labour-intensive agricultural farming mechanisms (Tsinigo & Bherman, 2017:48). Rice plants usually take around 120 days to grow from seeds to mature plants (Moglia et al., 2018:85). Rice farmers have to flood the rice fields because rice has better growth and produces higher yields when grown in flooded soils.

Rice farming is defined as the cultivation of rice by planting on dry land, transferring the seedlings to a flooded or wet field, and draining the field before harvesting (Tsinigo & Bherman, 2017:48). Rice is argued to be the most important human food crop in the world, directly feeding more people than any other food crop (Tippe et al., 2017:94). As a cereal grain, rice is the most widely consumed staple food for the largest part of the world's human population, especially those in Asia (Nimoh et al., 2012:36). Rice is the third-highest agricultural commodity with worldwide production, coming after sugarcane and maize (Moglia et al., 2018:86). In 2012, for instance, it is estimated that nearly half of the world's population (more than three billion people) depended on rice staples on a daily basis (Tippe et al., 2017:94). Rice is the dominant staple food in Asia (where it is estimated that around half of the world's poorest people live) and is increasingly becoming the main staple in Africa and Latin America (Tariq et al., 2018:73).

There different types of rice farmers are subsistence smallholder rice farmers and commercial rice farmers (Andre et al., 2017:888). The subsistence rice farmers mostly grow rice on a micro-scale, mainly to feed their family or households. In low-and middle-income countries (LMICs), subsistence farmers are mainly found in deprived villages.

Smallholder farmers, on the other hand, grow rice on a small scale for the purposes of both selling some and feeding their households from the farm (Tippe et al., 2017:94). Commercial rice farmers grow rice on a large scale for the purposes of both selling locally and exporting to the international markets. Sometimes commercial rice farms are organisations in themselves, who end up employing subsistence and smallholder farmers (Feng & Xue, 2014:11). Each of these types of rice farmers contributes to the broader rice production outputs.

The sharing of knowledge plays a pivotal role in climate change and rice farmers adaptation. For example, Andre, Baird, Swartling, Vaulturius and Plummer (2017:885) argue that a thorough understanding of the processes of climate change and adaptation among rice farmers requires serious attention to how different actors and stakeholders receive and act on knowledge and information related to the climate. Biconne (2014:125) also advises that, in order for rice farmers to deal with climate change in a competent manner, it is important to develop complex adaptation capability and capability systems that encourage the involvement of all stakeholders in the processes, dissemination and awareness-raising of climate change issues. Hence, rice farming is severely influenced by climate change (Andre et al., 2017:888). For example, in LMICs, where most farmers are not engaged in climate-friendly practices, it is important to pay attention to how farmers engage in knowledge about how their farming activities impact adverse climate (Prins et al., 2015:12). There have been various studies, for example, which have examined how different agricultural stakeholders interact with knowledge related to the climate.

2.2.1 Rice farming in Ghana

In Ghana, rice farming constitutes a critical and growing part of the agricultural sector. Ghana's agricultural sector is a well-established economic sector. It consists of a variety of commercial and food crops and livestock, providing employment both on a formal and an informal basis (Cadger et al., 2016:32). Consistently since independence, the agricultural sector has been the major contributor to both GDP and employment rate. The agricultural sector is the highest contributor to the GDP in Ghana annually. The

agricultural sector contributes between 35-40% of Ghana's GDP and provides livelihoods for an estimated 57% of the total labour force (Cadger et al., 2016:32).

Rice constitutes an important part of the main food crops in Ghana, alongside others like cassava, corn, yam and other root crops. The Sustainable Development Goals (SDGs), developed by the United Nations in 2015, seek to address critical concerns affecting global development. Goals 2 and 13, for instance, seeks to ensure food security and improve climate change adaptation strategies respectively. Rice products have a significant impact on addressing food security (Goal 2), and sustainable rice farming is fundamental to the achievement of improving climate change adaptation (Wijitdechakul, 2018:12). Rice is an agricultural cereal produce belonging to the *oryza sativa* or *oryza glaberrima* grass species (Tariq et al., 2018:74). The parent species of rice (i.e. *oryza sativa*) is argued to be native to Asia and certain parts of Africa, but, due to centuries of trade and exportation, rice has become commonplace in many countries worldwide (Tippe et al., 2017:95).

2.3 Concepts and theories of knowledge management

Understanding the concepts and theories of knowledge management was crucial in the discussion of knowledge sharing in rice farming because knowledge sharing is one of the processes of knowledge management. The concepts discussed in this section are knowledge, knowledge management and knowledge sharing. This section also discusses the theories underpinning knowledge sharing in the current study. In each of the sub-sections, how different authors have used the concepts are discussed first, followed by how the concepts are defined within the context of the current study.

2.3.1.1 Defining knowledge

Knowledge is an important component of knowledge management. To understand the concept of knowledge management and knowledge sharing among rice farmers, a first understanding of the concept of knowledge is essential. The global economy has been described as a knowledge economy, due to the superiority of knowledge in advancing the

developmental agenda of nations and organisations (Teixeira, Henriques & Santos, 2018:57). For this reason, the way in which knowledge is managed is critical, especially within the context of economic activities or endeavours. Even though knowledge is an important resource and highly researched concept, academics and researchers over the centuries have failed to provide a single generally accepted definition of knowledge (North & Kumta, 2018:207). The concept of knowledge is rarely defined, and therefore mostly used with the assumption of intuitive understanding (Teixeira et al., 2018:57). Any attempt at explaining or defining knowledge therefore must come with providing different definitions, and then drawing conclusions from them.

Knowledge has been defined in various ways. For instance, the Webster's New Collegiate Dictionary defines knowledge as a range of knowledge and understanding while knowledge, in turn, is said to be knowledge obtained from investigation, study or instruction, and data is defined as factual knowledge used as a basis for discussion. Nadason et al. (2017:39) also define knowledge as what the knower knows that does not exist out of the knower but rather is shaped by one's needs as well as one's initial stock of knowledge. However, Nonaka and Takeuchi (1995), assert that knowledge is the true and justified personal belief that increases an individual's capacity to take action. In many instances, also, the concept of knowledge was used synonymously with knowledge and data (North & Kumta, 2018:209). The argument is that knowledge involves the link people make between knowledge and its potential application. According to Mclerney (2002:87), knowledge is the awareness of what one knows through study, reasoning, experience or association or through various other types of learning (Biconne, 2014:125).

Analysing the different definitions, it is clear that the concept of knowledge is easier to describe than to define. Within the context of this study, however, knowledge is defined as a stock of knowledge that combined with experience, context, interpretation, reflection, intuition and creativity, plus the ability to use the knowledge to act or innovate Fomdad (2008). Thus, knowledge is defined as the understanding or awareness of a subject that is obtained from experience or education (North & Kumta, 2018:209). Therefore, knowledge is currently regarded as the most valuable resource globally (Nadason et al.,

2017:39). Within the context of rice farming, knowledge can be understood as the practical (through experience) or the theoretical (through education) understanding of rice farming processes and practices (Biconne, 2014:128).

2.3.1.2 Different approaches to knowledge

Over the years, there have been a different perspective that has been proposed as being important to knowledge management science. This is due to the ambiguity of defining and conceptualising the concept of knowledge. The different approaches offer diverging insights and perspectives to studying and researching knowledge, in order to prevent the tendency to focus on one dimension. The approaches include; i) data, information and knowledge approach, ii) personal perspective of knowledge, iii) social perspective of knowledge, and iv) organisational perspective of knowledge. Each of these approaches and perspectives was discussed within the context of the different strategies they each propose for managing knowledge and the implications for knowledge sharing and management.

2.3.1.2.1 The data, information and knowledge approach

Research involves data, information and knowledge to provide a deeper understanding of knowledge. There was need to demarcate the conceptual boundaries between three interlocking concepts; data, information and knowledge (Kiptot et al., 2006:168). Based on this, several knowledge management theorists have come up with definitions and differentiations of these concepts. In doing so, several scholars refer to data, knowledge and knowledge (DIK) as the knowledge pyramid (Hislop et al., 2018:12). The DIK has been referred to as 'knowledge hierarchy' within knowledge management (KM) literature and 'information hierarchy' within knowledge science (KS) literature (Kiptot et al., 2006:168). Therefore, the concepts discussed here are data, information and knowledge.

The concept of data has been defined differently by different scholars, depending on the field of study and the context within which the concept of data is used. In its general sense, the concept of data is often associated with empirical scientific research, where

data is gathered in different contexts (e.g. organisational context, institutional context and community context) to answer research questions (Mashavave, Mapfumo, Mtambanengwe, Gwandu & Siziba, 2013:6). According to North and Kumta (2018:205), the word 'data' is generally defined to refer to the bare facts void of any context. This implies that unarranged facts become data which is a key input in the information-knowledge process. This operational definition is used throughout this study. It is on this basis that Nadason et al. (2017:37) defined data as "a set of discrete, objective facts about events".

Data is gathered, measured and analysed (Nadason, Saad & Ahmi, 2017:33). Within the context of research, therefore, the concept of data is often used interchangeably with the concept of knowledge (Nadason et al., 2017:34). However, data and knowledge have their unique roles in relation to each other, with each of them having their own meaning. For instance, data is argued to become knowledge only when analysed for decision-making purposes (North & Kumta, 2018:203). Data as a general concept, therefore, refers to facts or the smallest units of measure.

After the conceptual definition of data, comes conceptualisation of information. In the face of ever-increasing technological advancement, the current age was described as the knowledge age (North & Kumta, 2018:211). This is due to the proliferation and abundance of knowledge for use and consumption (Nadason et al., 2017:35). Knowledge is seen as an entity in itself, with a lifespan (Qureshi, Fang, Haggerty, Compeau & Zhang, 2018:12). Knowledge is defined as data that has been analysed, sorted, displayed and communicated through a medium such as a language, graphics and numeric tables (Qureshi et al., 2018:14).

knowledge consists of facts or data and may take on any one of several forms, levels of abstractions, and degrees of certainties. Knowledge is used by knowledge to interpret or reason about a particular circumstance or case. The role of knowledge is description. Data is something that has been organised within a context and translated into a form that has structure and meaning (North & Kumta, G., 2018:233). Other scholars have also conceptualised knowledge as any entity or form that resolves uncertainty or provides

answers to questions (Qureshi, Sutter & Bhatt, 2018:1575). In fundamental forms, therefore, knowledge is related to data and knowledge (Qureshi et al., 2018:1588). Knowledge is always conveyed as contents of messages or via direct or indirect observation (North & Kumta, 2018:233). It can be encoded into various forms for interpretations and transmissions or encrypted for safe storage and communication (North & Kumta, 2018:233).

Knowledge serves as a good platform to interpret data. The concept of knowledge is fundamental to knowledge sharing and knowledge management. In order to understand knowledge sharing practices, it is imperative to first understand the concept of knowledge. Knowledge, as a concept, is defined as encompassing four distinct skills (i.e. know-how, know-what, know-why and know-who) acquired through experience or training (Nadason et al., 2017:35). Knowledge is the result of learning. Knowledge is the internalization of information, data, and experience (Laforge & McLachlan, 2018:258). Teixeira, Henriques & Santos (2018:57) also explicate that the part of knowledge that is more easily definable involves the accumulation and assimilation of multiple pieces of information.

Knowledge is a fluid mix of framed experiences, values, contextual knowledge and expert insight that provides a framework for evaluating and incorporating new experiences and knowledge (North & Kumta, 2018:209). Knowledge encompasses cognition and recognition (know-why), capacity to act (know-how) and critical understanding (know-why). Knowledge encompasses the fluidity and complex mixture of framed life experiences, contextual information, values and expert insights that act as a unified framework for the evaluation and incorporation of new experiences and knowledge (North & Kumta, 2018:209).

2.3.1.2.2 Personal perspective of knowledge

The personal perspective of knowledge brings in the individual or human factor into the discourse. More specifically, the personal perspective puts individuals at the centre of the discussion on knowledge. According to this perspective, knowledge is conceptualised to be existing within an individual, and therefore a focus on individuals' perspectives is key.

Researchers such as Laforge and McLachlan (2018:258) and North and Kumta (2018: 209) therefore make the distinction of knowledge based on individual-level entity proposed by this approach. The distinction was made between tacit and explicit knowledge (elaborated in section 2.3.1.3.1). However, the data-information-knowledge and personal perspectives do not provide a complete understanding of the meaning of knowledge. The social and organisational perspectives are therefore also developed to complement them.

2.3.1.2.3 Social perspective of knowledge

The social perspective broadens the scope of viewing where knowledge exists. The social perspective goes beyond the individual and proposes that knowledge is both created, inherent and contested within a group-level collective action (Nadason et al., 2017:35). This suggests that, for the social perspective, knowledge is produced and reproduced when people work together within the context of dependent and interdependent relationships within their social contexts (Fombad, 2008:47). Teixeira et al. (2018:57) argue that knowledge is not an individual property but rather the property of groups and communities. The claim is alluded or subscribed to by other researchers such as Laforge and McLachlan (2018:261) and North and Kumta (2018:212). Based on this perspective, the concept of communities of practice (elaborated in section 2.3.9.1) received attention in terms of conceptualising how it shapes knowledge sharing and management.

2.3.1.2.4 Organisational perspective of knowledge

The organisational perspective brings a more practical approach or dimension to knowledge discourse. The organisational perspective draws on the other three perspectives (i.e. data-information-knowledge, personal and social perspectives) to critically theorize how knowledge formed through unique patterns of interactions between technologies, processes, techniques, and people, which is shaped by the organisation's unique history and culture (Qureshi et al., 2018:1588). The fundamental assumption of the organisational perspective is that knowledge is fundamentally shaped by systems consisting of a series of processes such as creation, storage, transfer and application

with data information, knowledge and wisdom (Mashavave et al., 2013:8). Scholars such as Laforge and McLachlan (2018:261) for instance explain that, within the context of organisations, knowledge is created and generated daily and that organisations need wisdom to enable them to make efficient and profitable use of their knowledge. This has been referred to as organisational learning or organisational intelligence (Nadason et al., 2017:41).

2.3.1.3 Types of knowledge

There are different types of knowledge. For instance, knowledge can be classified as; tacit and explicit knowledge (Lave & Wenger, 1991:213; North & Kumta, 2018:211); declarative, procedural and analytical knowledge (Lave & Wenger, 1991:215; Mashavave et al., 2013:9); practical knowledge, intellectual knowledge, small talk or past time, spiritual knowledge and unwanted knowledge (Laforge & McLachlan, 2018:262); procedural and analytical knowledge (Nadason et al., 2017:39); human, mechanised, documented, and automated knowledge (Delors et al., 1996); know-how, know-about, know-why, know-when, know-with and care-why (Michalik, 2017:289; Trusson, Hislop & Doherty, 2017:1548); and internal, external, customer, and market knowledge (Mashavave et al., 2013:8). These types or classifications of knowledge are discussed in the next sections.

2.3.1.3.1 Tacit and explicit knowledge

Tacit knowledge is defined as the practical and action-oriented knowledge acquired from everyday lived experiences, habits and practices that are usually drawn upon for making every day intuitive decisions (Laforge & McLachlan, 2018:259). Tacit knowledge is regarded as the most fundamental or foundational of all forms of knowledge (North & Kumta, 2018:209). Tacit knowledge is defined as the very basic or personal knowledge that resides within the minds, behaviours and perceptions of individual members of a community or organisation (Nadason et al., 2017:35).

Tacit knowledge encompasses practical know-how acquired through practice and personal experience and embodies intuitive beliefs and values (Lave & Wenger, 1991:213). Tacit knowledge is regarded as an action-oriented form of knowledge because individuals draw on it functionally (Laforge & McLachlan, 2018:258). This means that individuals draw on tacit knowledge in response to a situation or action. Due to its nature, tacit knowledge is regarded as intuitive and subjective (Nadason et al., 2017:39). Tacit knowledge is transmitted through social engagements or interactions and dialogue between members or individuals in communities or organisations (Laforge & McLachlan, 2018:259). When tacit knowledge is articulated, it becomes explicit knowledge (Trusson, Hislop & Doherty, 2017:1548), which is discussed in the next subsection.

Explicit knowledge is defined as the type of knowledge that is formally communicated in the form of written down documents or contextually agreed rules of conduct that facilitate processes and operations among groups or within organisations (Teixeira et al., 2018:57). Explicit knowledge is also defined as the more formal, systemically recorded or the systemic forms of knowledge that are kept in the form of procedures, rules, principles, organisational archives and scientific formulas (Nadason et al., 2017:39). Due to its organised manner, explicit knowledge is regarded as objective because it can be stored, shared, easily accessed and transmitted and therefore can be easily evaluated by different individuals (Laforge & McLachlan, 2018:262).

Explicit knowledge is sometimes called know-what, codified, or academic knowledge (Michalik, 2017:289). Explicit knowledge is the knowledge that has been written down, processed by knowledge systems, codified or recorded, archived and protected by organisations (Trusson et al., 2017:186). Nadason et al. (2017:45) describes explicit knowledge as the type of knowledge most easily handled by knowledge management systems, which are very effective at facilitating the storage, retrieval and modification of documents and texts. Explicit knowledge is the captured and catalogued knowledge is made ready for people to use. Sometimes within businesses the term 'taxonomy' is used for the classification of knowledge. A good taxonomy or catalogue enables the same knowledge to be accessed via multiple paths.

Nadason, Saad and Ahmi (2017:33) observe that both explicit and tacit knowledge sharing practices facilitate innovation and improve productivity. In a systematic review of factors that influence knowledge practices, however, Nadason et al. (2017:35) observed that individuals are more willing to share explicit knowledge compared to tacit knowledge. Explicit knowledge is not too personalized and individuals do not have difficulties sharing such knowledge. Tacit knowledge on the other hand tends to be more personalized and therefore individuals do not readily share their tacit knowledge (Nadason et al., 2017:36).

2.3.1.3.2 Declarative, procedural and analytical knowledge

Declarative knowledge is defined as the type of knowledge constructed about things in descriptive forms, such as facts, things, methods and procedures (Hislop et al., 2018:15). However, declarative knowledge is argued to be common to explicit knowledge (Fombad, 2008:39). Declarative knowledge is consciously accessible, articulated and transmitted without loss of integrity once the syntactical rules for deciphering it are known (Rosenberry & Vicker, 2017:28). Procedural knowledge on the other hand manifests in knowledge of how to do something, how something happens, occurs or is performed (Sautier, Duru & Martin-Clouaire, 2017:41). Procedural knowledge is therefore often referred to as 'know-how' knowledge (Bozzato, Eiter & Serafini, 2018:73). Analytical knowledge manifests in knowledge of strategic analysis of issues, concepts, procedures and scenarios (Hislop et al., 2018:11). Analytical knowledge is therefore synonymous with asking questions regarding when and why (Nadason et al., 2017:35). Fombad (2008:39) argues that analytical knowledge "is deeply rooted in the intrinsic skills, experiences, ideals, values, minds and emotions of the individuals and is not easy to express, and that it results from analysing declarative knowledge".

2.3.1.3.3 Human, mechanized, documented and automated knowledge

The classification of knowledge into human, mechanized, documented and automated was influenced by the works of Jaques and Clement (1991). According to these distinctions, human knowledge can be found in the cognitive make-up of individuals (Quereshi et al., 2018:14). Mechanized knowledge on the other hand can be found in

machines needed for doing a job (Hislop et al., 2018:12). Documented knowledge is stored in various forms such as books, instruction manuals, and in the current technological world, that which is electronically stored. These classifications coincide with both tacit and explicit elements of knowledge. For instance, human knowledge is similar to tacit knowledge while mechanised, documented and automated knowledge are similar to explicit knowledge (Fombad, 2008:40).

2.3.1.3.4 Internal, external, customer and market knowledge

This type of knowledge is common among commercial organisations and industries with regards to three generic classifications of knowledge (Adamides & Stylianou, 2013:4). The internal knowledge speaks to the body of knowledge that is internal within the organisations (Clappison, Cranston, Rowley and Lloyd-Laney, 2013:58). External knowledge is acquired from outside the organisation to make the organisation survive the competition in the industry (North & Kumta, 2018:210). Customer knowledge focuses on what the customers of the organisation know and how that can help the organisation. Market knowledge has to do with the knowledge circulating on the market regarding knowledge of products, processes, best practices, expenses and competitors (North & Kumta, 2018:209).

2.3.1.3.5 Know-how, know-about, know-why, know-when, know-with and care-why

These categories of knowledge are based on the idea of “hierarchy of non-rational aspects of knowing” (Fombad, 2008:39). Know-how knowledge addresses questions of how to do things, and therefore aligns with procedural and tacit knowledge (Quereshi et al., 2018:14). Know-about knowledge addresses questions regarding facts, and therefore aligns with factual, declarative and explicit knowledge (Nadason et al., 2017:33). Know-why knowledge speaks to why things happen or some things occur. Know-when knowledge deals with understanding of when events or things occur. Know-with knowledge is relational and speaks to knowing the association between things. Care-why knowledge is argued to be the highest level of knowledge, and has to do with uncovering

the direct or indirect and hidden benefits and costs of possible contingencies and trade-offs. Fombad (2008:40) explains that know-why, know-when, know-with and care-why knowledges all correspond to analytical knowledge and that all of these knowledges can be considered a subset of declarative knowledge.

Even though there are clear distinctions between the various types of knowledge, the boundaries are blurred and fluid. There are conceptual linkages between all the types of knowledge, which speaks in fundamental terms to the fact that the types of knowledge are not completely independent, dichotomous and static. Rather, the types come together to provide holistic insights and understanding of the broader context of knowledge management, which is discussed in the next section.

2.3.2 The concept of knowledge management

This section provides a discussion of the overview of the concept of knowledge management (KM). Given that knowledge sharing constitutes a critical component of knowledge management. It is important to have an understanding of knowledge management. The discussion therefore focuses on defining knowledge management and explaining of knowledge management processes.

2.3.2.1 Defining knowledge management

Knowledge management is defined as the systematic ways by which knowledge is organised, shared and put together to achieve a desired end (Adamides & Stylianou, 2013:4). Laforge and McLachlan (2018:258) also define knowledge management as the process of acquiring, storing, defusing and implementing both tacit and explicit knowledge within the organisation's borders to accomplish corporate objectives most proficiently manner. However, Clappison, Cranston, Rowley and Lloyd-Laney, (2013:58) also referred to knowledge management as the set of business processes developed in an organisation to create, store, transfer and apply knowledge. This means that knowledge management structures the flow of knowledge or knowledge to the right people at the right time so they can act more efficiently and effectively to find, understand, share, and

use knowledge to create value. In this study, knowledge management is conceptualized as how the rice farmers acquire and handle informational resources that impact on their rice farming activities, both directly and indirectly.

Knowledge management includes processes; people (individuals or workers and the roles they play in supporting KM process); technology (the tools/infrastructure used to support KM processes) and culture (the norms/traditions of knowledge creation and sharing within and among individuals) (Ajani, 2014:45; Biconne, 2014:128). These elements have been referred to as the knowledge management framework (Adamides & Stylianou, 2013:8). The KM framework defines how KM elements (processes, technologies, structures, accountabilities and governance) should be in place, aligned and interconnected in a manner that supports the achievement of efficient practices and productivity (North & Kumta, 2018:209). This ensures that there are no gaps in the system and that there is a free flow of knowledge or knowledge sharing among individuals. Good knowledge management practices therefore have important implications for achieving high rice yields, especially among smallholder farmers in developing countries. In the proceeding subsections, approaches to and processes of knowledge management are discussed.

2.3.2.2 Knowledge management approaches

In this subsection, five approaches of knowledge management were discussed. These approaches are knowledge technology perspective, social or people track approach, individual or personal perspective, organisational perspective and business perspective.

2.3.2.2.1 Information technology perspective

The knowledge technology perspective was drawn from the literature on knowledge technology (Bilginoğlu, 2019:66). This perspective considers “knowledge management as a technological matter and treats knowledge as objects that can be identified and handled in a knowledge system” (Fombad, 2008:46). This perspective relies on factors such as knowledge management, knowledge systems, data bases, hardware and software and communication tools for managing knowledge (Holten et al., 2016:218).

2.3.2.2.2 Social or people track approach

The social or people track perspective considers knowledge management from a social learning approach (Holten et al., 2016:220). This means that the perspective on groups of people and social relationships is influenced by organisational structures, team work and culture (Bilginoğlu, 2019:68). Thus, from this perspective, organisations create, organise, and process knowledge to generate new knowledge through organisational learning, community of practice, knowledge ecology and knowledge networks (Yadav, Yaduraju, Balaji & Prabhakar, 2015:8).

2.3.2.2.3 Individual or personal perspective

The individual perspective argues that knowledge management within organisational contexts is influenced by individual and personal traits (Yadav, Yaduraju, Balaji, & Prabhakar 2015:11). This means that for this perspective, knowledge management was a continuous interplay between personal tacit and explicit knowledge in the organisation (Holten et al., 2016:219). Nonaka and Takeuchi (1995) therefore developed a SECI model (internalisation, externalisation, socialisation and combination) discussed in section 2.8.1 to explore the possibility of gathering people together to develop and make personal knowledge effective in organisations, use this perspective to explain how personal knowledge can be created and later convert it into explicit knowledge (Ortolani, Bocci, Bärberi, Howlett & Chable, 2017:22).

2.3.2.2.4 Organisational perspective

The organisational perspective proposes a fundamental assumption to the effect that the organisational perspective is critical to knowledge management (Nadason et al., 2017:41). Specifically, the perspective says that knowledge management is shaped by systems consisting of series of processes such as creation, storage, transfer and application with data information, knowledge and wisdom (Mashavave et al., 2013:8). For instance, within organisations, knowledge management is created and generated daily and organisations need wisdom to enable them to make efficient and profitable use of

their knowledge. This has been referred to as organisational learning or organisational intelligence (Nadason et al., 2017:41).

2.3.2.2.5 Business perspective

The business perspective draws from the knowledge-based view and the resource-based view of organisations. The knowledge-based view identifies knowledge as the primary rationale for the firm. It has long been recognised that economic prosperity rests upon knowledge and its useful application (Agyeman et al., 2016:351). According to Chen, Shanthikumar and Shen (2015:1430), the resource-based view of the firm on the other hand considers knowledge as a corporate organisational resource, intellectual capital, manageable assets, skills, capabilities, stock flows and competencies that constitute a basis for competitive advantage.

2.3.2.3 Knowledge management processes

Knowledge management processes are defined as the process by which knowledge or knowledge is shared among a group of people for goal attainment (Meijer et al., 2015:49; Patii et al., 2017:881). Knowledge management processes comprises several parts. Researchers like Laforge and McLachlan (2018:277); Bilginoğlu, (2019:64); Biconne, (2014:122) and Clappison et al., (2013:62) asserted that knowledge management processes would either be in four or five parts. However, all of them put together included; processes (the creation, capturing, storing, sharing and effective use of knowledge in an organisation); people (individuals and the roles they play in supporting knowledge management process in the organisation); technology (the tools/infrastructure that an organisation uses to support knowledge management processes) and culture (the norms/traditions of knowledge creation and sharing within an organisation) (Ajani, 2014:45; Biconne, 2014:128). These elements have been referred to as the knowledge management framework (Adamides & Stylianou, 2013:8). The researcher focused on knowledge management processes which include creation, acquisition, retention, codification, utilization, sharing and practices.

2.3.2.3.1 Knowledge creation

In the current knowledge economy, the ability to create knowledge is a fundamental competitive advantage in every economic endeavour, including rice farming. Fundamentally, knowledge creation is defined as the process of forming new concepts, notions, experiences or knowledge (Adamides & Stylianou, 2013:9). Knowledge creation involves how individuals form new ideas, concepts and experiences about different components of their work to improve productivity. Knowledge creation can occur through interactions between explicit and tacit knowledge. This was discussed in detailed with the SECI model in the theoretical framework section.

2.3.2.3.2 Knowledge acquisition

Knowledge acquisition is defined as the processes involved in extracting knowledge or knowledge from expert sources and structuring the knowledge in ways that make them readable (Biconne, 2014:128). Laforge and McLachlan (2018:257) also define knowledge acquisition as the process of developing and obtaining skills, insights or relationships from either internal or external sources. The internal sources may include tapping into the knowledge of existing staff and learning from experiences (Balaji et al., 2007:12). The external sources may include different practices such as hiring external experts, attending conferences and seminars and forming alliances, among others (Clappison et al., 2013:60). Knowledge acquisition helps individuals to gather knowledge and structure it to benefit their activities. The knowledge can be acquired internally by tapping into the expertise and experiences of expert colleagues. They can also acquire knowledge from external sources such as training seminars, hiring consultants and forming alliances with other organisations and groups.

2.3.2.3.3 Knowledge retention

Holding on to knowledge and making sure critical knowledge does not become extinct is also as important as creating new knowledge. Knowledge retention functions to protect and preserve important information. Knowledge retention is therefore defined as the part of knowledge management that involves focusing on critical knowledge that is at risk of

extinction, prioritizing it and developing actionable plans to retain and preserve that knowledge (Clappison et al., 2013:62). Even with increasing technological advancement, there may still be some forms of knowledge that individuals possess that can still be critical to productivity. Knowledge retention therefore ensures that individuals develop action plans to preserve and retain their ideas and concepts that stand the test of time and can apply them to help their work activities.

2.3.2.3.4 Knowledge codification

Knowledge codification is defined as the process of managing organisations' knowledge (both internal and external) and converting it into accessible and usable form (Biconne, 2014:122). Knowledge codification is aided by knowledge technology and knowledge management skills (Balaji et al., 2007:11). Knowledge codification involves a series of interrelated activities. These activities include integration, combination, structure, coordination, conversion, editing, review, approval or rejection, storage, organisation, maintenance, cataloguing, classification, retrieval and organisational memory (Clappison et al., 2013:68). As individuals forget what they learn, so do organisations also forget. Therefore, as Fombad (2008:53) asserts, the process of storage, organisation, and retrieval of organisational knowledge is an important component of the knowledge codification process.

2.3.2.3.5 Knowledge utilization

Knowledge utilization is defined as the processes involved in effectively and efficiently using knowledge (Bilginoğlu, 2019:64). Thus, knowledge utilization ensures that knowledge that was acquired properly integrated into the products, processes and services of organisations to gain competitive advantage (Balaji et al., 2007:12). Knowledge utilization, however, depends on several factors such as absorptive capacity (i.e. ability to acquire, assimilate, recognize value and use new knowledge) to generate the needed competitive edge in the industry (Bilginoğlu, 2019:63).

2.3.2.3.6 Knowledge protection

Knowledge protection is defined as the knowledge management process that aims to protect the organisation's knowledge from all forms of illegal and inappropriate use or theft (Fombad, 2008:54). For this reason, knowledge protection preserves and protects inimitable and rare quality of knowledge for competitive leverage (Bilginoğlu, 2019:63). Knowledge protection is a crucial part of knowledge because not all forms of knowledge in the firm can be protected with property rights and laws such as trademarks, copyrights and patents. Although it is inherently difficult to protect knowledge, an effort should nevertheless be made (Trusson et al., 2017:1543). The steps that may be taken to do this include: knowledge incentive alignment, employee conduct, and rules or the design of a security system that restricts access to a firm's vital knowledge (Bilginoğlu, 2019:66).

2.3.2.3.7 Knowledge sharing

The current study is on knowledge sharing among rice farmers in Ghana. Knowledge sharing is discussed in detail in this section, as one of the processes of knowledge management. Knowledge sharing is an integral part of the broader knowledge management processes (Balaji et al., 2007:11; Clappison et al., 2013:60). Knowledge sharing is therefore very important in the broader context of knowledge management. It is through knowledge sharing that knowledge or knowledge gets exchanged among individuals within an organisation.

The concept of knowledge sharing has contested meanings among different scholars. The definition of knowledge sharing has depended on the researcher and the research contexts. For this reason, some researchers use the term 'knowledge sharing' (Prins et al., 2015:18), while others use the term 'knowledge transfer' (Andre et al., 2017:896). Knowledge sharing is basically defined as the exchange of knowledge between individuals (Kaewchur & Phusavat, 2013:181). Prins et al., (2015:18) also define knowledge sharing as the activities of transferring or disseminating knowledge from one person, group or organisation to another. Knowledge transfer refers to the sharing or

dissemination of knowledge or knowledge from one part of an organisation to another (Andre et al., 2017:896).

However, in both cases the definitions included a common theme on making knowledge available to others to improve practices and productivity (Ting-Toomey & Dorjee, 2018:32). In this study, therefore, the two terms 'knowledge transfer' and 'knowledge sharing' are used interchangeably as suggested by researchers such as Andre et al., (2017:896) and Biconne (2014:143). Knowledge Sharing then becomes an activity through which knowledge (i.e., information, skills, or expertise) are exchanged among farmers within communities.

Therefore, in the current study knowledge sharing would be conceptualized as the practices and activities that enable knowledge sharing. Knowledge sharing practices are therefore discussed next.

2.3.2.3.8 Knowledge sharing practices

One of the key objectives of this study was to explore knowledge sharing practices among rice farmers in Ghana. Knowledge sharing practices have also seen various conceptualizations and definitions. However, the contestations surrounding knowledge sharing practices are not as rife as that surrounding knowledge sharing as a concept. This is because, as Kaewchur and Phusavat (2013:183) argued, when the concept of knowledge sharing is agreed upon, the practices for sharing knowledge are then easily identified. Therefore, most of the definitions of knowledge sharing practices have something common between them.

Tahlelo (2016:34) too was of the view that knowledge sharing practices are all the activities that are intended to improve the internal flow and use of knowledge within a team in an organisation. In other words, knowledge sharing practices also include all of the activities and processes, both formal and informal, by which knowledge is shared and created throughout an organisation. For instance, knowledge sharing practices have been defined by Bilginoğlu (2019:66) as to how critical informational resources are

communicated or exchanged among individuals. This definition suggests that the ways and means through which knowledge is communicated or exchanged among individuals are identified as practice. Andre et al., (2017:889) have also defined knowledge sharing practices as constituting the various means or behaviours that workers or individuals engage in to share knowledge or knowledge among themselves. They also suggest that the sharing practices constitute the strategies adopted by individuals in exchanging knowledge among themselves.

The definitions from Andre et al., (2017:889) and Bilginoğlu (2019:66) all included the specific activities or actions individuals undertake in disseminating information. Therefore, in this study, knowledge sharing practices are taken as activities and procedures that are employed by individuals to disseminate knowledge among themselves. The benefits of knowledge sharing, enabling factors, barriers, tools and technologies and strategies of knowledge sharing are discussed in the ensuing subsections.

2.3.3 Enablers of knowledge sharing

Enablers of knowledge sharing are the factors that promote or help knowledge to be shared among individuals and workers within an organisation. The factors that enable knowledge sharing have been categorised in various levels, which include individual-level factors, organisational factors and technological factors (Cadger et al., 2016:42). Each of these factors are discussed the subsections below.

2.3.3.1 Personal factors

The personal or individual factors are the qualities of individuals that make them more willing to share knowledge or knowledge with others (Rosenberry & Vicker, 2017:28). The personal factors are important due to a fundamental individual difference that workers have. Because of this, some individuals are more likely to share knowledge, while others may not. Research has therefore become interested in identifying personal factors, traits or characteristics that enable people to share knowledge (Martinez, 2000:14). Some of the individual factors that enable knowledge sharing include self-efficacy, effective

communication skills, personal relationships and interpersonal trust, and motivation to share (Ortolani et al., 2015:25).

2.3.3.2 Social and cultural factors

Several social and cultural factors have also been found to promote knowledge sharing. Sociocultural factors are defined as those factors within social and cultural spaces that create the broader atmosphere or context within which knowledge is shared or exchanged (Garcia et al., 2018:36). Therefore, social and cultural factors are important elements of knowledge sharing enablers. Different social and cultural factors have been identified to promote knowledge sharing. Some of the social factors include high sense of trust, frequent interaction between individuals and workers and integration of knowledge sharing in work processes (Chhim et al., 2017:751). Some of the cultural factors identified to enable knowledge sharing include collectivism, high sense of dependence and communality (Garcia et al., 2018:32; Ortolani et al., 2015:22). Social and cultural factors thus create safe social spaces and opportunities that make individuals feel comfortable about sharing knowledge (Chhim et al., 2017:753).

2.3.3.3 Organisational factors

Organisational factors are defined as the characteristics or factors of organisations and communities of practice that enable knowledge or knowledge to be shared and disseminated easily (Feng & Xue, 2014:11). This suggests that organisational factors can act as facilitators to knowledge sharing among individuals in an organisation or communities of practice (Nadason, Saad & Ahmi, 2017:34). Some of the organisational factors which have been identified to enable knowledge sharing are reward systems, leadership and management support, social networking, participation and democratic involvement and learning communities (Hislop et al., 2018:15).

2.3.3.4 Technological factors

There have been unprecedented advancements in technology in the last 50 years than there have ever been in the history of mankind (Adamides & Stylianou, 2013:6).

Technological advancement is predicted to rise even faster in the years ahead than it has been in the past (Yeşil & Hırlak, 2019:22). One of the fall outs of technological advancement is the discovery and development of factors that enable knowledge and knowledge to be shared easily and conveniently. Several knowledge sharing tools have been developed to enable knowledge sharing. These tools include the internet, intranet, e-mails, skype, blogs, social media, video conferencing and instant messaging (Yeşil & Hırlak, 2019:22). Apart from that, there has been the development of several knowledge sharing systems such as expertise locator systems, best practice databases, knowledge repositories and incident report databases (Assem & Pabbi, 2016:482). All of these technological factors improve and make knowledge sharing faster, effective and convenient.

2.3.4 Barriers to knowledge sharing

Barriers to knowledge sharing are the factors that undermine knowledge sharing among individuals in organisations. The factors that are found to inhibit knowledge sharing have been grouped into individual barriers, social and cultural barriers, organisational barriers and technological barriers (Cadger, Quaicoo, Dawoe & Isaac, 2016:35). Each of these barriers is discussed in the following subsections.

2.3.4.1 Individual barriers

Individual level barriers are the various factors about individual workers themselves that influence their knowledge sharing practices. These factors are also referred to as personal inhibiting factors (Cadger, Quaicoo, Dawoe & Isaac, 2016:35). Personal barriers have been found to influence knowledge sharing among individuals in general and workers in particular. Some studies have reported that personal characteristics of workers also affect their tendency to share knowledge with their colleagues. Some of the personal factors identified include trust and perceived power (Cadger et al., 2016:35). Others include knowledge hoarding, mistrust, dominance of sharing, explicit over tacit knowledge, individual differences, poor communication skills and time constraints (Rosenberry & Vicker, 2017:28).

2.3.4.2 Social and cultural barriers

Social and cultural factors can also act as barriers against knowledge sharing. Socio-cultural factors create the atmosphere within organisations or communities of practice that influence how individuals behave (Navarro & Hautea, 2014:66). Within the context of work, for instance, the socio-cultural factors include factors within the cultural and social fabric of life that act as disincentives to the workers to share information. Family ties constitute the major cultural factor and social network cohesion constitutes the major social factor that affects knowledge sharing among workers (Siziba et al., 2012:16). Other factors included elements of mistrust, suspicion and animosity, among others (Feng & Xue, 2014:11).

2.3.4.3 Organisational barriers

Organisational barriers constitute the factors at the level of organisations (in more formal sense) or communities of practice (in less formal sense) that impede or inhibit how individuals within the organisations share knowledge (Feng & Xue, 2014:11). Organisational factors can act as barriers to knowledge sharing in all kinds of work contexts, both in formal organisations and informal work contexts or communities of practice (Nadason, Saad & Ahmi, 2017:34). Some of the organisational factors that act as barriers of knowledge sharing include financial constraints, lack of leadership and managerial support, hierarchy of work and organisational culture.

2.3.4.4 Technological barriers

Several other studies have identified potential technological barriers to knowledge sharing. For instance, Yeşil and Hırlak (2019:22) indicate that lack of integration of IT systems and processes impedes the way people do things and constitutes a critical technological barrier to knowledge sharing among smallholder farmers. Ganguly, Chatterjee and Talukdar (2019) also point out the fact that lack of technical support (internal or external) and immediate maintenance of integrated IT systems obstructs knowledge sharing and communication flows. Other technological barriers identified include lack of compatibility between diverse IT systems and processes (Adamides &

Stylianou, 2013:6) and lack of training regarding workers' familiarisation with new IT systems and processes (Assem & Pabbi, 2016:482).

2.3.5 Technologies and tools for knowledge sharing

There are different technologies and tools that allow knowledge to be shared and disseminated among individuals, groups and organisations. In this section, knowledge repositories and databases and other software tools are discussed as technologies and tools that aid knowledge sharing.

2.3.5.1 Knowledge repositories and databases

Knowledge repositories have become vital in knowledge management in agriculture in general and rice farming in particular. Knowledge repositories are online databases that are used for systematically capturing, organising and categorising knowledge-based knowledge (Chhim et al., 2017:742). Knowledge repositories have evolved over the years from the traditional static archives of published documents to the now dynamic online communities for the facilitation of searching and navigating vital knowledge within learning platforms (Chhim et al., 2017:744). In most cases, knowledge repositories are private databases that manage organisations and proprietary knowledge (Bozzato, Eiter & Serafini, 2018:78). However, there are also public repositories that manage public domain intelligence (Chhim et al., 2017:753). In such instances, such databases are referred to in various ways as Electronic Performance Support Systems, Digital Learning Repositories and Digital Object Repositories (Taskin & Van Bunnan, 2015:159).

Digital knowledge repositories have several key features that make them very effective. First, there is centralisation feature which allows wide varieties of digital contents curated from multiple sources to be housed in a central location, where the content can be shared (Taskin & Van Bunnan, 2015:161). Second, there is content management which allows for breadth of learning contents (such as videos, audio visuals, articles, learning modules, etc) to be searched (using key words) and managed properly (Chhim et al., 2017:750). Third, there is access control which allows for restricting people's access to content

through the use of password authentication and/or other security functionalities (Bozzato et al., 2018:77).

2.3.5.2 Software tools

There has been the development of several software tools that allow knowledge to be shared with ease. These software tools are also referred to as knowledge sharing tools (Chhim et al., 2017:746). Thus, knowledge sharing tools are defined as technological platforms that aid in the sharing of knowledge or knowledge (Tsinigo & Behrman, 2017:49). Some of the common knowledge sharing tools include the internet, sharepoint/intranet, e-mail, skype, blogs, social media, instant messaging and video conferencing (Taskin & Van Bunnan, 2015:166).

2.3.6 Strategies and modes of knowledge sharing

There are different techniques, strategies and practices for sharing knowledge. Knowledge sharing practices are defined as the various fundamental ways, mechanisms and behaviours that are undertaken to ensure effective transfer of knowledge or knowledge within and among individuals or workers (Hameed et al., 2018:32). Within the context of work, knowledge sharing practices constitute the various means or behaviours that workers or individuals engage in to share knowledge or knowledge among themselves (Andre et al., 2017:889). Understanding knowledge sharing practices is important in ensuring that there is in-depth understanding of the various ways in which individuals share knowledge. Some of the strategies discussed here include communities of practice, mentoring and tutoring, expertise location, job rotation, SharePoint and others.

2.3.6.1 Communities of practice

Communities of practice (CoP) is defined as a group of individuals or people who share a profession or craft (Boateng & Agyemang, 2016:218). The concept of CoP was first proposed in 1991 by Jean Lave (a cognitive anthropologist) and Etienne Wenger (an educational theorist) in their book, *Situated Learning: Legitimate Peripheral Participation*.

In the book, Lave and Wenger (1991:4) viewed learning is fundamentally a social process, a situated activity, with legitimate peripheral participation (LPP) as its central defining characteristics. This means that learners participate in communities of practice and then move gradually towards full participation in the socio-cultural practices of the community. They used the concept to essentially theorise the complex relations between newcomers and old-timers in a profession about how they negotiate identities, activities, knowledge and practice (Cadger, Quaicoo, Dawoe & Isaac, 2016:33). They discussed different communities including butchers, midwives, tailors, quartermasters and recovering alcoholics. However, the processes by which new individuals learn in those communities can be generalised to all other social groups, including rice farmers in the context of this study.

Etienne Wenger then built on and expanded the concept in 1998 in his book, *Communities of Practice: Learning, Meaning and Identity*. In the book, Wenger (1998:3) argued that CoP are everywhere but mostly glossed over because of their inherent informal nature. He explained that, on the one hand, CoP give newcomers access to competence in the craft or profession and also invite a personal experience of engagement where newcomers incorporate the competence in their identity of participation (Wenger, 1998:214). He explained further that, for knowledge sharing to be efficient, members of CoP need a strong bond of communal competence and a deep respect for all members (Wenger, 1998:214). When the two conditions (strong communal bond and mutual respect) are in place, then CoP can be in a better place to create and share knowledge efficiently (Wenger, 1998:214).

Communities of practice can be created deliberately, through the process of sharing knowledge or knowledge and experiences within a group of workers (Chen, Shanthikumar & Shen, 2015:1435). In this way, members learn from one another in ways that offer greater opportunity for developing both personally and professionally. Communities of practice can exist in different settings, including physical settings, factory settings or even virtual settings. Different variations of communities of practice have been developed, such as 'virtual communities of practice' (VCoP) where members communicate via the internet,

and 'mobile communities of practice' (MCoP), where members communicate via mobile phone (Chen, Shanthikumar & Shen, 2015:1438). The key element is that knowledge sharing is taking place between members, regardless of where they are located.

2.3.6.2 Tutoring and mentoring

In general terms, mentoring is defined as a system of semi-structured forms of guidance in which individuals share their skills, knowledge and experience to assist other individuals to progress in their careers (Garcia et al., 2018:287). The experienced individual is referred to as the 'mentor' and the less experienced individual is referred to as the 'mentee or protegee' (Guo et al, 2015:106). Within the context of knowledge sharing, mentors need to be readily available, accessible and prepared to share their knowledge to assist the mentee to gain the relevant knowledge to improve on his or her activities. This means that the mentor willingly shares his/her knowledge, skills, technical know-how, experience and best practices to train the mentee (Hislop et al., 2018:43). The mentee, on the other hand, must be humble and ready to learn from the mentor for the mentoring process to become successful (Hameed et al., 2018:34).

2.3.6.3 Expertise location

In the current global economy, expertise location is regarded as one that is well positioned to provide organisations with the crucial support, they need in achieving their organisational learning goals (Dzandu, Boateng & Tang, 2014:349). Expertise location is defined as the efficient processes involved in identifying human expertise, determining the status of critical resources and integrating the expertise within the organisational interaction processes (Hameed, Basheer, Iqbal, Anwar & Ahmad, 2018:32). Expertise location is used for the maintenance of in-depth representations of skills, geographic positioning, availability and other indicators which are fundamental to the use of the expertise (Guo, Jia, Huang, Kumar & Burger, 2015:104).

Expertise location has become more relevant because organisations have begun chasing and accumulating high intellectual capital (Dzandu et al., 2014:352). For this reason,

some scholars (such as Hameed et al., 2018:35) have referred to expertise location as 'employee knowledge networking solution'. It has become the fundamental way of matching expertise and talents within an organisation or communities of practice. This has made the process of connecting to the right people with the right knowledge at the right time, very important in learning organizations (Dzandu et al. 2014:352). Expertise locations include activities such as the facilitation of mentoring programs, the identification of knowledge gaps and provision of both performance support and follow-up to formal training activities within organisations and communities of practice (Hameed et al., 2018:42).

2.3.6.4 Job rotation

Job rotation is defined as the technique that is used by organisations to rotate their employees' assigned jobs throughout their employment. Employers practice this technique for several reasons (Hislop et al., 2018:46). Job rotation is usually designed to promote flexibility of employees and to keep employees interested in staying with the company/organisation which employs them (Gava, Favilli, Bartolini & Brunori, 2017:108). There is also research that shows how job rotations help relieve the stress of employees who work in a job that requires manual labour (Hislop et al., 2018:46). Job rotation encourages knowledge sharing by making individuals versatile, gain broader understanding and receive knowledge from other colleagues (Hislop et al., 2018:54). This increases the sharing of knowledge in organisations.

2.3.6.5 Sharepoint/intranet

SharePoint or intranet is defined as a web-based collaborative platform that integrates Microsoft Office tools into technological tools to facilitate knowledge sharing and transfer (Karagoz, Korthaus & Augar, 2016:12). It was launched in 2001 and sold as a document management and storage system, but the product is highly configurable and usage varies substantially among organisations (Karagoz et al., 2016:12). It has some elements which include sites (for audience targeting), communities (that allow personal profiles for

engaging in group communications), content (that allows for managing knowledge content) and products (Karagoz et al., 2016:34).

2.3.7 Theories of knowledge sharing

Within the context of research on knowledge sharing, several theories and models have been proposed. Some of these theories and models were developed in the mid and late 1990s, while others were developed in the 2000s. Some of the earlier theories and models include the communication theory developed by Shannon and Weaver (1979:12), the theory of planned behaviour (TPB, Fishbein, 1979:4), the interactionist view by Benford and Fahlem (1993:9), the Conceptual Model Quality Framework (CMQF) by Lindland et al. (1994:12), the Learning and Organizational Learning developed by Nonaka (1994:3) and the Codification and Personalization Approach, developed by Davenport and Prusak (1998:7).

The post 2000 theories and models include the theory of reasoned action (TRA); Ajzen, 2000:2), Knowledge Management Model (Karadsheh, Mansour, Alhawari, Azar & El-Bathy, 2009:69), Social Exchange Theory (Cropanzano, Anthony, Daniels & Hall, 2017:479), Agricultural Knowledge Management Theory (Zheng, He, Ping & Ze, 2012:702) and the Socialization, Externalization, Combination and Internalization Model (SECI) MODEL (Nonaka, Toyama & Konno, 2000:8). Apart from these, there are other theories such as the Library Reference Knowledge Sharing Model (LRKM) developed by Daneshgar, Parirokh and Fattahi (2006:3), the Awareness Net Model developed by Daneshgar and Parirokh (2007:5), and the Technology Transfer Model (TTM) developed by Cummings (2003:12). Each of these theories and models proposes different pathways and approaches for knowledge sharing in particular and knowledge management in general.

2.3.8 Knowledge sharing practices in rice farming

Knowledge sharing provides opportunities for rice farmers to create context-relevant knowledge dissemination practices in ways that improve learning and knowledge sharing

among themselves (Adamides & Stylianou, 2013:6). Thus, rice farming communities can facilitate the flow of knowledge among their different rice farmer groups (Ahmed, Ragsdell & Olphert, 2014:8). Knowledge sharing is argued to take place within the context of a well-designed structural and organisational culture where the different units are interconnected in functional ways (Akram & Bokhari, 2011:45; Clappison et al., 2013:60). This suggests that, within the rice farming context, there is the need to develop a well-structured culture among rice farmers that allows knowledge to flow between and within them in interconnected and functional ways. This provides opportunities for mutual learning among rice farmers, in ways that stimulate a cyclical creation of new knowledge and simultaneously contribute to the rice farmers' ability to innovate and be creative in their rice farming practices (Assem & Pabbi, 2016:480).

Within the context of knowledge sharing among rice farmers, therefore, opportunities could be created for less experienced rice farmers to understudy more experienced and accomplished rice farmers. After the less experienced farmers build enough expertise, they would begin to develop and create their rice farming strategies and expertise which might be different from what they learnt from the experienced ones (Ajani, 2014:46).

However, knowledge sharing was found to constitute a major challenge, especially among farmers in general and rice farmers in particular for several reasons, including the fact that some farmers tend to resist sharing their knowledge with others (Assem & Pabbi., 2016:480). This situation leads to knowledge or knowledge hoarding in rice farming communities (Prins et al., 2015:18). Several factors have been suggested as to why rice farmers fail to share knowledge with their colleagues. These factors include protecting their competitive edge, lack of trust among rice farmers, lack of rewards of sharing of knowledge and personal characteristics, among others (Adamides & Stylianou, 2013:6). It is therefore imperative that these issues are adequately addressed among rice farmers to improve knowledge sharing between and among them.

2.4 Knowledge sharing among rice farmers

This section discusses the concept of knowledge sharing practices by specifically focusing on the context of rice farming. The section was discussed in line with the specific objectives of the study. The subsections discussed here therefore include; types of knowledge shared among rice farmers, knowledge sharing practices, technologies used for knowledge sharing, benefits of knowledge sharing practices for rice farmers, inhibitors of knowledge sharing, enablers of knowledge sharing and strategies for enhancing knowledge sharing practices.

2.4.1 Types of knowledge shared among rice farmers

There is a line of research that has examined the types of knowledge shared among farmers in general and rice farmers in particular. Some of these studies include Gava, Favilli, Bartolini and Brunori (2017:105), Kipnot et al. (2006:176), Meijer, Catacutan, Ajayi, Sileshi and Nieuwenhuis (2015:175) and Siziba et al. (2012:46). These groups of studies, even though very few, have focused on the types of knowledge that rice farmers have positive attitudes towards sharing in general. The findings across the studies point to the fact that rice farmers share different kinds of knowledge among themselves, including weed management strategies, food security, rice farming creativity and innovations (Gava et al., 2017:105; Meijer et al., 2015:175; Siziba et al., 2012:46). Other studies by Adamides and Stylianou (2013:4), Chen, Shanthikumar and Shen (2015:1433), Feng and Xue (2014:11), Gava, Favilli, Bartolini and Brunori (2017:105) and Tippe, Rodenburg, Schut, van Ast, Kayeke and Bastiaans (2017:95) provide insight into how farmers share knowledge concerning land preparation, produce harvesting, processing and marketing. The types of knowledge shared by farmers are discussed next.

2.4.1.1 Agricultural knowledge

Since rice farming falls within the broader context of agriculture, access to agricultural knowledge is critical, especially among rice farmers and other farmers whose households depend on agriculture for their livelihoods (Moore et al., 2014:292). Agricultural knowledge is defined as knowledge associated with improvement of farming practices,

sustenance of the environment and optimization of production within a given farm size (Mtega, Ngoepe & Dube, 2016:1). Lubell, Niles and Hoffman (2014:1091) for instance argue that access to and management of agricultural knowledge is a systemic issue which influences the level and quality of knowledge that individual farmers and farming communities can have access to.

Mtega et al., (2016:1) show that access to agricultural knowledge is shaped by the configuration of the knowledge infrastructure that is critically needed for disseminating information. The agricultural knowledge infrastructure is shown to be composed of knowledge and communication systems that process and transport knowledge in and out of boundaries (Mtega et al., 2016:2). The agricultural knowledge infrastructure is not evenly distributed within and between countries, and as such some individual farmers and farming communities can be knowledge-rich, while others can be knowledge poor (Mtega et al., 2016:2). Therefore, the sharing of agricultural knowledge among smallholder rice farmers is a critical factor in transforming and improving rice production. Access to agricultural knowledge is important in transforming the livelihoods of those relying on agriculture for a living and in enhancing food security (Lwoga, Ngulube & Stilwell, 2011:85).

To improve rice production, rice farmers should have access to timely and relevant knowledge at each stage of the rice-cropping calendar generally. Rice farmers should collect, manage and disseminate agricultural knowledge with their colleagues. Furthermore, Harvey et al., (2014:1-3) argued that agricultural production is knowledge exhaustive because it includes many risk factors such as pest and disease outbreaks, extreme weather events and market shocks which influence what and when to produce. Having such agricultural knowledge by the rice farmers would boost the yield on the farm. Harvey et al., (2014:4-5) make us understand that in agricultural systems farmers can have access to generated knowledge. Generally, agricultural knowledge may be organised and repackaged for easy consumption by the farmers including rice farmers. Organising and repackaging of agricultural knowledge capture the process of collecting, selecting, analysing, processing and translating knowledge to communicate a message

in a convenient and effective form to the target group which is the rice farmers in this circumstance.

Singh et al., (2014:574-375) point out that rice farmers share and create knowledge through cumulative experience and expertise in farming events. According to these writers, agricultural research institutes play an active and major role in generating new agricultural knowledge for the development of all categories of farmers, including the rice farmers (Mtega & Ngoepe, 2019:1-5).

Smallholder farmers, for instance, are argued to have severe agricultural knowledge needs which included “knowing what to grow, when to grow it, how to grow more, how to store and preserve their produce when to sell, where to sell and at what price to sell, and specific agronomic management skills” (Mtega et al., 2016:3). Therefore, being agricultural knowledge-rich involves individual farmers and farming communities critically combining both indigenous agricultural knowledge with exogenous scientific and evidenced-based agricultural knowledge in systematic and synergistic ways within their rice farming practices (Moore et al., 2014:295). This requires using both traditional and non-traditional agricultural knowledge that farmers can draw from to improve their rice farming.

2.4.1.2 Seed knowledge sharing

Studies such as those by Feng and Xue (2014:11) Gava et al. (2017:105), Knipot et al. (2006:176) and Tippe, et al. (2017:95) show that farmers share knowledge regarding seeds. Knipot et al. (2006:176) for instance, in an earlier study on sharing attitudes among farmers in Kenya, reported that the farmers had more positive attitudes towards sharing knowledge on seeds. The study was carried out among a randomly sampled 120 farmers involved in agroforestry from two districts (i.e., Siaya and Vihiga) of western Kenya. These farmers were involved in a pilot project on soil fertility replenishment by the World Agroforestry Centre (WAC), International Centre for Research in Agroforestry (ICRAF), Kenya Forestry Research Institute (KEFRI) and Kenya Agricultural Research Institute (KARI). Findings from the study indicated that the farmers were more willing to share

knowledge on seeds with other farmers who did not participate in the project but were less willing to share the knowledge with those who did participate. Similar findings have been reported by other studies, which found that the majority of smallholder farmers do share knowledge on seeds, fertilizer application and weed control (Kamarudin et al., 2015:114).

2.4.1.3 Land management practices

Traditional knowledge sharing on land management practices among farmers in general and rice farmers, in particular, have been argued to provide a critically good basis for sustainable rice farming and agriculture (Prins et al., 2015:12). This involves paying attention to what rice farmers know already to be able to develop strategies to widen their knowledge scope for various alternative action in better managing their rice farmlands (Biconne, 2014:143). Knowledge of land management practices creates a solid basis for the development of sustainable rice farming and also climate change adaptation strategies (Balaji et al., 2007:11). To this end, it is important to understand land management knowledge sharing among all rice farmers (Ajani, 2014:48).

For example, Biconne (2014:133) stated that the sharing of information in peri-urban Darkar areas in Senegal has given critical resources to the surrounding members of farming communities whose farmland is vulnerable to flooding. Sharing land management expertise on adaptive ability has helped these farming communities implement flood-resistant planting practices and land-preparation strategies that reduce their losses when flooding occurs (Biconne, 2014:143). The active involvement of local farmers in developing adaptive capacity approaches or solutions in a very participatory way was what made the information sharing initiatives work effectively among the communities (Biconne, 2014:143). Therefore, the participatory approach to the implementation of information-sharing activities in these agricultural communities in Senegal has been a useful tool in the decision-making processes that define their urban planning processes (Biconne, 2014:154).

2.4.1.4 Farming creativity and innovation sharing

Rice farming creativity and innovation are about developing new best ways of growing rice that are climate-sensitive and also ensure high rice yields. Rice farming creativity and innovation sharing involve sharing knowledge about rice farmers, the knowledge, technology, infrastructure and cultures they have created or learned, who they work with, and what new ideas they are experimenting with when it comes to improved rice farming practices (Biconne, 2014:154). This approach represents a major change in the way that the production of rice farming knowledge is viewed and thus supported (Ajani, 2014:48).

2.4.1.5 Rice harvesting, processing and marketing

Rice farmers share knowledge on various rice harvesting, processing and marketing approaches (Guo, Jia, Huang, Kumar & Burger, 2015:103). Rice harvesting is defined as the process of collecting the mature rice crop from the field (Tsinigo & Behrman, 2017:48). Paddy harvesting activities include reaping, stacking, handling, threshing, cleaning, and hauling (Tippe et al., 2017:96). Rice processing that produces white rice also removes much of the vitamins and minerals found primarily in the outer bran layers (Guo et al., 2015:106). Further processing is often done to restore the nutrients to the grain. Once complete, the rice is called converted rice (Tippe et al., 2017:96). Rice farmers, therefore, share knowledge on various tools, types of machineries and techniques for harvesting and processing rice for the market (Guo et al., 2015:106).

2.4.1.6 Weed management knowledge

Rice farmers also share knowledge of the mechanisms and processes for controlling weeds in their rice farms. Weed control or management involves the botanical aspect of pest control, which focuses on stopping weeds on the farm (Prins et al., 2015:12). Weed management knowledge helps rice farmers stopping injurious weeds on the farm from competing with the crops for nutrients in the soil (Andre et al., 2017:888). Rice farmers share knowledge on the various ways of weed management such as hand cultivation with hoes, powered cultivation with cultivators, smothering with mulch, lethal wilting with high heat, burning, and chemical attack with herbicides (weed killers) (Prins et al., 2015:12).

2.4.2 Knowledge sharing practices in rice farming

This subsection discusses knowledge sharing practices in general and among rice farmers in particular. Within the context of rice farming, knowledge sharing practices constitute the various means or behaviours that rice farmers engage in to share knowledge or knowledge among themselves (Andre et al., 2017:889). Knowledge sharing practices discussed here are after-action review, job shadowing, mentoring, coaching system, job rotation, peer assist, communities of practice, storytelling, brainstorming, discussion forum, apprenticeship, personalization/face-to-face meeting and documentation.

2.4.2.1 After Action Review/lessons learnt

The lessons learned process is a vital component of knowledge sharing practices. This is the process where new knowledge or the new things learned are identified through a series of activities and reviews and then incorporated into future work practices (Chhim, Somers & Chinnam, 2017:744). Within the context of rice farming, therefore, the lesson learnt or the after-action review would be that rice farmers would identify and share new knowledge by reviewing their activities and then incorporating the new knowledge into their future rice farming practices. Lessons learnt to seem a very simple concept, yet provide important feedback into the effectiveness of training programmes or sessions (Rosenberry & Vicker, 2017:21). Lessons learnt practice would ensure that training programmes organised for rice farmers become critically reviewed to distil and share the core knowledge in the training programmes or session. Thus, after organisations invest heavily in training rice farmers, their expectations are not met in terms of the knowledge coming into the lessons learned database that would be incorporated into future work practices. This suggests that in knowledge sharing practices lessons learnt are what allow rice farmers to incorporate the new knowledge into their future rice farming practices to increase rice productivity (Bozzato et al., 2018:78).

2.4.2.2 Job shadowing

Job shadowing is also another knowledge-sharing practice. Job shadowing is defined as a knowledge-sharing practice where a new employee is assigned to an experienced worker for understudying them (Hislop et al., 2018:46). Job shadowing is an effective form of job training for certain jobs. Within the context of rice farming, job shadowing allows less experienced rice farmers to gain comprehensive knowledge from more experienced rice farmers. Job shadowing, therefore, helps both less experienced and more experienced rice farmers to learn and exchange ideas. It helps in networking among rice farmers, exploring opportunities, giving and receiving feedback, and also collaborating with different aspects of rice farming (Michalik, 2017:285).

2.4.2.3 Mentoring

Mentoring is also one of the important knowledge-sharing practices. In general terms, mentoring is defined as a system of semi-structured forms of guidance in which an individual share his or her skills, knowledge and experience to assist another individual to progress in his or her career (Garcia et al., 2018:287). The experienced individual is referred to as the 'mentor' and the less experienced individual is referred to as the 'mentee' or 'protegee' (Guo et al., 2015:106).

Within the context of knowledge sharing in rice farming, mentoring allows access to knowledge, especially for new rice farmers from old rice farmers. For mentoring to be effective in sharing knowledge among rice farmers, old rice farmers (who are mentors) need to be readily available, accessible and prepared to share their knowledge to assist the new rice farmers (who are mentees) to gain the relevant knowledge to improve on their rice farming activities and practices. This means that the old rice farmers willingly share their knowledge, skills, technical know-how, experience and best practices to train new rice farmers (Hislop et al., 2018:43). The new rice farmers, on the other hand, must be humble and ready to learn from the mentor for the mentoring process to become successful (Hameed et al., 2018:34).

2.4.2.4 Coaching system

Within the context of knowledge sharing in rice farming, coaching involves a rice farmer learning by working alongside an experienced rice farmer who knows when and how to intervene and share tacit rice farming knowledge (Akram & Bokhari, 2011:48). Biconne (2014:128) explains that coaching systems differ from mentoring in the sense that coaching is focused on a specific task or skill, whereas mentoring is a more general and all-encompassing relationship between mentee and mentor. In this sense, coaching aims specifically to develop new skills such as, for instance, pest control in rice farming, rice farmland management, rice harvesting or rice marketing. Thus, instead of focusing on rice farming broadly, coaching focuses on a specific aspect of rice farming (Kamarudin et al., 2015:117).

2.4.2.5 Job rotation

Job rotation also constitutes one of the important knowledge sharing practices. In the general sense, job rotation is defined as the technique that is used within the workplace to rotate the workers' assigned jobs throughout their working tenure. Within the context of rice farming, job rotation could be done through assigning rice farmers to different components of the rice farming chain. For instance, a rice farmer can be assigned to land preparation and management, rice planting, pest control, rice harvesting, etc. at different times for their training. Job rotation is usually designed to promote flexibility and to keep rice farmers learning the different components of the rice production in detail, one point at a time (Gava, Favilli, Bartolini & Brunori, 2017:108). There is also research that shows how job rotations help relieve the stress among workers who work in a job that requires manual labour, such as rice farming (Hislop et al., 2018:46). Job rotation, therefore, encourages knowledge sharing by making rice farmers versatile, gain a broader understanding and receive knowledge from other experienced rice farmers.

2.4.2.6 Peer assist

Peer assist also forms an important knowledge-sharing practice. Peer assist is defined as the process for bringing knowledge into a project, or piece of work at the outset

(Karagoz, Korthaus & Augar, 2016:8). Within the context of rice farming, peer assist involves rice farmers' meetings, where they invite colleague rice farmers with relevant knowledge and experience in rice farming to share critical insights into the different aspects of rice farming. Peer assist was considered to be arguably one of the easiest and most effective ways of bringing knowledge to the point of need (Lave & Wenger, 1991:45). A peer assist meeting may take anything from a few hours to a few days, depending on the scale of the subject matters around rice farming that they want to discuss (Karagoz et al., 2016:8).

2.4.2.7 Communities of practice

In its general sense, communities of practice (CoP) are defined as a group of individuals or people who share a profession or craft (Boateng & Agyemang, 2016:218). More specifically, communities of practice theorize the complex relations between newcomers and old-timers in a profession about how they negotiate identities, activities, knowledge and practice (Cadger, Quaicoo, Dawoe & Isaac, 2016:33). Within the context of rice farming, all smallholder rice farmers in a particular community or village constitute a community of practice. Lave and Wenger (1991:4) indicate that new rice farmers participate in communities of practice on the periphery and then move gradually towards full participation. Communities of practice, therefore, give new rice farmers access to knowledge that build the competence of new rice farmers in rice farming and production (Chen, Shanthikumar & Shen, 2015:1435).

2.4.2.8 Storytelling

Storytelling is the skilled delivery of stories used to present anecdotal evidence, clarify a point, support a point of view and crystallize ideas (Garcia et al., 2018:293). Within the context of knowledge sharing among rice farmers, storytelling can be used to share knowledge by creating spaces for rice farmers to share their personal experiences in rice farming among themselves through stories. Stories use verbal pictures to spark interest, add variety, and change the pace of a discussion (Dzandu, Boateng & Tang, 2014:352). Therefore, the rice farmers, in sharing their stories, can use both verbal means and

pictures to be able to communicate their ideas and knowledge effectively to the other rice farmers.

2.4.2.9 Brainstorming

Brainstorming is argued to be one of the key strategies of knowledge sharing that allows effective use and transfer of knowledge. Brainstorming is often regarded as a group creativity technique through which efforts from individuals are directed towards finding a conclusion for a problem (Kamarudin et al., 2015:117). In brainstorming for sharing knowledge among rice farmers, a group of rice farmers meet to generate new ideas and solutions to their most pressing problems. With brainstorming, the rice farmers can think freely and come up with spontaneous ideas, which are all welcome and noted down for evaluation. Within the context of rice farming, knowledge can be shared through brainstorming to find solutions to collective problems associated with rice farming (Hislop et al., 2018:36).

2.4.2.10 Discussion forum

In recent years, discussion forums and chats have become an important knowledge-sharing practice. They are an in-person or electronic forum for the staff or like-minded individuals to exchange ideas, post questions, offer answers or offer help on relevant subjects (Garcia et al., 2018:287). Within the context of rice farming, discussion forum provides platforms for rice farmers to share knowledge by posting questions and responding to others' questions on a common platform set up for exchanging ideas. The rice farmers can post questions about issues they want to understand in rice farming, and others would respond with different possible ideas or solutions. Through such a discussion forum, knowledge is shared among rice farmers.

2.4.2.11 Apprenticeship

Apprenticeship programmes are designed for sharing tacit knowledge amongst experienced and inexperienced team members (Rosenberry & Vicker, 2017:21). In traditional apprenticeship training within the context of rice farming more experienced rice

farmers help inexperienced rice farmers by letting the less experienced rice farmers observe the process and practices of improved rice farming, then assisting the learner rice farmers to apply these on their rice farms, sometimes under supervision (Garcia et al., 2018:287). During apprenticeship activities, experienced rice farmers share their tacit knowledge with their inexperienced rice farmers so that tacit knowledge of rice farming practices is preserved (Chhim, Somers & Chinnam, 2017:744). Apprenticeship allows new entrant rice farmers to acquire tacit knowledge and gradually take ownership of their rice farms (Rosenberry & Vicker, 2017:28).

2.4.2.12 Personalization/face-to-face meetings

Personalization strategy or face-to-face meetings involve sharing tacit knowledge through direct contact with the person in possession of this knowledge (Bozzato et al., 2018:78). In the context of rice farmers, the personalization strategy commonly entails acquiring tacit knowledge that cannot be codified and stored in a database (Michalik, 2017:285). Face-to-face meetings are argued to be highly useful ways of sharing tacit knowledge among smallholder rice farmers (Bozzato et al., 2018:78). This was because face-to-face meetings allow immediate feedback that facilitates understanding and accurate interpretation by all the rice farmers involved (Rosenberry & Vicker, 2017:21).

2.4.2.13 Documentation

Working teams or individual workers can also adopt a codification and personalisation strategy to knowledge sharing (Bozzato et al., 2018:81). The codification strategy focuses on codifying and storing explicit knowledge in databases so that it can be accessed and used by other members of the working team (Michalik, 2017:285). In the context of rice farmers, experienced rice farmers can be made to document, in detail, all processes and practices undertaken, for instance, in a given rice farming season, to provide access to explicit knowledge. These experienced farmers would need to be compensated for such efforts. Other rice farmers can access such documents to read and apply in their rice farms and, through that, knowledge is shared among the rice farmers.

2.4.3 Technologies used for knowledge sharing among rice farmers

This subsection presents discussions on related literature regarding technologies used for rice farming, as well as technological use for knowledge sharing in rice farming in particular, and within agriculture in general. Understanding the technologies used in agriculture in general and rice farming, in particular, provides a good context for understanding how technology is used in knowledge sharing among farmers in general and rice farmers in particular. The knowledge-sharing tools and technologies are discussed first, followed by knowledge sharing systems.

In the face of increasing technological advancement, there have emerged attendant advancement in the technologies used within the agricultural sector in general and rice farming in particular. Agricultural technologies are defined basically as Agric-productivity-enhancing technologies that bring efficiency in farming processes and lead to higher yields in productivity in climate-free ways (Otsuka, 2019:36). Productivity-enhancing technologies are increasingly being promoted as a bundle of technologies to be adopted as one potential bundle or subset of bundles from which smallholder farmers could choose (Nagothu, Bloem & Borrell, 2018:6). Some of the newly emerged agricultural technologies include soil and water sensors, weather tracking technologies, satellite imaging, pervasive automation, minichromosomal technology and vertical farming.

Soil and water sensors, for instance, are used in detecting moisture content and nitrogen levels to determine when to water and apply fertilizer (Yan, Shi, Ye, Zhou & Shi, 2015:68). Soil and water sensors lead to efficient use of resources and therefore lowered costs, but also help the farm be more environmentally friendly by conserving water, limiting erosion and reducing fertilizer levels in local rivers and lakes (Otsuka, 2019:38). Weather tracking technology uses computerized weather modelling to help rice farmers detect advanced notice of weather changes and take precautionary measures to protect crops and mitigate losses (Eberhardt & Vollrath, 2018:485).

Rice farmers can access the weather tracking technological app on dedicated onboard and handheld farm technology but also via mobile apps that run on just about any

consumer smartphone (Nagothu, Bloem & Borrell, 2018:9). The remote satellite imaging technology also helps rice farmers and other farmers in general view real-time crop imagery (Otte, Bernardo, Phinney, Davidsson & Tivana, 2018:288). With this technology, rice farmers can, for instance, examine crops as if they were standing there without actually standing there (Yan et al., 2015:69). The satellite imaging technology can be integrated with the crop, soil and water sensors so that the farmers can receive notifications along with appropriate satellite images when danger thresholds are met (Otte et al., 2018:290). Vertical farming technology is the practice of producing food in vertically stacked layers (Otsuka, 2019:39). This offers many advantages to rice farmers such as the ability to grow rice within urban environments and thus have fresher foods available faster and at lower costs (Yan et al., 2015:69). Rice farmers in all areas can also use it to make better use of available land and to grow crops that wouldn't normally be viable in those locations (Eberhardt & Vollrath, 2018:489).

Fundamentally, technology is transforming nearly every aspect of agriculture, and rice farming is no exception. Agriculture technology will become ever more computerized in the decades ahead. For instance, there have been advances in technologies used in agriculture, including but not limited to agricultural biotechnology, technology-based irrigation systems, improved fertilizer application technologies and weed management technologies that bring efficiency in farming and sustainable protection of land and climatic conditions (Nagothu et al., 2018:11). Agricultural technologies ensure that there is less chemical leaching to groundwaters, less soil erosion, lower water requirements and higher agricultural yields (Eberhardt & Vollrath, 2018:485). In Ghana, for example, the Government of Ghana is vigorously pursuing rice productivity-enhancing technologies for rice production. One of the technologies in this regard is the improved rice variety technology (i.e. NERICA), which acts as a complementary input with established optimum fertilizer requirement levels, weed management regime, and planting density for farmers to adopt (Tsinigo & Behrman, 2017:48).

2.4.3.1 Knowledge sharing technological tools

Knowledge sharing technological tools discussed here are the internet, SharePoint/intranet, e-mail, skype, blogs, social media, instant messaging and video conferencing.

2.4.3.1.1 The internet

The internet is one of the tools that can be used to aid knowledge sharing among rice farmers. It is defined as the global system of interconnected computer networks which uses internet protocol suite in linking devices globally or worldwide (Garcia, Galeon & Palaoag, 2018:282). The internet is seen as a network of networks consisting of public, private, academic, business and governmental networks from local to global scope, which is linked by varieties of electronic, wireless and optical networking technologies (Hislop et al., 2018:36). Varieties of knowledge or knowledge are carried via internet resources and services (Chen et al., 2015:1439). These resources and services include interlinked hypertext documents, application of the World Wide Web (www), electronic mail and file sharing (Garcia et al., 2018:293).

Within the context of knowledge sharing among rice farmers, the internet helps to redefine, reshape and bypass most traditional communication media such as television, radio, telephone, newspapers and paper mails used for disseminating knowledge to farmers. The internet thus provides faster and more efficient knowledge sharing services to rice farmers, including the email, online television, online radio, online telephony, digital newspapers and online video streaming (Kamarudin, Aziz, Zaini & Ariff, 2015:114). For these reasons, the internet accelerates learning and knowledge sharing between and among rice farmers.

2.4.3.1.2 Sharepoint/Intranet

SharePoint or intranet is defined as a web-based collaborative platform that integrates Microsoft Office tools into technological tools to facilitate knowledge sharing and transfer (Karagoz, Korthaus & Augar, 2016:12). SharePoint is a web-based collaborative platform

that integrates with Microsoft Office. The intranet has some elements including sites (for targeting rice farmers), communities (that can allow rice farmers to engage in group communications) and content (that can allow for managing rice farming knowledge content) and products (Karagoz et al., 2016:34)

2.4.3.1.3 E-mail

Electronic mailing (e-mail for short) is defined as a technological method of sharing digital knowledge or messages via the internet or other computer networks (Garcia et al., 2018:297). In terms of knowledge sharing among rice farmers, e-mails are an important collaboration tool and channel for communicating knowledge amongst rice farmers (Kamarudin et al., 2015:114). The process of sending and receiving e-mails to and from colleague rice farmers results in the sharing of knowledge among themselves. E-mails are an effective means of sharing knowledge because the knowledge, knowledge or tips contained in e-mails can be accessed and reused by rice farmers whenever the need arises (Chen et al., 2015:1437). Garcia et al. (2018:293), for instance, indicates that archiving personal e-mails result in a repository of e-mail conversations, which can be useful for rice farmers for the purposes of managing and sharing knowledge.

2.4.3.1.4 Skype

Skype is a telecommunication application software that provides a platform for video chat and voice calls between technology-mediated communication devices such as computers, mobile devices, tablets, console and smartwatches via the internet (Ting-Toomey & Dorjee, 2018:26). For rice farmers, Skype can provide instant messaging services where rice farmers can send and received both text and video messages, including the exchange or sharing of digital documents that contain knowledge on rice farming (Rosenberry & Vicker, 2017:7). Skype also permits video conference calls where rice farmers can be connected to a single call simultaneously to discuss rice farming issues (Balaji, Meera & Dixit, 2007:8). For these reasons, Skype constitutes a technological or digital platform that can enhance knowledge sharing among rice farmers.

2.4.3.1.5 Blog

A blog is a shorthand version of a weblog (Holten et al., 2016:212). A blog is a discussion platform or an informational website that consists of discrete and often informal personal text entries called posts (Taskin & Van Bunnem, 2015:169). In terms of knowledge sharing, blogs offer technologically advanced means of writing stories or knowledge where rice farmers can go to access knowledge on rice farming (Rosenberry & Vicker, 2017:12). Rice farmers can create 'multi-author blogs' (MABs), where posts are written by a large number of rice farmers, covering varieties of topics on rice farming. The posts can be peer-reviewed and professionally edited before posting to ensure that relevant knowledge only is posted there for sharing (Chhim et al., 2017:713).

2.4.3.1.6 Social media

For sharing knowledge among rice farmers, social media represent the most revolutionized technology-mediated form of mass communication or mass media to aid knowledge sharing (Rosenberry & Vicker, 2017:23). Further, social media is defined as interactive computer-mediated technology that facilitates the creation and sharing of ideas, knowledge and other forms of expression of interests via virtual communities and networks (Taskin & Van Bunnem, 2015:172). Examples of social media platforms include WhatsApp, Facebook, LinkedIn, Twitter, Imo, Telegram, Instagram, Snapchat, Facetime, Skype, YouTube, Messenger, Viber and MySpace. In a way, these social media platforms provide interactive features where individuals and groups meet to discuss and share ideas. Due to the interactive nature of social media, they can play a critical role in knowledge sharing among rice farmers. For example, various training programmes and workshops on rice farming can be delivered through social media to rice farmers across different geographic locations (Ting-Toomey & Dorjee, 2018:21).

2.4.3.1.7 Instant messaging

Instant messaging is also one of the most frequently used means of sharing knowledge. Holten et al. (2016:215) and Michalik (2017:289) intimate that an instant messaging system is designed for the primary purpose of enabling real-time text-based

communication. For rice farmers, instant messaging can facilitate conversations and interactions in which the rice farmers can take turns as sender and receiver of messages during their knowledge sharing. Instant messaging therefore can connect both virtual and non-virtual rice farmer groups and create communication patterns that can positively affect knowledge sharing by facilitating the search for solutions or knowledge among the farmers (Ting-Toomey & Dorjee, 2018:21).

2.4.3.1.8 Video conferencing

Technological advancement has offered the opportunity to hold virtual conferences involving different participants from different geographical locations. This is referred to as video conferencing. Video conferencing is therefore defined as a technologically-mediated platform that provides broadcast of video and audio simultaneously to different users by means of digital communication tools (Holten et al., 2016:215). Video conferencing systems consist of various components that can be used by rice farmers to enhance their knowledge sharing. The components include endpoint (e.g. computer), infrastructure (e.g. server which controls multipoint video conferencing sessions), peripheral equipment for the endpoint (e.g. microphones, cameras, etc.) and additional infrastructure expansion (e.g. instant messaging, telephony, recording and streaming) (Ting-Toomey & Dorjee, 2018:21). Video conferencing can help rice farmers in knowledge sharing in the form of virtual training and workshops.

2.4.3.2 Knowledge sharing systems

This sub-section discusses knowledge sharing systems as components of tools and technologies for knowledge sharing. The knowledge-sharing systems discussed here included expertise locator systems, knowledge repositories, best practice databases, lessons learnt databases and incident report databases.

2.4.3.2.1 Expertise locator systems

In rice production, expertise location is well-positioned to provide rice farmers with crucial support they need in achieving their knowledge sharing and knowledge management

goals (Dzandu, Boateng & Tang, 2014:349). Expertise location is defined as the efficient processes involved in identifying human expertise, determining the status of critical resources and integrating the expertise within the organisational interaction processes (Hameed, Basheer, Iqbal, Anwar & Ahmad, 2018:32). In the context of rice farming, expertise location can be used for the maintenance of in-depth representations of skills, geographic positioning, availability and other indicators which are fundamental to the use of the expertise (Guo, Jia, Huang, Kumar & Burger, 2015:104).

Expertise location has become more relevant because of the need to generate and accumulate high intellectual capital for rice farmers (Dzandu et al., 2014:352). It has become the fundamental way of matching expertise and talents within communities of practice, such as rice farmers. An expertise location system helps in the process of connecting to the right rice farmers with the right knowledge at the right time (Dzandu et al., 2014:352). Expertise location includes activities such as the facilitation of mentoring programmes, the identification of knowledge gaps and the provision of both performance support and follow-up to formal training activities, all of which can enhance knowledge sharing among rice farmers (Hameed et al., 2018:42).

2.4.3.2.2 Knowledge repositories

Within the context of rice farming, knowledge repositories can become the means for retaining and sharing knowledge-based knowledge that is critical for rice farmers (Taskin & Van Bunnem, 2015:161). Knowledge repositories can allow rice farmers to connect individuals with knowledge and expertise globally through online platforms such as online discussion fora, online libraries and others (Chhim et al., 2017:749). Knowledge repositories can also provide rice farmers with a central location where people can digitally collect, contribute and share vital learning resources within both traditional and non-traditional work or learning environments (Bozzato et al., 2018:77). They serve as both a critical vehicle a just-in-time learning and enabling post-training support and assessment for rice farmers (Taskin & Van Bunnem, 2015:165).

2.4.3.2.3 Best practice databases

Best practice databases can help rice farmers create a database to accumulate all indicators of best rice farming practices. Best practices are defined as benchmarks of excellence in terms of techniques and methods that are vetted through experience and research and are proved to reliably lead to desired results in rice production (Holten, Hancock, Persson, Hansen & Høgh, 2016:218). Best practices are fit well for the knowledge rice farming context because the farmers get to define indicators and thresholds of best rice farming practices (Cheney & Lee Ashcraft, 2007:145). Having a best practices database, therefore, can help rice farmers to be able to keep track of how their lessons learnt to translate into best practices to increase efficiency and productivity in rice farming (Taskin & Van Bunnan, 2015:164).

2.4.3.2.4 Lessons learned databases

Lessons learned databases are one of the best and most effective ways of sharing valuable explicit knowledge (Taskin & Van Bunnan, 2015:164). In terms of rice farming, lessons learned databases are defined as knowledge sharing systems or databases that contain knowledge gained from previous rice farming experience (Taskin & Van Bunnan, 2015:159). These previous experiences or lessons learned include knowledge of how colleagues have approached similar problems in rice farming in the past, and knowledge about efficient and effective methods that experienced rice farmers use to carry out their work (Holten et al., 2016:212). They involve sharing knowledge about what went well, what could be improved and how issues can be addressed before a task is carried out again. Thus, lessons learned databases are an effective technology for capturing knowledge in the form of lessons learned and making it available in a central location, where all rice farmers can have access to it (Holten et al., 2016:212).

2.4.3.2.5 Incident report database

Chhim et al. (2017:750) and Bozzato et al. (2018:79) all define an incident report database as a database that contains explicit knowledge of incidents that have occurred. In rice farming, an incident report database can help the rice farmers to document how they

respond to incidents in their daily operations, and document what happened during the incident in the form of a report. This knowledge of incidents is often shared with other rice farmers through an incident report database (Taskin & Van Bunnem, 2015:161).

2.4.4 Benefits of knowledge sharing practices among rice farmers

Various studies have been undertaken on knowledge sharing to understand the process and benefits of it in an organisation's set-up. Elum (2019) is of the view that knowledge sharing is recognized as one of the biggest success factors for digital organisations. A glance at the big five, namely, Google, Apple, Facebook, Amazon and Microsoft, gives enough evidence and also convinces us that knowledge sharing is practicable, and it's happening now. This is evident in the integration of knowledge management and sharing systems that supports the flow of agriculture knowledge within the individual search engines.

This subsection discusses the benefits of that knowledge sharing practices. The benefits discussed here are: performance improvement, effective utilization of information, increased competitiveness, discouraging knowledge hoarding, encouraging learning, encouraging leadership and filling knowledge gaps.

2.4.4.1 Performance improvement

Knowledge sharing has been found to help individuals to learn more about jobs and this helps improve production (Adetimehin et al., 2018:76-83). Among different work or organisational contexts for instance, some studies have reported that knowledge sharing helps the workers to gain new experience and skills in their jobs (Feng & Xue, 2014:11; Garcia et al., 2018:32; Ortolani et al., 2015:22). Further, the need for sharing of knowledge has become more and more critical in the face of increasing competitiveness in the world of work. In this context, research is expected to produce knowledge, methods and tools to help individuals and organisations anticipate and cope with the effects of the changing nature of work. These efforts have called for greater investment in knowledge creation, knowledge access, and the wider use of knowledge and communication technologies to aid knowledge sharing (Rosenberry & Vicker, 2017:28).

2.4.4.2 Effective utilization of information

According to Adetimehin, Okunlola and Owolabi (2018) citing Obidike (2011), to increase production there needs to be an increase in access to and effective utilization of information. Therefore, knowledge sharing, which ensures access to and possible utilization of knowledge on improved productivity technologies, leads to substantial change in production, income and standard of living of the workers.

2.4.4.3 Increased competitiveness

Knowledge sharing helps individuals and organisations to be competitive. Ensuring knowledge sharing provides opportunities for innovation in the world of work, improved working practices and performance, integration and continuous improvement to ensure competitive advantage in production (Hislop et al., 2018:12). Knowledge sharing is therefore argued to be an enabler of organisational learning (North & Kumta, 2018:209).

2.4.4.4 Discourages knowledge hoarding

Knowledge sharing and knowledge hoarding have been argued to be direct opposites (North & Kumta, 2018:210). This means that among workers within organisations or work contexts where knowledge sharing thrives, knowledge hoarding does not exist (Hislop et al., 2018:12). This is because individuals willingly and freely share knowledge and ideas with their colleagues. Thus, as argued by Martinez (2000:12), encouraging knowledge sharing among work colleagues or within organisations prevents knowledge hoarding.

2.4.4.5 Encourages learning among individuals

Knowledge sharing has also been found to encourage learning among individuals. Martinez (2000:14) for instance states that learning does not happen exclusively through a push-down approach consisting of only formal activities such as lectures and classroom-based training. Indeed, in organisations, groups and associations where knowledge sharing is encouraged, individuals can learn relevant skills and experiences associated with improving their work practices (Hislop et al., 2018:15).

2.4.4.6 Encourages leadership among individuals

Knowledge sharing also encourages development of leadership skills and qualities among individuals (Martinez, 2000:14). Encouraging knowledge sharing helps workers not only help their colleagues gather information, but also knowledge sharing becomes a strategy that can be extremely powerful in fostering leadership among individuals in organisations, groups and associations (Garcia et al., 2018:34). Some scholars have therefore argued that knowledge sharing can help close the leadership gap more efficiently (Ortolani et al., 2015:24).

2.4.4.7 Fills knowledge gaps

In the current knowledge-driven global economy and work contexts, knowledge sharing also helps in filling knowledge gaps (Rosenberry & Vicker, 2017:28). In the context of work, for instance, as old employees or workers retire and new workers enter the world of work, a gap in production knowledge is created (Ortolani et al., 2015:22). Promoting a culture that encourages knowledge sharing can help fill the generational knowledge gap by ensuring that old workers share their knowledge with the new workers (Adetimehin et al., 2018:21).

2.4.5 Inhibitors of knowledge sharing for rice farmers

This subsection discusses the various factors that can inhibit knowledge sharing among rice farmers. This classification is applied in this section by discussing individual, organisational and technological inhibitors of knowledge sharing among rice farmers.

2.4.5.1 Individual-level knowledge sharing inhibitors

The individual-level inhibitors that act as barriers to knowledge sharing among rice farmers discussed here are; knowledge hoarding, mistrust, the dominance of sharing explicit over tacit knowledge, individual differences, poor communication skills and time constraints.

2.4.5.1.1 Knowledge hoarding

Knowledge hoarding is argued to be the most critical individual-level factor that inhibits knowledge sharing. Some individuals are known to keep all knowledge to themselves for their personal use. These individuals are often referred to as knowledge hoarders (Trusson, Hislop & Doherty, 2017:1541). Knowledge hoarding is therefore defined as the act of gathering and guarding knowledge for personal preservation or future use (Bilginoğlu, 2019:63). It is sometimes referred to as knowledge hoarding (Trusson et al., 2017:1543). The two terms are therefore used interchangeably in this subsection.

Within the context of rice farming, therefore, some individuals can engage in knowledge hoarding, keeping all their knowledge to themselves, a situation which inhibits knowledge sharing. Regardless of the importance of the knowledge in question, or the reason for not sharing it, the act of knowledge hoarding is argued to have a profound impact and grave consequences on rice production (Bilginoğlu, 2019:66). Knowledge hoarding can prevent rice farmers from having access to vital knowledge that could enhance efficiency in rice farming and improve rice productivity (Holten et al., 2018:219).

2.4.5.1.2 Mistrust

Holten et al. (2018:219) argue that it is virtually impossible to discuss knowledge sharing without dealing with trust issues. This is because mistrust issues are linked to knowledge hoarding (Trusson, Hislop & Doherty, 2017:1547). Rice farmers are unlikely to share their knowledge without a feeling of trust: trust that other rice farmers do not misuse their knowledge or trust that knowledge is accurate and credible due to the knowledge source (Bilginoğlu, 2019:66). Research shows that there are high levels of mistrust among co-workers (Holten et al., 2018:219). Some studies even report that as high as 25 – 30% of people do not trust their co-workers or their employers (Bilginoğlu, 2019:66). Therefore, when mistrust is high, rice farmers become hesitant to share information, thereby holding on to knowledge instead of sharing it with colleague rice farmers.

2.4.5.1.3 Dominance of sharing explicit over tacit knowledge

Another inhibitor or barrier to knowledge sharing, in general, is the dominance of sharing explicit knowledge over tacit knowledge (Trusson et al., 2017:1548). Holten et al. (2018:219) argue that knowledge sharing is complicated by the nature of the two types of knowledge and the fact that explicit knowledge tends to be easier to transfer than tacit. Many people believe that if they produce a report (explicit knowledge) detailing how to complete a task, their colleagues or other team members should be able to find all of their knowledge about that task in their report (Bilginođlu, 2019:68; Trusson et al., 2017:1548). However, this inhibiting factor is found to be more dominant in organisations rather than farmer groups in developing countries. The reason is that, because the educational level of farmers in many developing countries is low, reporting on production among farmers is not common. Among smallholder rice farmers this issue has not been well explored. Nonetheless, that can still inhibit knowledge sharing.

2.4.5.1.4 Individual differences

Individual differences among rice farmers can also influence knowledge sharing practices among individuals in an organisation. Agyemang, Boateng and Dzandu (2017:485) have reported in Ghana that individual differences such as intellectual stimulation, idealized influence (where leaders act in ways that make them role models) and individualized consideration (where leaders attend to the needs of individual followers) have a significant impact on knowledge sharing practices among industry workers. Agyeman, Dzandu, Boateng and Tang (2016:352) have also reported among university students that having high self-esteem and positive attitudes towards knowledge sharing promote knowledge sharing among the students. In the context of rice farmers, individual differences such as negative attitudes towards knowledge sharing, low self-esteem and low need for group influence can inhibit knowledge sharing among rice farmers.

2.4.5.1.5 Poor communication skills

Communication skill is essential in today's world of work. The ability to communicate effectively is seen as an essential skill that enhances knowledge flow (Michalik, 2017:285). Within the context of knowledge sharing among rice farmers, effective and efficient communication skills facilitate the sharing of accurate information, prevent distortions and limit misinformation or misrepresentations (Michalik, 2017:284). Poor communication skills can, therefore, prevent individual rice farmers from sharing knowledge or knowledge with their colleague rice farmers. In the cases where knowledge is shared among rice farmers, poor communication skills can lead to distortions, misrepresentations and miscommunication of the knowledge (Cheney & Lee Ashcraft, 2007:148).

2.4.5.1.6 Low motivation to share knowledge

Motivation is an important factor affecting knowledge sharing behaviours and practices in general (Agyeman et al., 2016:351). Therefore, when the motivation to share knowledge is low among rice farmers, it is expected that knowledge sharing will be inhibited in significant ways. Akram and Bokhari (2011:44), drawing on Maslow's hierarchy of needs theory, argue that when individuals are struggling with basic needs motivation for sharing knowledge with others is low. Within the context of rice farming, therefore, most smallholder rice farmers engage in rice farming for survival and livelihoods. For this reason, they might experience low motivation to share knowledge, and that can be a very significant inhibitor of knowledge sharing among the rice farmers.

2.4.5.1.7 Time constraints

Another individual level barrier to knowledge sharing is time constraints (Holten et al., 2018:219). Among rice farmers, time constraints can manifest as sheer lack of time to share knowledge, and time to identify colleague rice farmers in need of specific knowledge (Trusson et al., 2017:1543). Time constraints can also explain some of the reasons some rice farmers may potentially hoard their knowledge rather than spend time

sharing knowledge with others (Holten et al., 2018:221). For this reason, the time to share knowledge can be seen as a cost factor, either in transferring it from one person to the next or from a tacit into an explicit format (Feng & Xue, 2014:11).

2.4.5.2 Organisational level knowledge sharing inhibitors

The organisational level inhibitors of knowledge sharing among rice farmers discussed in this subsection include financial constraints, lack of leadership and managerial support, the hierarchy of work and organisational culture.

2.4.5.2.1 Financial constraints

Financial constraints are a key knowledge-sharing barrier. However, Yeşil and Hırlak (2019:16) state that strong financial commitments are necessary to enhance knowledge sharing. Given that rice farmers are mostly stressed financially, financial constraints become an integral barrier to knowledge sharing among them (Ganguly, Chatterjee & Talukdar, 2019:273). In many cases, technological infrastructures needed for knowledge sharing can be very expensive and therefore rice farmers or rice farmer associations may not be able to afford them. Therefore, a lack of funds dedicated to the costs of knowledge sharing systems is a major financial barrier to knowledge sharing (Ajani, 2014: 44).

2.4.5.2.2 Lack of leadership and managerial direction

Yeşil and Hırlak (2019:23), state that a lack of managerial direction and leadership can limit knowledge sharing practices. This is also true among rice farmer cooperatives or groups. According to Ganguly, Chatterjee and Talukdar (2019:282), the leadership of rice farmer associations must get involved by providing support and taking the necessary steps towards effective knowledge sharing. They are responsible for building a knowledge sharing culture to encourage knowledge sharing among the rice farmers. Therefore, the challenge to leaders of rice farmer groups is to create an environment in which rice farmers both want to share what they know and make use of what others know, instead of hoarding knowledge (Quereschi et al., 2017:1578).

2.4.5.3 Technological inhibitors to knowledge sharing

This section discusses the technological factors that inhibit knowledge sharing practices among rice farmers. Technology has also been linked to knowledge sharing among farmers in general and rice farmers in particular. There is ample evidence to show that knowledge sharing among farmers is further made difficult in the absence of appropriate technology-mediated means (Ortolani et al., 2017:26). Garcia, Galeon and Palaoag (2018:32) also reported that a series of studies conducted among smallholder farmers indicated that great worth of agricultural knowledge is shared via short messaging services (SMS), especially among farmers in high-income countries. There are no other technological-mediated means that were used by the farmers, a situation that was identified to hamper their knowledge sharing.

2.4.6 Enablers of knowledge sharing for rice farmers

This subsection discusses factors that enable efficient knowledge sharing among rice farmers in particular and farmers in general. Several factors have been identified to enable knowledge sharing. These factors include individual-level factors, organisational factors and technological factors (Cadger et al., 2016:42). Each of these factors is discussed below.

2.4.6.1 Individual enablers of knowledge sharing

The individual factors that enable knowledge sharing include self-efficacy, effective communication skills, personal relationships and interpersonal trust, and motivation to share.

2.4.6.1.1 Self-efficacy

Self-efficacy is defined as the individuals' trust in their abilities to effectively and efficiently engage in an activity (Cadger et al., 2016:42). There have been some empirical studies to the effect that as rice farmers believe in their abilities to share knowledge, their tendency to share knowledge with their colleague's increases (Ortolani et al., 2017:26).

Gava, Favilli, Bartolini and Brunori (2017:103) show how important individuals' ability to access knowledge resources is in influencing knowledge sharing. In a study that examined knowledge retrieval and knowledge sharing within the context of farm biogas innovation system adoption among farmers in Italy, Gava et al., (2017:107) observed that self-accessible resources were major providers of knowledge among the farmers. This suggests that empowering rice farmers' capacity to access knowledge also influences their knowledge sharing practices.

2.4.6.1.2 Effective communication skills

Over the years, research into communication processes has identified some vital elements of effective and efficient communication skills that aid knowledge sharing. These vital elements are collectively classified as communication skills (Ting-Toomey & Dorjee, 2018:22). These communication skills include active listening, nonverbal communication skills, emotional intelligence or empathy, clarity and concision, friendliness, confidence, respect, open-mindedness, feedback and right medium (Cheney & Lee Ashcraft, 2007:153). Each of these elements has the peculiar roles it plays in bringing about efficient and effective knowledge sharing. This means that when rice farmers develop effective communication skills their knowledge sharing behaviours also improve.

Active listening among rice farmers also encourages the knowledge sharer to feel important and appreciated (Rosenberry & Vicker, 2017:81). Empathy on the part of rice farmers ensures as well that, even in disagreements, each person's point of view is considered and respected (Rosenberry & Vicker, 2017:55). Empathy, therefore, encourages respect for ideas and opinions of others in interaction (Ting-Toomey & Dorjee, 2018:31). Open-mindedness among rice farmers also ensures that people become open to new ideas and incorporate them into their knowledge systems when they find it worthy or capable of improving their lives (Rosenberry & Vicker, 2017:71). Friendliness promotes interpersonal trust among rice farmers and therefore increases the willingness to share knowledge (Ting-Toomey & Dorjee, 2018:22). Confidence also promotes the willingness to share knowledge by preventing knowledge hoarding due to

hunger for power (Ting-Toomey & Dorjee, 2018:42). Each of these communication skills becomes ways of promoting knowledge sharing among rice farmers.

2.4.6.1.3 Personal relationships and interpersonal trust

The quality of personal relationships among rice farmers influences their knowledge-sharing strategies. For instance, Ortolani, Bocci, Bàrberi, Howlett and Chable (2017:22) have reported that farmers are found to share knowledge with other farmers if they personally trust the knowledge and are ready to work with it. There are others who also perceive the knowledge they have as power over others and therefore for fear of losing power they decide not to share the knowledge (Yadav, Yaduraju, Balaji, & Prabhakar, 2015:8).

Chen, Shanthikumar and Shen (2015:1430) also show that encouraging personal relationships is fundamental to promoting both knowledge sharing and knowledge learning among rice farmers. They conducted a systematic synthesis of the empirical evidence regarding the incentives for peer-to-peer knowledge sharing among farmers in low- and middle-income countries. Chen et al. (2015:1433) observed that knowledge sharing is improved in contexts where personal and interpersonal relationships are encouraged and supported among farmers.

Siziba et al., (2012:18) have reported that frequent interaction among rice farmers facilitates knowledge sharing. They conducted a study among a group of 70 smallholder farmers within the farming area of Makoni district in Zimbabwe. The study examined knowledge sharing within the context of improving knowledge on integrated soil fertility management, in the context of field-based learning alliances. The findings showed that frequent interaction between the farmers and other farmers increased the rate at which new information was shared. Gava, Favilli, Bartolini and Brunori (2017:105) have also reported similar findings among smallholder farmers in Italy. They observed that farmers share knowledge easily and frequently when there was frequent interaction between them compared to when they do not interact often.

2.4.6.1.4 Motivation to share knowledge

Motivation is an important factor affecting knowledge sharing behaviours and among rice farmers. Akram and Bokhari (2011:44) developed an integrated model that explains the role that motivation plays in the link between knowledge sharing behaviour. Drawing on Maslow's hierarchy of needs, they posited that motivation acts as an intermediate or intervening variable, explaining the mechanisms through which knowledge sharing impacts on productivity. They reasoned that knowledge sharing behaviours increase productivity only when the motivation to share knowledge is high and vice-versa (Akram & Bokhari, 2011:47). This suggests that there was a need to increase motivation to share knowledge among rice farmers in order to enable knowledge sharing among them. It is worth mentioning that there is limited empirical evidence that provides evidence-based support to this integrated model. However, theoretically, motivation plays a significant role in knowledge sharing behaviour among individuals.

2.4.6.2 Organisational enablers of knowledge sharing among rice farmers

The organisational factors discussed in this section are reward systems, leadership and management support, social networking, participation and democratic involvement and learning communities.

2.4.6.2.1 Reward systems

It is a well-acknowledged fact that motivation by rewards increases positive behaviours. The same thing applies to knowledge sharing among rice farmers. Phung et al. (2016:77) state that team members need to be motivated by rewards in order to share knowledge; if not, knowledge sharing activities could be unsuccessful due to a lack of transparent rewards and recognition systems. Creating a reward system among rice farmers for knowledge sharing is a common solution for encouraging their participation in knowledge-sharing activities (Zheng et al., 2012:703). The motivation or willingness of rice farmers to participate in knowledge sharing can be influenced through special rewards and incentive systems acting as extrinsic or intrinsic motivators (Trusson et al., 2017:1544). Rewards providing extrinsic motivation may be financial or material, such as providing

rice farming tools. Rewards providing intrinsic motivation may be non-financial, such as giving leadership roles to make an impact on knowledge sharing within rice farmer associations.

2.4.6.2.2 Leadership and management support

Leadership support has been identified as critical organisational factors that enable knowledge sharing among rice farmer cooperatives or associations. According to Cadger et al. (2016:35) and Kamarudin, et al. (2015:115), knowledge sharing requires full support from leadership and management. The ability of leaders of rice farming associations to influence members' willingness to share knowledge significantly improves knowledge sharing. In the same way, a lack of implementation, leadership or support from management in terms of clearly communicating the benefits and values of knowledge sharing practices may hinder effective knowledge sharing among rice farmers (Kamarudin et al., 2015:118). Hence, leadership is primarily responsible for supporting and sustaining a knowledge-sharing environment among rice farmers (Siziba et al., 2012:14).

2.4.6.2.3 Social networking

Different knowledge sharing cultural factors have been found to influence knowledge sharing. For instance, social networking has been found to be one of the important knowledge-sharing strategies among farmers. Cadger, Quaicoo, Dawoe and Isaac (2016:32) have investigated how social networking is used to enhance farmer knowledge transfer in Ghana. Data was gathered from social networks among farmers in six communities from two regions in Ghana (Ashanti and Brong Ahafo regions) using the name-generator technique (Cadger et al., 2016:35). They found that farmers who participated in multiple networks had more knowledge about farming activities and also were more willing to share knowledge with their colleagues. Male farmers tended to have larger social networks compared to female farmers.

2.4.6.2.4 Participation and democratic involvement

Participatory and democratic involvement of farmers has also been found to improve knowledge sharing among farmers. Some studies have also shown that the culture of inclusiveness and democratic participation among communities of practice encourages knowledge sharing (Tariq et al., 2015:34). This suggests that participation and democratic involvement opens up a conducive atmosphere where rice farmers can feel a sense of belonging in sharing knowledge and knowledge within and among their communities.

2.4.6.2.5 Learning communities

Learning communities have also been found to influence knowledge sharing practices among farmers. Laforge and McLachlan (2018:256) used learning communities to examine agroecological learning processes among new farmers in Canada. This was to provide an understanding of how learning communities can transform food systems. The study involved in-depth interviews of three categories of farmers: new and aspiring farmers, mentor farmers and farmer trainers (Laforge & McLachlan, 2018:258). Findings from the study showed three categories of learning; independent learning, social learning and individual learning. When it comes to the type of learning, it was found that the farmers placed a high value on social learning ahead of independent learning. Institutional learning was rated as the least preferred system of learning among the farmers (Laforge & McLachlan, 2018:260).

2.4.6.3 Technological enablers of knowledge sharing among rice farmers

Technological factors influence knowledge sharing practices among rice farmers. It is argued that with the rapid development of technology, knowledge communication technology (ICT) has had the most significant impact on knowledge management in general and knowledge sharing in particular, far more than any other factor (Bozzato, Eiter & Serafini, 2018:73). ICT is used as an umbrella term to include any communication device or application, encompassing: radio, television, cellular phones, computers and network hardware and software, satellite systems and so on. With the advent of ICT tools, the old inefficient methods of managing knowledge have been challenged (Bozzato, Eiter

& Serafini, 2018:73). Technology has also been linked to knowledge sharing among rice farmers. There is ample evidence to show that knowledge sharing among rice farmers is further made easy in the presence of technology-mediated means (Ortolani et al., 2017:26).

2.4.7 Strategies for enhancing knowledge sharing practices for farmers

This subsection discusses strategies for enhancing knowledge sharing practices among rice farmers. Knowledge sharing strategies are simply blueprints that describe how rice farmers can better manage their knowledge resources and assets for the benefit of their rice production activities (Kamarudin et al., 2015:118). Knowledge sharing strategies, therefore, show the approaches that rice farmers can follow in deciding how best to use their knowledge resources to identify performance gaps, increase efficiency and boost rice productivity (Garcia et al., 2018:32). Studies by Kamarudin et al., (2015:115), Knipot et al., (2006:175), Garcia et al., (2018:32) and Wood et al., (2014:74) provide an understanding of different strategies that can be leveraged to improve or enhance knowledge-sharing practices. These strategies include leadership and management support, use of appropriate technology, investment and financial support, building trust, integration of knowledge sharing initiatives, constant training and retraining and provision of opportunities for knowledge sharing. Each of these strategies is discussed below.

2.4.7.1 Leadership and management support

Leadership can play a vital role in enhancing knowledge sharing or sharing of knowledge among rice farmers. Leaders of rice farmer associations and cooperatives have a duty to create the necessary atmosphere that increases the willingness to share knowledge among the rice farmers. It further ensures that rice farmers become focused on the knowledge gaps that impact on their productivity. Tsinigo and Behrman (2017:48) also argue that managing performance as people management policies and processes are essential for the improvement of knowledge sharing among rice farmers.

2.4.7.2 Use of appropriate technology

Another factor which is considered critical for the success of knowledge sharing among rice farmers is the use of appropriate knowledge technology. Gold, Malhotra and Segars (2001:185-214) in considering the broader elements of enhancing knowledge sharing identified the use of appropriate technology as a critical aid to knowledge flow. There is ample evidence to show that knowledge sharing among farmers is further made easy in the presence of technology-mediated means (Ortolani et al., 2017:26). Garcia, Galeon and Palaoag (2018:32) also reported that in a series of studies conducted among smallholder farmers it was found that a great deal of agricultural knowledge is shared via short messaging services (SMS), especially among farmers in high-income countries. This evidence points to the fact that using appropriate technology is the most effective way of accelerating efficient knowledge sharing.

2.4.7.3 Investment and financial support

Another critical way of enhancing knowledge sharing is for government and leadership of rice farmer cooperatives to provide the resources needed for sharing knowledge (Tien, 2018:72). These resources can be in the form of financial resources, human resources, material resources and symbolic resources such as time (Chhim et al., 2017:753). Tsinigo and Behrman (2017:51) state that allocating quality time for sharing knowledge contributes to creating a climate that supports knowledge. Hence, it is imperative for management to support and value knowledge sharing initiatives by providing the needed resources in order to build and provide a positive knowledge sharing culture among rice farmers (Cadger et al., 2016:43).

2.4.7.4 Building trust

The element of trust has been argued to be fundamental in improving knowledge sharing among rice farmers. There is enough empirical evidence discussed above to show that mistrust encourages knowledge hoarding (Trusson et al., 2017:1547) and that interpersonal trust between workers improves motivation to share (Holten et al.,

2018:217). It is therefore essential that strategies for enhancing knowledge sharing among rice farmers include aspects of building interpersonal trust.

2.4.7.5 Integration of knowledge sharing initiatives in goals and strategies

Integration of sharing initiatives into the goals and strategies of organisations or communities of practice is another important way of enhancing knowledge sharing among rice farmers (Riege, 2005:19). One way of integrating knowledge sharing strategies in introducing knowledge sharing behaviour as a criterion for performance evaluation among rice farmers (Yeşil & Hırlak, 2019:111). This strategy has been found to work very well in commercial organisations. For instance, research shows that a lot of multi-national companies are introducing knowledge sharing in their performance evaluation indicators (Ganguly, Chatterjee & Talukdar, 2019:273). For instance, multinational companies such as KPMG, Hewlett Packard and Ernst & Young have increasingly introduced formal performance reviews stipulating that employees are expected to capture valuable knowledge, archive it, share it and use others' knowledge when they become aware of it themselves (Ganguly et al., 2019:273). This helps to institutionalize knowledge sharing into the working culture among rice farmers.

2.4.7.6 Constant training and retraining

Knowledge sharing behaviours and expertise for rice farmers to learn may require training and ongoing support. Clear guidelines seem to be an obvious prerequisite for effective knowledge sharing (Ganguly et al., 2019:273). Rice farmers cannot always be expected to share their knowledge and insights simply because it is the right thing to do (Riege, 2005:22). The challenge for leaders, therefore, is to be able to institutionalise specialized training and retraining programmes to enhance the knowledge sharing capabilities and expertise of rice farmers

2.4.7.7 Providing space and opportunities for knowledge sharing

Rice farmers generally might not feel comfortable sharing knowledge and ideas if they fear that thinking outside the box, taking risks, and being different will get them ridiculed

(Ganguly et al., 2019:273). It is therefore imperative that safe social spaces and opportunities are provided for rice farmers to feel comfortable with sharing knowledge (Chhim et al., 2017:753). For instance, if rice farmers do get the opportunities to interact often and discuss ideas freely, it helps to create an atmosphere where everybody feels safe and has opportunities to share ideas with their colleague rice farmers (Yeşil & Hırlak, 2019:122).

2.5 Empirical review on studies related to Knowledge sharing in rice farming

This section discusses related literature on knowledge sharing within the agricultural sector in general and within rice farming in particular. The discussion coheres around what other studies say about knowledge sharing in rice farming, and the technologies used for such knowledge sharing. There is a line of research that has examined the types of knowledge shared among farmers in general and rice farmers in particular. Some of these studies include Gava, Favilli, Bartolini and Brunori (2017:105); Kipnot et al. (2006:176); Meijer, Catacutan, Ajayi, Sileshi and Nieuwenhuis (2015:175) and Siziba et al. (2012:46). These groups of studies, even though very few, have focused on the types of knowledge that rice farmers have positive attitudes towards sharing in general. The findings across the studies point to the fact that rice farmers share different kinds of knowledge among themselves including weed management strategies, food security, rice farming creativity and innovations (Gava et al., 2017:105; Meijer et al. 2015:175; Siziba et al. 2012:46). Other studies by Adamides and Stylianou (2013:4), Chen, Shanthikumar and Shen (2015:1433), Feng and Xue (2014:11), Gava, Favilli, Bartolini and Brunori (2017:105) and Tippe, Rodenburg, Schut, van Ast, Kayeke and Bastiaans (2017:95) provide insight into how farmers share knowledge concerning land preparation, produce harvesting, processing and marketing. The types of knowledge shared by farmers are discussed next.

Studies such as those by Gava et al., (2017:105), Knipot et al., (2006:176), Tippe et al., (2017:95) and Feng and Xue (2014:11) show that farmers share knowledge regarding seeds. Knipot et al., (2006:176) in an earlier study on sharing attitudes among farmers in Kenya reported that the farmers had more positive attitudes towards sharing knowledge

on seeds compared to other farming aspects. The study was carried out among a randomly sampled 120 farmers involved in agroforestry from two districts (i.e. Siaya and Vihiga) of western Kenya. These farmers were involved in a pilot project on soil fertility replenishment by the World Agroforestry Centre (ICRAF), Kenya Forestry Research Institute (KEFRI) and Kenya Agricultural Research Institute (KARI). Findings from the study indicated that the farmers were more willing to share knowledge on seeds with other farmers who did not participate in the project but were less willing to share the knowledge with those who did participate. Similar findings have been reported by other studies that have found that the majority of smallholder farmers do share knowledge on seeds, fertilizer application and weed control (Kamarudin et al., 2015:114).

There have also been some studies that have focused on creativity and innovation sharing among rice farmers in particular. Rice farming creativity and innovation is about the best ways of bringing new ways of growing rice in ways that are climate-sensitive and also ensure high rice yield. Rice farming creativity and innovation sharing, therefore, involve sharing knowledge about rice farming, the knowledge, technology, infrastructure and cultures they have created or learned, who they work with, and what new ideas they are experimenting with when it comes to improved rice farming practices (Biconne, 2014:154).

The approach represents a major change in the way that the production of rice farming knowledge is viewed and thus supported (Ajani, 2014:48). Rice farmers share knowledge on various rice harvesting, processing and marketing approaches (Guo, Jia, Huang, Kumar & Burger, 2015:103). Rice harvesting is defined as the process of collecting the mature rice crop from the field (Tsinigo & Behrman, 2017:48). Paddy harvesting activities include reaping, stacking, handling, threshing, cleaning, and hauling (Tippe et al., 2017:96). Rice processing that produces white rice also removes much of the vitamins and minerals found primarily in the outer bran layers (Guo et al., 2015:106). Further processing is often done in order to restore the nutrients to the grain. Once complete, the rice is called converted rice (Tippe et al., 2017:96). Rice farmers, therefore, share

knowledge on various tools, types of machineries and techniques for harvesting and processing rice for the market (Guo et al., 2015:106).

Rice farmers also share knowledge of the mechanisms and processes for controlling weeds in their rice farms. Weed control or management involves the botanical aspect of pest control, which focuses on stopping weeds on the farms (Prins et al., 2015:12). Weed management knowledge helps rice farmers to stop injurious weeds growing on the farm and competing with the crops for nutrients in the soil (Andre et al., 2017:888). Rice farmers, therefore, share knowledge on the various ways of weed management such as hand cultivation with hoes, powered cultivation with cultivators, smothering with mulch, lethal wilting with high heat, burning, and chemical attack with herbicides (weed killers) (Prins et al., 2015:12).

In the current knowledge world, knowledge sharing plays a pivotal role in climate change and adaptation. Farming activities in general, and rice farming in particular, has serious and critical implications on climate change (Andre et al., 2017:888). In low- and middle-income countries, where most farmers do not engage in climate-friendly practices, it is important to pay attention to how farmers engage with knowledge relating to how their farming activities impact on adverse climate (Prins et al., 2015:12). There have been different studies that have examined how different stakeholders in agriculture interact with climate-related knowledge. In a study to examine climate-related knowledge sharing practices among private forest owners in Sweden, Andre et al. (2017:892) showed that perception of climate risks, the timing of knowledge sharing and social networks are important factors that shape their willingness to share climate-related knowledge.

Andre, Baird, Swartling, Vaulturius and Plummer (2017:885) have reported in their study that an in-depth understanding of climate change processes and adaptation among rice farmers requires serious attention to be paid to how various actors and stakeholders receive and act upon climate-related knowledge and information. Biconne (2014:125) also advises that in order for rice farmers to competently deal with climate change, it is important to develop complex systems of adaptation capacities and abilities, which

encourage the involvement of all stakeholders in the processes, dissemination and awareness creation of climate change issues.

Ortolani et al., (2015:22) and Tariq et al., (2018:75) have also reported that more and more farmers are sharing knowledge on climate change and food security. Knowledge sharing on climate change has been found to be critical for farmers because climate change has had and continues to have a catastrophic impact on human settlements and livelihoods (Clappison, Cranston, Rowley & Lloyd-Laney, 2013:56). Climate change adaptability is therefore seen as a case of risk management, aimed at securing food, water, timber and other means of livelihoods (Balaji, Meera & Dixit, 2007:7). Studies by Chen et al. (2015:1433), Feng and Xue (2014:11), Garcia, Galeon and Palaoag (2018:32), Ortolani et al. (2015:22), Tariq et al., (2018:75) and Wood, Blair, Gray, Kemp, Kenyon, Morris and Sewell (2014:74) also provide insight into the potential of knowledge sharing practices among farmers that can impact on climate change.

Some studies have also focused on understanding knowledge sharing with regards to land management practices. Knowledge sharing on traditional land management practices among rice farmers, in particular, have been argued to provide a critically good basis for sustainable rice farming and agriculture (Prins et al., 2015:12). This involves paying attention to what rice farmers know already in order to be able to develop strategies to widen their knowledge scope for various alternative action in better managing their rice farmlands (Biconne, 2014:143). Knowledge of land management practices create a solid basis for the development of sustainable rice farming and also climate change adaptation strategies (Balaji et al., 2007:11). To this end, it is important to understand land management knowledge sharing among all rice farmers (Ajani, 2014:48).

Kamarudin et al., (2015:115) found that the rice farmers willingly shared farming knowledge among themselves. They observed that for the Selangor rice farmers it is not necessarily about competition or survival but about collectively making a decent income. The rice farmers were therefore found to be working cooperatively and closely in undertaking their farming activities. The culture of cooperation and collective interest were

found to improve knowledge sharing among the rice farmers. Tariq et al., (2018:72) for example examined knowledge sharing in the assessment of mitigation practices for the dissemination of climate-friendly rice production systems in Vietnam. The findings from the study showed that involving rice farmers in decision-making processes in a participatory manner enhances knowledge sharing practices among the rice farmers (Tariq et al., 2018:75).

Guo, Jia, Huang, Kumar and Burger (2015:100), have also demonstrated that participatory involvement of rice farmers improves both farmer knowledge acquisition and farmer knowledge sharing in China. The study was conducted using a randomized controlled trial (RCT) to examine how farmer field schools (FFS) affect knowledge acquisition among rice farmers in China (Guo et al., 2015:100). The study was undertaken in relation to the Chinese Ministry of Agriculture's piloted project aimed at the introduction of climate-friendly farming practices among rice farmers through its public extension systems (Guo et al., 2015:102).

The farmer field schools (FFS) were first introduced in Indonesia in 1989 as a way of promoting the dissemination of production and pest management knowledge among farmers (Guo et al., 2015:101). The FFS are made up of a group of between 20-25 farmers who hold periodic meetings to deliberate on best farming practices (Guo et al., 2015:101). Findings from the study showed that the FFS has a complex influence on knowledge sharing and knowledge management among the rice farmers. Specifically, FFS were found to effectively improved knowledge sharing on agro-environment and pest knowledge. However, the FFS did not improve knowledge sharing of nutrient management and cultivation knowledge (Guo et al., 2015:105).

2.6 Knowledge sharing and other agricultural products

Some studies have also examined knowledge sharing among other farmers. For instance, the ways in which the culture of communities of practice influence knowledge sharing among members have also been reported among other farmers. Kamarudin, Aziz, Zaini and Ariff (2015:113), conducted a study to assess knowledge sharing practices among

paddy rice farmers in Selangor, Malaysia. Data was gathered using a qualitative approach, using both individual interviews and focus group discussions among the rice farmers. Findings from the study indicated that the culture of the paddy farmers affected their knowledge sharing practices.

Other studies such as that of Cadger, Quaicoo, Dawoe and Isaac (2016:33), Chen, Shanthikumar and Shen (2015:1435) and Garcia et al., (2018:287) have also focused on examining different knowledge sharing practices. The findings from these studies indicate that there are several knowledge sharing practices available. These include after-action review, job shadowing, mentoring, coaching, job rotation, peer assist, communities of practice, storytelling, brainstorming, discussion forum, apprenticeship, personalization/face-to-face collaborations and documentation (Hameed et al., 2018:32; Karagoz, Korthaus & Augar, 2016:8).

Some studies have reported that where strong ties exist rice farmers are more willing to share knowledge with other colleague farmers (e.g. Kamarudin et al., 2015:115; Navarro & Hautea, 2014:66). A study by Gava et al., (2017:103) also shows how critical organisational culture is in influencing knowledge sharing among smallholder farmers. Organisation culture was conceptualised as the systems of knowledge sharing among the farmers who constitute communities of practice with regards to biogas farming. Data for the study was gathered using a survey. Findings from the study showed that knowledge flow from top-down was vital for knowledge sharing among the farmers. Knowledge was found to diffuse across the farmers easily when such knowledge is coming from experts who are involved in the biogas production. Gava et al., (2017:108) therefore argued that it is important to pay attention to a culture of knowledge circulation that is usually created among groups of farmers who form a community of practice.

Biconne (2014:133) has reported that in the peri-urban area of Darkar in Senegal, knowledge sharing has provided critical resources to surrounding members of agricultural communities whose farmlands are vulnerable to flooding. The sharing of land management knowledge on adaptive capabilities has helped these agricultural communities to adopt flood-resistant planting methods and land preparation techniques

that limit their losses whenever there is flooding (Biconne, 2014:143). What made the knowledge sharing interventions work effectively among the communities was the active involvement of the local farmers in the development of adaptive capacity strategies or interventions in a very participatory manner (Biconne, 2014:143). In these agricultural communities in Senegal, therefore, the participatory approach to the development of knowledge sharing interventions has been a useful tool in the decision-making processes that characterise their urban planning processes (Biconne, 2014:154).

Given the increasing use of technologies in rice farming, there was a need to also understand how technology is used to aid knowledge sharing among rice farmers. Some studies have examined the role technology plays in knowledge sharing among farmers in general and rice farmers in particular. ICT is regarded as the pillar of knowledge sharing and knowledge management (Bozzato et al., 2018:78). Previous studies have reported that technology plays a significant role in knowledge sharing and knowledge management in a variety of ways. For instance, ICT is found to bring efficiency in informing members of a group or organisation (Michalik, 2017:285). ICT has been found to facilitate the creation, accumulation, access and retrieval of knowledge and improve collaboration for the purposes of knowledge sharing (Rosenberry & Vicker, 2017:21).

Other researchers such as Akram and Bokhari (2011:45) also refer to knowledge sharing systems as the tools or technologies that facilitate the creation, organising, storing, transfer, sharing and application of knowledge. These technological systems process and generate value from their intellectual and knowledge-based assets. In other words, KM systems are repositories of knowledge from a collection of experts, organised in a manner such that it can be accessed easily (Tsinigo & Behrman, 2017:46). In organisations, these technologically based tools include groupware systems and KM 2.0, the intranet and extranet, data warehousing and mining, decision support systems, content management systems, document management systems, artificial intelligence tools, simulation tools, semantic networks (Michalik, 2017:285), portal, profile, collaborative workspaces, urgent requests, document libraries, servers, databases, knowledge bases, blogs and advanced search tools, e-learning systems and communities of practice (Rosenberry & Vicker,

2017:21). Kamarudin et al., (2015:116) also found that technology facilitators influenced knowledge sharing practices among rice farmers in Selangor, Malaysia. They observed that mobile phones were used heavily in sharing knowledge among the rice farmers. Adamides and Stylianou (2013:8) in a study among smallholder farmers in Cyprus reported that knowledge sharing is higher among farmers who use mobile phones than those who don't. Laforge and McLachlan (2018:258) have shown that technology enhances knowledge sharing among farmers in Manitoba and Ontario in Canada.

Adamides and Stylianou (2013:3) examined the role of ICT and mobile phones in agricultural knowledge sharing practices among farmers in Cyprus. The study also sought to assess the level of satisfaction of the farmers in the available knowledge sources and how ICT can be leveraged to transform their agricultural activities. Data for the study was gathered among 250 farmers using a cross-sectional survey. Findings showed that 98% of the farmers used mobile phones as a means of accessing and sharing agricultural knowledge. The extent of mobile phone use as a means of accessing and sharing agriculture knowledge was found to be equal among both crop farmers and livestock farmers. There were also no differences in the extent of mobile phone use between farmers with higher educational levels and those with low educational levels. The farmers were found to rate themselves as highly satisfied with the knowledge they are able to access and share via the mobile phone. These findings suggest that mobile phones play an integral part of agricultural knowledge access and sharing among the farmers, regardless of educational level and the specific farming activities they are engaged in (Adamides & Stylianou, 2014:8). There are several elements regarding how ICT and technology facilitate knowledge sharing.

2.7 Theoretical framework

This section discusses the theoretical framework for the study. A theory is defined as a group of interrelated ideas that are intended to explain something (Mackey & Jacobson, 2011:66). A theory works as a set of principles on which the practice of an activity is based or an idea used to account for a situation or justify a course of action (Tewell, 2015:7). The theory forms the basis for a theoretical framework, and therefore plays significant

roles in research. It guides the conduct of the entire research process. The fundamental unit of a theoretical framework is a theory or a model (Tewell, 2015:8). A theory is defined as a system of ideas that are organised to explain a phenomenon (Lloyd, 2010:148). Within the context of research, theories shape how ideas and concepts are organised together to achieve the overarching aim or purpose of a study (Mackey & Jacobson, 2011:63).

In this sense, theories are formulated to help in explaining, predicting and understanding, or even challenging assumptions in pre-existing knowledge in order to broaden the boundaries of knowledge (Tewell, 2015:7). Theories guide the development of theoretical frameworks, which are created by synthesizing the arguments and assumptions of more than one theory or model to provide a broader context for guiding the research process (Lloyd, 2010:247). According to Mackey and Jacobson (2011:65) a theory acts as a structure that supports the entire research process. Theories thus explain, predict and understand phenomena.

The theoretical framework, on the other hand, is defined as the structure that holds and supports a theory or group of theories in a study (Lloyd, 2010:248). It introduces and describes the theory that explains why the research problem under study exists (Mackey & Jacobson, 2011:68). A theoretical framework plays an important part in research because it allows the researcher to conceptualize the study in a broader context or field of knowledge (Tewell, 2015:7). It thus incorporates all of the necessary knowledge components researchers use within the context of the purpose of the research (Tewell, 2015:7)

In this study, the social exchange theory (SET) and socialisation, externalisation, combination and internalisation (SECI) model are used as the theoretical framework. The SECI model is used as the overarching framework, within which the SET is situated and integrated. The SET is integrated within the SECI model to examine the dynamics involved in knowledge sharing practices in their broader sense among the rice farmers. This means that the SECI model is used as the overarching or the main theory and the

SET is used as a supporting theory in the framework for this study. Both models are discussed in the subsequent sections 2.7.1 and 2.7.2

2.7.1 The socialization, externalization, combination and internalization

The SECI model was proposed by Nonaka and Takeuchi (1996:835) as a model for explaining how knowledge is created, shared, transferred and used. The SECI model, since its development about two decades ago, has become an integral framework of knowledge creation, knowledge sharing and transfer (Hislop, Bosua & Helms, 2018:9). The SECI model rests on the fundamental assumption or proposition of two fundamental types of knowledge. These are tacit knowledge and explicit knowledge. Based on these two types of knowledge, Nonaka and Takeuchi (1996:839) proposed four different ways through which various types of knowledge can be combined and converted simultaneously to show the complex ways in which knowledge is created and shared within organisational contexts.

According to the SECI model, the four (4) modes through which knowledge is created and shared are socialization (S), externalization (E), combination (C) and internalization (I) (Hislop et al., 2018:10; Nonaka et al., 2000:8). The model, therefore, derives its name from the initials of the four modes of knowledge transformation, i.e. SECI model. The model is shown in Figure 2.2. The four modes are discussed next.

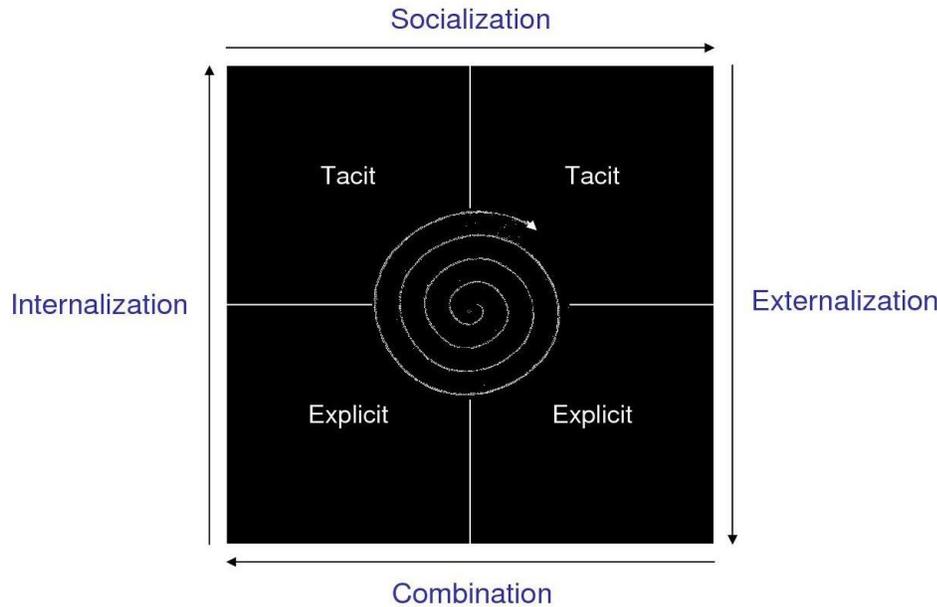


Figure 2.2: The Knowledge Spiral as described by Nonaka and Takeuchi

Source: Nonaka and Takeuchi (1996)

2.7.1.1 Socialization: tacit to tacit

According to the SECI model, socialization is the first mode through which knowledge can be transformed. Socialization in this context is conceptualised as the processes involved in the transfer of tacit knowledge between and among individuals within an organisation through observations when working with more skilled and knowledgeable workers (Nonaka & Takeuchi, 1996:837). The process is often used to denote the transfer or transformation of tacit knowledge to tacit knowledge. In other words, socialization is the process of transferring tacit knowledge between individuals through observations and working with a mentor or a more skilled and knowledgeable worker. There are different examples of how tacit knowledge is created through socialization. For instance, some ways of tacit to tacit knowledge creation include face-to-face interactions or meetings, and video and teleconferences (Daneshgar & Parirokh, 2007:25). With the socialization process, tacit knowledge is passed on from experienced to less-experienced workers through various means such as guidance, practice, imitation, and observation.

2.7.1.2 Externalization: tacit to explicit

According to the SECI model, externalization is the second mode of knowledge transformation. With the externalization process, tacit knowledge is transferred or transformed into explicit knowledge. Therefore, the externalization process encompasses all the processes involved in turning or converting tacit knowledge into explicit knowledge through documentation, verbalisation, etc. (Hislop et al., 2018:12). Externalization is deemed, however, to be particularly important, yet it is a difficult knowledge conversion mechanism (Karadsheh et al., 2009:73). This is because, according to Hislop et al. (2018:34), there are some levels of difficulty when theoretical knowledge (such as tacit knowledge) is being translated into practical knowledge (such as explicit knowledge). Tacit knowledge is defined as the type of knowledge that is codified into documents (e.g. manuals and web pages) so that it can easily be circulated throughout an organisation. The externalization process will help to examine the processes by which the rice farmers convert tacit rice farming knowledge into explicit knowledge to guide their rice farming activities. The use of an image will be cited as an important externalization mechanism.

2.7.1.3 Combination: explicit to explicit

The combination is the third mode or process of knowledge transformation in the SECI model. Within the context of the model, the combination is the mode of knowledge conversion involving the combination of different types of explicit knowledge (Nonaka & Takeuchi, 1996:838). This involves the ways in which codified knowledge sources (e.g. documents and web pages) are combined to create new knowledge for use within an organisation (Daneshgar & Pariokh, 2007:22-33). Creative use of databases to get business reports, sorting, adding and categorising are some examples of the combination process.

In other words, the combination is a mode of knowledge conversion which involves the combining of different types of explicit knowledge. This will happen when people exchange knowledge via documents, telephone, WhatsApp, Facebook and meetings. Knowledge transfer through the use of email, intranet, groupware, distribution of printed

documents and CD-ROMs are examples of how ICT has also greatly enabled this type of knowledge sharing. This new knowledge will normally be a valuable source for decision making and planning for rice farmers in the Eastern Region (Daneshgar & Pariokh, 2007:22-30). The combination is argued to be the simplest form of knowledge sharing (Hislop et al., 2018:10; Nonaka et al., 2000:8).

2.7.1.4 Internalization: explicit to tacit

Internalization is the last mode or pathway of knowledge transformation within the SECI model. Internalization within the context of the SECI model encompasses learning knowledge in a way that it becomes part of an individual's daily life activity (Sanchez, 2018:6). Internalization, therefore, constitutes the processes by which individuals internalize explicit knowledge to create tacit knowledge (Sanchez, 2018:4). The internalization process occurs when the user's existing tacit knowledge is modified when explicit sources are used and learned (Hislop et al., 2018:12).

The internalization process, therefore, helps to transform explicit knowledge into tacit knowledge. Thus, internalization is the process in which an individual will internalize explicit knowledge to create tacit knowledge (Hislop et al., 2018:19). As explicit sources are used and learned, the knowledge is internalized, modifying the user's existing tacit knowledge. For instance, organisations try to innovate or learn when this new knowledge is shared in the socialization process. Organisations also provide training programmes for its employees at different stages of their working with the company. Therefore, during the process of reflecting on explicit knowledge and embodying explicit knowledge by the employees, explicit knowledge gets transformed into tacit knowledge (Nonaka & Toyama, 2003:2-10). Because tacit knowledge includes mental models and beliefs in addition to knowhow, moving from tacit to the explicit is really a process of articulating one's vision of the world – what it is and what it ought to be (Nonaka & Toyama, 2003:2-10).

The SECI model is significant to this study because it provides an adequate framework for examining knowledge sharing among rice farmers within the Ghanaian context. In the first place, the SECI model provides a framework for examining how the rice farmers

create and convert knowledge within their rice farming activities. This helps to understand how the rice farmers continuously create, use and reuse knowledge in a continuous and dynamic manner (Hislop et al., 2018:16). Apart from helping to explain how the rice farmers create and convert knowledge, the SECI model also provides a framework for understanding how the knowledge is shared and transferred among the rice farmers.

The model also helps in exploring the different dynamics associated with how tacit and explicit knowledge are shared among the farmers. This helps to uncover the nuances in knowledge sharing and challenges faced with different kinds of knowledge among the farmers. The model also yields itself to different methodological studies, whether quantitative, qualitative or mixed-methods. It is therefore imperative to note that the SECI model provides the opportunities for identifying context-relevant knowledge regarding the rice farming knowledge creation and sharing and how that impacts on rice farming production in Ghana.

2.7.2 The social exchange theory (SET)

The social exchange theory (SET) explains the social exchange as processes of negotiation between individuals. The SET proposes that human exchanges are guided by subjective cost-benefit analysis, where individuals consider what they will lose or gain by exchanging something (Cropanzano et al., 2017:480). The SET has been used in several social science fields such as sociology, economics and social psychology to study the dynamics of exchange of material and symbolic knowledge between different individuals and groups (Cropanzano et al., 2017:484).

The SET was chosen for this study because it provides an understanding of the motivations of knowledge sharing among the rice farmers. Using the SET to examine knowledge sharing among rice farmers, therefore, provides a deeper understanding of the motivating factors underlying knowledge sharing practices among the farmers. The SET identifies four basic concepts that influence exchange processes between individuals. These are cost-benefit analysis, reciprocity norms, social penetration, and

equity and inequity (Cropanzano & Mitchell, 2005:878). These concepts are discussed within the context of the exchange of knowledge or knowledge among rice farmers.

2.7.2.1 Cost-benefit analysis

According to the SET, social exchanges are shaped within cost-benefit analysis. This means that individuals are more likely to exchange when the benefits outweigh the costs. Knowledge sharing fundamentally encompasses individuals who have access to knowledge and therefore decide to make the knowledge available to others. In the case of rice farmers, knowledge sharing becomes an exchange of relevant knowledge about best rice farming practices with their colleague farmers. Therefore, using the SET, farmers who hold critical rice farming knowledge or knowledge will engage in subjective cost-benefit analysis before deciding whether to share the knowledge or not (Cropanzano et al., 2017:480).

2.7.2.2 Reciprocity norm

The reciprocity norm explains that the benefits associated with social exchanges should be returned, and individuals who give benefits should not be harmed (Cook, Cheshire, Rice & Nakagawa, 2013:66). Within the context of knowledge sharing, the reciprocity norm ensures that individuals who freely share knowledge are never denied access to knowledge (Yan, Wang, Chen & Zhang, 2016:646). This means that when it comes to knowledge sharing among rice farmers those who freely share knowledge with their colleague rice farmers also end up getting more knowledge or knowledge from other rice farmers. Cooks et al., (2013:68) argue that the reciprocity norm is used to stabilize relationships by inviting individuals to consider other people's welfare rather than focus on their own self-interests. This suggests that the kind of reciprocity norms that exist among the farmers would significantly influence their knowledge sharing. When relationships between the rice farmers are stabilized, they come to understand that sharing knowledge with their colleagues also helps them get access to more knowledge, and therefore they are more likely to do so.

2.7.2.3 Social penetration

The social penetration concept explains that social exchanges build quality relationships and close interpersonal bonds (Oparaocha, 2016:537). Thus, once individuals begin to exchange or give more of themselves to their colleagues, their relationship progresses from exchanging superficial goods to exchanging more meaningful commodities such as knowledge (Cooks et al., 2013:69). The quality of their relationships progresses to the point called “self-disclosure”, where the individuals share innermost thoughts and feelings with one another (Oparaocha, 2016:537). Applying social penetration within the context of knowledge sharing among rice farmers implies that the sharing of knowledge among the farmers indicates a high level of quality relationships among them. Knowledge sharing is a form of self-disclosure (Yan et al., 2016:647) and therefore the better the quality of relationships between the farmers, the more likely they are to share knowledge.

2.7.2.4 Equity and inequity

The equity and inequity concept relate to the cost-benefit analysis discussed earlier. With the equity-inequity analysis, individuals balance their inputs and outputs in social exchanges (Cropanzano & Mitchell, 2005:882). At least, an equitable input-output ration is believed to encourage knowledge-sharing (Cropanzano et al., 2017:649). Within the context of rice farmers, the amount of time and energy they invest in knowledge sharing would always be compared to their productivity. Therefore, the more they find that knowledge sharing improves their rice productivity, it means a favourable input-output ratio is achieved, and therefore they become more willing to share knowledge or knowledge among themselves, and vice-versa.

2.8 Conceptual framework

The conceptual framework also plays a critical role in the research process. Bertoldi, Giachino, Rossotto and Bitbol-Saba (2018:588) define conceptual framework as the part of the research that draws from concepts and theories as to the basis of explaining interrelationships between the concepts in a study. Thus, the conceptual framework helps in domesticating or fitting a theoretical framework to a specified research topic (Elliott,

Patacconi, Swierzbinski & Williams, 2018:7). In studies where two or more theories are used, conceptual frameworks show how the various concepts from the theories are integrated into a model or framework to explain the research problem being studied (Brown & Ingene, 2019:8).

In the current study, two theories were used as the theoretical framework to explore knowledge sharing practices among rice farmers. These were the SECI model and the SET. In this section, therefore, the conceptual framework discusses how concepts from the SECI model and the SET are integrated to explore knowledge sharing among rice farmers in Ghana (as shown in Figure 2.2). As shown on Figure 2.2, knowledge sharing among the rice farmers in Ghana is examined in terms of the types of knowledge shared by the rice farmers, knowledge sharing practices, the inhibitors of knowledge sharing and enablers of knowledge sharing. Strategies for enhancing knowledge sharing among rice farmers are also examined.

In integrating the SECI model and the SET, the current study examined knowledge sharing as a social exchange between rice farmers (as argued by the SET), which is shared through socialization, externalization, combination and internalization (as proposed by the SECI model). Therefore, concepts from the SECI model are used to explain how knowledge is created and shared among the rice farmers, while concepts from the SET are used to explain how knowledge sharing among the rice farmers constitute a fundamental social exchange process. From the SECI model, knowledge is created and shared among the rice farmers in four main modes, which are socialization, externalization, combination and internalization.

In applying the socialization process to this study, the rice farmers also gain new knowledge from outside its boundary like by interacting with customers, suppliers and stakeholders. In other words, training programmes should be initiated for rice farmers through face-to-face and video conferencing means to share and retain knowledge in the Eastern Region by rice farmers. Thus, rice farming knowledge is passed on through practise, guidance, imitation, and observation by rice farmers. According to Daneshgar

and Pariokh (2007:22-25), the adoption of such an approach will enable rice farmers to expand their horizons in terms of knowledge sharing.

Through the externalization mode, rice farmers convert tacit knowledge into explicit knowledge. The most common form of capturing tacit knowledge and making it explicit is documentation, which can be used for tacit knowledge to be made available at knowledge repositories (Sanchez, 2018:3). The knowledge repositories will be giving the chance to organise, share and retain knowledge by using the intranet and document management systems (Daneshgar & Pariokh, 2007:27).

Based on the combination mode, the rice farmers convert explicit knowledge to another explicit rice farming knowledge. Specifically, codified knowledge sources (such as documents) are merged to create new knowledge for rice farmers in the Eastern Region of Ghana. In this regard, it will help to unearth how the rice farmers sort and categorize explicit knowledge to become a more valuable source for planning and decision-making purposes for rice farmers in the Eastern Region (Daneshgar & Pariokh, 2007:22).

The internalization mode ensures that explicit rice farming knowledge is converted to tacit knowledge. This means that when rice farmers are exposed to new rice farming knowledge, they internalize it by forming mental representations of the new knowledge (Sanchez, 2018:3). The internalization, therefore, helps to examine how new knowledge of rice farming becomes internalized among the rice farmers. By reading training manuals and documents, rice farmers will internalize the tacit knowledge and try to create new knowledge after the internalization process. Conferences, discussion sessions, meetings, and professional publications are some examples that provide opportunities for rice farmers to analyse and assess their knowledge and increase their thinking abilities and to create new knowledge for efficiency (Daneshgar & Pariokh, 2007:25-30).

Thus, through the SECI model, knowledge and knowledge about rice farming are created among the rice farmers. In terms of the sharing of the knowledge, the social exchange theory is used to examine how knowledge sharing among the rice farmers is influenced by social exchange processes. Thus, knowledge sharing among rice farmers constitutes

a social exchange which is influenced by several processes. As shown by the SET, rice farmers are influenced by cost-benefit analysis, reciprocity norm, social penetration and equity-inequity ratio in deciding whether and how to share knowledge or knowledge with their colleague farmers.

As proposed by the SET, knowledge sharing among the rice farmers will be influenced by cost-benefit analysis. This means that the rice farmers would weigh how knowledge sharing could benefit rice productivity, and if the benefits outweigh the cost, they are more likely to share knowledge and information. Their knowledge sharing will also be influenced by the prevailing reciprocity norms that exist among the rice farmers. Thus, whether knowledge sharers also get access to the knowledge and knowledge of other rice farmers or not would impact their willingness or otherwise to share information. This means that when it comes to knowledge sharing among rice farmers, those who freely share knowledge with their colleague rice farmers also end up getting more knowledge or knowledge from other rice farmers. The study examines the prevailing reciprocity norms among the rice farmers.

Knowledge sharing would help to stabilize relationships among rice farmers. When the interpersonal relationships between the rice farmers improve, then there would be social penetration of rice farming knowledge. As argued by the SET, knowledge can lead to relationship progress to the point where the rice farmers share their personal experiences, knowledge and knowledge with their colleagues.

The current study, therefore, also examines the quality of interpersonal relationships that exist among the rice farmers. In so doing, when the rice farmers realize that knowledge sharing has improved their productivity, they would experience that a favourable input-output ratio has been achieved, and thus they would become more willing to share knowledge or knowledge among themselves, and vice-versa. The conceptual framework for the study is represented in Figure 2.3.

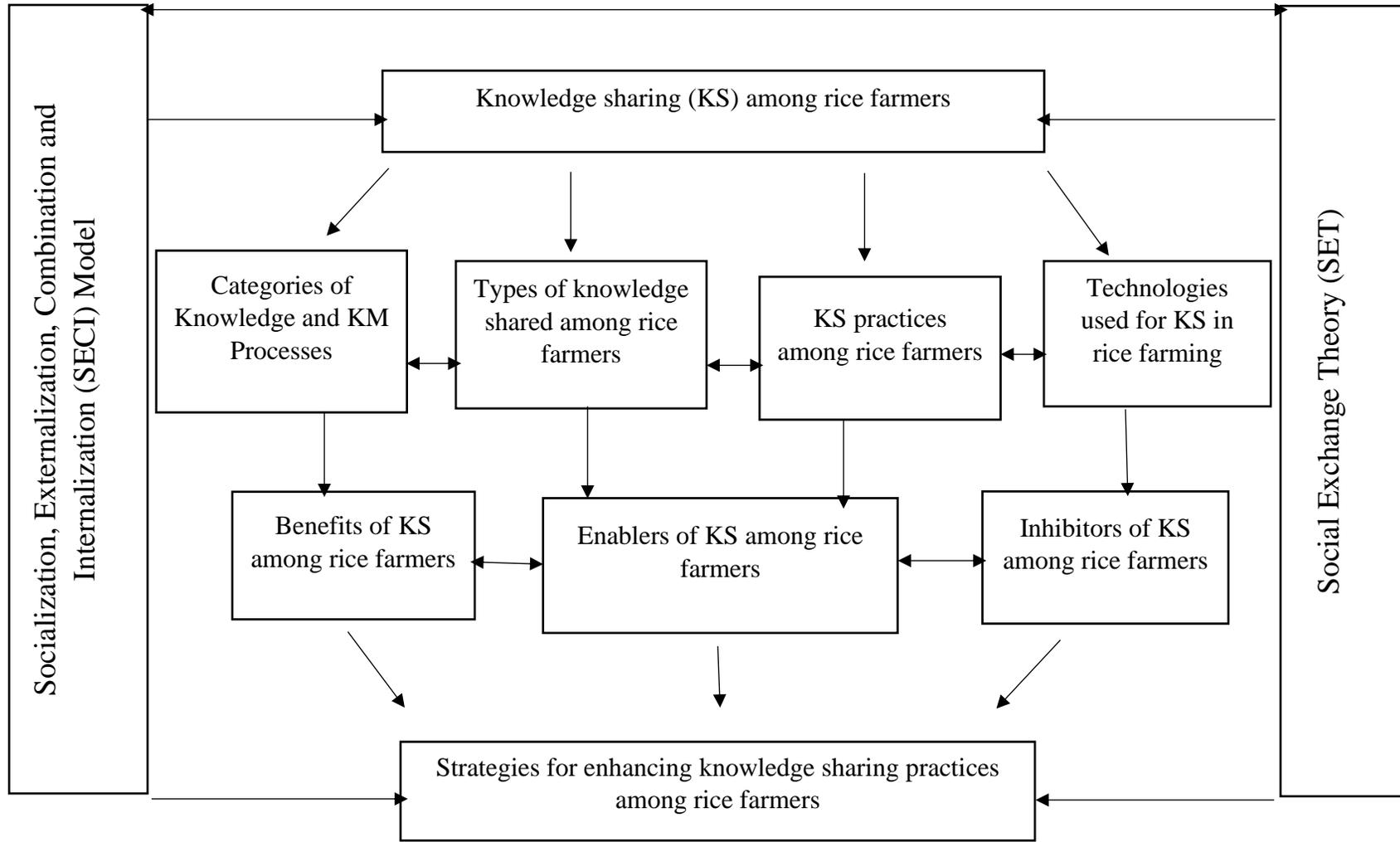


Figure 2.3: Conceptual framework for knowledge sharing practices among rice farmers

Source: Researcher's construct (2019)

As shown on Figure 2.3, the SECI model and the SET are integrated into a conceptual framework for the study. The framework helps in exploring deeper the knowledge sharing among the rice farmers. The conceptual framework provides entry point to explore the types of knowledge shared, knowledge sharing practices, technologies and tools for knowledge sharing, benefits, enablers and inhibitors of knowledge sharing. Both the SECI and the SET both feed into developing strategies to enhance knowledge sharing among the farmers.

2.9 Synthesis of literature review

The literature review has indicated that research on knowledge sharing among rice farmers and other farmers, in general, has been steadily increasing in the last decade. The common theme that runs through these studies is the fact that knowledge sharing and knowledge management are fundamental to improving rice production through sustainable agriculture, especially among smallholder rice farmers in developing countries who mainly use non-mechanized systems of rice farming. There is, however, much to be done in order to provide a comprehensive understanding of the nuances and complexities of knowledge sharing among smallholder farmers in different agricultural sectors, especially among rice farmers in developing country contexts. For instance, the studies fail to establish factors that either enable or inhibit knowledge sharing among rice farmers.

There is therefore limited understanding concerning which knowledge sharing practices improve productivity and those that undermine productivity within the context of rice farming. The majority of the studies are conducted among large-scale or commercialized rice farmers in high-income countries. Also, while some studies have looked at smallholder farmers in general, rice farmers have not featured much in these studies. There is, therefore, limited knowledge on factors that influence knowledge sharing among smallholder rice farmers.

2.10 Summary of the chapter

This chapter has provided a discussion of knowledge sharing within the context of rice farming. A literature map (Figure 2.1) was provided to show the flow of the literature review. The general concept of rice farming was discussed first, followed by discussion of rice farming and the agricultural sector in Ghana and technologies used in rice farming. This was followed by a discussion of the concepts of knowledge (explicit and tacit) and the types of knowledge shared among rice farmers. Knowledge management and knowledge management processes were then discussed to set the context for a discussion of the concept of knowledge sharing, both situated within the context of rice farming.

After that, discussions were provided on each of the objectives, within the context of related studies drawn from knowledge sharing literature in rice farming in particular, but also incorporating literature on knowledge sharing in agricultural and some organisational contexts broadly. The review of the related studies (from both global and local literature) showed that there is rising interest in knowledge sharing within agricultural context due to the impact of climate change that threatens food security, especially in developing countries.

The interest has therefore been on understanding how knowledge sharing can be enhanced among smallholder farmers to adopt improved and climate-friendly farming practices, while at the same time increasing productivity. Given the important role that rice plays in addressing global food insecurity, researchers have begun focusing on rice farmers. However, the studies are very few. This review, therefore, supports the justification of focusing on rice farmers in the current study and the significance that the findings would provide in enhancing rice productivity, and invariably contribute to addressing food insecurity in Ghana, and by extension contributing to addressing the global food crisis.

The concepts of theory and the theoretical framework were then discussed. The framework drew from concepts in both the SECI model and SET to examine the context of and the factors that enable or undermine knowledge sharing in general and then narrowed down to how that applied within the context of rice farming. This informed the conceptual framework of the study. A synthesis of the literature review was then finally provided to pull the evidence from the literature review together.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The research methodology is the systematic scientific processes and procedures that are used to gather and analyse data to arrive at findings, and answer research questions (Patten & Newhart, 2017:12). Detailed and systematic accounts of research processes are essential because they allow both for providing context and also for serving as replication, where other researchers can follow the same systematic processes to verify the findings (Creswell & Creswell, 2017:12). For this reason, it is essential for researchers to critically explain all the steps and decisions that were made at each step in gathering and analysing data in response to a research problem (Patten & Newhart 2017:12; Plonsky, 2017:8).

This chapter presents the detailed methodological processes that were followed in collecting the data for the study. The chapter consists of a detailed description of the research setting, research paradigm, research approach, research design, the population of the study, sample size, sampling techniques and data collection tools, procedure and methods. The chapter presents detailed descriptions of the questionnaire and the interview guide used. Subsequently, the trustworthiness of the research process is discussed. Ethical standards that were observed are discussed next, followed by how the data is analysed and presented. A summary of the chapter is then provided. The sections discussed are provided in Table 3.1.

Table 3.1: Table showing methodological steps of the study

Section	Issues discussed
3.1 Introduction	This section discusses the various issues that are covered in the chapter

3.2 Research paradigm	The current study is underpinned by pragmatism. This section thus discusses the various research paradigms, which include positivism, constructivism, critical theory, phenomenology and pragmatism.
3.3 Research approach	The mixed-method approach was used for the study. This section, therefore, discusses the three methodological approaches, quantitative, qualitative and mixed-method, and then justifies why the mixed-method was chosen.
3.4 Research design	The parallel mixed-method design was used for the study. This section, therefore, discusses the various designs in the mixed-method approach, and why the parallel design was used.
3.5 Research locality	This section discusses the research locality where the current study was conducted.
3.6 Target population	This section discusses the target population for the study
3.7 Sample size	The sample size for the study is discussed in this section
3.8 Sampling techniques	The techniques for selecting the participants for the study are discussed in this section
3.9 Data collection tools, procedures and methods	This section discusses the tools, procedures and methods for gathering data for the study
3.10 Trustworthiness, validity and reliability	This section discusses the processes for ensuring the trustworthiness of the research process

3.11 Data analysis and presentation	This section discusses how the survey and the interview data were analysed
3.12 Evaluation of the research methodology	This section discusses the evaluation of the Research Methodology
3.13 Summary	This section summarizes all the issues discussed in the chapter

3.2 Research paradigm

The research paradigm is defined as the ideological perspective from which a researcher approaches a research problem (Cartwright & Montuschi 2014:11). The philosophical foundation is important, particularly in higher degree research because the specific philosophy informs the research paradigm that needs to be adopted for the study (Kivunja, 2016:165). There are different research paradigms in social science which include positivism, constructivism, critical theory, feminism and pragmatism (Jarvie & Zamora-Bonilla, 2011:15). Out of these paradigms, the three most used ones are positivism, constructivism and pragmatism (Cartwright & Montuschi, 2014:11; Tashakkori & Teddlie, 2008:29)

Each of these paradigms has its interpretations of reality and knowledge construction and therefore shapes the methodological choices it makes (Patten & Newhart, 2017:32). Thus, the paradigms have their philosophical foundations regarding belief about what constitutes reality (i.e. ontology) and how reality should be studied (i.e. epistemology) and the best method for studying the reality (i.e. methodology) (Tashakkori & Teddlie, 2008:29). The paradigms were discussed in the subsequent paragraphs about their ontology, epistemology and methodology.

Positivism is based on the ontological foundation that there is a single reality out there which is directly observable (Cartwright & Montuschi, 2014:9). For this reason, the

epistemology of positivism rests on value-free research (Jarvie & Zamora-Bonilla, 2011:17). This means that, epistemologically, positivists propose that in doing research values should be driven out, and the methodological approach they propose in achieving value-free research is quantitative research (Patten & Newhart, 2017:32).

Fundamentally, all the other philosophies (i.e. critical theory, constructivism and pragmatism) contest the ontological, epistemological and methodological assumptions of positivism. For instance, the critical theory makes the ontological argument that there is no single reality, and that reality is shaped by power relations (Jarvie & Zamora-Bonilla, 2011:17). Therefore, epistemologically, critical theory believes that context matters in research and the need to let contextual characteristics reflect (Cartwright & Montuschi, 2014:9). Methodologically, critical theory contests the hegemony of any methodology, particularly quantitative methods, and argues that any method chosen should pay attention to contextual differences (Plonsky, 2017:32).

The constructivism ontological assumption is that there is no single reality (as assumed by positivism) and that reality is subjective and constructed (Fuller, 2019:12). This means that, epistemologically, research should focus on paying attention to values, and the methodological way to achieve that is through qualitative research (Sheehan, 2018:9). Phenomenology aligns with the ontological assumption of subjective reality, with feminism arguing that reality is shaped by gender differences, and phenomenology arguing that reality is shaped by lived experiences (Jarvie & Zamora-Bonilla, 2011:213). Nonetheless, both feminism and phenomenology align (with constructivism) on the epistemological relevance of values in research, and methodologically favour qualitative over quantitative research (Cartwright & Montuschi, 2014:9).

Pragmatism was the research paradigm adopted for this current study. From the ontological view, pragmatism is defined as a philosophical paradigm that argues that there is the possibility of a single social reality, but that, that single social reality is interpreted differently by different individuals (Jarvie & Zamora-Bonilla, 2011:213). Epistemologically, pragmatism sees all knowledge as social knowledge, which means

that social context is critical to studying reality and must therefore be taken into consideration (Cartwright & Montuschi, 2014:12). The adoption of pragmatism means that both the positivist and interpretivist philosophical assumption would be used for the study (Cartwright & Montuschi, 2014:12). This means that instead of the fixed reality assumption of positivism or the strictly subjectively constructed assumptions of constructivism, pragmatism adopts inter-subjectivity where a single reality can be assumed bearing in mind that this reality manifests differently in different contexts (Cartwright & Montuschi, 2014:10). Therefore, for pragmatism, the social reality being studied or the research problem being addressed should dictate the methodology used. Pragmatism was chosen as the research paradigm for the current study because it provided the opportunity for methodological innovation, which is different from what many studies within the context of knowledge sharing in rice farming use. Methodologically, pragmatism leans more towards mixed methods. This was because pragmatism helps to combine methodological approaches to allow for a research question to be adequately answered (Cartwright & Montuschi, 2014:10).

The majority of the studies on knowledge sharing follow either purely quantitative (e.g. Chen et al., 2015:1433; Feng & Xue, 2014:11) or purely qualitative research (e.g. Gava et al., 2017:105; Meijer et al., 2015:175; Siziba et al., 2012:46). Therefore, the pragmatist approach in the current study contributes methodologically by bringing in different ontological, epistemological and methodological perspectives to knowledge sharing among rice farmers in the developing country context.

Pragmatism favours mixed-methods and it ensures that the contextual realities of the people being studied are taken into consideration (Davies & Fisher, 2018:22) in ways that allow contexts to be compared and contrasted (Cartwright & Montuschi, 2014:9). This means that the contextual realities of the rice farmers and rice farming are taken into consideration in the knowledge creation process but also allow for their realities to be compared and contrasted with findings from studies in other countries. This helps to unearth both views and perspectives on how knowledge sharing impacts on their rice

farming activities, and also the ability to quantify data from larger groups of rice farmers and therefore this gives the researcher the power to generalise the findings of the study.

In concluding, the three most used paradigms in social science research are positivism, constructivism and pragmatism. Fundamentally, the paradigms fall within a continuum by how they interpret social reality, with positivism and constructivism being the far ends of the continuum (Plonsky, 2017:32). Positivism argues that all reality is fixed and therefore should be studied objectively using quantitative methods (Cartwright & Montuschi, 2014:5). The other paradigms (i.e. constructivism, critical theory, feminism and phenomenology), on the other hand, assume that reality is socially constructed and therefore should be studied using qualitative methods.

3.3 Research approach

The research approach is defined as the various methodological procedures used in gathering data for a study (Patten & Newhart, 2017:21). A research approach, therefore, encompasses the overall strategy that is chosen to integrate different parts of a study coherently to address a research question (Plonsky, 2017:21). It describes the ways, the processes or techniques for gathering and analysing data (Creswell & Creswell, 2017:18). Three main research approaches are dominantly used in social science, the quantitative approach, qualitative approach and mixed-method approach (Creswell & Creswell, 2017:34).

The quantitative research approach is defined as the kind of studies that are usually undertaken using numbers as the basic data for analysis among a large sample of participants (Plonsky, 2017:54). Tashakkori and Teddlie (2008:12) argue that the “dominant and relatively unquestioned methodological orientation in the social and behavioural sciences for much of the 20th century was QUAN and it is associated with postpositivist/positivist”. Thus, for long time in the history of social sciences, the quantitative research approach was seen as the ‘scientific method’ because this method is exemplified in the work of modern physicists, and it consists of the rigorous testing of

hypotheses using data that takes the form of quantitative measurements (Creswell & Clark, 2017:14). The quantitative research approach, therefore, uses numbers as the route to meeting research goals (Saunders & Tosey, 2015:13).

The qualitative research approach, on the other hand, is defined as research studies that use mostly narratives or observations as data for analysis among a small sample of participants (Creswell & Creswell, 2017; Plonsky, 2017). The qualitative research approach began mainly in the last quarter of the twentieth century. Among some of the classic texts that served as the basis for the development of the qualitative research include Glaser and Strauss (1967), Lincoln and Guba (1985), Miles and Huberman (1984, 1994), Patton (1990, 2002), Stake (1995), and Wolcott (1994). The qualitative research approach fundamentally objects to and contests the basic tenets of positivism, which are fixed reality, objectivity and numbers as routes to objectivity (Lyon, Møllering & Saunders, 2015:21). Mainly being underpinned by paradigms such as constructivism, feminism, critical theory and phenomenology, qualitative research pays critical attention to the subjectivity of life, and therefore focuses on using narratives and observations as routes to understanding the meaning of people's reality. This means that rather than being interested in numbers and treating individuals as statistics, the qualitative research approach treats individuals as human beings who have sociocultural and religious values, morals and norms which shape their peculiar life experiences, which must be considered when conducting research.

However, in some cases, both quantitative and qualitative methods are combined to form a mixed-method approach to gather data for research (Mbila, 2017:137). In its formative years, the mixed-method approach was defined as a research approach where both quantitative and qualitative methods are used in gathering and analysing data for a study (Creswell & Creswell 2017:12). In recent years, however, the mixed-method approach has moved beyond just a combination of quantitative and qualitative methods to become the third tradition on its own. This means that mixed-method has its peculiar philosophical underpinnings and terminologies (Creswell & Clark, 2017:8). Tashakkori and Teddlie (2008:14) also define mixed-method as the "type of research design in which QUAL and

QUAN approaches are used in types of questions, research methods, data collection and analysis procedures, and/or inferences”. Others also define it as “research in which the investigator collects and analyses data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or program of inquiry” (Saunders & Tosey, 2015:18).

The mixed-method research approach is better suited for research studies that are underpinned by pragmatic philosophical paradigms (Cartwright & Montuschi, 2014:10; Davies & Fisher, 2018:22; Mabila, 2017:136). The choice of which approach to use depends on several factors such as the research paradigm used, the research question under investigation and whether or not the issue is well researched within the context of the study (Plonsky, 2017:18). In the current study, the mixed-method approach was used.

3.3.1 Justification for the use of the mixed-method research approach

The choice of the mixed-method research approach was influenced by the research question, research paradigm and the issue being studied (Mabila, 2017:138). This is because the combination of quantitative and qualitative approaches in gathering data reveals the complexities and nuances in social reality under investigation (Davies & Fisher, 2018:22; Jarvie & Zamora-Bonilla, 2011:18). The researcher took into consideration the issue being studied, the research question and the context within which the study was being conducted. The issue of knowledge sharing within the agricultural context in general and within the context of rice farming, in particular, happens within a sociocultural context (Uchida et al., 2019:3). All farming activities are deeply informed by the sociocultural ways of life of the farmers in their communities (Casanova-Pérez, Martínez-Dávila, López-Ortiz, Landeros-Sánchez, & López-Romero, 2016:849). In general, rice farming practices are not insulated from the socio-cultural values, norms and beliefs of the rice farmers (Kwak, Kim & Lee, 2017:1093).

Based on the socio-cultural differences between farming communities, rice farmers in different countries, and even rice farmers in different communities within the same

country, may differ (Casanova-Pérez et al., 2016:851). Therefore, knowledge sharing may be understood and approached by different rice farming communities differently depending on their cultural norms and practices that govern farming activities (Kwak et al., 2017:1095). There is thus the need to use research approaches that unearth how peculiar socio-cultural norms, beliefs and practices influence knowledge sharing among rice farmers. In this case, the qualitative approach offered the opportunity for digging deeper into knowledge sharing among rice farmers in the Eastern Region of Ghana.

While admitting that cultures are different, there is also the need to understand that there may be some socio-cultural characteristics that cut across cultures and communities (Kwak et al., 2017:1097). This means that, even in differences, some rice farming practices cut across different rice farming communities across the world. This also means that there are some elements of knowledge sharing in the agricultural context that cut across communities and cultures (Casanova-Pérez et al., 2016:856). This also means that there is a need to use a research approach that can unearth knowledge sharing that is common across different contexts. In this case, quantitative data offers the opportunity for gathering data from a large sample of rice farmers so that the findings can be generalised.

3.4 Research design

Research design is defined as the specific methods used in gathering and analysing data based on the research approach chosen (Dawson, 2019:23). In the mixed-method approach, there are two main research designs, which are the sequential and concurrent mixed-method designs, with each having three dimensions (Dawson, 2019:27). The sequential mixed-method is a two-phase design where different data is collected in each phase (Tashakkori & Teddlie, 2010:23). There are three dimensions of sequential mixed-method designs, depending on which data is collected first. These are the sequential explanatory design (where quantitative data is collected and analysed first followed by qualitative data), the sequential exploratory design (where the qualitative data is collected and analysed first followed by the quantitative data) and the sequential transformative

design (where the order of the data collection is determined by the researcher's theoretical perspective) (Creswell & Clark, 2017:8; Creswell & Creswell, 2017:12; Saunders & Townsend, 2018:34; Tashakkori & Teddlie, 2008:35).

The concurrent mixed-method design, on the other hand, is a one-phase design where both qualitative and quantitative data are collected and analysed (Teddlie & Tashakkori, 2011:35). There are three dimensions to this design. These are the concurrent triangulation design (where both the qualitative and quantitative data are collected and analysed at the same time, and then compared or combined), the concurrent nested design (where both qualitative and quantitative data are collected and analysed at the same time but one is given priority over the other), and the concurrent transformative *design* (concurrent data collection of both quantitative and qualitative data, guided by a theoretical perspective in the purpose or research questions of the study) (Creswell & Clark, 2017:8; Creswell & Creswell 2017:12; Saunders & Townsend, 2018:34; Tashakkori & Teddlie, 2008:35).

In the current study, the concurrent triangulation design was used. The qualitative data and the quantitative data were gathered and analysed at the same time and merged in the end to provide a holistic understanding of the research questions. The quantitative data was gathered using a cross-sectional survey which is defined as a quantitative method for collecting data where researchers collect data from a representative cross-section of the population of interest to understand the situation (Creswell & Creswell, 2017:45; Schutt, 2018:12). According to Plonsky (2017:33), cross-sectional survey design is best suited and chosen for its appropriateness in descriptive and explanatory studies and is mostly used in studies that have the individual as the unit of analysis. The cross-sectional survey method was therefore used for this study because it allowed the researcher to collect the data from a large number of rice farmers so that results could be generalised (Creswell & Creswell, 2017:22).

The qualitative data was gathered using narratives, specifically, individual interviews. The individual interviews were conducted among the smallholder rice farmers and

stakeholders involved in the support of rice farming in the selected study sites. These individuals include agricultural extension officers, executives of rice farmer cooperatives and owners and staff on rice farms. The narratives from these interviews formed the basis of the analysis in understanding their knowledge sharing and how it affects rice farming practices and productivity.

3.5 Research locality

The study was conducted in three rice farming communities in the Eastern Region – Akuse, Asutsuare and Kpong. These three areas constitute three of the top rice farming settings in Ghana (Tinsley, 2009:11). The three areas were chosen for the study because of the commonality between them for being the dominates in rice farming. Again, judging from this, and considering the communities proximity and remoteness, and given the resources available for the study, the researcher restricts the study to three communities.

Akuse and Asutuare are two indigenous communities where rice farming is predominantly undertaken by smallholder farmer. Rice farming in Kpong is however commercial, undertaken by the Kpong Farms. The land area for Kpong Farms is appropriately 252.75 hectares out of which 100 hectares are irrigated lands suitable for rice production. Kpong Farms Limited (KFL), incorporated in May 1982 by Volta River Authority (VRA), is a wholly-owned agricultural commercial venture. It carries out mechanised commercial farming, agro-processing and provision of machinery services. The Authority established KFL to harness the water resources of the Volta Lake at Kpong for viable agricultural ventures and for the farms to serve as a demonstration project in a modern agricultural system for the community and the nation at large. VRA plans to engage a strategic investor interested in running the farms under a Public-Private Partnership (PPP) arrangement. The Project has been registered with the Ministry of Finance and is at the procurement stage. This arrangement would allow VRA to retain control and ownership of the Kpong Farms Limited's land and facilities while protecting the VRA from business and financial risks associated with agricultural production. (VRA, Annual Report, 2017:17).

The project's location is about 61 km (38 miles) from Accra on the main Accra-Kpong road, opposite the junction to Asutsuare. It is on the watershed which divides the Accra plains into two (2) parts: the coastal and Volta catchments. The typical climate of the area is that of the Northern Accra plains with a bimodal rainfall pattern totalling 1016-1270 mm a year. Around Akuse, a major town, rainfall ranges from 625 mm to 1961 mm a year with a wind speed of 40 km/hr. Mean temperature is highest in February and March (29°C) and decreases to 26°C in July and August (cloudy period). The annual potential evapotranspiration (Accra plains) is about 1676 mm (intermediate between Forest – 1372 mm and Northern Savanna – 1981 mm). The climate is the savannah type. The distribution facilities are good and the gates and turnouts are all in good condition. Some portions of the main canal are in good condition (KFL, 2016:1-2),

3.6 Target population

The population of a study is defined as the collection of all individuals who share similar characteristics based on what a researcher is interested in and therefore qualify to be included in the study (Creswell, 2013:18). Within the context of research, a population is defined as a group of individuals taken from the general population who share a common characteristic, such as age, sex, or work conditions who are researched because of their relevance to a research question (Plonsky, 2017:43).

In the current study, the population of interest encompassed all individuals directly involved in rice farming in the Eastern Region of Ghana. Specifically, the target population was one hundred and ten (110). This included smallholders, namely rice farmers, farm managers and agricultural/extension officers in Kpong, Akuse and Asutsuare communities. The target population for the study is shown in Table 3.2.

Table 3. 2: Target population of the study

Categories	Total population
Smallholder rice farmers	78
Agricultural/extension officers	24
Farm managers	8
Total population	110

Source: Ministry of Food and Agriculture, 2018

The researcher engaged all stakeholders involved in rice farming in the selected settings in Ghana. These stakeholders were targeted because the researcher believed that they were well versed in rice farming in the Eastern Region of Ghana. Data from the smallholder farmers were collected using a survey and interviews. Data on the other stakeholders were gathered using only interviews.

3.7 Sample size

The sample size is defined as the proportion of a population of interest that is selected for a research study (Patten & Newhart, 2017:45). The reason for selecting a sample size for research is that in most social science research it is sometimes impossible or impractical to study the entire population, for which reason there is the need to select a portion to study and make inferences to the general population of interest (Creswell & Creswell, 2017:56; Patten & Newhart, 2017:47). However, for rigour analysis of the study, it is important to ensure that the characteristics of the population guide the sample selected so it adequately reflects the entire population. For this reason, Creswell and Creswell (2017:19), Nardi (2018:53) and Plonsky (2017:44) all agree that, if the population of interest is small and easily accessible, there is the need to include all of them in the study, especially when the study has a survey component.

In the current study, the total sample size was 110. The survey data was gathered from 101 participants, involving 75 rice farmers, 21 Agric Extension Officers and 5 Farm Managers. After that, the remaining nine (9) of them were interviewed, involving three (3) farm managers and three (3) extension/agricultural officers, and three (3) smallholder rice farmers. Thus, for the qualitative component of the study, the sample size was nine (9) participants.

3.8 Sampling techniques

Sampling technique is defined as the processes involved in selecting part of a population for research (Gravetter & Forsano, 2018:31). Thus, a sampling technique denotes the processes utilized in the selection of research participants from a larger group or population so that conclusions can be drawn as a representation of how the larger group of people act or what they believe (Plonsky, 2017:51). There are two main types of sampling techniques, probability and non-probability sampling. Probability sampling is defined as a sampling technique in which all individuals in a population have an equal chance of being selected (Plonsky, 2017:53). Probability sampling includes simple random sampling, systematic sampling, cluster sampling and stratified sampling (Patten & Newhart, 2017). Non-probability sampling technique is also defined as procedures for selecting participants where the members of a population do not have an equal chance of being selected (Gravetter & Forsano, 2018:37). Examples of non-probability sampling techniques include convenience, purposive, quota and snowballing (Patten & Newhart, 2017:32).

In the current study, different selection criteria were used in selecting respondents for the quantitative and qualitative components. For the survey, all the 101 members of the population were selected for the study using census sampling. The minimum sample size suggested for survey research is one hundred (100) depending on the population size (Gravetter & Forsano, 2018:43). Where the population size is below or equal to two hundred, the entire population should be surveyed (Nardi, 2018:41). Researchers use different terminologies for describing such a selection process, such as census, complete

enumeration and complete count (Creswell, 2009:23; Gravetter & Forsano, 2018:43; Nardi, 2018:41).

For the qualitative data, a purposive sampling technique was used to select participants. Purposive sampling is defined as a process of selecting participants for a study based on their specific roles (Gravetter & Forsano, 2018:45). All the interviewees selected for the qualitative data were three top position holders in their respective groups. The three (3) farm managers were purposively selected because their oversight responsibility gives them a deeper understanding of knowledge sharing among the farmers. The three (3) extension officers were purposively selected because they were the head of all the extension officers and therefore are directly involved in giving knowledge to the farmers and therefore have an understanding of how knowledge is shared among them. The three (3) rice farmers were purposively selected because they hold various positions in the local associations of the smallholder rice farmers and therefore have a deeper insight into knowledge sharing among their colleagues.

3.9 Data collection tools, procedures and methods

This section discusses the various tools, procedures and methods that were used to collect the data. Data collection tools and methods are the various instruments, methods and means such as observation, survey questionnaire, interview guide and focus group guide that are used to obtain research data (Pattern & Newhart, 2017). In the current study, a questionnaire and an interview guide were the main data collection tools used.

3.9.1 Questionnaire

For the quantitative component, a questionnaire was used to gather the survey data. A questionnaire is defined as a research instrument that consists of a series of question items (and sometimes possible responses) that are used to gather knowledge or data from research respondents (Pattern & Newhart, 2017:51). According to Nardi (2018:63), a questionnaire is the most widely used research tool because it helps to collect knowledge from a sample of people in a short period and less cost-effective. The results

of the questionnaires can be easily quantified by either a researcher or through the use of software analysis tools. There are two main types of questionnaires. These are closed-ended questionnaires and open-ended questionnaires. The questionnaire used in the current study had both close-ended and open-ended elements.

3.9.1.1 Closed-ended questionnaire

A closed-ended questionnaire consists of question items that provide a range of responses from which respondents are restricted to choose. In many closed-ended questionnaires, the range of responses come in the form of Likert scale items, where respondents are sometimes provided with a 5-point Likert scale ranging from strongly agree to strongly disagree. In some instances, respondents are restricted to selecting a Yes-No response, and a middle-range response when respondents are not aware of their responses.

In the current study, both the Likert scale type and the Yes-No type of closed-ended questions were used. The Yes-No responses were used to explore the types of knowledge shared, knowledge sharing practices, knowledge sharing tools, methods and technologies among the rice farmers. A 'SOMEWHAT' option was provided in the case that respondents were not so sure of their response. The 5-point Likert scale response was used to examine benefits of knowledge sharing, inhibitors of knowledge sharing, enablers of knowledge sharing and strategies for enhancing knowledge sharing among the rice farmers. The Likert scale ranged as follows; 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), 5 = Strongly Agree (SA).

3.9.1.2 Open-ended questionnaire

An open-ended questionnaire consists of question items that allow respondents room to provide their responses. This option is used when researchers cannot think of all possible options to give and therefore give the chance to respondents to provide context-specific responses. In the current study, the open-ended option was used with the Yes-No closed-ended option, in exploring the types of knowledge shared, knowledge sharing practices,

knowledge sharing tools, methods and technologies among the rice farmers. After lists were generated, the researcher left spaces for respondents to include issues in their rice farming context which were not captured in the questionnaire.

3.9.2 Interview

Interviews are defined as interactive conversations between two or more people where one individual (referred to as the interviewer) asks questions to others (interviewee or interviewees) to elicit knowledge (Ritchie, Lewis, Nicholls & Ormston, 2013:12). Within the context of qualitative research, the researcher becomes the interviewer and the respondents become the interviewees. Interviews could be conducted through different media such as face-to-face, telephone and internet (Silverman, 2015:72). Interviews can be categorised into structured, semi-structured and unstructured (Ritchie et al., 2013:18). In structured interviews, an interview guide is developed and strictly followed when interviewing different respondents, such that issues not listed in the guide are not discussed (Silverman, 2015:73). In semi-structured interviews, an interview guide is used, but there is a room for probing questions to unearth issues not listed in the interview guide (Dawson, 2019:33). In an unstructured interview, there is no interview guide to control the interview but the context of the interaction determines the direction of the interview (Clarke & Braun, 2013:122).

In the current study, a semi-structured interview was used so an interview guide was developed to guide the interview process. The interview guide opened conversations into issues addressing each of the study objectives, which included exploring types of knowledge shared, knowledge sharing practices, benefits of knowledge sharing, inhibitors of knowledge sharing, enablers of knowledge sharing, tools, methods and technologies for knowledge sharing and strategies for enhancing knowledge sharing among the rice farmers. The interview guide served as an entry into the conversation, and after that several probing questions are asked based on responses from the respondents. The probing questions helped to delve deeper into contextual issues

relating to knowledge sharing in rice farming within the communities where the study was conducted.

3.9.3 Pre-test

After developing the study instrument (both the questionnaire and the interview guide), a pre-test was conducted. A pre-test is defined as a small-scale preliminary study that is conducted to evaluate the feasibility, time, cost and adverse events of the research due to be conducted and to improve upon the study design before to carrying out the full-scale or main research project (Dawson, 2019:31). The purposes of the pre-test, among other things, were to; assess if the questionnaire and the interview guide made sense to the respondents, and to identify any challenges that are likely to arise in order finalize all necessary corrections to enhance the questionnaire and the interview guide for the main study based on the feedback obtained. Researchers such as Pattern and Newhart (2017:72) advise that a sample size of between 10 - 20% of the sample size for the main study is adequate for piloting a study.

3.9.3.1 Pretesting of instruments

The instruments for data collection were pre-tested in Asuogyaman District in June 2019. This area was chosen because in the Eastern Region Asuogyaman District also recorded the highest rice production. Asuogyaman District is one of the thirty-three districts of the Eastern Region of Ghana. The sample for the pretesting was thirty-three (33) for both questionnaires and interviews. Twenty (20) rice farmers, five (5) managers and five (5) extension/agricultural officers were selected for the quantitative phase. However, for the qualitative phase, one (1) farmer, one (1) manager and one (1) extension officer were also interviewed for the qualitative phase. The essence of the pre-test helped to test the instruments for the data collection on consistency, accuracy, and applicability of questionnaire items or interview items.

3.9.3.2 Report of pretesting

The test-retest method was used to check reliability. For instance, respondents were given the questionnaire to answer and it was analysed. After three (3) weeks they were given the same questionnaire to answer to check if the results were similar. Pearson r was used to establish test-retest reliability. As rule of thumb, for test-retest to be deemed reliable, the r should more than 0.7 and valid. It is a statistic commonly quoted by authors to validate that tests and scales that have been created or adapted for research projects are fit for purpose. Creswell (2014) reveals that, if the Pearson r is more than 0.7, then the indication is that the instrument being used as high reliability and the items meet reasonable standards of consistency. Table 3.3 shows the distribution of scale of pre-test results for pilot test one (Cronbach, 1951:297-334).

Table 3.3: Distribution of scale for pre-test results

Scale	Results for Test 1				Results for Test 2		
	N	Mean	Std. Dev.	Pearson r	Mean	Std. Dev.	Pearson r
B	6	18.83	4.34	.88***	19.50	3.35	.75***
C	15	42.66	7.51	.78***	44.23	8.45	.85***
D	20	59.66	11.29	.89***	60.03	11.94	.91***
E	10	28.73	5.69	.78***	29.70	6.03	.85***
F	10	29.96	5.78	.80***	29.40	5.67	.75***
G	13	39.10	7.99	.89***	38.86	7.78	.87***
H	13	36.93	6.01	.70***	39.10	7.29	.83***

Source: Field data (2019);

*** means r is significant at $p < .001$

Table 3.3 shows a summary of the first pre-test. Comparing the results computed for the alpha 1 and alpha 2 show consistency of response to the statements on the instrument. For instance, looking at the range of Section D, F and G on the instrument, an alpha level (.89, .91; .79, .75 and .88, .87) was recorded for both tests. Using Pearson r, the instrument for yielded a reliability level of .81 for test 1 and .83 for test 2. The overall consistency was computed by finding the average of the two (2) test. The overall reliability for the students' instrument yielded an alpha level of .822 which shows the instrument was reliable.

The interview was conducted at the farm site of the participants. The interview session lasted for 30-40 minutes. To ensure consistency during the interview, the researcher developed an interview schedule that guided him for asking a question. Before the interview session, the researcher introduced himself, described the research, its purpose, category of participants, and the steps being taken to maintain confidentiality and anonymity. The following were the essence for the pilot testing of instruments:

- Reduction, rewording and restructuring of interview questions: The initial interview questions were too verbose and too long and the interviewees felt overwhelmed, confused and tired. A shorter and more concise interview schedule was developed. The sequencing of some questions was also changed, following the specific objectives.
- Identification of new agricultural knowledge to focus on: The development of the initial interview questions was guided by the literature review; the pilot interviews added the agricultural and rice farming aspect to be investigated.
- Sharpening of interview skills: For instance, listening to the interview tapes the author realized a habit he had of finishing sentences for interviewees.

Reviews were done before each field trip. The author reviewed knowledge about the research site, the rice farming areas and knowledge sharing practices among them. This knowledge was received from different sources such as farmers, consultants and the internet. Also, as part of the preparation, the researcher started looking at online

newspapers and e-resources from the research locales. This helped the researcher to develop a better understanding of the context.

3.10 Trustworthiness, reliability and validity

This section presents a discussion of trustworthiness, validity and reliability of the study. Issues of trustworthiness, reliability and validity are arguably fundamentally critical issues that need to be addressed, particularly in mixed-method studies that involve qualitative research components (Montuschi, 2014:123). The core reason is based on the argument that qualitative research is subjective and value-laden through and through (Montuschi, 2014:126).

3.10.1 Reliability and validity in quantitative studies

Reliability and validity are conceptually used for quantitative research (Morse et al., 2002:16), even though both concepts also apply to some extent to qualitative research in practice and principle (Creswell & Creswell, 2017:55). Reliability is defined as the extent of consistency to which research studies can produce the same results when repeated by different researchers (Silverman, 2015:28). Others also define reliability as the consistency of research measurement (Tashakkori & Teddlie, 2010:28), or the degree to which an instrument measures the same way each time it is used under the same conditions with the same respondents (Creswell & Creswell, 2017:55). The fundamental issue of reliability is, therefore, replicability of findings (Morse, Barrett, Mayan, Olson & Spiers, 2002:15). Reliability in quantitative research is established using two criteria, test-retest and internal consistency. Test-retest criteria are when the instrument gives consistent scores when taken by the same respondents at different times (Morse et al., 2002:23). Internal consistency estimates reliability by grouping questions in a questionnaire that measure the same concept (Silverman, 2015:33).

The validity, on the other hand, is defined as the extent to which a concept is accurately measured in a quantitative study (Tashakkori & Teddlie, 2010:28). Other researchers also define validity as the degree to which research findings accurately reflect the social

phenomena under investigation (Creswell & Creswell, 2017:51). There are three main ways of establishing validity in quantitative research; face validity, content validity, construct validity and criterion validity (Heale & Twycross, 2015:66). Face validity is the extent by which questionnaire is deemed to be adequate for research question by examining what the questionnaire measures. Content validity is established by assessing the extent to which a research instrument accurately measures all aspects of a construct. Construct validity is established by assessing the extent to which a research instrument (or tool) measures the intended construct (Heale & Twycross, 2015:66). Criterion validity is also established by assessing the extent to which a research instrument is related to other instruments that measure the same variables (Heale & Twycross, 2015:66). In the current study, face and content validity were used to establish the validity of the questionnaire. The researcher ensured that the items in the questionnaire adequately captured what the literature says and also adequately answered the research question.

3.10.2 Trustworthiness in qualitative studies

Several qualitative researchers such as Creswell and Creswell (2017:67) and Silverman (2015:28) have come up with various strategies for strengthening and enhancing trustworthiness in qualitative research. Four fundamental ways have been suggested for ensuring rigour in qualitative research. These are dependability, confirmability, credibility and transferability (Lincoln & Guba, 1985:13; Silverman, 2015:28). Each of these four strategies speaks to different aspects of reliability and validity. Dependability is often called reliability and refers to the consistency with which findings from qualitative research can be repeated (Silverman, 2015:32). Confirmability is also defined as the measure of objectivity in evaluating results (Smith, 2005:21). Confirmability denotes the extent to which findings are accurately supported by the actual data collected (Lincoln & Guba, 1985:21). Credibility refers to the extent of trustworthiness and believability of findings and is often associated with internal validity (Mayan, 2009). Transferability is mostly associated with external validity (Silverman, 2015:20), and refers to the extent the findings from qualitative research can be transferred from one context to other similar contexts (Lincoln & Guba, 1985:14). The four strategies require that care is taken at different

stages of qualitative research to ensure that the study is both reliable, internally and externally valid and trustworthy. In each of the stages, there are specific or special skills needed to ensure rigour.

In mixed-method studies, there are two main ways of ensuring trustworthiness, which is inference quality and inference transferability (Tashakkori & Teddlie, 2010:28). Inference quality refers to “the standard for evaluating the quality of conclusions that are made based on both the QUAN and QUAL findings” (Tashakkori & Teddlie, 2010:32). Inference quality, therefore, incorporates internal validity and trustworthiness of the research process (Silverman, 2015:28). Inference transferability, on the other hand, refers to “the degree to which the conclusions from an MM study may be applied to other settings, people, periods, contexts” (Tashakkori & Teddlie, 2010:32). Inference transferability incorporates external validity and transferability (Creswell & Creswell, 2017:55).

Tashakkori and Teddlie (2010:261) argue that there is the need to integrate the inference quality and inference transferability into an integrative framework to ensure trustworthiness in the mixed-method research process. The indicators in the integrative framework include design appropriateness (Was the method of study appropriate?), design fidelity (Was the data collection and sampling implemented adequately?), within-design consistency (Did the design components fit together?), and analytic adequacy (Is the data analysis appropriate?). All these indicators and their questions were adequately ensured in the current study. In this study, reliability, validity and trustworthiness were ensured all through the different stages of the data gathering and analysis processes. In terms of design appropriateness, the process started from the research design stage where the researcher ensured that the best methods were used for eliciting the needed knowledge on knowledge sharing from the rice farmers.

The choice of the mixed-method is a good fit for the pragmatic research paradigm which underpinned the current study. In terms of design fidelity, in collecting data, the researcher ensured that the data was collected from multiple sources including the rice farmers and other stakeholders who are directly involved with rice farming in the study

setting. Multiple methods involving a survey and individual interviews were also used in collecting the data. This is often referred to as data triangulation (Smith, 2005:31). Collecting data from multiple perspectives ensures verification and cross-checking of facts to make sure that the data collected adequately reflects social reality (Creswell & Creswell, 2017:33).

In terms of analytical adequacy, after successfully collecting data, the way and manner with which the data is analysed also have implications on rigour or reliability and validity, both for the quantitative and the qualitative components of mixed-method studies (Creswell & Creswell, 2017:33). Analysis of data has strong implications, especially on the internal validity or credibility of the research (Silverman, 2015:33). When the data is analysed right, it ensures that the findings are accurate and credible. In the current study, the first strategy used in achieving reliability and trustworthiness was providing a detailed account of the procedures used in analysing the data (Silverman, 2015). This ensures that readers are left with no doubt in their minds as to who did the qualitative analyses and how the data analysis was done (Creswell & Creswell, 2017:37). Another strategy that was also used was that of inter-rater reliability, where two other MPhil graduates who are experienced analysed the data and their findings were compared (Morse et al., 2002:17). This reduces subjectivity in the analysis and improves credibility and dependability (Creswell & Creswell, 2017:43; Morse et al., 2002:18).

Lastly, the researcher was also mindful of reflexivity. Reflexivity refers to acknowledging the input of the researchers in actively co-constructing the situation which they want to study (Creswell & Creswell, 2017:42; Pattern and Newhart, 2017:44). The subjectivity of the researcher and of those being studied becomes part of the research process. Therefore, the researcher's reflections on their actions and observations in the field, their impressions, irritations, feelings, and so on, become data in their own right, forming part of the interpretation. In this case, the researcher is a trained information scientist with much knowledge in knowledge sharing and knowledge management in organisational settings. The researcher is also very familiar with the rice farming communities. This background of the researcher helped in exploring the issue of knowledge sharing among

the rice farmers. However, as much as possible, the researcher bracketed his knowledge and opinions and allowed the voices of the respondents to reflect in the data. The researcher's background knowledge was only drawn on in asking probing questions, especially in the semi-structured interviews.

3.11 Data analysis and presentation

Data analysis is defined as the processes involved in transforming raw data into meaningful knowledge in answering research questions or meeting study objectives (Braun, Clarke, Hayfield, & Terry, 2019:844). Data analysis leads to refined findings that expand knowledge, influence policy and practice, and also broaden theory and literature (Creswell & Creswell, 2017:33). In the case of mixed-method studies, different analytical techniques and procedures are employed in analysing the quantitative and the qualitative data. Therefore, in the current study, the quantitative data and qualitative data were analysed differently, separately and independently.

3.11.1 Quantitative data analysis

For the quantitative component, the survey data was analysed using both descriptive and inferential statistics using the Statistical Package for Social Sciences (SPSS), version 26. The first stage of the survey data analysis involved coding responses of the respondents on the questionnaire into the SPSS software. The coding was done by assigning numbers to all the responses on the questionnaire, to convert the responses into numerical language, which the software understands. Each coded number was assigned an interpretation based on the questionnaire. For example, gender was coded as male = 1, female = 2 and educational level was coded as no school = 1, basic school = 2, high school = 3 and tertiary = 4. The coding gave meaning to each of the figures to guide the software in processing the data.

After the coding process, the next stage involved conducting descriptive statistics of the responses from the respondents. The descriptive statistics are presented using frequencies and percentages, to estimate the patterns in the data. From the frequencies

and percentages, the data is also represented in the form of tables. Descriptive statistics (frequency and percentages) were used to analyse the research questions. Knowledge arising from the data analyses were then interpreted for meanings, summarized and recommendations drawn.

3.11.2 Qualitative data analysis

The qualitative data was gathered in the form of interviews and focus group discussions. In both instances, the data was received in the form of audio narratives from the respondents. The qualitative data was analysed using thematic analysis. The thematic analysis was done following the procedures provided by Clarke and Braun (2013:4) for analysing interview data. With the permission of participants, all interviews and focus group discussions were audio-recorded.

The first stage of the thematic analysis involved transcribing all the audio data into transcripts. The next stage of the analysis involved the researcher familiarizing himself with the interview data to analyse it well. This was done through reading and coding all the transcripts within the context of the study objectives and the research questions (Braun et al., 2019:848). After the coding process, the third stage involved grouping the codes into minor themes. The last stage involved grouping the minor themes into major themes in ways that provide insight into the research question under study.

The qualitative data analysis was very subjective, the researcher sought the assistance of two MPHIL graduates in the qualitative data analysis processes on the advice of Braun and Clark (2013:9) and Creswell and Creswell (2017:44) to reduce the subjectivity of the researcher. Therefore, the researcher and the two graduate assistants all went through the same processes of coding the transcripts and developing the minor and major themes. The findings from the three of us were compared at every stage and all issues of disagreement discussed and incorporated into the next stage of the analysis to reduce researcher subjectivity. The qualitative findings are then presented using themes, codes and quotes from participants' narratives.

3.12 Evaluation of the research methodology

The methodology used for this current study is concurrent with triangulation mixed-method design, where both survey data and interviews were gathered to provide a holistic understanding of the research questions from different perspectives. The methodology used in the current study is different from what other previous studies have used. Most of the previous studies conducted on knowledge sharing or knowledge management among rice farmers either used the quantitative research approach (e.g. Chen et al., 2015:1433; Feng & Xue, 2014:11) or the qualitative research approach (e.g. Gava et al., 2017:105; Meijer et al., 2015:175; Siziba et al., 2012:46). While these studies provide important insights, they are methodologically limited in providing holistic understanding.

For instance, while the quantitative studies provide a breadth of understanding, they are unable to offer a depth of understanding, and vice-versa with the qualitative studies. Therefore, in the current study, the mixed-method, underpinned by pragmatism, was best suited to provide both breadth and depth in unearthing how knowledge sharing among rice farmers in the Eastern Region of Ghana simultaneously compares with and differs from knowledge sharing in other contexts. The mixed-method approach was the best research approach to be able to satisfy both conditions. The quantitative data provides insight into the context of knowledge sharing among a large sample of rice farmers, while the qualitative data provides an in-depth understanding of knowledge sharing among the rice farmers through in-depth discussions. Mixed-method therefore helps to compare findings from the quantitative and qualitative data. The quantitative and the qualitative data are measured to help reveal the complexities and nuances of knowledge sharing among the rice farmers in the Eastern Region of Ghana. This will also help to inform policy and practice of rice farming and to contribute to the global literature on knowledge sharing, knowledge management, and agriculture with special reference to rice farming in developing economies

3.13 Summary of chapter three

This chapter has presented a detailed description and discussion of the methodological processes and procedures that were followed in collecting and analysing data in meeting the study objectives. The research paradigm, research approach, research design, population, sample size, sampling techniques, pre-test, pretesting instruments, report of pretesting, data collection tools, procedures and methods were discussed. The study adopted a mixed-method approach to ensure that both breadth and depth of knowledge sharing practices among the rice farmers are unearthed. The next chapter presents the results obtained from the study based on the responses from the questionnaire and the interviews conducted.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS OF THE STUDY

4.1 Introduction

The previous chapter established the methodological framework for gathering and analysing data for the study. The chapter aim to present the analysis and findings from the empirical data. The data was gathered using a concurrent triangulation mixed-method design, using survey a questionnaire and semi-structured individual interviews. The Quantitative data and qualitative data were collected and analysed simultaneously, and finally merged to provide holistic understanding of research questions. The survey questionnaire had open-ended questions and an 'other' category in addition to the closed-ended questions due to inherent bias and omissions in closed-ended questions (Creswell and Clark, 2017:14; Dawson, 2019:12).

Overall, the study involved a survey of all 101 members of the population and nine purposively sampled respondents for interviews. It is worthy of noting, however, that only 12 (11.9%) of the respondents completed the open-ended and the 'other' category of the questionnaire. The reason could be attributed to the fact that the questionnaire was developed after a comprehensive review of the literature and so most of the key issues were included in the survey questionnaire. However, the few responses to the open-ended questions and 'other' category provided useful insight into understanding knowledge sharing practices among the rice farmers.

In all, the data collection instruments (i.e. the survey questionnaire and the interview guide) were designed to answer the following research questions:

1. What are the different types of knowledge shared among rice farmers in the Eastern Region of Ghana?
2. What are the knowledge sharing practices used among rice farmers in the Eastern Region of Ghana?

3. Which technologies are used for knowledge sharing among the rice farmers in the Eastern Region of Ghana?
4. How do we assess the benefits of knowledge sharing practices among rice farmers in the Eastern Region of Ghana?
5. What are the factors that inhibit knowledge sharing among rice farmers in the Eastern Region of Ghana?
6. What are the different enablers to knowledge sharing among rice farmers in the Eastern Region of Ghana?
7. What are the strategies to enhance knowledge sharing practices among rice farmers in the Eastern Region of Ghana?

The findings in this chapter are presented in two parts. The first part presents findings from the quantitative survey data, and the second part presents findings from the qualitative interview data.

4.2 Quantitative findings from the survey data

This section presents findings from the survey data. In all, 101 questionnaires were distributed to respondents. Much of the questionnaire administration to the rice farmers were researcher administered with the help of field assistants due to low levels of education among the rice farmers. Fieldwork was carried out until all the questionnaires were retrieved. Respondents who had misplaced theirs were given new questionnaires to fill. Therefore, the researcher ensured a 100% response rate of the questionnaire after about eight months of data gathering. This assumes that the entire 101 questionnaires that were distributed to the respondents, with the help of field assistants, were all filled and returned for analysis and discussion. Table 4.1 provides the response rate.

Table 4. 1: Response rate for survey questionnaire

Sample (n)	Response Retrieved	Response Percent
Rice farmers (75)	75	100%
Agric/Extension Officers (21)	21	100%
Farmer Managers (5)	5	100%
Total Response Rate	101	100%

Source: Field data, (2019)

Using the Statistical Package for Social Sciences (SPSS) version 23.0 and Microsoft Excel, data were coded and analyzed in frequencies, percentages, charts and graphs. The findings in this section were presented according to survey questionnaire. The survey questionnaire consisted of a total of fourteen (14) questions divided into eight (8) sections as follows: a) biodata of respondents, b) types of knowledge shared among the rice farmers, c) knowledge sharing practices among the rice farmers, d) benefits of knowledge sharing among the rice farmers, e) factors that inhibit knowledge sharing among the rice farmers, f) enablers of knowledge sharing among the rice farmers, g) tools, methods and technologies for knowledge sharing among the rice farmers, and h) strategies for enhancing knowledge sharing among the rice farmers (Appendix 2). The first section of the research instrument (both the survey questionnaire and the interview guide) sought to examine the sociodemographic profiles of the respondents in the study.

4.2.1 Sociodemographic profile of respondents

In all, 101 respondents were used. This section presents the demographic knowledge of the respondents. The sociodemographic characteristics examined included gender, age, number of years of farming, and educational level of the rice farmers.

4.2.1.1 Gender distribution of respondents

Question 2 examined how respondents were distributed in terms of gender. Figure 4.1 shows gender distribution of the study.

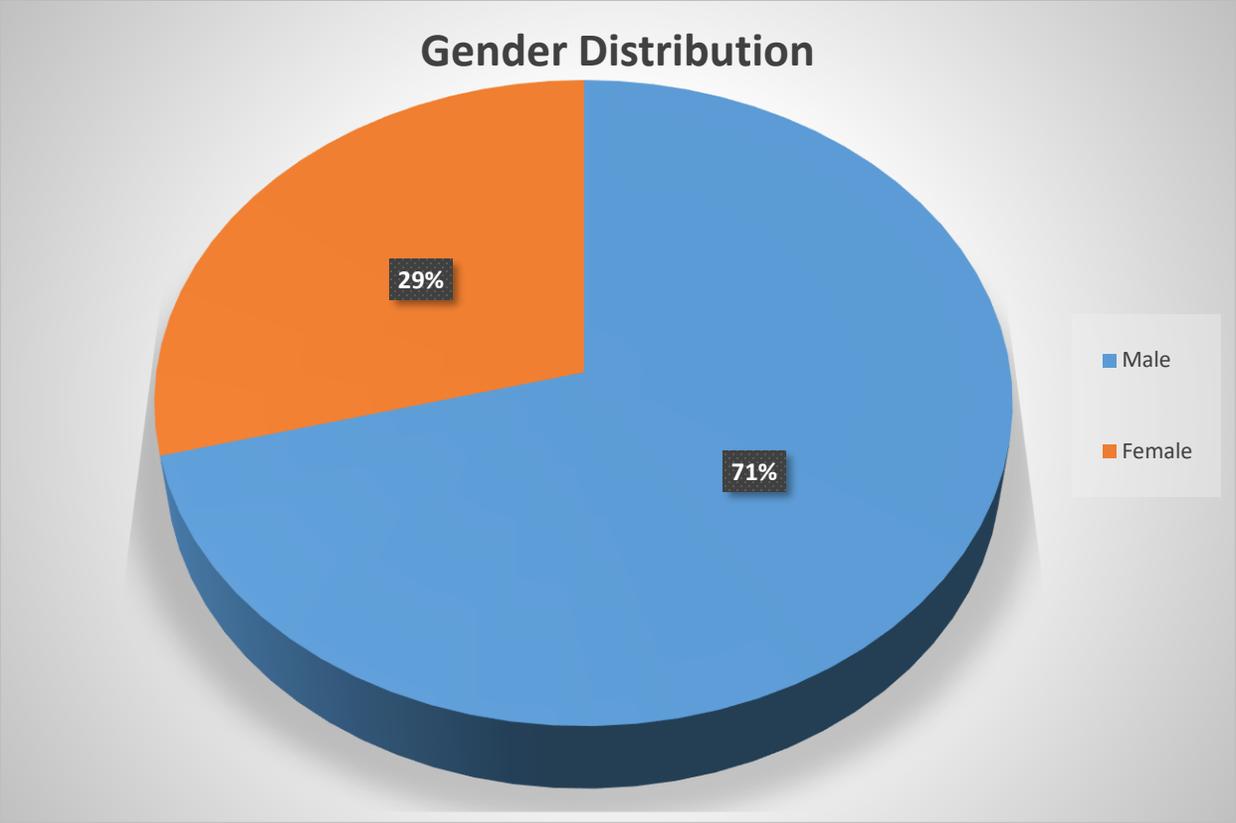


Figure 4.1: Gender distribution of respondents (N = 101)
 Source: Field data, (2019)

As shown in Figure 4.1, the majority of the respondents were males (70.9%) as against females (29.1%) who were the minority. The males outnumbered the females because a report from the Ministry of Agriculture Report 2017 confirms that, in Ghana, there is the enrolment of more males than females in farming activities in general and rice farming in particular. This is also consistent with global statistics that suggest that rice farming is dominated by males. The subsequent figure 4.2 presents the age distribution of the farmers.

4.2.1.2 Age distribution of respondents

Question 3 sought to establish the ages of the rice farmers. The respondents were therefore asked to tick against age brackets that accurately reflect their ages. The findings are provided in Figure 4.2.

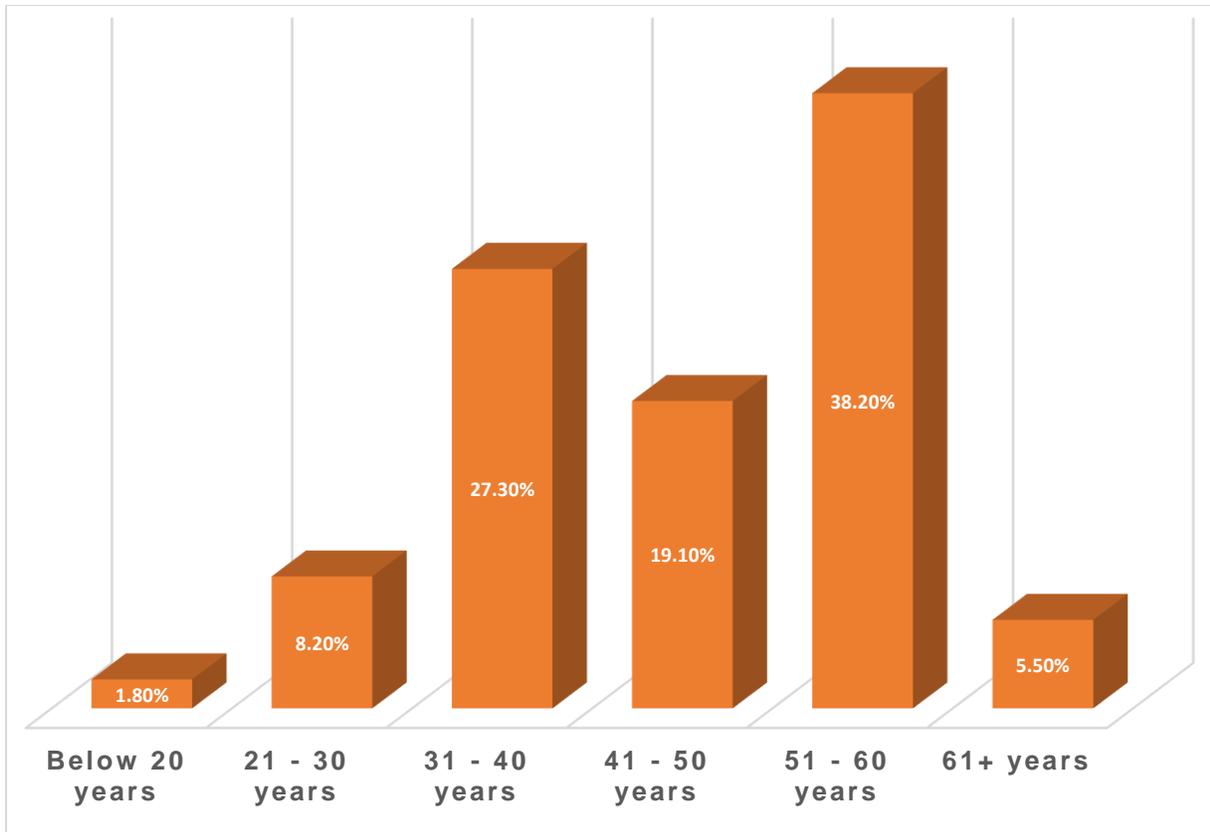


Figure 4.2: Age distribution of respondents (N = 101)
 Source: Field data, (2019)

As shown in the bar chart (Figure 4.2), it was revealed that the majority of the respondents (42) constituting 38.2% were within the ages of 51-60 years. Thirty (30) respondents representing 27.3% were within the ages of 31-40, and 21-30 recorded 8.2% respectively. Again, the ages from 61 and above and below 20 recorded 5.5% and 1.8% respondents respectively. The age distribution suggests that rice farmers are ageing. This has implications on how they will be able to relate to or use technology for sharing knowledge. The next section explains how long respondents have gained experience in farming.

4.2.1.3 Years of rice farming

Question 4 sought to establish the number of years that the respondents have been engaging in rice farming. The respondents were asked to tick against the categories of

years that reflected how long they have been engaging in rice farming. The results are shown in Figure 4.3.

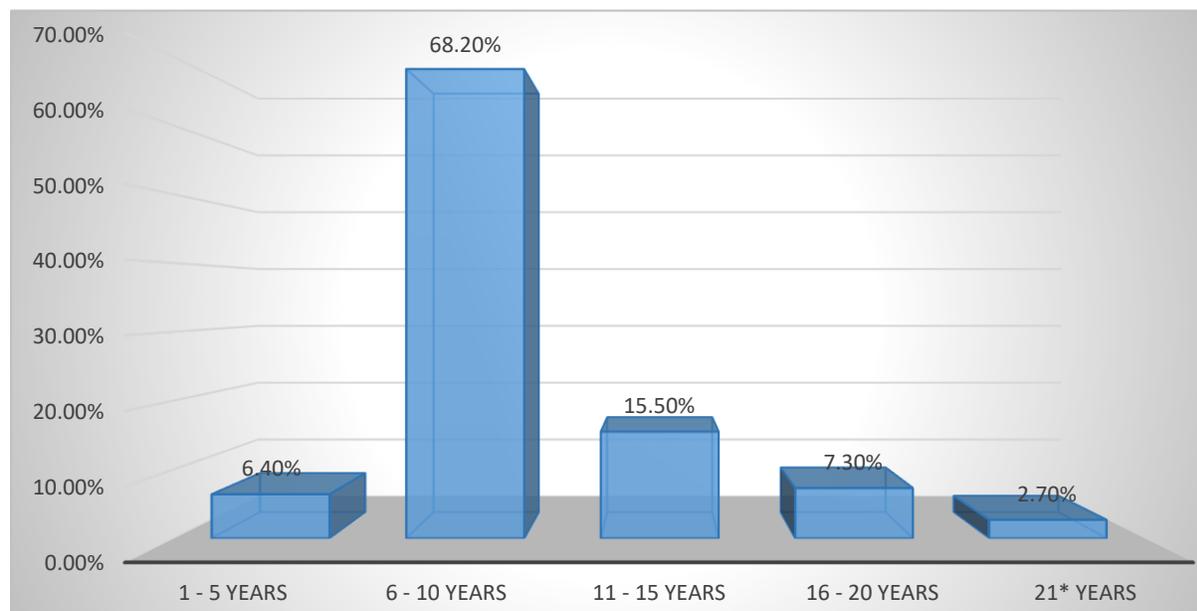


Figure 4.3: Distribution of respondents based on years of rice farming (N = 101)
Source: Field data, (2019)

The bar chart (Figure 4.3) shows that the majority of the respondents constituting 68.2% have worked between 6-10 years as compared to 15.5% of them having been involved in farming activities between 11-15 years. Between 16 and 20 working years' experience recorded 7.3% and 1-5 years recorded 6.4% respectively. Again, farmers whose working experience were above 20 years had the least percentage of 2.7%. The next section discusses how participants were distributed by their educational level.

4.2.1.4 Educational level of participants

Question 5 examined the respondents' educational level. The respondents were asked to tick against the highest level of education that they have attained. The results are provided in Figure 4.4.

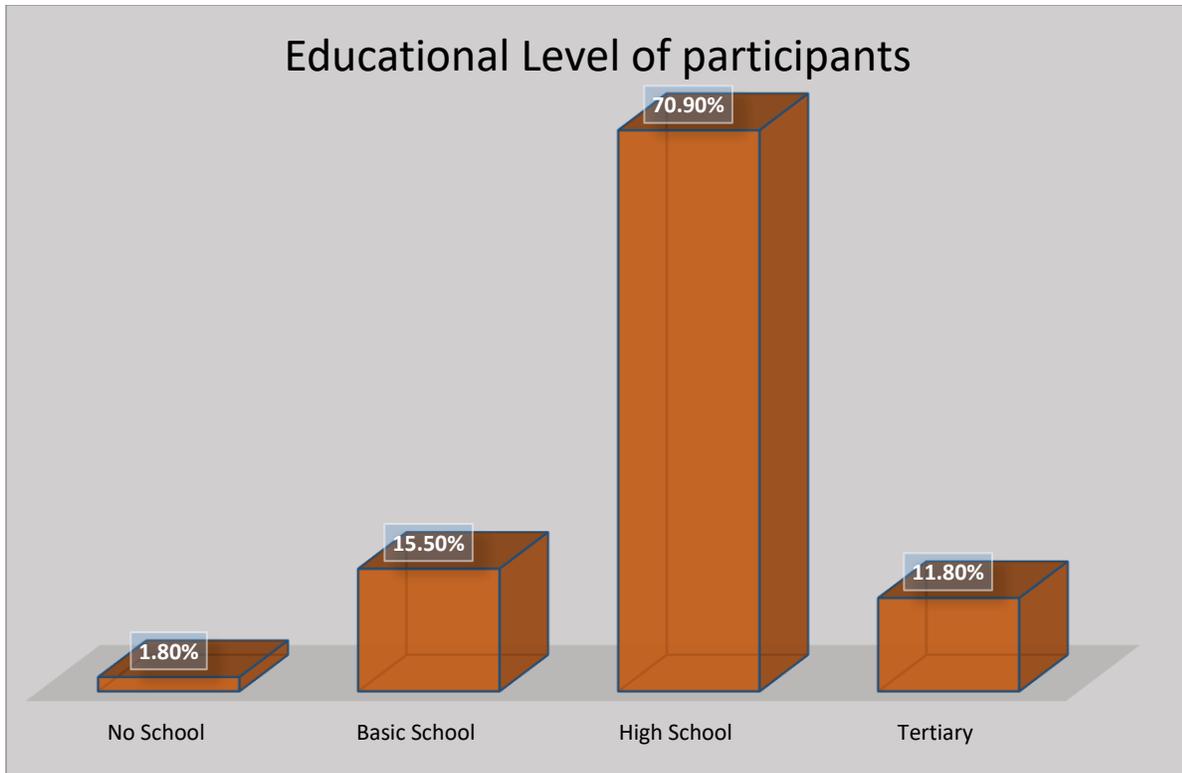


Figure 4.4: Distribution of respondents by educational level (N = 101)
 Source: Field data, (2019)

Figure 4.4 reveals that majority of the respondents constituting 70.9% completed high school as compared to 15.5% of the farmers who had completed basic school education. About 11.8% had completed tertiary education while 1.8% had not attended school before. The next section presents findings from the research questions.

4.2.2 Type of knowledge shared among rice farmers

The first objective of the study was to identify the different types of knowledge shared among the rice farmers in the Eastern Region of Ghana. The main research question addressed here was; What are the different types of knowledge shared among rice farmers in the Eastern Region of Ghana? The purpose of question 6 of the survey questionnaire and questions 3 and 4 in the interview guide were meant to meet this objective.

In question 6 of the survey questionnaire, the respondents were asked to indicate against a list of types of knowledge in agriculture whether they share that type of knowledge by ticking; YES, NO or SOMEWHAT. The results of the frequency of types of knowledge shared to provide insight into the different types of knowledge that are mostly shared among the rice farmers. The results are presented as percentages in Table 4.2 below. The findings on the table have been arranged according to the order of percentages of frequencies in which the types of knowledge are shared.

Table 4.2: Types of knowledge shared among the rice farmers

Types of knowledge shared	YES (%)	NO (%)	SOMEWHAT (%)
Weed management knowledge	97.3	-	2.7
Rice harvesting, processing and marketing	92.7	3.6	3.6
Agricultural knowledge	88.2	3.6	8.2
Land management practice	73.6	6.4	20.0
Seed knowledge sharing	69.1	27.3	3.6
Farming creativity and innovation	43.6	2.7	53.6

Source: Field data, (2019)

As indicated in Table 4.2, the response rate was 100%. Findings showed that the dominant types of knowledge shared were: weed management information, rice harvesting, processing and marketing information, and general agricultural knowledge. As shown in Table 4.2, most respondents suggested that the type of knowledge shared among farmers was on weed management which recorded 97.3% for YES and 2.7% for 'SOMEWHAT'. Rice harvesting, processing and marketing statement recorded 92.7% for YES and 3.65% was recorded for NO and SOMEWHAT.

Again, the findings showed that agricultural knowledge and land management practice scored (88% YES; 3.6% NO; 8.2% SOMEWHAT) and (73.6 YES%; 6.4 NO%; 20% SOMEWHAT) respectively. However, it was observed that seed knowledge sharing yielded 69.1% for YES; 27.3% for NO and 3.6% for SOMEWHAT. Farming creativity and innovation was the least type of knowledge shared, with more people responding SOMEWHAT (53.6%) compared to 43.6% who responded YES.

Other types of knowledge shared that was indicated by the respondents were food security (35.5%) and climate change (31.1%). Some of the other types of knowledge sharing that emerged from the open-ended question cohered around three thematic areas; pest control, food security and climate change. These other types of knowledge are described below.

Pest control knowledge

The pest control knowledge shared among the farmers centred around various traditional and non-traditional ways and means of fighting off pests and other animals that pose a threat to the rice plants. The dominant theme in the respondents' responses was how to fight birds from the farm. Some of the responses provided included:

"We share knowledge on how to fight birds from our farm" (Female Rice Farmer)

"The farmers also share among themselves ways they can use to drive birds away from their farms" (Agric/Extension Officer)

"We discuss among ourselves how to fight the birds that come to eat the rice in our farms" (Female Rice Farmer)

"We share ideas on how to make scarecrows in ways that can scare birds from the farms" (Female Rice Farmer)

Apart from fight birds, the responses also showed they share knowledge on how to fight other pests and other insects like weevils, maggots, ants, armyworms, caterpillars and others. Some of the responses were:

“We teach among ourselves how to fight animals that infect the rice after harvesting” (Female Rice Farmer)

“The farmers share knowledge on different kinds of sprays and fertilizers to apply to fight against pests like armyworm, ants and others on the farms” (Agric/Extension Officer)

“Sharing knowledge about controlling rice weevils, maggots, caterpillars and armyworms” (Male Rice Farmer)

“We also share knowledge on pest control” (Male Rice Farmer)

Food security knowledge

The food security knowledge shared among the respondents focused on how increasing rice production can help Ghana manage food shortages in future. Some of the responses from the respondents are provided here verbatim:

“Share ideas on how to increase rice production to fight hunger” (Male Rice Farmer)

“We discuss how our rice production activities can help to increase food supply to the increasing Ghanaian population” (Female Rice Farmer)

“We share knowledge on how to meet the increasing demand for rice in Ghana” (Female Rice Farmer)

“We share knowledge on food security and other relevant matters” (Agric/Extension Officer)

“We also discuss how we can increase the rice we produce every year because Ghana’s population is increasing” (Female Rice Farmer)

“We share food security knowledge” (Female Rice Farmer)

Climate change knowledge

The responses on climate change knowledge shared among the farmers focused on sharing knowledge about the changing nature of weather conditions and how they affect rice farming activities. Some of the responses provided by the respondents were:

“We share knowledge among ourselves about how the weather changes affect our farming activities” (Female Rice Farmer)

“The rice farmers discuss among themselves on how to mitigate the adverse effect of climate changes on rice farming” (Agric/Extension Officer)

“We discuss the changes in weather patterns a lot among ourselves” (Male Rice Farmer)

“Weather changes are part of the knowledge we share” (Male Rice Farmer)

“We share knowledge on climate change patterns” (Male Rice Farmer)

“Share knowledge on weather patterns and climate change” (Agric/Extension Officer)

“Knowledge sharing practices help improve organizational performance and achieve the mission” (Farm Manager)

4.2.3 Knowledge sharing practices among farmers

The second objective of the study sought to examine different knowledge sharing practices used among the rice farmers in the Eastern Region of Ghana. The main research question that this objective addressed was; What are the knowledge sharing practices used among rice farmers in the Eastern Region of Ghana? Question 7 of the survey questionnaire was meant to meet this objective. The respondents were presented with statements on knowledge sharing practice which the response was “YES, NO or SOMEWHAT” used to denote the statement. The results of the frequency of knowledge sharing practices provide insight into the different ways the rice farmers shared knowledge among themselves. The results are presented on percentages in Table 4.3. The findings in the table have been arranged according to the order of percentages of frequencies in which the knowledge sharing practices are used.

Table 4.3: Knowledge sharing practices among the rice farmers

Knowledge sharing practices	YES (%)	NO (%)	SOMEWHAT (%)
Workshops, training and seminars	98.2	0.9	0.9
Knowledge fairs	97.3	2.7	-
Discussion forums	95.5	0.9	3.6
Personalization/Face-to-face collaboration	95.5	0.9	3.6
Coaching system	92.7	3.6	3.6
Storytelling	91.8	5.5	2.7
Community of practice	90.9	4.5	4.5
Mentoring system	88.2	3.6	8.2
Peer assists	85.5	0.9	13.6
After action review /Lessons learnt	77.3	20.9	1.8
Incidence report	77.3	12.7	10.0
Use of knowledge banks and portals	38.2	45.5	16.4
Documentation	38.2	30.0	31.8
Job shadowing	30.9	37.3	31.8
Job rotation	11.8	84.5	3.6

Source: Field data (2019)

The finding from Table 4.3 shows that the common ways for knowledge sharing practice were through workshops, training and seminars (98.2%), knowledge fairs (97.3%) and discussion forums (95.5%), personalization/face-to-face collaboration (95.5%), coaching system (92.7%), storytelling (91.8%) and community of practice (90.9%). These practices were the most frequently used method for knowledge sharing among farmers. On the other hand, Job rotation (11.8%), Job shadowing (30.9%) and use of knowledge banks and portals (38.2%) had the lowest values. The next section presents the benefits that the rice farmers derive from knowledge sharing in their rice farming activities.

Other knowledge sharing practices

Some of the other additional knowledge sharing practices that emerged from the open-ended questions were; knowledge sharing capabilities, use of community knowledge centres and monthly meetings.

Knowledge sharing capabilities

“Let us build knowledge-sharing capabilities around rice farming” (Farm Manager)

“Sharing best practices through knowledge sharing platform will allow rice farmers with creative and innovative ideas to boost performance and productivity” (Farm Manager)

“We should increase awareness and understanding of knowledge sharing across rice farms” (Agric/Extension Officer)

“Knowledge sharing practices enable reuse and regeneration of knowledge by individuals and organisational level” (Agric/Extension Officer)

“It is the process of transferring knowledge from people to people” (Rice Farmer, Male)

“It is the kind of social interaction among people” (Rice Farmer, Male)

Knowledge sharing is a viable means by which rice farmers could improve on their farms” (Agric/Extension Officer)

Community knowledge centre

The community knowledge centres are community-based radio transmission systems used to pass knowledge to community members. The respondents indicated that sometimes some knowledge is passed through this medium to rice farmers:

“Sometimes we get knowledge from the knowledge centre” (Female Rice Farmer)

“We use the knowledge centre in the community to also pass knowledge to the rice farmers” (Agric Extension Officer)

“We get an announcement from the knowledge centre to us the rice farmers” (Male Rice Farmer)

“The knowledge centre also gives us information” (Male Rice Farmer)

“The knowledge centre in the communities also help us to give knowledge to the rice farmers” (Agric/Extension Officer)

“We share stories on rice farming” (Male Rice Farmer)

“Workers with experiences are assigned mentoring roles and responsibilities” (Female Rice Farmer)

Monthly meetings

The rice farmers hold regular monthly meetings among themselves, during which meetings they engage in knowledge sharing. This is exemplified by these verbatim responses provided by the respondents:

“We use our monthly meeting to also share information” (Male Rice Farmer)

“We share knowledge during our monthly meetings” (Male Rice Farmer)

“Every month when we meet, we share information” (Female Rice Farmer)

“The rice farmers meet on a monthly basis and they share knowledge among themselves” (Agric Extension Officer)

“Our monthly meetings also help us to share knowledge” (Male Rice Farmer)

“We use video-conferencing extensively for monthly meetings” (Farm Manager)

“Meetings are done both virtually and physically by rice farmers” (Male Rice Farmer)

“Workers come together to share their experiences, difficulties and agricultural knowledge they encountered on the rice farms” (Male Rice Farmer)

4.2.4 Technologies used for knowledge sharing among farmers

The third objective of the study examined the tools, technologies and systems used for knowledge sharing among the rice farmers. This objective was assessed in three parts; tools for knowledge sharing, systems of knowledge sharing, and technologies for knowledge sharing. Questions 8 to 14 of the survey questionnaire and question 5 of the interview guide provided insight into the context of the tools, technologies and systems used for knowledge sharing among the rice farmers. In the survey questions 8 – 10, the respondents were provided with a list of possible tools (question 8), methods (question 9) and technologies (question 10) to indicate which of them they use in knowledge sharing by ticking YES, NO or SOMEWHAT. The results provided insight into the different tools, methods and technologies that are mostly used for knowledge sharing among the rice farmers. The results are presented as percentages in Tables 4.4-4.5 below.

4.2.4.1 Technological tools used for knowledge sharing among the rice farmers

This subsection presents the findings on the tools that are mostly used for knowledge sharing among the rice farmers. The results from the survey questionnaire are provided in Table 4.4. The technological tools are arranged according to the highest percentage frequencies of YES responses to show dominant use.

Table 4. 4: Technological tools used for knowledge sharing among farmers

Technological Tools	YES (%)	NO (%)	SOMEWHAT (%)
Magazines	88.2	8.2	3.6
Electronic databases	75.5	9.1	15.5
Expertise locator system	70.0	22.7	7.3
Email	64.5	10.9	24.5
Extranet	58.2	35.5	6.4
Intranet	41.6	47.3	10.9
Video conferencing	19.1	67.3	13.6
Skype	13.6	72.7	13.6
Blogs	11.8	74.5	13.6

Source: Field data (2019)

Findings showed that magazines, electronic databases and expertise locator were the dominant tools used for knowledge sharing among the rice farmers. As shown in Table 4.4, the majority of the respondents suggested that the technological way for the knowledge shared among farmers was with Magazines which recorded 88.2% for YES,

8.2% representing NO and 3.6% for SOMEWHAT. Electronic Databases recorded 75.5% for YES and 9.15% and 15.5% were both recorded for NO and SOMEWHAT respectively. Again, the findings showed that Expertise Locator System (70.0% YES, 22.7% NO, 7.3% SOMEWHAT) and Email” scored (64.5% YES, 10.9% NO, 24.5% SOMEWHAT) respectively.

However, it was observed that Blogs as a technological tool for knowledge sharing yielded 11.8% for YES; 74.5% for NO and 13.6% for SOMEWHAT. Overall, Skype and Video Conferencing recorded the least use, with the lower value of scores.

Some of the other tools that emerged from the open-ended questions revealed that;

“Sometimes we share knowledge with them by sending them letters” (Farm Manager)

“We also share knowledge using letters and memos” (Male Rice Farmer)

“We use Intranet for our day-to-day activities” (Male Rice Farmer)

“We also upload documents on rice production and farming from the Intranet or SharePoint” (Farm Manager)

The next section presents findings on the technologies used for knowledge sharing practices among farmers.

4.2.4.2 Technologies used for knowledge sharing among the farmers

The findings on the technologies used for knowledge sharing among the rice farmers are presented in this subsection. The results are provided in Table 4.5.

Table 4. 5: Technologies used for knowledge sharing among farmers

Technologies	YES (%)	NO (%)	SOMEWHAT (%)
WhatsApp	91.8	3.6	4.5
Twitter	25.5	60.9	13.6

Facebook	23.6	62.7	13.6
LinkedIn	20.9	65.5	13.6
Imo	10.0	65.5	24.5
Instagram	8.2	69.1	22.7

Source: Field data (2019)

Findings showed that, generally, the use of technologies in knowledge sharing among the rice farmers was very low. WhatsApp platform came up as the dominant technology platform that is mostly used. All the other platform recorded extremely low YES responses and extremely high NO responses. As shown in Table 4.5, the majority of the respondents showed that the technological procedure for the knowledge shared among farmers was through WhatsApp which recorded 91.8% for YES, 3.6% for NO and 4.5% representing SOMEWHAT. The finding from Table 4.4 shows again that the other procedures for knowledge sharing practise were through Facebook, LinkedIn and Twitter. These procedures were less frequently used to share knowledge among farmers. To confirm these, the statement recorded (23.6%, 62.7%, 13%), (20.9%, 65.5%, 13.6%) and (25.5%, 60.9%, 13.6%) representing the values for Facebook, LinkedIn and Twitter.

However, it was observed that Instagram as a technological procedure for knowledge sharing yielded 8.2% for YES, 69.1% for NO and 22.7% for SOMEWHAT. On the contrary, “Imo” also recorded a lower value of scores. Some of the other technologies provided by the respondents in the open-ended question are revealed as follows;

- “Sometimes we get some knowledge from research-gate and we share with the rice farmers” (Farm Manager)*
- “Snapchat too can be used to share knowledge among the farmers” (Farm Manager)*
- “Technologies are used effectively for knowledge sharing” (Female Rice Farmer)*

The next section shows technological systems used for knowledge sharing which was found in Table 4.6.

4.2.4.3 Systems used for knowledge sharing among the rice farmers

This subsection presents findings on the technological systems used for knowledge sharing among the rice farmers. The results are provided in Table 4.6.

Table 4. 6: Systems used for knowledge sharing among farmers

Knowledge sharing systems	YES (%)	NO (%)	SOMEWHAT (%)
Expertise locator systems	67.3	30.0	2.7
Incident report databases	64.4	19.1	14.5
Best practices databases	59.1	29.1	11.8
Lessons learned databases	39.1	37.3	23.6
Alert systems	38.2	35.5	26.4

Source: Field data (2019)

The findings showed that the use of technological systems for knowledge sharing was on average high. Expertise locator systems, incident report database and best practices databases recorded above-average use in knowledge sharing among the rice farmers. Table 4.6 revealed that the majority of the respondents believed that technologies used for knowledge systems were Expertise locator system (67.3% YES, 30.0% NO, 2.7% SOMEWHAT) and Incident Report Database which yielded (64.4% YES, 19.1% NO, 14.5% SOMEWHAT).

Again, Table 4.6 shows that the other systems for knowledge sharing practise were on Alert Systems (38.2% YES, 35.5% NO, 26.4% SOMEWHAT), Best practices database (59.1% YES, 29.1% NO, 11.8% SOMEWHAT) and Lessons learned database (39.1%

YES, 37.3% NO, 23.6% SOMEWHAT). These systems were not frequently used to share knowledge among farmers.

Some of the other systems of knowledge sharing indicated by respondents in the open-ended question revealed that;

“Rice farmers use knowledge bank and to learn quickly thereby improving rice production” (Male Rice Farmer)

“Knowledge sharing portals are also used for sharing knowledge among the rice farmers” (Farm Manager)

“Rice farmers should be trained to use electronic resources effectively” (Rice Farmer Male)

4.2.5 Benefits of knowledge sharing practices among farmers

Objective three of the study assessed the benefits that the rice farmers derive from knowledge sharing. The fundamental question addressed here was; What benefits do the rice farmers derive from knowledge sharing in their rice farming activities? Question 11 of the survey questionnaire provided a list of potential benefits derived from knowledge sharing within the context of rice farming. The respondents were asked to rate these factors on a five-point scale of “strongly agree”, “agree” “neutral,” “disagree” and “strongly disagree”. An “other” option category was provided for respondents to indicate any other benefits that the rice farmers derive from engaging in knowledge sharing.

The responses from the participants in the survey questionnaire were re-categorised for analysis. Specifically, all responses for ‘strongly agree’ and ‘agree’ were considered as ‘agree or positive’ while responses for ‘strongly disagree’ and ‘disagree’ were re-categorised as ‘disagree or negative’. Responses on ‘neutral’ were made to stand on its own as an indication of participants not being sure. The results from the survey questionnaire are presented in percentages in Table 4.7.

Table 4. 7: Benefits of knowledge sharing practices among the rice farmers

Benefits of knowledge sharing practices	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Performance improved for rice farmers	80.9	14.5	1.8	2.7	-
Knowledge sharing helps rice farmers to learn and do research more about rice farming and this helps improve rice production	76.4	9.1	9.1	3.6	1.8
Discouraged knowledge hoarding among the rice farmers	74.5	9.1	16.4	-	-
Encouraged learning among the rice farmers	74.5	9.1	13.6	2.7	-
Knowledge sharing has helped the rice farmers to gain new experience and skills in rice farming	68.2	25.5	6.4	-	-
Increased competitiveness among the rice farmers	66.4	24.5	9.1	-	-
Rice farmers use knowledge bank and knowledge sharing portals to learn quickly thereby improving rice production.	66.4	19.1	14.5	-	-
Effective utilization of rice farming knowledge	62.7	24.5	5.5	4.5	2.7

Encouraged leadership among the rice farmers	62.7	4.5	-	-	32.7
Fill important knowledge gaps among the rice farmers	60.0	9.1	-	8.2	22.7

Source: Field data (2019)

As shown in Table 4.7, findings from the survey data showed that the main benefits the rice farmers derived from knowledge sharing included; performance improvement (80.9% strongly agree, 14.5% agree), followed by learning and researching more (76.4% strongly agreed, 9.1% agreed), discouraging knowledge hoarding (74.5% strongly agreed, 9.1% agreed) and encouraging learning (74.5% strongly agreed, 9.1% agreed).

Even though the strongly agree responses on the other benefits of knowledge sharing were below 70%, merging it with the agree responses show high responses in the region of 80%. For instance, knowledge sharing helped the farmers to gain new experiences and skills (93.7%), increased competitiveness (90.5%) and effective utilization of rice farming knowledge (87.2%). The next section presents findings on the factors that inhibit or impeded knowledge sharing among the rice farmers.

Some of the ‘other’ benefits provided by the participants in the open-ended question revealed that;

“Knowledge sharing helps the rice farmers to understand how climate change is affecting rice-farming activities in the region” (Male Rice Farmer) (Agric/Extension Officer)

“Knowledge sharing helps rice farmers in this region to know how to adapt to climate change” (Male Rice Farmer)

“Knowledge sharing practices help improve organizational performance” (Farm Manager)

“Knowledge sharing improves productivity” (Rice Farmer Female)

“Knowledge sharing gives a better return on investments” (Farm Manager)

“Knowledge sharing discourages hoarding” (Rice Farmer, Female)

“When it comes to knowledge sharing, it places greater importance on experts”
(Agric/Extension Officer)

“Knowledge sharing in rice farming is an excellent way of developing a community within a business” (Farm Manager)

4.2.6 Inhibitors of knowledge sharing among farmers

The fourth objective of the study examined the various factors that inhibit or undermine knowledge sharing among rice farmers. The main research question answered here was; What factors inhibit knowledge sharing among rice farmers in the Eastern Region of Ghana? Question 12 of the survey questionnaire provided a list of possible inhibitors that constrain knowledge sharing among the rice farmers. The respondents were asked to rate these factors on a five-point scale of “strongly agree”, “agree”, “neutral”, “disagree” and “strongly disagree”. An “other” option category was provided for respondents to indicate any other inhibiting factors that constraint knowledge sharing among the rice farmers.

The responses from the participants in the survey questionnaire were recategorized for analysis. Specifically, all responses for “strongly agree” and “agree” were considered as “agree” or “positive” while responses for “strongly disagree” and “disagree” were recategorized as “disagree” or “negative”. Responses on “neutral” were made to stand on their own as an indication of participants not being sure. The results were shown in Table 4.8.

Table 4. 8: Inhibitors of knowledge sharing among the rice farmers

Inhibitors of knowledge sharing	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Financial constraints	89.1	1.8	-	-	9.1

Lack of technology to creates an institutional memory that is accessible to all the rice farmers	74.5	9.1	16.4	-	-
Poor communication skills	70.9	13.6	10.9	-	4.5
Dominance of explicit over tacit knowledge	63.6	19.1	12.7	-	4.5
Rice farmers' support of collaboration in technology of knowledge sharing	62.8	17.2	5.5	10.2	4.3
Time constraints	61.8	4.3	-	-	33.6
Poor organisational culture	57.3	20.9	4.5	17.3	-
Knowledge hoarding	52.7	14.5	-	2.7	30.0
Mistrust	45.5	12.7	10.0	9.1	22.7
Individual differences	38.2	9.1	-	4.5	48.2

Source: Field data (2019)

The findings indicated that there were several inhibiting factors against knowledge sharing among the rice farmers. As shown in Table 4.8, the dominant inhibiting factors included; financial constraints (90.9%), technological challenges (83.6%), poor communication skills (84.5%), the dominance of explicit over tacit knowledge (72.7%) and lack of collaboration among the rice farmers (70%). Others included organisational culture (78.2%), knowledge hoarding (76.2%) and time constraints (65.3%). Factors such as individual differences (47.3%) and mistrust (58.2%) posed minimal threat to knowledge sharing among the rice farmers.

Some of the other inhibitors indicated by the respondents in the open-ended question revealed that;

“There is too much competition among the rice farmers” (Agric/Extension Officer)

“Internet facilities are not available to rice farmers for looking up any knowledge on rice farming” (Male Rice Farmer)

“Leaders do not create a climate of openness and trust among the rice farmers to share knowledge” (Agric/Extension Officer)

“There is too much favouritism for some rice farmers” (Female Rice Farmer)

“Sometimes jealousy is also the reason why some farmers don’t share knowledge” (Male Rice Farmer)

“Rice farmers are reluctant to promote knowledge sharing due to lack of economic viability” (Farm Manager)

Retention of skilled and experience rice farmers is not a high priority” (Agric/Extension Officer)

“Lack of ICT systems and processes” (Rice Farmer, Male)

4.2.7 Enablers of knowledge sharing

Having established the constraints of knowledge sharing, the fifth objective of the study was to examine the factors that enable or promote knowledge sharing practices among the rice farmers. Question 13 of the survey questionnaire and question 8 of the interview guide provided insights into the enablers of knowledge sharing among the rice farmers.

In question 13 of the survey questionnaire, a list of possible factors that promote knowledge sharing was provided to the respondents to indicate their extent of agreement or disagreement. The respondents were asked to rate these factors on a five-point scale of “strongly agree”, “agree”, “neutral”, “disagree” and “strongly disagree”. An “other” option category was provided for respondents to indicate any other factors that enable the rice farmers to share knowledge among themselves.

The responses from the respondents in the survey questionnaire were re-categorised for analysis. Specifically, all responses for strongly agree and agree were considered as “agree or positive” while responses for strongly disagree and disagree were re-categorised as “disagree” or “negative”. Responses on “neutral” were made to stand on

their own as an indication of respondents not being sure. Table 4.9 presented enablers of knowledge sharing.

Table 4. 9: Enablers of knowledge sharing among the rice farmers

Enablers of knowledge sharing	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Improvement of trust	84.5	1.8	-	-	13.6
Social networking	82.7	1.8	-	-	15.5
Reward system	82.7	1.8	-	-	15.5
Self-efficacy	80.0	1.8	-	10.0	8.2
Participation and democratic involvement	80.0	1.8	-	18.2	-
Effective communication skills	79.1	1.8	5.5	4.5	9.1
Improvement of training and learning communities	79.1	1.8	-	19.1	-
Trust of participation	79.1	1.8	-	-	19.1
Willingness to share information	78.2	1.8	-	8.2	11.8
Availability of technology to helps knowledge sharing	74.5	1.8	-	-	23.6
Motivation to share knowledge	72.7	1.8	17.3	-	8.2
Incentives or rewards for sharing knowledge	70.9	1.8	-	-	27.3
Effective leadership that encourages knowledge sharing	61.8	0.9	-	-	37.3

Source: Field data (2019)

The findings showed the presence of several enabling factors that promote knowledge sharing among the rice farmers. As shown in Table 4.9, all the factors provided recorded high levels of agreement, with the least frequent being 61.8% for “strongly agree”. There was high levels of “strongly agree” to enablers such as; improvement of trust (84.5%), social networking (82.7%), reward system (82.7), self-efficacy (80.0%) and participation and democratic involvement (80.0%). Nonetheless, there were the practice of incentives or rewards for sharing knowledge and effective leadership that encourages knowledge sharing which were not effectively practised by the respondents.

Some of the other enablers that were indicated by the respondents in the open-ended question revealed that:

“Some of the farmers live close to one another and it helps them to share knowledge” (Male Rice Farmer)

“We develop friendships which help us to share knowledge” (Agric/Extension Officer)

“We use our local language in discussions and it helps a lot” (Male Rice Farmer)

“It helps improve rice farmers performance and production” (Farm Manager)

“There is lack of learning culture among us” (Rice Farmer Male)

“Let us trust in other rice farmers’ reliability and competences” (Rice farmer, Male)

4.2.8 Strategies to enhance knowledge sharing practices

Having examined the context of knowledge sharing among rice farming, the last objective of the study assessed different strategies that can be used to improve knowledge sharing among the rice farmers. Question 15 of the survey questionnaire and question 10 of the interview guide provided insights into the various strategies for improving knowledge sharing among the rice farmers. In the survey question 15, respondents were asked to rate a list of strategies for improving knowledge sharing on a five-point scale of “strongly agree”, “agree”, “neutral”, “disagree” and “strongly disagree”.

An “other” option category was provided for respondents to indicate any other strategies that they think can help improve knowledge sharing among the rice farmers.

The responses from the respondents in the survey questionnaire were re-categorized for analysis. Specifically, all responses for strongly agree and agree were considered as “agree” or “positive” while responses for “strongly disagree” and “disagree” were re-categorized as “disagree” or “negative”. Responses on “neutral” were made to stand on their own as an indication of respondents not being sure. The results from the survey questionnaire are presented in percentages in Table 4.10.

Table 4. 10: Strategies for enhancing knowledge sharing practices

Strategies for enhancing knowledge sharing practices among the rice farmers	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Use of appropriate technology	87.3	1.8	3.6	-	7.3
Leadership and management support	82.7	1.8	-	-	15.5
Integration of knowledge sharing initiatives in goals and strategies	78.2	4.5	-	9.1	8.2
Provide space and opportunities for knowledge sharing	74.5	13.6	-	4.5	7.3
Various forms of knowledge sharing and farming systems are encouraged among rice farmers here	72.7	11.8	1.8	-	13.6
Constant training and retraining of the rice farmers	74.5	7.3	-	10.0	8.2
Build trust	72.7	10.0	-	7.3	10.0
There are reward systems for rice farmers who willingly share	76.4	6.4	-	-	17.3

their knowledge on rice farming with their colleagues					
We set aside time for face-to-face collaborations and knowledge sharing	70.0	13.6	-	-	16.4
Investment and financial support	72.7	1.8	8.2	1.8	15.5
Opinions and inputs are sought from new rice farmers on all issues	68.2	17.3	-	7.3	7.3
Familiarization of other category of knowledge	67.3	8.2	-	7.3	17.3
All individuals who enter into rice farming are given mentors	68.2	1.8	-	13.6	16.4

Source: Field data (2019)

Findings showed that there were generally high levels of agreement on the strategies for improving knowledge sharing practices. As shown in Table 4.10, the results indicated that “use of appropriate technology” was the most frequent strategy used to promote effective knowledge sharing (87.3% strongly agree). The second statement that respondents identify as the most frequent strategy was leadership and management support (82.7% strongly agree). These were followed by providing space and opportunities for knowledge sharing (88.1% total agreement), encouraging various knowledge sharing systems (84.5% total agreement), building trust (82.7% total agreement), and setting aside time for face-to-face collaborations and knowledge sharing (83.6% total agreement).

Some of the other strategies suggested by the participants in the open-ended question revealed that:

“Leaders should do away with favouritism in the rice farmers” (Agric/Extension Officer)

"Some of the knowledge should be translated into local language so we can all understand" (Male Rice Farmer)

"Leaders should promote the culture of knowledge sharing" (Female Rice Farmer)

"The knowledge should be provided in videos and pictures so everybody can understand and share" (Farm Manager)

"Rice Farmers should be rewarded financially" (Male Rice Farmer)

"Knowledge sharing strategies can improve rice farmers' engagement and retention"
(Agric/Extension Officer)

"It facilitates decision-making capabilities" (Male Rice Farmer)

"Let us nurture learning culture" (Rice Farmer Male)

"Leaders should initiate knowledge sharing and knowledge transfer policy"
(Agric/Extension Officer)

"Let us trust in other rice farmers' reliability and competences" (Rice farmer, Male)

4.3 Qualitative findings for interviews

This section presents findings from the qualitative phase. The semi-structured interviews were conducted to provide complementary and comprehensive knowledge on knowledge sharing among the rice farmers. For the interviews, a semi-structured interview guide was used to seek first-hand knowledge from the participants. The interviews were recorded and transcribed verbatim before analysing. The researcher adapted Braun and Clark's (2013:34) procedure for thematic data analysis. For ethical considerations, the researcher assured the participants of the anonymity of the study. To achieve this, the researcher instructed the respondents not to mention their names, locations and names of their farms in the study.

In all, a total of nine (9) participants were interviewed. The semi-structured interview guide, on the other hand, had ten (10) questions, which were divided into eight (8) sections that complemented the survey questionnaire (Appendix 3). The eight sections examined: a) biodata of participants, b) types of knowledge shared among the rice farmers, c) knowledge sharing practices among the rice farmers, d) benefits of knowledge sharing among the rice farmers, e) factors that inhibit knowledge sharing among the rice farmers, f) enablers of knowledge sharing among the rice farmers, g) tools, methods and technologies for knowledge sharing among the rice farmers, and h) strategies for enhancing knowledge sharing among the rice farmers. The findings are presented in the order in which the questions were asked in the interview guide.

4.3.1 Background knowledge of participants

The first section of the interview guide sought to examine the sociodemographic profiles of the participants in the study. The demographic knowledge of the participants examined consisted of age distribution, marital status, educational level and years of experience as farmers or work pertaining to farming activities. Demographic knowledge about the participants is presented in Table 4.11.

Table 4.11: Demographic knowledge of interview participants

Participants' Code	Status	Gender	Age	Education	Years of Experience
IFMAD-1	Farm Manager	Male	53 years	Master's Degree	12 years
IFMKD-2	Farm Manager	Male	50 years	Master's Degree	9 years
IFMAD-3	Farm Manager	Male	55 years	Master's Degree	15 years
IFAD-4	Farmer	Female	57 years	Middle School	27 years
IFKD-5	Farmer	Female	44 years	No Education	18 years

IFAD-6	Farmer	Female	46 years	No Education	20 years
IAOAD-7	Agric Officer	Male	60 years	Diploma	20 years
IAOKD-8	Agric Officer	Male	58 years	Bachelor's Degree	18 years
IAOAD-9	Agric Officer	Male	42 years	Bachelor's Degree	12 years

Source: Field data (2019)

The demographic knowledge of the nine participants was provided in Table 4.11. The researcher represented each respondent's name or identity with a serial number based on their location and titles. For instance, Interviewee Farmer Manager from the Akuse District was coded as (IFMAD-1). Again, Interviewee Farmer Manager from the Kpong District (IFMKD-2); Interviewee Farmer Manager from the Asutruare District (IFMAD-3); Interviewee Farmer from the Akuse District (IFAD-4); Interviewee Farmer from the Kpong District (IFKD-5); Interviewee Farmer from the Asutruare District (IFAD-6); Interviewee Agric Officer from the Akuse District (IAOAD-7); Interviewee Agric Officer from the Kpong District (IAOKD-8) and Interviewee Agric Officer from the Asutruare District (IAOAD-9).

The majority of the participants were males. Concerning participants' age distribution, IFMAD-1, IFMAD-3, IFAD-4, IAOAD-7 and IAOKD-8 age grouping were within 50-60 years. However, IFMKD-2, IFKD-5 and IAOAD-9 were between 40-49 years. Out of the nine participants, it was only IFAD-6 whose age grouping was between 30-39 years. With respect to the education level of the interviewees, IFMAD-1, IFMKD-2 and IFMAD-3 hold masters degrees and IFAD-4, IFKD-5 and IFAD-6 have acquired either a degree or a diploma education. All the interviewees were married and had between 9 to 27 years of working experience in rice farming.

4.3.2 Types of knowledge shared among farmers

In line with the research objective 1, the first part of the interview guide examined the types of knowledge shared from the perspective of the participants. This section was directly related to research question one (1). However, before exploring the types of knowledge shared, the researcher assessed the participants' views of their understanding of knowledge sharing. Therefore, the first question posed to the participants was; When you hear the term 'knowledge sharing', what comes to mind? Findings from the participants indicated that they had a good understanding of the idea of knowledge sharing. The explanations provided by the participants showed that they understood and appreciated knowledge sharing within their rice farming activities. Some of the quotes from the participants are provided below;

Manager Akuse Farms – IFMAD-1 shared his opinion as;

“In my opinion, it is a practical way to transfer knowledge from one person to another. Rice farming here is very difficult and several factors affect whether the rice will do well or not. So we encourage farmers to share ideas and strategies. That is my understanding of knowledge sharing so that it can help rice farmers to improve performance and achieve ultimate goals on the farms. It is also ensured that the knowledge held by rice farmers is accessible to other rice farmers.”

Farmer, Asutsuare Farms- IFAD-6 also said that;

“My understanding of knowledge sharing is that it is the exchange of knowledge with others. The farmers here, what we do often is that we talk a lot amongst ourselves wherever we meet. When we talk, we discuss our challenges and the problems we face. We also discuss what different people do and what we can do to improve our rice farming. All of these are part of knowledge sharing. That is what I think.”

Manager, Asutsuare farms-IFMAD-3, also indicated that;

“In my view, any knowledge that is from one person to another is purely knowledge sharing. On our farms, knowledge is shared mainly through the meeting. Rice farmers are allowed to share their experiences and difficulties encountered on the farms. It improves learning by doing on the farms. It also provides opportunities for rice farmers to share their expertise and skills.”

Extension Officer, Akuse Farms- IAOAD-7 said;

“Ohh...my view on knowledge sharing is that it is the exchange of knowledge or ideas with others. For example, where rice farmers are brought together and encouraged to share strategies and ideas, it constitutes knowledge sharing, I think.”

Another Extension Officer, Kpong Farms-IAOKD-8 also said;

“Knowledge sharing is a way to speed up decision making and improve performance on rice farms. For knowledge sharing to be effective, it is very important to communicate with one another.”

After that, the types of knowledge shared among the rice farmers were probed. The participants were asked to discuss some of the main issues about which rice farmers usually share knowledge. The interviewer asked the participants about the type of knowledge they shared with farmers or the knowledge they shared among themselves. From the study, it was observed that participants' comments were on the marketing of farm products, harvesting, contemporary mechanism of farming, land management system, seed management and pesticides control.

For instance, IAOAD-9 shared that:

“Ask an extension officer in my district, my main duty is to teach farmers about the modern mechanism of farming. Knowledge shared among farmers are normally land preparation, how to apply pesticides and fertilizers, harvesting, marketing and how to prevent post-harvest losses.”

IAOAD-7 and IAOKD-8 shared a similar comment that we guide farmers during every stage of the farming. Probing further, the interviewer asked, what kind of knowledge do you share with the farmers?

IAOKD-8 indicated that:

“I share with them how to prepare the land, innovative and creative way of farming and sometimes, on how to seek financial support for their farming.”

Contrary to IAOKD-8’s comment, IAOAD-7 said that most farmers in the district are peasant farmers. I appealed to them to register with the Farmers’ Association of Ghana. Probing, I asked, what benefit do you get from these associations?

IAOAD-7 commented:

“Seeking funding when you are registered member of the association becomes easy and sharing knowledge among members on strategies to adapt to reduce the rates of post-harvest losses and another farming mechanism also is simple because all the farmers are on one WhatsApp platform from which knowledge is easily shared.”

IFAD-6 concluded, *“I have not regretted joining farming association”*. The researcher then asked why and IFAD-6 responded that *“the knowledge I have gained is an innovative way of farming were all as a result of the association I joined”*.

The interviewer asked them about their understanding of knowledge sharing and IFAD-4, IFKD-5 and IFAD-6 mentioned that it is the knowledge given by superiors, extension officers, agricultural officers and managers about the farming system. IFAD-4 asserted that managers and extension officers in the district educate them on harvesting methods, drying techniques and storage facilities. However, IFKD-5 posited climate change, seed management and land preparation as being part of knowledge received from colleague farmers and extension officers.

However, all the interviewees attested to the fact that knowledge shared either among themselves or from experts in agriculture has yielded better results by an increase in their production. Lastly, IFAD-4 confirmed that effective education on book-keeping by their extension officers and forums attended in Accra have helped him and colleagues in managing their finances. He further posited that per this book-keeping process, he was able to know the amount expended on every stage until harvest.

4.3.3 Knowledge sharing practices among farmers

This subsection presents findings on the various practices the rice farmers engage in to share knowledge. This theme was in relation to research question two. Question 5 of the interview guide, therefore, provided further insight into the knowledge sharing practices among the rice farmers. So, after asking about the types of knowledge shared, the researcher then probed by asking, “So where does such knowledge by the superiors you mention take place?”

Findings from the participants’ narratives indicated that there are several knowledge sharing practices used. The major themes highlighted in this section are on forum discussions, workshops, training, peer assistance or advice, storytelling or film shows, action reviews by experts, communities of practice, mentoring and coaching.

For instance, IFKD-5 commented that;

“The extension officer organises workshop for farmers normally in the first and last quarter of the year. This programme has helped us to know our colleagues in different districts who are in rice production”.

Manager, Asutsuare farms-IFMAD-3 also indicated that

“On our farms, knowledge is shared mainly through the meeting. Rice farmers are allowed to share their experiences and difficulties encountered on the farms. It improves learning by doing on the farms. It also provides opportunities for rice farmers to share their expertise and skills.”

On the issue of workshop organisation, IFMAD-1 also supported that workshops and training are organised for farmers. The interviewer asked, “How are such workshops and training organised?” IFMAD-1 said that farmers in each district are grouped in zones based on the type of crop they produce. Venues are announced to them either through their WhatsApp platform or community radio available in that district.

IFKD-5 claimed that they had just ended their workshop for the first quarter which was held at the district assembly hall. On the contrary, IAOAD-9 said that they already had existing groups, so the extension officers come to talk to them. The interviewer asked if there was a specific time for meetings. IAOAD-9 responded that there was not because the extension officers are always with them, educating and guiding them from land preparation to harvesting and the marketing stage.

Other interviewees (IFMAD-1) and (IFMKD-2) shared a similar comment, saying that co-operative organisations or NGOs who are into farming activities also organise discussions or meetings with farmers. IFMKD-2 further said that this normally happens in the form of visits to check if the farmers are implementing the right mechanisms that they were taught during their public forums. IFMAD-3 added that most municipal or district assembly agricultural directors or officers normally or most often organise meetings for farmers not solely for rice farmers but all farmers. Probing, the interviewer asked where they held the meetings and what was the purpose of such meetings. IFMAD-3 said that they were held at the assembly premises/hall or at one zonal community centre. This is normally done as a form of follow-up or in the form of re-educating farmers on pesticide application or other mechanisms of farming.

To make an in-depth assessment, the interviewer asked the farmers, “What is the procedure used in sharing knowledge among yourselves?”. Leaders were chosen from each group and a new farmer who was yet to start a rice production area to mentor them (IFAD-4). Normally, with peer assistance, farmers share knowledge with their colleagues (IFAD-6). Contrary to what IFAD-4) and IFAD-6) stated IFKD-5 cited that farmers are

asked to share their story on the previously implemented mechanism on how they are benefiting from such an innovation.

Within the groups, experienced farmers are chosen as coaches or team leaders (IFMKD-2). Probing, the interviewer asked, “What is the work of coaches and team leaders?” New farmers are asked to understudy the experienced ones (IFMKD-2). IFMAD-1 explained that:

“Before I started my rice farming, I studied previous rice on land preparation, planting and how to prevent birds from coming into contact with your farms. The skills acquired from my mentor has made me gain knowledge on harvesting, pesticides control and marketing.”

IFMAD-3 added:

“As a beginner to any profession, mentorship is very important? Because the key knowledge to succeed in such a profession lie on professional knowledge/development from people who have been in such occupation for a long time.”

4.3.4 Technologies used for knowledge sharing among farmers

This subsection of the chapter presents the qualitative findings of the technologies used for knowledge sharing among farmers. This was in direct relation to research question three (3). The responses suggested that WhatsApp, community radio announcements, film shows and instant messages etc. were the technological means by which knowledge was sent to them as farmers.

Manager, Kpong farms –IFMKD-2 said:

“Knowledge sharing is the means of exchange of knowledge or knowledge via knowledge management systems such as electronic mail, skype, telephone. Besides it is also a way to share insights and experiences.”

With regards to this theme, IFMAD-3 said that:

“During conference or workshops, we advise the farmers to form WhatsApp groups per district or zonal of proximity between them and their colleague rice farmers. Because disseminating knowledge to them on such platform than calling each of them... .”

The interviewer asked what happens if a farmers’ phone does not support WhatsApp or if that farmer is using ‘Yam Phone’ (‘Yam phone’ is terminology in Ghana used to refer to analogue phones or phones that do not support social media platforms).

The interviewee said that;

he presumed his colleagues would inform him (IFMAD-3).

The researcher probed further by asking what about if their colleagues to inform them;

They are on the same platform with the extension officer who visits their farms mostly twice a month. IFMKD-2 added, “Although there is an existing WhatsApp group, messages sent to that group are also followed by calls or asking the agricultural officers to inform them when they visit them on their farms”.

Interviewer, the managers and officers are saying they always send a message on your WhatsApp platform? It’s true! But some of us are not ICT inclined to know or read each message (IFAD-6). Again, extension officers come to inform us of such messages but always come a week to the time.

With respect to the WhatsApp theme, IFMAD-1, IFAD-4, IFAD-6, IAOAD-7, IAOKD-8, and IAOAD-9, all commented that WhatsApp messages are sent to the group platform.

However, IAOAD-7 again said that, aside from the WhatsApp message, instant messages are normally sent by the officers before the programme due date.

Yes, I have received such a message before, that was when we were going for the Planting for Food and Job workshop in the regional capital, Koforidua (IFAD-4).

IAOKD-8 posited that:

“We have the bio-data for all farmers in the district including other emergency lines of contact. We the officers in the district do call them before we even embark on our journey to their farms. The calls are effectively done through WhatsApp platform messaging.”

Aside from the instant messages and WhatsApp, IFMAD-I said that they also communicate through the community radio. The interviewer asked what dissemination of knowledge about how to implement certain mechanism?

IFMAD-1 said:

“Such activities are normally done when we are having a workshop. We first show a video of such activities to them before giving them a hard booklet.”

Probing, the interviewer asked, “So what happens to the modern technological way of disseminating knowledge like IMO, Skype, Facebook and the rest?”

IFMAD-1 replied, “Ahhh!!!! These systems are done between the managers and extension officers.” IFMAD_2 said:

“There are network challenges in some of the farms and most of the farmers, sorry to say, are not ICT inclined to know these systems of communication. Even the easy one like a phone call and replying sent messages become a challenge.”

IFKD-5 attested to the fact that:

“Messages are communicated to them on regular bases but how to access them becomes a problem. My farm is located about 40 miles away from the district capital. Coupled to the location is the poor network and bad road network makes

it difficult for the extension officers to disseminate knowledge to us regularly. For the messages they send, but how to access them becomes the challenge”.

IAOAD-7 shared that:

“The knowledge is distributed to us and it is sent to them. This is because we are closer to the farmers and we work with them on a day-to-day basis.”

The respondents suggested that group WhatsApp messages, instant message, community radio broadcasts and video shows by way of presentation during the workshops were more effective technological ways for sharing knowledge than other means like Facebook, Skype, email and face-time due to availability of good telecommunication network support.

4.3.5 Benefits of knowledge sharing practices among farmers

This subsection presents the benefits that knowledge sharing practices bring to farmers. This theme was in relation to the research question (4). Question 6 of the interview guide required the interviewees to indicate and show in specific terms how knowledge sharing benefits rice farming in general and the rice farming within the study settings. How do we assess the benefits of knowledge sharing practices among rice farmers? The findings show that there is an increase in performance, effective utilization of farming information, increased competitiveness, improve learning/skills and filling knowledge gaps.

On the issue of increase in performance, all interviewee comments show that knowledge shared among rice farmers has helped increase their yield (IFMAD-1, IFMKD-2, IFMAD-3, IFAD-4, IFKD-5, IFAD-6, IAOAD-7, IAOKD-8, and IAOAD-9). For instance, the innovative way of farming has helped increase production (IAOAD-7). Again, IFKD-5 shared that “the knowledge gained from the workshop has helped her in weeds control, harvesting and marketing her farm produce”. In fact, knowledge sharing helps rice farmers to learn and do research more about rice farming and this helps improve rice

production (IFAD-4). IFAD-6 said that knowledge reaching them shows that, “knowledge sharing among rice farmers has helped gain new skills in rice farming.”

IFMAD-3 said that:

“Mentorship training instituted by my district has helped farmers to gain more knowledge on rice production. Because the new farmers who understudy the experience, gained more knowledge before starting their own farm. The knowledge gained helps prevent beginning loses.”

Furthermore, IFMAD-1 added that every quarterly refresher training course and frequent organisation of meetings have given the farmers more knowledge on how to access capital to improve their farm size and productivity.

IFMKD-2 commented that “Information sharing among farmers helped in increasing farmers’ knowledge on modern farming practice which discourages poor cultural practices associated with rice farming.” Again, IFKD-5 said, “Yes! The knowledge received from peer, extension officers and from workshop training has equipped me to have a newer skill in land preparation, pest control, planting, harvesting and marketing.”

For instance, this respondent cited that:

“Effective knowledge sharing practices have ensured access to knowledge about the process of farming and improved in the technology used in farming. The effective knowledge received has led to substantial progress in my produce, income and my standard of living” (IFAD-4).

Manager, Asutsuare farms-IFMAD-3 also indicated that:

“In my view knowledge sharing improves learning. It also provides opportunities for rice farmers to share their expertise and skills”

Extension Officer, Kpong Farms-IAOKD-8 said:

“Knowledge sharing is a way to speed up decision making and improve performance on rice farms.”

Manage Akuse Farms – IFMAD-1, for instance, reiterated that:

“Knowledge sharing helps rice farmers to improve performance and achieve ultimate goals on the farms. It is also ensured that the knowledge held by rice farmers is accessible to other rice farmers.”

IAOAD-9 posited that:

“There is a saying that one who ignores knowledge grows old and one who accepts learning becomes young. Sharing of knowledge between farmers equip them with necessary skills so as to broaden their swiipe on farming, hence, increasing one’s productivity. Artificial intelligence, that is the technology which has taken the face of the world and now being channelled into farming needs sharing knowledge so as to address the difficulties and deficiencies within farming.”

IAOKD-8 added that:

“Farmers encounter different problems in their farming activities; therefore, different methods are used by various farmers in doing farming activities. The nature of climate also determines how to decrease and increase in the production activities, when farmers share knowledge, they would be able to know when and how to plant and cultivate their rice.”

4.3.6 Factors that inhibit knowledge sharing among farmers

This section deliberates on various factors that inhibit knowledge sharing among rice farmers. This section relates to the research question (5). Question 7 of the interview guide required the interviewees to indicate the various factors that undermine knowledge sharing among the rice farmers. What are the factors that inhibit knowledge sharing among rice farmers?

The findings showed that factors that inhibit knowledge sharing among farmers were grouped into individual factors, organisational factors and technological factors.

IFMKD-2, for instance, suggested that:

“In communication, the most important thing is how the final consumer can be able to receive/understand and process the knowledge been given to them to become meaningful and useful to them. For instance, if the communicator does not have good communication skills, the message becomes boring which may take away the attention of the listeners. When listeners do not get the message clear, they perform the given task on how best it can suit them, which may sometimes not solve the problem at hand.”

IAOAD-7 also stated:

“Availability of knowledge is key in every implementation process. The time to which knowledge is been delivered to the final consumer is very important. When knowledge is delayed, decision-making also delayed and vice versa. If the extension officers delay in communicating to the farmers on time, the farmers may fail in how certain mechanism should be implemented.”

IAOAD-9 also commented on knowledge of hoarding:

“When knowledge is being hoarded, it creates problems. There is a saying that “a problem shared is half solved”. People always want to be rewarded for whatever knowledge they bring on board and do not know the importance of freezing the mind when it has an important message to deliver. When knowledge is being hoarded, it sometimes brings about the wrong ways of managing things and sometimes delays decision-making. Farmers should be willing and freely share knowledge and ideas with their colleagues.”

Others suggested that due to technological or network challenges encountered in their farming areas, sending messages or receiving messages becomes a problem (IFAD-4, IFKD-5 and IFAD-6).

IFKD-5 further stated that:

“Technology is now a game-changer in the farming section. When farmers have the right technological skill, it boosts their productivity than the mechanical method. Most of the farmers in this district are not abreast with technology and it led to low production. This is a major challenge in farming if a farmer wants to be efficient and effective.”

IFKD-5 complained, “From personal observation, if you fail to attend meetings, colleagues delay in giving feedback to you.” Probing further, the interviewer asked, “But you have WhatsApp groups that messages are sent to you after meetings?” IFKD-5 further stated “Some of the knowledge may have been on manual or techniques needed to implement something or solve a problem you might be facing.”

4.3.7 Different enablers to knowledge sharing among farmers

This part discusses factors that enable efficient knowledge sharing among rice farmers. This relates to the research question (6). What are the different enablers to knowledge sharing among rice farmers? Question 8 of the interview guide required the interviewees to indicate the various factors that enable knowledge sharing among the rice farmers. The findings showed that technology, learning communities, forming social networking, leadership and management support, reward systems, motivation and effective communication skills.

IFAD-4, for instance, indicated that:

“For effective knowledge sharing practises, motivation is important. The individual giving out the message or knowledge should have inner or intrinsic motivation” (IFAD-4).

IAOAD-7 also reiterated that:

“...corporative union or groups should have special rewards for farmers who share knowledge wholly or heartily to their colleagues.”

IFMKD-2 on his part also said however that:

“...the leader of various farmers association should inspire members to share knowledge or knowledge among themselves.”

He further stated that a lack of communication could hinder effective knowledge sharing among the rice farmers.

Other participants suggested that forming groups for social networking would help them receive different knowledge from different farmers (IFAD-6, IFKD-5 and IAOKD-8).

For instance, IFMAD-3 posited that:

“... allowing farmers from different cultural background to involved in knowledge sharing create democratic involvement of all members.”

However, respondent IFMAD-1 said, “...participation in meetings or leaders/management seeking the view of members give them the spirit of commitment to share knowledge to others” and IAOAD-9 said, “Modern means of communication help in effective knowledge sharing.”

4.3.8 Strategies to enhance knowledge sharing practices among farmers

This section presents findings on strategies to enhance knowledge sharing among rice farmers. This relates to the research question (7). What are the strategies to enhance knowledge sharing practices among rice farmers in the Eastern Region of Ghana? Question 10 of the interview guide required the interviewees to indicate various strategies that can improve knowledge sharing among the rice farmers.

From this theme, participants reviewed that leadership and management support, financial support, building trust, integration of knowledge-sharing initiatives, use of appropriate technology and continuous training and re-training.

Some of the participants indicated as follows:

Leadership factors are very essential strategies to enhance knowledge sharing (IAOAD-7).

IFAD-4, supported by saying that:

“To have high or low production in a farming season mostly depended on leadership training and extension officer’s frequent visitation to the farms.”

Probing, the interviewer asked if they could explain further. IFAD-6 explained that:

“A leader could be good or bad. If you are lucky to have good extension officer, he/she will always assemble farmers to give pep talks about how to increase yields or pest control, but others will come as normal visitation.”

He again explained that:

“a good leader must be a person with a high level of intelligence and must possess certain qualities like a good human relationship, different ideas, methods and systems to help farmers in solving their problems” (IFAD-6).

IFMAD-1 stated that:

“Management support could be a strategy to help enhance knowledge sharing among rice farmers. Good management can provide efficient and effective services to their farmers. Management can do this through the organizing of workshops, upgrading of farmers knowledge or skills to make them know the modern tools and practise available. Management should always seek the interest of their farmers and help them to achieve high production”.

IAOKD-8 also said:

“If the leadership of the farmer's associations create an enabling environment or good personal relationship, farmers would be willing to share knowledge among themselves”.

IFMAD-3 commented that:

“Farmers need to the knowledge shared about investors, good financial support and where to purchase agrochemicals for their farm product.”

Others also commented that financial support and other support services must be known to them, such as educational scholarships for their children (IFAD-4 & IFAD-6).

However, IFMKD-2 highlighted that:

“Farmer cooperative unions should share appropriate financial knowledge to help the farmers on how to access funds. Again, knowledge of business advisory services should be shared to them on how to get access to an already established market for their farm products.”

Again, IAOAD-9 said:

“Constant practise makes one perfect. There should be intensive training for farmers on the practices that can help in sustaining and making them productive. As time fades, so are new methods and instruments that come out.”

So without training and re-training on these, how then can the farmer be efficient?

IFKD-5 stated that:

“On a regular basis, seminars and conferences should be organized so as to inform and train them on climate changes and their effect on farming.”

He also said that knowledge sharing from experts will help them in their production. As time goes on, does knowledge and other methods of farming fade out. Corporative organisation and farmers association should establish training programmes to enhance the knowledge sharing among expertise in rice farmers (IFMAD-3).

On the contrary, IFAD-6 and IAOKD-8 said that:

“building trust among farmers is a fundamental concept for knowledge sharing procedure. When farmers trust their superiors, who is giving the information, how would they know, understand and believe in their knowledge shared to them” (IFAD-6).

Extension Officer, Kpong Farms-IAOKD-8 indicated that:

“Knowledge sharing is a way to speed up decision making and improve performance on rice farms. For knowledge sharing to be effective, it is very important to communicate with one another.”

“Considering how technology is important in knowledge sharing, rice farmers should be taught how to use appropriate technology as an aid to knowledge flow between them and their extension officers” (IAOKD-8).

4.4 Summary of chapter four

In this chapter, the survey questionnaire and the interview guide have been analysed to present the findings of the current study regarding the context of knowledge sharing among the rice farmers in the Eastern Region of Ghana. A combination of frequencies, percentages, pie charts and bar graphs were used to analyse the survey data, with the help of the Statistical Package for Social Sciences (SPSS) and Microsoft Excel. The interview data was analysed using thematic analysis, as outlined by Braun and Clark (2006). Knowledge regarding the sociodemographic profiles of the participants was presented. The types of knowledge shared among the rice farmers were identified. The knowledge sharing practices among the rice farmers were also examined. Besides, the

benefits of knowledge sharing, inhibitors and enablers of knowledge sharing, technologies used for knowledge sharing and strategies to improve knowledge sharing practices among the respondents were all identified. The findings, as presented in this chapter, thus provide the empirical context of knowledge management among the rice farmers, and therefore sets the background for discussion in the next chapter.

CHAPTER FIVE

INTERPRETATION AND DISCUSSION OF FINDINGS

5.1 Introduction

This chapter presents the interpretation and discussion of findings. This chapter was done in line with findings presented in chapter four. Hart (2018:15) states that the discussion and interpretation of research findings should be done separately from the section or chapter where the findings are presented so that it gives readers the opportunity to examine how the findings were made sense of by the researcher(s). In this chapter, the interpretations and discussion of the findings were presented in accordance with the thematic area of the study. The fundamental purpose of this study was to investigate knowledge sharing among rice farmers in the Eastern Region of Ghana. The study had had seven (7) specific objectives, which were to compare quantitative and qualitative data on;

- The different types of knowledge shared among the rice farmers in the Eastern Region of Ghana
- The knowledge sharing practices among rice farmers in the Eastern Region of Ghana
- The technologies used for knowledge sharing among the rice farmers
- The benefits of knowledge sharing practices among the rice farmers
- The factors that inhibit knowledge sharing among the rice farmers
- The different enablers to knowledge sharing among the rice farmers
- The strategies to improve knowledge sharing practices among rice farmers in the Eastern Region of Ghana

Data for the study was collected using a combination of a survey and interviews. The demographic profile of survey respondents and interview participants was identified and described first. Subsequently, findings from each of the objectives were presented, interpreted and discussed. For each of the objectives, the interpretations and discussions

were situated within the context of the literature and theories as discussed in Chapter Two. After that, a summary of the chapter was provided.

5.2 Demographic profile of respondents

The demographic characteristics that were examined among the respondents were gender, years of experience in rice farming and their educational level. Demographic factors are important to assess among respondents or participants in a study in order to provide an understanding of the distribution of the sample in terms of these social categories. Patten and Newhart (2017:51), Nardi (2018:53) and Plonsky (2017:44) all contend that assessing the demographic factors provide an opportunity for understanding how individual factors affect the variables being studied. Within the context of knowledge sharing and knowledge management in general Gava et al. (2017:105) and Meijer et al. (2015:175) also argue that demographic factors play a role in how knowledge is shared or managed within a group of people.

In terms of gender distribution, the study showed that the majority of the survey respondents were males (70.9%) compared to females (29.1%) (see subsection 4.2.1.1). Of the nine (9) interviewees, six (6) of them were males and three (3) of them were females (subsection 4.3.1). This gender distribution meant that male rice farmers far outnumbered the female rice farmers. The gender distribution of the rice farmers was consistent with the general gender distribution of rice farmers in the Eastern Region, and Ghana as a whole. A report from the Ministry of Agriculture Report in 2017 confirms that in Ghana more males than females have been engaged in farming activities in general and rice farming in particular. This is also consistent with global statistics showing that suggests that the field of rice farming market was dominated by males (Tippe et al., 2017:95). The dominance of males in rice farming communities was likely to influence the dynamics of knowledge sharing because previous studies have shown that there are fundamental gender differences in knowledge sharing factors such as mistrust, cooperation, tensions and hoarding (Holten et al., 2018:219; Trusson et al., 2017:1548).

The study also revealed that the ages of both the survey respondents (subsection 4.2.1.2) and interviewees (subsection 4.3.1) ranged from 19 – 62 years. The majority of them were within the ages of 51-60 years, followed by those within the ages of 31-40, with the least of them between the ages of 21-30 and below 20 years. The age characteristics indicate that the rice farmers included in the sample were relatively old, which suggests that in a few years ' time most of them would retire from active rice farming, which would require young people to be replaced. Ways and means of getting their knowledge passed on to younger rice farmers are therefore critical.

In terms of years of experience (subsections 4.2.1.3 and 4.3.1), most of them have been farming for between 6 – 10 years, followed by those who have farmed for between 11 – 15 years. The number reduces as the years of experience increase from 16 – 20 years, and above 20 years. This indicates that the average years of experience among the rice farmers were closed to ten (10) years. Juxtaposing their years of experience with their age, it is evident that most of the rice farmers did not enter rice farming in their early years. Some of them may have moved from other careers to rice farming. This was dominant in the study communities, and other farming communities in Ghana, where young ones move to cities for jobs and then move to their hometowns to start farming in general (Cadger et al. 2016:34; Donkor et al., 2018:153).

In terms of educational level (subsections 4.2.1.4 and 4.3.1), the study showed that the majority of them had either high school or basic school education. Only 11.8% had some sort of tertiary education. This suggests that educational level among the rice farmers was generally low. This was a result of the general educational level in farming communities in Ghana, even though the educational level of the sample in this study was comparatively better, provided that 70.9% had high school education. The educational level of rice farmers has an effect on the exchange of knowledge on how they interact with software and written documents.

5.3 Types of knowledge shared

The first objective of the study assessed types of knowledge shared among the rice farmers. Assessing types of knowledge shared, particularly within the context of rice farming and agricultural research, in general, was critically important. Gava et al., (2017:105) argue that understanding the types of knowledge shared among smallholder farmers provides an understanding of aspects of their farming activities where they struggle with knowledge. This helps in implementing more targeted knowledge sharing or knowledge management programmes for such farmers.

The types of knowledge shared among the rice farmers were assessed both quantitatively through a survey (subsection 3.9.1) and qualitatively through interviews (subsection 3.9.2). The findings from the study showed that the rice farmers shared varieties of knowledge. In subsection 4.2.2, the quantitative data showed that weed management knowledge was mostly shared by rice farmers. Weed management was found to be an integral part of rice farming activities. The researcher's experience in the study communities shows, for instance, that weed pests for rice such as *Ischaemum rugosum*, (a weed) is prevalent on rice farms, competing with the crop for nutrients. This weed pest was also prevalent in other rice farming communities in Ghana (Tsinigo & Behrman, 2017:48). This may explain why weed management knowledge was the highest knowledge shared among the rice farmers. The researcher suggests that good management would help farmers stop injurious weeds from competing with nutrients in the soils. In a way, it is very important to upgrade the cropping systems and to have non-chemical alternatives.

The study further shows that rice harvesting, processing and marketing knowledge was the second most shared knowledge among the rice farmers. One of the greatest challenges faced in the rice production sector in Ghana was the problem of harvesting and processing of rice for both the Ghanaian and international markets. Local rice produced in Ghana was found to have challenges with patronage on the Ghanaian market and the international markets for want of packaging. The researcher believes that

maintaining farm produce quality from the farm to the buyer was a major prerequisite for successful farming. Again, ensuring postharvest handling of the commodity from the producer to the consumer was essential in farming. There have been several intervention programmes targeting rice farming communities on how to harvest and process local rice for the market. This explains why knowledge on harvesting, processing and marketing were important for rice farmers.

The survey component of the study also found that knowledge was moderately shared included; knowledge on agriculture, knowledge on land management practice, seed knowledge and then farming creativity and innovation. Other categories of types of knowledge that were shared among the rice farmers included pest control, food security and climate change. The qualitative data highlighted on; marketing of farm products, harvesting, contemporary mechanisms of farming, land management systems, seed management and pesticides control. There was an increasing record of sustainable land-management practices in an array of environments which had been seen as difficult, marginal, and scientifically challenging. From this, the researcher wants to ascertain how farmers ensure the integration of pest management, soil nutrition and water conservation practices during land management practice. Also, sharing and spreading agricultural knowledge was a way of combating malnutrition. It promotes and improves agricultural productivity in rice farming practices. Research indicated that agricultural knowledge flows among rice farmers to enable them to perform their jobs proactively (Moore et al., 2014:292).

The study found that a wide variety of knowledge was shared among the rice farmers. The knowledge types also go beyond the confines of rice farming to structural level factors that influence local level rice farming practice. These knowledge types include climate change knowledge and food security. Lwoga et al., (2011:85), for instance, reiterates that to improve rice production, rice farmers should have access to timely and relevant knowledge at each stage of the rice-cropping calendar generally.

The rice farmers are found to share and use the knowledge at various levels of their rice farming practice. The findings from the current study align with some previous studies. For instance, some studies have reported that rice farmers share different types of knowledge among themselves such as weed management strategies, food security, rice farming creativity and innovations (Gava et al., 2017:105; Meijer et al., 2015:175; Siziba et al., 2012:46). Other studies conducted among other smallholder farmers also reported that smallholder farmers share knowledge concerning land preparation, produce harvesting, processing and marketing (Chen et al., 2015:1433; Feng & Xue, 2014:11; Gava et al., 2017:105).

Each of these different types of knowledge serves specific purposes for rice farmers, which suggest that the rice farmers have a high appreciation of the role of knowledge sharing in their rice farming practice. It is worth noting, however, that some forms of knowledge are more important to rice farmers than others. Previous studies have rarely explored these dynamics of knowledge sharing among rice farmers. For this group of rice farmers, more emphasis was placed on knowledge on weed management knowledge, rice harvesting, processing and marketing knowledge.

This speaks to the relevance of context in understanding knowledge sharing among rice farmers. For instance, studies in high-income countries suggest that smallholder rice farmers place more emphasis on technological use compared to weed management, harvesting and processing (Chhim et al., 2017:742). For smallholder rice farmers in the Eastern Region, and by extension, Ghana in general, weed management, innovative ways of harvesting and processing, and marketing are fundamental challenges they face in their rice farming practice. Knowledge sharing offers potential for addressing context-specific challenges that rice farmers face.

5.4 Knowledge sharing practices

The second objective examined knowledge sharing practices used by the rice farmers. Knowledge sharing practices provide an understanding of the various practices and

strategies that the rice farmers use in sharing or exchanging knowledge among themselves. Findings from the study (as reflected in subsections 4.2.3 and 4.3.3) showed that the rice farmers engaged in several practices in sharing knowledge among themselves. From the survey data, the study found that the dominant knowledge sharing practices used by the rice farmers included; workshops, training and seminars, knowledge fairs, discussion forums, face-to-face collaboration, coaching, storytelling and community of practice. These coincided with the findings from the qualitative data where the major themes highlighted were forum discussions, workshops, training, peer assistance or advice, storytelling or film shows, action reviews by experts, communities of practice, mentoring and coaching.

The dominant practices used by the rice farmers in sharing knowledge suggest that most of the platforms used involved groups and meetings. The researcher's experience and observation with the rice farming communities used for this study show that the farmers in the districts were affiliated to different associations and groups. Importantly, these associations that the rice farmers belong to hold regular meetings to discuss various issues. In most cases, some of the meetings were turned into training sessions or workshops, as they often invite people to come and share knowledge with them. This explains the reason why, workshops, training, seminars and discussion forums were the most used practices. Therefore, communicating or sharing knowledge during these workshops or training was common. Workshops, training and seminars contribute immensely to knowledge sharing among rice farmers. Such mediums for knowledge sharing help to solve rice farmers' problems.

The use of workshops, training, seminars and discussion forums as the dominant knowledge sharing practices suggests that the rice farmers tend to share knowledge in groups. This speaks to the existence of high levels of social engagement in knowledge sharing among the rice farmers (Nadason et al., 2017:35). Teixeira et al. (2018:57) argue that knowledge is not an individual property but rather the property of groups and communities. Thus, perhaps the property of groups and communities was best shared in groups and communities, and that may explain why there was dominant use of group-

based practices for sharing knowledge among the rice farmers. However, group-based practices for knowledge sharing also have elements of top-down approaches to knowledge dissemination, where groups invite or wait for an expert to give them knowledge (Laforge & McLachlan, 2018:261).

In this sense, the researcher argues that the rice farmers have a preference for a top-down approach to knowledge sharing in the form of workshops and seminars. This was inconsistent with findings from Akram and Bokhari (2011:48), Andre et al. (2017:889), and Michalik (2017:285). However, such a top-down training approach to knowledge sharing was not regular because of the cost involved, as argued by researchers such as Bozzato et al. (2018:78) and Rosenberry and Vicker (2017:21).

The knowledge-sharing practices that were moderately used by the rice farmers included; mentoring system and peer assist, after-action review and incidence report. The knowledge sharing practices used moderately suggest a blend of interpersonal (such as mentoring and peer assist) and group (such as after-action review and incidence report) level practices. In terms of the interpersonal practices, the mentoring situation and peer assist in the communities were valuable methods because of the sharing of the farming skills possessed by the mentors, such as providing timing of agricultural operations and teaching new farmers how to plan and to take decisions in running their enterprises with regard to harvesting, marketing and land maintenance.

The least used knowledge sharing practices were; knowledge banks and portals, documentation, job shadowing and job rotation. Different factors may have accounted for why these knowledge sharing practices were least practise among rice farmers. In terms of knowledge banks and portals and documentation, it was established in subsection 4.2.1.4 that educational levels among the rice farmers were generally low. For this reason, they may have little engagement with the explicit knowledge that was formally written down in the form of documentation or knowledge portals. This observation was alluded to by other researchers such as Teixeira et al. (2018:57), Laforge and McLachlan (2018:262) who all intimate that even though explicit knowledge was easily stored,

accessed and shared, explicit knowledge was more effective among groups with high levels of education. Therefore, knowledge banks, portals and documentation as forms of explicit knowledge sharing may work very effectively in formalized organizational settings, among rice farmers with low levels of education these practices may not be effective. On this basis, the current study challenges literature on the effectiveness of explicit knowledge sharing, and the researcher argues that its effectiveness was context-dependent.

In terms of the limited use of job rotation and job shadowing as means of sharing knowledge, this might be explained by the difficulties of reassigning roles that were associated with the nature of rice farming in the study settings. Among the rice farmers, there was a sense of a high level of awareness and understanding of the rudimentary knowledge attached to their core duties. However, the nature of job rotation and shadowing both involve extra explanation to new farmers or the individual gains experience in the field before he/she can perform to the optimum level of satisfaction. The rice farmers or employers, therefore, fear the risk of assigning employees to a new role, particularly when they may not come with income adjustment. The least used practices of knowledge sharing suggest that self-directed and interpersonal practices were limited, which was reflected in limited use of knowledge banks and portals, documentation, job shadowing and job rotation, as shown in subsections 4.2.3 and 4.3.3. The researcher thus advocates the need to encourage a more bottom-up and interpersonal approach to knowledge sharing among the rice farmers.

Other knowledge sharing practices identified were the use of community knowledge centres and monthly meetings. The use of community knowledge centres was particularly common among the rice farmers for developing all kinds of information. In Ghana, the establishment of community knowledge centres (CIC) was spearheaded by the Ministry of Communication in 2006 to establish CICs to create access centres and use of the ICT medium to promote community-based systems of knowledge delivery that were effective and timely in rural and peri-urban communities. The idea was to bridge the digital divide between rural and urban areas, and to meet the knowledge needs of less developed

communities, particularly in the areas of health, local government, agriculture and environment, among others (Bekoe, Atiso, Ayoung & Dzandu, 2018:6).

Over the years, CICs have become a force to be reckoned within local communities in terms of knowledge dissemination, with some private individuals establishing CICs, and delivering well-tailored knowledge to residents in their local languages on a daily basis. In farming communities in Ghana, CICs have become one of the dominant media through which knowledge is shared to farmers. This explains why the rice farmers listed CIC as one of the practices used in sharing information. The concept of CICs has been implemented in many LMICs such as in Asia, Latin America and Africa for almost two decades (Agwuna & Enweani, 2018:7; Bekoe et al., 2018:8; Islam & Hoq, 2017). During this time, several studies have been conducted on knowledge sharing among different smallholder farmers in different developing countries (Gava et al., 2017:105; Meijer et al., 2015:175; Siziba et al., 2012:46). However, CICs have not been identified as one of the practices or media for knowledge sharing. The current study expands current literature by uncovering CICs as a key part of knowledge sharing practices among rice farmers in Ghana.

5.5 Technologies used for knowledge sharing

Technologies are fundamental to knowledge sharing. Access to and availability of the right technologies and tools facilitate quote access, storage and sharing of information. In order to critically understand the context of knowledge sharing among the rice farmers, there was a need to understand the context of technological tools and technologies available to them. The third objective assessed the technological tools, technologies and systems used for knowledge sharing among the rice farmers. This would provide an understanding of how technologies and tools enable or inhibit knowledge sharing among the rice farmers.

Findings from the quantitative data (as shown in subsection 4.2.4) showed that the dominant technological tools used for knowledge sharing were; magazines, electronic

databases, and the expertise locator system. The dominant tools used for knowledge sharing among the rice farmers suggest there was an emphasis on expertise or experience. Expertise locator systems fundamentally provide a platform to accumulate high intellectual capital by leveraging existing skills, knowledge and experience to boost productivity (Hameed et al., 2018:42). This finding was in line with those of Dzandu et al. (2014:355), reiterating that the expertise locator system helps to connect the right rice farmers with the right knowledge at the right time. This means that the rice farmers have systems that allow them to connect the rice farmers to local and context-based experience within a reasonable time.

Tools such as extranet, internet and emails were moderately used by the rice farmers for knowledge sharing (as shown in subsection 4.2.4). The least tools used were video conferencing, skype and blogs. Apart from these, there were other tools identified such as letters, memos and other documents, which are all used for knowledge sharing (Chhim et al., 2017:713). These tools are mainly functional technologies that allow for easily accessing and sharing of information. Blogs, for instance, provide technological means of writing stories of individuals' experiences where others can access knowledge (Rosenberry & Vicker, 2017:12). This finding was in line with Chhim et al. (2017:715) who reported that rice farmers can create 'multi-author blogs' (MABs), where posts are written by a large number of rice farmers covering varieties of topics in rice farming. Skype and video conferencing also help rice farmers to hold virtual meetings where knowledge can be shared. Skype, in particular, has features that allow for video conferencing where rice farmers are able to join virtual meeting platforms to discuss rice farming issues (Ting-Toomey & Dorjee, 2018:26).

The study showed that the main technology used for knowledge sharing was WhatsApp. The least used technologies were Twitter, Facebook, LinkedIn, Imo and Instagram. Other technologies identified included ResearchGate and Snapchat (as shown in subsection 4.2.4). Findings from the quantitative data (shown in subsection 4.3.4) coincided with the qualitative data which showed that the technologies identified from the qualitative data for knowledge sharing included; WhatsApp, instant messages, electronic mail, telephone,

IMO, Skype and Facebook. These are mainly social media platforms that have gained popularity in the last decade. Nonetheless, the use of the social media platform offers the rice farmers opportunity for accessing and sharing knowledge in print, pictures or images, and in video formats. This was because social media platforms provide interactive features and allow individuals to discuss and share ideas anytime and anywhere without physical or time boundaries (Holten et al., 2016:215).

However, some of the social media platforms were used more often than others. In Ghana, for instance, research suggests that WhatsApp was the most widely used social media platform (Bernard & Dzandza, 2018:14). WhatsApp and Facebook were used both by individuals with high and those with low levels of education to accessed information. This may explain why WhatsApp was indicated by the rice farmers as their most used technology for knowledge sharing. The other social media platforms (e.g. Twitter, LinkedIn, Instagram and others) were used mainly by individuals with the appreciably high level of education. However, ResearchGate was mostly used by the academic community for disseminating research knowledge (Taskin & Van Bunnan, 2015:172). This may explain why ResearchGate was the least use among the rice farmers.

The study showed that knowledge-sharing systems were moderately used for knowledge sharing among the rice farmers, including systems such as expertise locator systems, incident report database, and best practice database. The least used systems were the lesson learned database and alert systems. Apart from these, other systems identified included knowledge bank, knowledge sharing portals and electronic resources. Knowledge sharing systems perform a critical role in knowledge sharing and knowledge management (Hameed et al., 2018:42). More specifically, knowledge sharing systems support the process through which explicit or tacit knowledge is communicated to other individuals (Bozzato et al., 2018:77). They also help in storing knowledge for future use. For this purpose, knowledge sharing systems were also referred to as knowledge repositories (Holten et al., 2016:212).

These critical roles notwithstanding, knowledge sharing systems were not used much among the rice farmers. The reason could be the fundamental technological challenges that are experienced in the study setting. Technological penetration, in terms of structures that support technological architecture, was extremely low in the communities. Most farmers in the districts were therefore not used to the modern technological system of knowledge sharing. Per the location of the farm sites, there was less technological advancement in the villages where the farms were situated. Where farms were sited do not have the connection to high-speed internet to support 3G and 4G internet service to enhance access to knowledge sharing application like Imo, Instagram and Facebook.

This accounts for the limited use of technological systems for knowledge sharing. The farmers were therefore left to depend on community-based engagement technologies such as community radio announcements and film shows for knowledge sharing, as reflected in the qualitative data of the study.

5.6 Benefits of knowledge sharing practices

Knowledge sharing plays a critical role in the success factors of not just organizations, but all communities of practice. Within the context of agricultural, knowledge sharing has a huge role to play when it comes to the improvement of farming practices and increased productivity. It is therefore imperative to understand how different farmers perceive the benefits of knowledge sharing in their farming practice. The fourth objective assessed the benefits that the rice farmers derive from knowledge sharing. Knowledge sharing can provide significant changes to the rice farmers' farming processes, structures and strategies to provide a favourable and supportive context for rice farming.

Findings from the quantitative data (subsection 4.2.5) showed that the main benefits of knowledge sharing identified by the respondents were; performance improvement, learning to do research, discouraging knowledge hoarding and encouraging learning. The moderate benefits of knowledge sharing that the rice farmers identified include; gaining new experience, increased competitiveness, quick learning, effective utilization of rice

farming information, encouraging leadership and filling important knowledge gaps. Apart from these, other benefits identified by the respondents included; understanding the effect of climate change, adapting to climate change, improving organizational performance, and improving productivity. The findings from the quantitative data (subsection 4.3.5) aligned with the qualitative data where the participants identified the major benefits of knowledge sharing to include; increase in performance of rice productivity, effective utilization of rice farming knowledge or knowledge, increased competitiveness of the rice farmers, improved learning skills among the rice farmers and filling knowledge gaps in rice farming among the rice farmers.

The findings suggest that there was a high level of appreciation and understanding of the benefits of knowledge in rice farming among the rice farmers in the current study. The findings from this study were aligned with other previous studies (Feng & Xue, 2014:11; Garcia et al., 2018:32; Ortolani et al., 2015:22), while at the same time contradicting others (Garcia et al., 2018:34; Ortolani et al., 2015:24). In support with the findings, Feng and Xue (2014:11) for instance have reported that knowledge sharing leads to significant improvement in performance. Garcia et al. (2018:32) have also reported that knowledge sharing leads to performance improvement due to the fact that workers are exposed to new knowledge and experience which helps them to function effectively. Ortolani et al. (2015:24) reiterated this point by arguing that knowledge was ~~new~~ the most vital part of organizations' resources, and therefore knowledge sharing helps in redistribution of symbolic resources.

However, the findings from this study also contradict what some other studies have reported (Garcia et al., 2018:34; Martinez, 2000:14; Ortolani et al., 2015:24). The contradiction was mainly based on the role of leadership in improving or encouraging leadership among individuals. The literature provides a strong link between knowledge sharing and the leadership potentials of individuals (Martinez, 2000:14; Ortolani et al., 2015:24). Martinez (2000:14) in an earlier study made the argument that knowledge sharing is fundamental to encouraging leadership skills and qualities among individuals. In a recent study, Garcia et al. (2018:35) reiterated the point to the effect that providing

context for knowledge sharing becomes a strategy that can be extremely powerful in fostering leadership among individuals in organizations, groups and associations. However, in the current study, as shown in subsections 4.2.5 and 4.3.5, leadership skills and qualities do not appear among the benefits of knowledge sharing in the rice farming communities. This suggests that context matters when it comes to discussing the key benefits of knowledge sharing. Some particular benefits of knowledge sharing (such as performance improvement, learning to do research, discouraging knowledge hoarding, encouraging learning, gaining new experience and increased competitiveness) may be generic and therefore cut across context, while others (such as leadership qualities) may be present in some contexts but absent in others.

However, the literature on the beneficial impact of knowledge sharing has mainly come from formalized organizational settings (as reflected in section 2.3.3). When it comes to the context of agricultural in general, and rice farming in particular, research on the benefits of knowledge sharing from the perspective of smallholder (rice) farmers was limited. Findings from the current study thus contribute to expanding the literature on knowledge sharing and, by extension, knowledge management, by providing empirical evidence from rice farmers in a developing country context like Ghana. In the study communities, knowledge sharing has improved the living conditions of farmers by way of having credit/loan facilities and by improving their yield. From the researchers' observation, knowledge sharing was a crucial resource for preserving valuable heritage, learning new things, solving problems, creating core competencies, and initiating new situations for individual farmers, both now and in the future.

Among these rice farmers, improved productivity and subsistence were key in their rice farming activities. Rising to become leaders was not something they prioritize. Unlike employees in formalized commercial organizations who seek promotion to top positions, acquiring leadership skills was important to their career trajectory. There are fundamental contextual differences between commercial organizations and rice farming communities, and between employees in organizations and rice farmers, particularly when it comes to the quest for leadership. Therefore, the leadership qualities as a benefit of knowledge

sharing depend on contexts that prioritizes promotion and leadership. This was less so in the context of rice farming communities and, by extension, farming communities.

5.7 Inhibitors of knowledge sharing

Knowledge sharing in all contexts come with certain factors that undermine the smooth and easy flow of knowledge among individuals. There were different factors that account for barriers, inhibiting knowledge sharing. Understanding these inhibitors of knowledge sharing was critical in order to be able to develop strategies that can be used to overcome these inhibitors (Cadger et al., 2016:37; Rosenberry & Vicker, 2017:28). In the current study, the inhibitors of knowledge sharing among the rice farmers were examined as the fifth objective.

Findings from the quantitative data (as shown in subsection 4.2.5) reported that the major inhibitors faced by the rice farmers in knowledge sharing were; financial constraints, technological constraints and poor communication skills. Apart from these major inhibitors, the moderate forms of inhibitors identified included; the dominance of tacit over explicit knowledge, limited collaborative support, time constraints, organizational culture and knowledge hoarding. The least significant inhibitors identified were mistrust and individual differences. Apart from that, there were other categories of inhibitors identified including; too much competition among rice farmers, unavailability of internet facilities, lack of climate of openness, mistrust, favouritism and jealousy. The findings from the quantitative data aligned with findings from the qualitative data (subsection 4.3.5). The main inhibitors identified from the qualitative data included; network challenges in farming areas, limited technological know-how, lack of knowledge and leadership challenges, lack of communication skills, knowledge hoarding and non-attendance of meetings.

The findings suggest several factors that undermine knowledge sharing among the rice farmers. In synthesizing the findings on the inhibiting factors, knowledge sharing among the rice farmers is faced with inhibitors on all four levels evident in the literature, as to reflected in chapter two, section 2.3.5. Current literature (as shown in section 2.3.5)

identifies four levels of inhibitors of knowledge sharing, which are technological inhibitors (Adamides & Stylianou, 2013:6; Yeşil & Hırlak, 2019:22), organizational inhibitors (Feng & Xue, 2014:11; Nadason et al., 2017:34), social and cultural inhibitors (Navarro & Hautea 2014:66; Siziba et al. 2012:16), and individual level inhibitors (Cadger et al., 2016:35; Rosenberry & Vicker, 2017:28).

Technological inhibitors were the lack of infrastructure that allows for easy access and use of technology for communication. In this study, the technological inhibitors identified were network challenges in farming areas and limited technological know-how (as shown in section 5.5). The network challenges were as a result of limited connectivity of telecommunication in the farming communities, which feed into all aspects of deploying the needed technology to aid knowledge sharing. The technological situation in the district lacks integration of the IT system for a free flow communication. The location of the farms was in the villages where the network system for sharing the free flow of knowledge was a challenge. In support of the study Adamides and Stylianou, (2013:6), and Yeşil and Hırlak (2019:22), show that technological barrier to knowledge sharing among the rice farmers poses challenges to them. However, Yeşil and Hırlak, (2019:22) reported that lack of technological integration impedes the ease and speed of knowledge sharing in farming communities.

Organizational level inhibitors were the factors that operate at the level of organizations (in the more formal sense) or communities of practice (in the less formal sense) that impede or inhibit how individuals within the organizations share knowledge (Feng & Xue, 2014:11). Thus, within the context of this study, the organizational level inhibitors were those factors that work at the level of the associations, groups and cooperatives among the farmers that impede knowledge sharing. The main organizational level inhibitors identified included; lack of knowledge and leadership challenges including financial constraints, the dominance of tacit over explicit knowledge and limited collaborative support. These were barriers beyond those individual rice farmers which impact their everyday practices as rice farmers. These factors identified align with previous studies that have all reported similar findings (Feng & Xue, 2014:11; Nadason et al., 2017:34).

It was worthy to note that the dominance of tacit over explicit knowledge found in the current study contradicts literature. As discussed in chapter two (subsection 2.3.1.3.1), tacit knowledge encompasses skills and experience gained from everyday lived experiences (Laforge & McLachlan, 2018:259), whereas explicit knowledge encompasses written forms of knowledge in documents (Teixeira et al., 2018:57). Most previous studies report that in knowledge sharing, emphasis was always placed on the explicit knowledge over tacit knowledge (Michalik, 2017:289; Nadason et al., 2017:36; Trusson et al., 2017:186). In the current study, more emphasis was placed on tacit knowledge over explicit knowledge. Within the context of the study setting, the farmers (as shown in subsections 4.2.1.4 and 4.3.1) have low levels of education.

This makes them have limited engagement with written documents, thus preferring tacit forms of knowledge which are easily accessible through observation or orally. The researcher, therefore, challenges the dominant assumption of explicit knowledge in literature and advances a new argument that the dominance of explicit or tacit knowledge is context-dependent (Trusson et al., 2017:186). The social and cultural inhibitors encompass how the atmosphere created within communities of practice undermines knowledge or knowledge flow (Siziba et al., 2012:16; Feng & Xue, 2014:11). The sociocultural factors were built within the social fabric of life which shape social processes such as interpersonal relations, social networking and cooperation (Navarro & Hautea, 2014:66). In the current study, the main sociocultural inhibitors identified included; culture of mistrust, too much competition among rice farmers and non-attendance of meetings. These factors create an atmosphere which makes it difficult for knowledge or knowledge to easily flow between the rice farmers.

Some of the inhibitors identified were operating at the individual level. The individual-level inhibitors encompass personal characteristics or factors about individual rice farmers that make it difficult for them to share knowledge (Cadger et al., 2016:35). In the current study, the individual level inhibiting factors identified included; lack of communication skills, knowledge hoarding, non-attendance of meetings, favouritism and jealousy and time constraints. These factors were in line with Cadger, et al. (2016:35) and Rosenberry and

Vicker (2017:28) studies that reported on impeding or undermine knowledge sharing at the individual level.

The configuration of the technological, organizational, socio-cultural and individual level inhibitors suggests that knowledge sharing among the rice farmers occurs within the context of a share-compromising environment, at all levels. These multilevel inhibitors need to be creatively addressed to be able to overcome how they prevent or delay knowledge flow between and among the rice farmers. Strategies to improve knowledge sharing would, therefore, require a multilevel approach that targets the inhibitors at all the four levels, in order to successfully anchor improved knowledge sharing within the context of the rice farming communities.

5.8 Enablers of knowledge sharing

The factors that enable or promote knowledge sharing practices among the rice farmers were also examined. Just as there were factors that inhibit knowledge sharing, there were those that promote or enable knowledge sharing. Thus, knowledge sharing enablers are factors that promote easy and effective sharing of knowledge among individuals (Ortolani et al., 2015:25). Therefore, it was imperative that enablers of knowledge sharing were identified in order to have an understanding of the existing factors that can be leveraged to promote knowledge sharing. The sixth objective of the study thus assessed enablers of knowledge sharing among the rice farmers.

Findings from the study showed several enabling factors that promote knowledge sharing within the rice farming communities. Specifically, findings from the quantitative data (as reflected in subsection 4.2.7) showed that the dominant enablers identified were; improvement of trust, social networking, reward systems, self-efficacy and democratic involvement. Further, the study showed that the moderate enablers identified included; effective communication skills, improvement of training, the trust of participation, willingness to share, provision of technology, motivation to share, incentives and rewards, and effective leadership. Apart from that, other categories of enablers identified included;

living in close proximity, friendships among the farmers and use of local language. In accordance to the qualitative data (as provided in subsection 4.3.7), the main enablers identified from the qualitative data for knowledge sharing included; technology that supports knowledge sharing, learning communities, forming social networking among the rice farmers, leadership and management support, reward systems for rice farmers who share knowledge, motivation for sharing knowledge and effective communication skills.

In synthesising the findings, there exist several opportunities in the rice farming communities that provide a context for enabling knowledge sharing. The enabling factors also exist on multi levels, ranging from organizational enablers (Feng & Xue, 2014:11; Nadason et al., 2017:34), sociocultural enablers (Navarro & Hautea, 2014:66; Siziba et al., 2012:16), technological enablers (Kamarudin et al., 2015:115; Navarro & Hautea, 2014:66) to individual-level enablers (Cadger et al., 2016:35; Rosenberry & Vicker, 2017:28).

Organizational enablers were various factors within the communities of practice that promote the ease and effectiveness of sharing knowledge and knowledge (Quaicoo, Dawoe & Isaac, 2016:33). In the current study, the organizational level enabling factors uncovered include; reward systems, democratic involvement, improvement of training, incentives and rewards, and effective leadership. The reward system ensures that the rice farmers were incentivized for sharing knowledge. Democratic involvement creates opportunities for every rice farmer to be able to participate in knowledge sharing. Effective leadership provides opportunities for creating the needed context, including providing training opportunities where individuals can conveniently share knowledge. The findings in this study align with some previous studies which were found in the literature. For instance, Guo et al. (2015:100) found that the participatory involvement of rice farmers improves both farmer knowledge acquisition and farmer knowledge sharing in China. Biconne et al. (2014:243) also found that democratic decision-making processes encourage farmers' knowledge sharing in Senegal.

The sociocultural enablers of knowledge sharing encompass factors within the social and cultural fabrics of the rice farmers' life that promote knowledge sharing (Navarro & Hautea, 2014:66; Siziba et al., 2012:16). In the current study, the sociocultural enablers of knowledge sharing uncovered were improvement of trust, social networking, the trust of participation, and forming social networking among the rice farmers. These enabling factors create positive interactions between and among the rice farmers in ways that create enabling social contexts for sharing knowledge. For instance, networking among rice farmers promotes collaboration and togetherness, which increases knowledge sharing. The positive social interaction increases mutual trust between the rice farmers, making them more willing to share knowledge and information. In support of the findings Kamarudin et al. (2015:118), found that social networking improves knowledge sharing among paddy farmers in Malaysia. Again, Kamarudin et al., (2015:115) and Navarro and Hautea, (2014:66) also found that strong networking ties among rice farmers encourage knowledge sharing.

The role of technology as enablers of knowledge sharing cannot be overemphasized. Researchers like Bozzato et al. (2018:78), Michalik (2017:285), Rosenberry and Vicker (2017:21) and Akram and Bokhari (2011:45) all report the importance of technology, particularly knowledge communication technology in improving knowledge sharing. The findings from the current study align with these previous studies. Technological enablers were also identified. Although severe technological challenges of knowledge sharing exist in the study communities, as shown in chapter four (sections 4.2.6 and 4.3.6) and chapter five (section 5.7), there was still a degree of hope with some level of technological enablers in the study communities. For instance, the use of smart mobile phones among rice farmers was higher. There was the availability of service of the major telecommunications companies in Ghana in the study communities. Even though the services were not strong and not found on the rice farms, some form of service can be accessed in the residences of rice farmers. Therefore, existing technological opportunities that provide context for expanding technological enablers to improve knowledge sharing.

Individual-level enablers of knowledge sharing were also critical. Even though organizational, technological and social enablers were provided, it still boils down to some individual characteristics whether knowledge or knowledge would be shared or not (Laforge & McLachlan, 2018:259; Michalik, 2017:289; Nadason et al., 2017:36; Trusson et al., 2017:186). In the current study, the individual level enablers identified include self-efficacy, effective communication skills, willingness to share and motivation to share. These factors were important because they show that, regardless of the structural and technological challenges, the rice farmers believe in their efficacy, willingness and motivation to share their information. Studies by Adamides and Stylianou (2013:6) and Yeşil and Hırlak (2019:22) show that the existence of these individual-level enablers means that the rice farmers would be able to improvise and still share their information. The researcher acknowledges enormous inhibiting factors in the study settings and was still hopeful that there would be some level of enabling factors that need to be drawn on in the implementation of knowledge sharing interventions.

5.9 Strategies for enhancing knowledge sharing practices

Ensuring that knowledge sharing becomes effective means there was the need to be intentional about it by developing critical strategies to enhance or improve knowledge sharing. However, being able to develop the need strategies requires critical understanding of the perspectives of individuals' perspectives on the strategies that exist already (Andre et al., 2017:889). Operationally, strategies for enhancing knowledge sharing were defined in terms of the specific context-relevant approaches that are used to overcome challenges of knowledge sharing (Boateng & Agyemang, 2016:218). Accordingly, the last objective of the study examined different strategies that can be used to improve knowledge sharing among rice farmers.

The findings showed various existing strategies being used to overcome the challenges of knowledge sharing among the rice farmers. Specifically, findings from the quantitative data (as shown in subsection 4.2.8) showed that the dominant strategies identified were; use of appropriate technology, leadership and management support, integration of

knowledge sharing in goals and strategies, providing spaces and opportunities for knowledge sharing, training and retraining, and using reward systems. The moderate strategies identified were; building trust, setting time aside for face-to-face meetings, financial support, seeking opinions and inputs from new rice farmers and mentorship to new rice farmers. Other categories of strategies identified were; reducing favouritism among leaders, translating knowledge into the local language, promoting a knowledge sharing culture, using videos and pictures, and rewarding knowledge sharing.

The findings from the quantitative data of the study aligned with the findings from the qualitative data of the study. The main strategies identified from the qualitative data (as shown subsection 4.3.8) for improving knowledge sharing among the farmers included; leadership and management support for knowledge sharing, financial support for acquiring or creating knowledge, building interpersonal trust among the rice farmers, integration of knowledge sharing initiatives for the rice farmers, use of appropriate technology to aid knowledge sharing, and continuous training and re-training of the rice farmers.

The findings from this study were in line with those reported by previous studies regarding the strategies needed to improve knowledge sharing. Findings from previous studies in literature, as discussed in chapter two (section 2.4.6), indicate that the strategies for improving knowledge sharing included leadership and management support (Tsinigo & Behrman, 2017:48), use of appropriate technology (Garcia et al., 2018:32; Ortolani et al., 2017:26), investment and financial support (Cadger et al., 2016:43; Chhim et al., 2017:753), building trust (Holten et al., 2018:217; Trusson et al., 2017:1547), integrating knowledge sharing into goals and strategies (Ganguly et al., 2019:273; Riege, 2005:19; Yeşil & Hırlak, 2019:111), constant training and retraining (Ganguly et al., 2019:273; Riege, 2005:22) and providing space and opportunities for knowledge sharing (Chhim et al., 2017:753; Yeşil & Hırlak, 2019:122).

The current study show that the participants have a deep insight into the strategies to put in place to improve knowledge sharing among the rice farmers in the study communities.

These strategies require that a lot needs to be done if knowledge sharing among the rice farmers was to be improved. However, some of the strategies would require a long-term approach, while others would be addressed in a short-time. For instance, when it comes to investment and financial support and provision of technological infrastructures, these were long-term investments, particularly at the national level, in expanding internet connectivity and telecommunication within the rice farming communities in the Eastern Region and, by extension, other similar rice farming communities.

However, when it comes to the organizational, social and individual level enablers, these can be addressed within a short to medium term. For instance, there was a need to create leadership support for knowledge sharing among the rice farmers. Strategies such as building trust, integrating knowledge sharing in goals and strategies, training and retraining, and providing space and opportunities for knowledge sharing are strategies that can be implemented without waiting for technological problems to be addressed. These strategies fall within the capacity of the individual rice farmers and the communities of practice that exist within the rice farming communities. What is needed is critical strategies that can help to address the short-term challenges, while advocating at the structural level to get structural inhibitors addressed. The researcher's contribution to knowledge in terms of proposing a context-specific strategy to improve knowledge sharing is discussed next.

5.9.1 Researcher's proposed strategy for improving knowledge sharing practices

This section presents a discussion of the researcher's contribution to knowledge in terms of developing a multilevel and multi-sectoral strategy approach to improving knowledge sharing practices among the rice farmers. The multilevel nature of the strategy means that the strategy targets inhibitors at the structural, community and interpersonal levels that undermine knowledge sharing. The multi-sectoral nature of the strategy means that implementation of the strategy would involve partnership between stakeholders in different sectors such as government agencies, rice farming communities, rice production-based NGOs and researchers, It is hoped that this strategy, if well

implemented, will lead to sustainable improvement in knowledge sharing in among rice farmers in Ghana, and other rice farming communities in other African countries whose contexts are similar to Ghana.

The study has established that a successful implementation of knowledge sharing would depend on identifying and linking knowledge sharing enablers to tools and technologies, and practices. The researcher recommends further that in terms of enhancing effective agricultural knowledge management it is important to develop targeted and context-fit strategy for addressing challenges and leveraging opportunities for knowledge sharing practices among the rice farmers.

Within the context of this study, strategies for improving knowledge sharing practices would need to include; developing effective knowledge infrastructure, involving different stakeholders and using appropriate knowledge and communications technology tools in enhancing access to knowledge. These findings form the basis of the proposed strategic framework (see Figure 6.1) to guide the successful implementation of knowledge sharing in rice farming communities in Ghana. The suggested strategy can be used by stakeholders involved in rice farming in particular, and rice production in general in Ghana to improve knowledge sharing practices in rice farming communities.

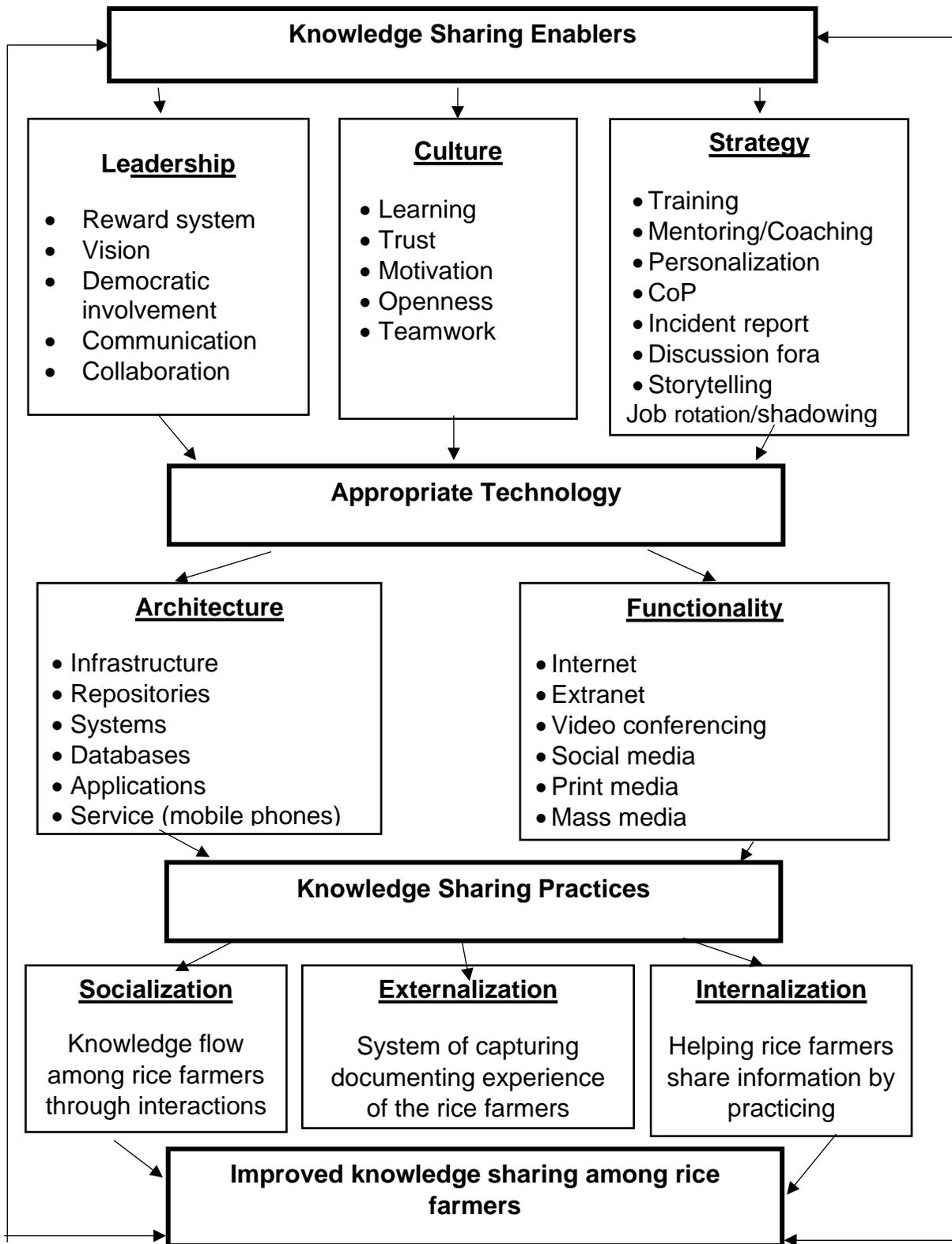


Figure 6. 1: Strategies for Improving KS in Rice Farming Communities
 Source: Researcher's Construct (2019)

As shown in Figure 6.1, in developing appropriate strategies to improve knowledge sharing, there is the need to link knowledge sharing enablers to appropriate technology and knowledge sharing practices. In the rice farming communities, leadership, culture and strategy are critical enablers. Leadership is needed to create reward systems, vision, democratic involvement, communication and collaboration among the rice farmers. The strategies (as reflected in Figure 6.1) also provide for a strong need to establish a culture of learning, the trust of participation, motivation to share, openness to new knowledge, and teamwork among the farmers.

Training (in the form of seminars and workshops), mentoring, coaching, personalization, communities of practice, meetings and discussion forums and storytelling need to be well implemented. There is also the need to strengthen job rotation and job shadowing among the rice farmers. The technology was a major inhibitor of knowledge sharing among rice farmers. There was a need for appropriate technology in terms of its architecture and functionality. The architecture would involve providing the needed technological infrastructures, such as services for mobile phones, applications, repositories, systems and databases. The functionality would involve technological tools that function within technological infrastructures. These would involve internet services (e.g. for emails), extranet, video conferencing, social media (e.g. Facebook, Twitter, Instagram, etc), print media (e.g. magazines and brochures), and mass media (particularly community-based, such as community knowledge centres).

Nonetheless, it is worthy to note that there is a possible draw backs in implementing the strategies as outlined in the Figure 6.1. The drawback is mainly structural in nature, particularly when it comes to appropriate technological architecture. This require the government to ensure that technological infostructures are deployed into rice farming communities. However, such infrastructures may take longer to reach rice farming communities, which are mostly rural in nature.

However, it is critical that the technological infrastructures are provided. These strategies would improve knowledge sharing practices through three knowledge conversion, which

are in line with the SECI model. These are socialization (where opportunities for interactions are provided for the rice farmers so they can share knowledge and experience), externalization (where systems are put in place to document the traditional knowledge and experience of the rice farmers), and internalization (where opportunities are provided for the rice farmers to share information through practice). These three routes to knowledge conversion would enhance the effectiveness of knowledge sharing among the rice farmers.

5.10 Chapter summary

This chapter has provided the interpretation and discussion of the findings from the study provided in chapter four. The interpretation and discussion of the findings were organized around the objectives of the study provided in chapter one. The interpretation and discussion of the findings were situated within the context of relevant literature and theories (provided in chapter two) with reference to chapter four (data presentation and analysis). It was established from chapter four that there was a high level of appreciation of knowledge sharing among the rice farmers.

The main types of knowledge shared among the farmers included weed management, rice harvesting, processing and marketing knowledge, agricultural knowledge, land management practice knowledge, seed knowledge and farming creativity and innovation. Knowledge sharing practices were used including workshops, training and seminars, knowledge fairs, discussion forums, face-to-face collaboration, coaching, storytelling and community of practice. Those that were used moderately included; mentoring system and peer assist, after-action review and incidence report. Tools and technologies used for knowledge sharing included WhatsApp, magazines, electronic databases, expertise locator system, emails, extranet and intranet. There was limited use of knowledge sharing systems for knowledge sharing.

The benefits of knowledge sharing for the rice farmers cohered around; performance improvement, learning to do research, discouraging knowledge hoarding and

encouraging learning, gaining new experience, increased competitiveness, quick learning, effective utilization of rice farming information, encouraging leadership and filling important knowledge gaps. Major inhibitors of knowledge sharing were; financial constraints, technological constraints and poor communication skills. The main enablers were improvement of trust, social networking, reward systems, self-efficacy and democratic involvement. Strategies for improving knowledge sharing cohered around; use of appropriate technology, leadership and management support, integration of knowledge sharing in goals and strategies, providing spaces and opportunities for knowledge sharing, training and retraining, and using reward systems.

This chapter has presented a discussion on these findings, interpreting and relating them to the context of literature, theories and the context-specific knowledge of the rice farming communities used for the study. The next chapter (chapter six) presents the summary, conclusions and recommendations from the study.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The preceding chapter presented the interpretations and discussion of the findings from the study. The findings were presented and analysed within the context of the objectives of the study, with the data collected in chapter three. This chapter presents the summary of the findings, conclusion and recommendations. A summary of the thesis was presented first. This was followed by a summary of the study objectives. After that, conclusions would be drawn, and the implications of the findings would be discussed. Recommendations for future research were also made, and then an overall conclusion was presented.

6.2 Summary of findings

This section presents a summary of the findings of the study. The main aim of the study was to explore the knowledge sharing practices among rice farmers in the Eastern Region of Ghana to develop strategies to enhance knowledge sharing among them. Data was gathered using a mixed-method approach, combining survey, interviews and focus group discussions. This section presents the findings from the quantitative data. The findings were presented by synthesizing the quantitative and qualitative findings together based on the research objectives addressed. The summary of the findings are presented below:

1. The first objective assessed types of knowledge shared among the rice farmers. Findings showed that weed management knowledge was mostly shared by the rice farmers. This was followed by rice harvesting, processing and marketing knowledge, agricultural knowledge, land management practice knowledge, seed knowledge and then farming creativity and innovation. Other categories of knowledge shared included pest control, food security and climate change. In

essence, the farmers share complex types of knowledge which addresses different aspects of rice farming.

2. To develop targeted knowledge sharing practices, there was the need for understanding of what the rice farmers were doing already, so that more sustainable and context-relevant knowledge sharing practices can be anchored within their context. The second objective examined knowledge sharing practices used by the rice farmers. The findings showed that workshops, training and seminars are predominantly used practices for sharing knowledge. These suggest that their main knowledge sharing practices have been face-to-face and top-down, where agricultural extension officers share knowledge with the rice farmers. Self-directed and interpersonal practices are limited, which is reflected in limited use of knowledge banks and portals, documentation, job shadowing and job rotation. Relating to the theoretical framework, the findings suggest that the rice farmers utilize socialization, externalization in their knowledge sharing practices, which helps them to convert explicit knowledge to another explicit rice farming knowledge.
3. The third objective examined the tools, technologies and systems used for knowledge sharing among the rice farmers. Findings showed low use of technologies in the knowledge sharing process among the rice farmers. However, there appear to be opportunities for expanding technological use in knowledge sharing among the farmers. During the data gathering process, the researcher found that there was a possible enabling context for addressing the technological challenges or inhibitors to knowledge sharing. Specifically, the researcher thought that technology, particularly smartphone use, has become ubiquitous in Ghana, defying educational and economic status. Among the rice farmers used in this study, for instance, the researcher found that the majority of them had smartphones, even though the functional use of the phones was limited. This means that the rice farmers were already engaging with technological tools, even if their functional use was limited.

4. The fourth objective examined the benefits that the rice farmers derived from knowledge sharing. Findings established that the rice farmers perceive high benefits of knowledge sharing. Their perceived benefits included performance improvement, learning to do research, discouraging knowledge hoarding and encouraging learning. Other benefits identified by the respondents included; understanding the effect of climate change, adapting to climate change, improving organizational performance, and improving productivity. These benefits suggest that the rice farmers were aware of the critical role of sharing knowledge in their rice farming activities. This was in line with the arguments of Michalik (2017:285), Rosenberry and Vicker (2017:21) and Holten et al., (2018:219).
5. The inhibitors of knowledge sharing among the rice farmers were also examined in the fifth objective. Findings showed that several inhibitors of knowledge sharing were identified among the rice farmers. The dominant inhibitors cohered around technology (as shown in subsections 4.2.4 and 4.3.4), and leadership and interpersonal factors (subsections 4.2.6 and 4.3.6). Technology use was limited among the rice farmers and therefore technology-mediated systems of sharing knowledge were low, as evidenced in subsections 4.2.4 and 4.3.4. Also, there were several leadership problems such as not creating a conducive atmosphere for knowledge sharing and not rewarding knowledge sharing among the factors. There were also fundamental interpersonal tensions such as mistrust and competition, which create knowledge hoarding among the rice farmers.
6. The sixth objective examined factors that enable or promote knowledge sharing practices among rice farmers. Findings that notwithstanding the numerous inhibiting factors identified, there were several opportunities for anchoring sustainable knowledge sharing among the farmers. Several enablers were also identified among the rice farmers. There was a high level of social networking, sense of self-efficacy and democratic involvement among the rice farmers. This creates an atmosphere of being willing to share knowledge among the rice farmers. The researcher suggests that these human-related factors can be leveraged as enablers to overcome the 'soft' inhibitors of knowledge sharing.

Drawing on the social exchange theory (SET), every individual should be rewarded for work done.

7. The last objective of the study assessed different strategies that can be used to enhance knowledge sharing among the rice farmers. Findings showed that the study has established that a successful implementation of knowledge sharing would depend on identifying and linking knowledge sharing enablers to tools and technologies, and practices. The researcher recommends further that in terms of enhancing effective agricultural knowledge management it is important to develop targeted and context-fit frameworks for addressing challenges and leveraging opportunities for knowledge sharing among the rice farmers.

6.3 Conclusions

This section presents the conclusions from the findings. The conclusions in this section are discussed based on the objectives and research questions of the study. In drawing up the conclusions for each of the objectives, the findings from both the quantitative and the qualitative data were combined and synthesized to provide a concise and coherent conclusive answer to each of the research questions.

Based on the first objective, the study showed that several types of knowledge are shared among the rice farmers. There also exists a good understanding of the idea of knowledge sharing. They understood and appreciated knowledge sharing within their rice farming activities. It can be concluded that the fundamental building blocks of knowledge sharing exist among the rice farmers.

Based on the second objective, the study found that dominant knowledge sharing practices included workshops, training and seminars, knowledge fairs, discussion forums, face-to-face collaboration, coaching, storytelling and community of practice. It can be concluded that there is a high preference for traditional face-to-face engagement as the main ways through which the rice farmers share knowledge within and among themselves.

Based on findings from the third objective, the study found limited use of technology use in knowledge sharing among the farmers. Even though there are attempts at integrating various tools, technologies and systems into knowledge sharing, its use is still limited due to fundamental challenges in structural level technological infrastructures, architecture and functionalities. The technological competence among rice farmers is also low due to low levels of education.

The findings from objective four suggest that there was a high level of appreciation of benefits of knowledge sharing among the rice farmers. They particularly recognize the benefits of knowledge sharing within the areas of performance improvement, learning to do research, discouraging knowledge hoarding and encouraging learning. This provides good context for the high acceptance of implementing strategies within their context to improve knowledge sharing.

The fifth objective of the study showed high level of inhibitors or constraints of knowledge sharing among the rice farmers. The inhibitors cut across structural factors, organizational factors and individual factors. The multilevel nature of these inhibitors requires developing strategies that target different levels simultaneously in order to overcome the inhibitors and improve knowledge sharing.

Based on the findings from the sixth objective of the study, it can be concluded that there are opportunities for improving knowledge sharing practices among the rice farmers. There exist some enabling factors (such as social networking, trust, effective leadership, motivation to share and others) which can be leveraged to overcome some of the inhibitors of knowledge sharing.

Based on the findings from the last objective, it can be concluded that strategies for enhancing knowledge sharing among the rice farmers should be multilevel in approach. This is because the factors that impede improved knowledge sharing operate at different levels. A multilevel strategy approach would help address all inhibitors at the structural, community and individual levels. The strategies are discussed in details in the previous chapter (Chapter 5) under sub-section 5.9.1.

6.4 Contribution to knowledge

The research explored the knowledge sharing practices among rice farmers in the Eastern Region of Ghana in order to develop strategies to enhance knowledge sharing. The study contributes knowledge to theoretical development, knowledge sharing practice in Ghana and methodological innovation.

The theoretical contributions, through the empirical evidence on how SECI model and social exchange theory was use in knowledge sharing, would best integrate indigenou and scientific knowledge and provide insight for sharing all-inclusive knowledge to support relevant stakeholders. Insight on the theoretical review shows that interaction with the rice farmers based on a self-interested analysis of the costs and benefits, would result in maximization of their gains and minimize their costs. Theory contributed that building interpersonal trust through interaction with farmers could edge them closer to practical equilibrium in maintaining the best and efficient practice way of rice farming.

The study contributes to the role of agricultural experts (i.e. extension officers) as knowledge-sharing brokers and adds to the body of knowledge. The role of extension officers in the current agricultural extension system in Ghana and other developing countries was to transfer knowledge and technology from research to local rural communities. Nevertheless, this research results in the different roles and activities of extension officers as who act as information brokers, and technology transfer which facilitate knowledge sharing. in one direction, including enhanced engagement, involvement of extension officers, knowledge and technology translation, networking, and coordination of cooperation and negotiation. These suggestions are essential to information exchange and integration. It would also result in the expertise and information requirements of extension officers as agents for championing knowledge sharing. Therefore, the results of this research potentially lead to the expansion of the roles and practices of knowledge brokering and the skills and knowledge needed of extension agents as knowledge brokers in rice farming.

The study contributes to knowledge in terms of methodological innovation. Lau (2017:48) indicated that multiple research design in knowledge sharing can provide a unique opportunity to bridge theory (basic research) with practice (applied research), which can allow for solving real-world problems and contributes to the generation of new knowledge. On methodology, how the researcher blended different approach, by way of seeking views from different perspectives would help stakeholders in rice production. The contribution made by these stakeholders would transform the procedure of soil maintenance, harvesting, fertilizer application, weed control, irrigation and financial activities that pertain to agricultural.

6.5 Implications of the findings

The current study aided in uncovering the nature and context of knowledge sharing among rice farmers in the Eastern Region of Ghana. Findings from the study were critical and relevant to practice and research on knowledge sharing within rice farming in particular and knowledge management within the agricultural context. The findings may be used as the basis for improving knowledge sharing among smallholder rice farmers, as reflected in frameworks that guide knowledge sharing among and within communities of practice.

The major contributions from the current study were grounded, on the findings from the study and findings from other previous studies, which were well established in the knowledge sharing literature in particular and knowledge management literature in general. In line with the theoretical and conceptual basis discussed in chapter two, there was the need to advance the argument, if rice farmers in the Eastern Region and by extension, those in other regions of Ghana could be intentional about knowledge sharing in their rice farming practices, they could increase productivity and become competitive.

In this section, the implications of the study findings were discussed. The discussion was structured in three parts. First, the implications of the practice of rice farming were discussed. Secondly, implications for policy on rice farming in Ghana were described.

Lastly, the implications of the findings from the study of theory and literature were also presented.

6.5.1 Implications for theoretical development

The relevant theories and literature regarding knowledge sharing were based on the SECI model and SET. The SECI model and SET are significant to this study because they provide an adequate framework that creates and converts knowledge within their rice farming activities. This helps to understand how the rice farmers continuously create, use and reuse knowledge in a continuous and dynamic manner. Apart from helping to explain how the rice farmers create and convert knowledge, the SECI model also provides a framework for understanding how the knowledge is shared and transferred among the rice farmers. The SET also provides insights into the conditions that inform the sharing of knowledge among the rice farmers.

The findings from this study added to the body of knowledge regarding knowledge creation and sharing based on the SECI model. The findings provided evidence of how knowledge was shared face-to-face amongst the farmers during presentations and discussions in the meetings (tacit to tacit). Farmers then recorded their own notes and coded it according to their understanding to facilitate ease of recalling the knowledge shared at the meeting (tacit to explicit). This was then followed by the process of combining the knowledge recorded with other sources such as policies and implementation plans mentioned at the meeting and follow-ups outside (explicit to explicit) using telephones or e-mails. Social exchange theory provided empirical evidence that farmer should have a strong relationship amongst themselves which transcends the boundaries created by diverse positions and ranks, establishes trust, promotes a willingness to share their knowledge due to altruistic values, provides a sense of belonging to a network and creates a reciprocal system that eliminates the silo mentality. It is imperative to note that the theories such as SECI and SET contribute greatly to individual rice farmer and the business entity as a whole, in understanding the factors that drive to knowledge sharing practices.

6.5.2 Implications for policy framework

The current study has established that there were fundamental challenges and problems regarding knowledge sharing among the rice farmers. The researcher argues that the problems of knowledge sharing identified among the rice farmers in the Eastern Region were reflective of the fundamental challenges of knowledge sharing among other rice farming communities in Ghana. Therefore, policy-makers and all other relevant stakeholders such as; Ministry of Food and Agriculture (MoFA), the Ghana country office of Food and Agriculture Organization (FAO), Agric-based NGOs involved in rice production, and Departments of Agriculture of University in Ghana need to take practical and pragmatic steps to ensure the enhancement of the implementation of knowledge sharing in rice farming communities.

The findings from the study have established that there were elements of knowledge sharing happening among the rice farmers. However, their knowledge sharing can be described as being in its infancy stage, particularly regarding the types of knowledge shared, the practices used in sharing knowledge, the tools and technologies used, and the inhibitors faced. There was, therefore, the need to develop a policy to improve knowledge sharing in rice farming communities. This ensures that the right policy environment was established to strengthen knowledge sharing and, by extension, knowledge management, not just in rice farming communities, but also all other smallholder farming communities in Ghana.

6.6 Recommendations

This subsection presents a discussion of recommendations, based on the implications that the findings from the study have for rice farming practice and future studies.

6.6.1 Recommendations for improving knowledge sharing practices

The recommendations for practise have been synthesized and discussed the objectives of the study.

1. The study has revealed that the dominant types of knowledge shared speak to the fundamental challenges that the rice farmers are confronted with on a daily basis in their rice farming practice.
 - a. The researcher recommends that there is a need to develop targeted knowledge sharing strategies to address these challenges. The rice farmers should be encouraged to know the critical importance of all the types of knowledge as they relate to rice farming.
 - b. Further, the researcher recommends that the farm managers should put measures in place to ensure that the rice farmers share knowledge on other types of knowledge that are least shared among the farmers.
2. The study established that self-directed and interpersonal practices in knowledge sharing are limited, which is reflected in limited use of knowledge banks and portals, documentation, job shadowing and job rotation.
 - a. The researcher recommends that there is a need to encourage more bottom-up and interpersonal approaches to knowledge sharing among the rice farmers. They have been found to prefer top-down approaches to knowledge sharing in the form of workshops and seminars. However, such top-down training approach to knowledge sharing was not regular because of the cost involved. The researcher recommends that more cost-effective and decentralized approaches should be encouraged in rice farming communities.
 - b. The researcher also recommends that strategic alliances be built between the Ministry of Agriculture and the community knowledge centres so that rice farming knowledge can easily be shared with them in a decentralized manner to reduce cost, and also to facilitate frequency of knowledge sharing. Thus, the rice farmers are increasingly turning to community information centres for knowledge on rice farming. These centres use traditional means to broadcast messages to residents within sections of community confines using audio in local language. They are growing in

popularity, particularly in rural and peri-urban areas and other farming communities in Ghana.

3. The research has established low use of technologies in the knowledge sharing process among the rice farmers. However, there appear to be opportunities for expanding technological use in knowledge sharing among the farmers.
 - a. The researcher recommends that mobile phones can be used to improve knowledge sharing among rice farmers. Smartphone use has become ubiquitous in Ghana, defying educational and economic status. Among the rice farmers used in this study, for instance, the researcher found that the majority of them had smartphones, even though the functional use of the phones was limited. This means that the rice farmers were already engaging with technological tools, even if their functional use was limited. The researcher thus suggests that there is a need to find innovative ways of encouraging knowledge sharing among rice farmers via mobile phones.
 - b. Further, the researcher recommends using more audio and video-based technologies and apps, preferably in the local language. This is because the educational levels of the rice farmers were generally low, with the majority not having tertiary education. Using audio and video technologies in local language would make knowledge easily accessed and shared by the rice farmers among themselves to encourage more horizontal ways of ensuring knowledge sharing.
4. This research has established that the rice farmers perceive the high benefits of knowledge sharing. This suggests that the rice farmers were aware of the critical role of sharing knowledge in their rice farming activities.
 - a. The researcher recommends that farm managers have to leverage the high awareness of the benefits of knowledge sharing among the farmers as a critical opportunity that creates a supportive context for implementing knowledge sharing programmes among the farmers.
 - b. The researcher recommends further that perception of the benefits of knowledge sharing should be the foundational grounds needed to anchor

knowledge sharing among communities. This means that knowledge sharing practices may not be met in high standards, but there should be a fundamental recognition on how important knowledge should be shared. From the researcher, this is a good context that can offer support from the rice farmers for knowledge sharing interventions.

5. Several inhibitors of knowledge sharing were identified among the rice farmers. The inhibitors include various factors including structural, community and interpersonal factors.
 - a. The researcher recommends that improving knowledge sharing among the rice farmers would involve complex and multifaceted approaches that competently address both the structural and interpersonal inhibitors to knowledge sharing.
 - b. The structural inhibitors would involve addressing the technological challenges. the interpersonal inhibitors would involve addressing the human factors, which are leadership and interpersonal tensions.
6. There exist opportunities for implementing sustainable knowledge sharing among the farmers.
 - a. The researcher recommends that human-related factors should be leveraged as enablers to overcome the 'soft' inhibitors of knowledge sharing. Several enablers were also identified among the rice farmers. There was a high level of social networking, sense of self-efficacy and democratic involvement among the rice farmers. This creates an atmosphere of being willing to share knowledge among the rice farmers.
 - b. Further, drawing on the social exchange theory (SET), every individual should be rewarded for Knowledge sharing work done. The researcher recommends that authorities and management should draw on SET to reward members who embody the knowledge sharing movement in the district. Supervisors can make announcements when team members have contributed their quota to something valuable that benefits farmer groups or associations in this regard. Specify exactly what the content was, and some

tangible ways everyone benefited when he/she shared knowledge to the benefit of the farmers' association. Supervisors can also give small prizes like t-shirts, water bottles, and other swag to team members who are demonstrating excellent collaboration skills to knowledge sharing. Again, the farmers' association can consider giving a bonus to the farmers who share the most highly utilized knowledge.

6.6.2 Recommendations for future research

The following recommendations are made for future research:

- i. The researcher suggests that experimental research on knowledge sharing practice can be studied. The experimental research would involve differentiation of basic conditions: exposure and non-exposure to the treatment condition of the independent variable, where one group would be exposed to knowledge sharing and other would not be exposed to see the outcome.
- ii. The researcher recommends further that an in-depth mixed methods study that builds on this base in one community where knowledge sharing is strong. Such studies would provide insights into what such rice farming communities do right and how their successes can be transferred to other similar communities.

6.7 Overall conclusion

This section provides the overall conclusion of the research problem. The main purpose of the study was to explore the knowledge sharing practices among rice farmers in the Eastern Region of Ghana to develop a framework and strategies to enhance knowledge sharing among them. The concurrent triangulation mixed-method design was used to gather the data through the use of a survey questionnaire and semi-structured individual interviews. Overall, the study involved a survey of 101 respondents and nine purposively sampled participants for the interviews. An overall conclusion was drawn by the research objectives stated in chapter one.

Synthesizing the findings which are situated within the context of a theoretical framework of knowledge sharing, the study concludes that for knowledge sharing to be improved among rice farmers, there is the need to pay critical attention to context. The strategies to improve knowledge sharing practices should take into consideration the context of the rice farmers and their communities so that more sustainable and context-supportive strategies for knowledge sharing practices can be anchored among the rice farmers. Effective knowledge sharing was the most fundamental tool for development because it helps to increase productivity.

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APPENDIX A: QUESTIONNAIRE



QUESTIONNAIRE FOR FARMERS, AGRICULTURAL OFFICERS, MANAGERS, ETC

**TOPIC; KNOWLEDGE SHARING PRACTICES AMONG RICE FARMERS IN THE
EASTERN REGION OF GHANA**

Dear Respondent,

As part of my PhD research work in the University of South Africa, Pretoria, I am conducting a survey on the topic: **Knowledge Sharing Practices Among Rice Farmers in the Eastern Region of Ghana**. The study is for an academic purpose and I will be happy if you could please take some few minutes out of your busy schedule and respond to this questionnaire. For your information, any knowledge obtained from this survey will remain confidential. You are free to withdraw your participation in the study. In addition,

if you have any comments, questions and suggestions about this study, please contact me through my email; randy.kommey37@gmail.com.

Thank you very much for your cooperation.

A handwritten signature in blue ink, appearing to read "Randy Kommey", is shown on a light-colored background.

Randy Emmanuel Kommey

PhD CANDIDATE, UNISA

Research Objectives

1. Investigate the different types of knowledge shared among the rice farmers in the Eastern Region of Ghana
2. Explore the knowledge sharing practices among rice farmers in the Eastern Region of Ghana
3. Identify the technologies used for knowledge sharing among the rice farmers
4. Assess the benefits of knowledge sharing practices among rice farmers
5. Examine factors that inhibit knowledge sharing among rice farmers
6. Establish the different enablers to knowledge sharing among rice farmers
7. Examine strategies to enhance knowledge sharing practices among rice farmers in the Eastern Region of Ghana

SURVEY INSTRUMENT

SECTION A: BIO-DATA OF RESPONDENTS

Instructions: Please indicate your preferred choice by ticking the option that applies to you.

1.	Please indicate your locality	
	Option	
	a. Kpong	
	b. Asutsuare	
	c. Akuse	
2.	Gender	
	a. Male	
	b. Female	
3.	Age range	
	Below 20 years	
	a. 21 - 30 years	
	b. 31 - 40 years	
	c. 41 - 50 years	
	d. 51 - 60 years	
	e. 61 years and above	
4.	Number of years of doing rice farming	
	a. 1 - 5 years	
	b. 6 - 10 years	
	c. 11 - 15 years	
	d. 16 - 20 years	
	e. Over 21 years	
5.	Highest level of education	
	a. No school	

	b. Basic school	
	c. High school	
	d. Tertiary	

SECTION B: TYPES OF KNOWLEDGE SHARED AMONG RICE FARMERS IN THE EASTERN REGION OF GHANA

This section s the different types of knowledge shared among farmers. Please mark your responses depending the types of knowledge shared among rice farmers in this region.

6. Types of Knowledge Shared	Yes	No	SOMEWHAT
a. Agricultural Knowledge			
b. Seed knowledge Sharing			
c. Land Management Practice			
d. Farming creativity and innovation			
e. Rice Harvesting, Processing and Marketing			
f. Weed Management Knowledge			
What are the other types of knowledge shared?			
g.			
h.			
i.			

In your view, what are some other types of knowledge shared?

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SECTION C: KNOWLEDGE SHARING PRACTICES AMONG RICE FARMING IN THE EASTERN REGION OF GHANA

Below is a list of different knowledge sharing practices. Please mark your responses depending on your use or otherwise of these knowledge sharing practices among rice farmers in this region.

7. Knowledge Sharing Practices	Yes	No	SOMEWHAT
a. Discussion Forums			
b. After Action Review /Lessons Learnt			
c. Communities of practice (CoP)			
d. Incidence report			
e. Personalization/Face-to-face meetings			
f. Job rotation			
g. Job shadowing			
h. Coaching system			
i. Mentoring system			
j. Use of knowledge banks and portals			
k. Documentation			
l. Story telling			
m. Peer Assists			
n. Knowledge Fairs			
o. Workshops, Training and Seminars			
What other knowledge sharing practices are used?			
p.			
q.			

r.			
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What other understanding do you have for knowledge sharing practices?

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SECTION D: TECHNOLOGIES USED FOR KNOWLEDGE SHARING AMONG THE RICE FARMERS

Please select the tools and technologies that are available and used for knowledge sharing in your rice farm

8. Knowledge sharing technological tools	Yes	No	SOMEWHAT
a. Intranet			
b. Extranets			
c. Skype			
d. Video conferencing			
e. Email			
f. Blogs			
g. Expertise Locator System			
h. Electronic Databases			
i. Magazines			
What are the other technological tools used?			
j.			
k.			
l.			

9. Technologies used for knowledge sharing	Yes	No	SOMEWHAT
a. WhatsApp			
b. Facebook			
c. LinkedIn			
d. Twitter			
e. Imo			
f. Instagram			
What are the other technologies used?			
g.			
h.			
i.			
10. Knowledge sharing systems	Yes	No	SOMEWHAT
a. Incident Report Databases			
b. Alert Systems			
c. Best Practices Databases			
d. Lessons Learned Databases			
e. Expertise Locator Systems			
What are some other knowledge sharing systems used?			
f.			
g.			
h.			

What other understanding do you have for technologies used for knowledge sharing?

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SECTION E: BENEFITS OF KNOWLEDGE SHARING PRACTICES TO RICE FARMING IN THE EASTERN REGION OF GHANA

Please mark your responses below depending on the degree, which you agree to the statement.

1 = *Strongly Disagree (SD)*, 2 = *Disagree (D)*, 3 = *Neutral (N)*, 4 = *Agree (A)*, 5 = *Strongly Agree (SA)*

11. Benefits of Knowledge Sharing Practices	SD	D	N	A	SA
a. Knowledge sharing helps rice farmers to learn and do research more about rice farming and this helps improve rice production	1	2	3	4	5
b. Performance improved for rice farmers	1	2	3	4	5
c. Effective utilization of rice farming information	1	2	3	4	5
d. Increased competitiveness among rice farmers	1	2	3	4	5
e. Discourages knowledge hoarding among rice farmers	1	2	3	4	5
f. Fills knowledge gaps among rice farmers	1	2	3	4	5
g. Encourages learning among rice farmers	1	2	3	4	5
h. Encourages leadership among rice farmers	1	2	3	4	5
i. Knowledge sharing helps the rice farmers to gain new experience and skills in rice farming	1	2	3	4	5
j. Rice farmers use knowledge bank and knowledge sharing portals to learn quickly thereby improving rice production.	1	2	3	4	5
What are some other strategies used to enhance for knowledge sharing practices?					

k.					
l.					
m.					

What are some other benefits of knowledge sharing practices?

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SECTION F: INHIBITORS OF KNOWLEDGE SHARING AMONG RICE FARMERS IN EASTERN REGION OF GHANA

Please indicate your preferred response by ticking (√) your preferred choice
NB: 1 = *Strongly Disagree (SD)*, 2 = *Disagree (D)*, 3 = *Neutral (N)*, 4 = *Agree (A)*, 5 = *Strongly Agree (SA)*

12. Technology, Financial Constraints, Organizational culture and others	SD	D	N	A	SA
a. Technology creates an institutional memory that is accessible to the entire rice farmers.	1	2	3	4	5
b. Rice farmers support collaboration in technology of knowledge sharing	1	2	3	4	5
c. Financial Constraints	1	2	3	4	5
d. Organizational Culture	1	2	3	4	5
a. Dominance of Explicit over Tacit	1	2	3	4	5

b. Individual Differences	1	2	3	4	5
c. Poor communication skills	1	2	3	4	5
d. Time constraints	1	2	3	4	5
e. Knowledge Hoarding	1	2	3	4	5
f. Mistrust	1	2	3	4	5
Other (specify)					
g.					
h.					
i.					

In your opinion, what are some other factors inhibit knowledge sharing?

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SECTION G: ENABLERS TO KNOWLEDGE SHARING AMONG THE RICE FARMERS

Please mark your responses below depending on the degree which the following factors enables knowledge sharing practices.

1 = *Strongly Disagree (SD)*, 2 = *Disagree (D)*, 3 = *Neutral (N)*, 4 = *Agree (A)*,
5 = *Strongly Agree (SA)*

13. Enablers of Knowledge Sharing	SD	D	N	A	SA
a. Trust of participation	1	2	3	4	5

b. Willingness to share information	1	2	3	4	5
c. Self-Efficacy	1	2	3	4	5
d. Effective Communication Skills	1	2	3	4	5
e. Motivation to Share Knowledge	1	2	3	4	5
f. Reward System	1	2	3	4	5
g. Social Networking	1	2	3	4	5
h. Participation and Democratic Involvement	1	2	3	4	5
i. Improvement of training and Learning Communities	1	2	3	4	5
j. Incentives or rewards for sharing knowledge	1	2	3	4	5
k. Availability of technology to helps knowledge sharing	1	2	3	4	5
l. Improvement of trust	1	2	3	4	5
m. Effective leadership that encourages knowledge sharing	2	2	3	4	5
Other (specify)					
n.					
o.					
p.					

What are some other enablers of knowledge sharing?

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SECTION H: ENHANCING KNOWLEDGE SHARING PRACTICES AMONG THE RICE FARMERS

Please mark your responses below depending on the degree which you agree to the statement.

1 = *Strongly Disagree (SD)*, 2 = *Disagree (D)*, 3 = *Neutral (N)*, 4 = *Agree (A)*, 5 = *Strongly Agree (SA)*

14.Strategies to Enhance Knowledge Sharing Practices	SD	D	N	A	SA
a. Leadership and Management Support	1	2	3	4	5
b. Use of Appropriate Technology	1	2	3	4	5
c. Investment and Financial Support	1	2	3	4	5
d. Building Trust	1	2	3	4	5
e. Integration of knowledge sharing initiatives in goal and strategies	1	2	3	4	5
f. Constant training and retraining	1	2	3	4	5
g. Provide space and opportunities for knowledge sharing	1	2	3	4	5
h. Various forms of knowledge sharing and farming systems are encouraged among rice farmers here.	1	2	3	4	5
i. We set aside time for face-to-face collaborations and knowledge sharing.	1	2	3	4	5
j. There are reward systems for rice farmers who willingly share their knowledge on rice farming with their colleagues.	1	2	3	4	5
k. All individuals who enter into rice farming are given mentors.	1	2	3	4	5
l. Familiarization of other category of knowledge	1	2	3	4	5

m. Opinions and inputs are sought from new rice farmers on all issues	1	2	3	4	5
Other (specify)					
n.					
o.					
p.					
q.					
r.					

What are some other strategies used to enhance for knowledge sharing practices?

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Thank you for your responses

APPENDIX B: INTERVIEW GUIDE



INTERVIEW GUIDE FOR RICE FARMERS IN THE EASTERN REGION OF GHANA

Dear Respondent,

As part of my PhD research work in the University of South Africa, Pretoria, I am conducting a survey on the topic: **Knowledge Sharing Practices Among Rice Farmers in the Eastern Region of Ghana**. The study is for an academic purpose and I will be happy if you could please take some few minutes out of your busy schedule and respond to this interview. For your information, any knowledge obtained from this survey will remain confidential. You are free to withdraw your participation in the study. In addition, if you have any comments, questions and suggestions about this study, please contact me through my email; randy.kommey37@gmail.com.

Thank you very much for your cooperation.

A handwritten signature in blue ink, appearing to read "Randy Kommey", is written over a rectangular area that has been redacted with a grey box.

Randy Emmanuel Kommey

PhD CANDIDATE, UNISA

INTERVIEW GUIDE

Date of Interview.....

Place of Interview.....

Rank of Interviewee.....

Gender of Interviewee.....

AIM OF THE STUDY

To explore the Knowledge Sharing Practice among Rice Farmers in Eastern Region of Ghana in order to develop strategies to enhance knowledge sharing among them.

Question Route	Question No.	Question
Opening	1	Tell me who you are in terms of experience in rice farming; age, marital status, educational level, years of farming etc.
Introduction	2	When you hear the term knowledge sharing, what comes to mind?
Key Questions	3	What are the Different types of knowledge shared among rice farmers in the Eastern Region of Ghana? a) What type of knowledge you are familiar with? b) What are the different types of knowledge shared by rice farmers?
Key Questions	4	What are the Knowledge Sharing Practices used among the Rice Farmers?

		<p>a) Do you understand the term knowledge sharing practices?</p> <p>b) What knowledge sharing practices do rice farmers here use in sharing knowledge among themselves?</p> <p>c) What are the best ways to share knowledge among tice farmers?</p>
	5	<p>Which Technologies are used for Knowledge Sharing among the Rice Farmers?</p> <p>a) What type of technologies are used for knowledge sharing among the rice farmers?</p> <p>b) What knowledge sharing systems you are familiar with?</p> <p>c) What type of social media you are familiar with?</p> <p>d) What kind knowledge sharing tool you are comfortable with?</p> <p>e) What challenges have you encountered when using these technologies for knowledge sharing?</p>
	6	<p>What are the benefits of Knowledge Sharing practices among the Rice Farmers?</p> <p>a) In your opinion, how does knowledge sharing benefit the rice farmers themselves?</p> <p>b) In what way does knowledge sharing benefit rice farming activities in this region?</p> <p>c) Has knowledge sharing helped rice farmers to learn and do research more about rice farming and this helps improve rice production?</p>

		d) Has knowledge sharing helped the rice farmers to gain new experience and skills in rice farming?
	7	<p>What are the Factors inhibiting knowledge sharing among the Rice Farmers?</p> <p>a) What are the factors that inhibit knowledge sharing practices and platforms among the rice farmers?</p> <p>b) How do you identify the factors that inhibit knowledge sharing practices?</p> <p>c) How will you manage technological challenges on the rice farms in terms of knowledge sharing?</p> <p>d) How will you do away with knowledge hoarding on the rice farms?</p> <p>e) In your view, how will you manage mistrust on the rice farms?</p>
	8	<p>What are the different Enablers of knowledge sharing among the Rice Farmers</p> <p>a) How is knowledge sharing among rice farmers encouraged and enabled?</p> <p>b) How will the rice farmers show willingness to share knowledge?</p> <p>c) In your view, how will trust be improved among rice farmers?</p> <p>d) How will you motivate rice farmers to share knowledge?</p> <p>e) Will you introduce reward management to rice farmers?</p>
	9	What are strategies for enhancing knowledge sharing practices among the Rice Farmers?

		<p>a) What strategies do you use to enhance knowledge sharing among rice farmers in this region?</p> <p>b) Do you have leadership and management support for the rice farm enhancement?</p> <p>c) Do rice farmers get investment and financial support in rice farming?</p>
Ending Question	10	I would like to develop a framework to enhance knowledge sharing among rice farmers in this region, what advice would you give me?

Thanks for your time, comments and ideas

APPENDIX C: CONSENT TO PARTICIPATE IN STUDY

I,------(participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the <insert specific data collection method>.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname..... (please print)

Participant Signature.....Date.....

Researcher's Name & Surname.....(please print)

Researcher's signature.....Date.....

APPENDIX D: ETHICAL CLEARANCE



DEPARTMENT OF INFORMATION SCIENCE ETHICS REVIEW COMMITTEE

15 January 2019

Dear Mr Randy Emmanuel Kommey

Decision:

**Ethics Approval from 15
January 2019 2018 to 15
January 2024**

DIS Registration #: Rec-150119

References #: 2019-DIS-0001

Name: RE Kommey

Student #: 63507021

Researcher(s): Randy Emmanuel Kommey
63507021@mylife.unisa.ac.za
+ 233 247 285 446

Supervisor(s): Prof MC Fombad
fombamc@unisa.ac.za
012 429 6042

**Knowledge sharing practices among rice farmers in the Eastern region of
Ghana.**

Qualifications: PhD



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Thank you for the application for research ethics clearance by the Unisa Department of Information Science Research Ethics Committee for the above-mentioned research. Ethics approval is granted for five years.

The **low risk application** was reviewed and expedited by the Department of Information Science Research Ethics Committee on 15 January 2019 in compliance with the Unisa Policy on Research Ethics and the Standards Operating Procedure on Research Ethics Risk Assessment. The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy of Research Ethics.
2. Any adverse circumstances arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Department of Information Science Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards the protection of participants' privacy and the confidentiality of the data should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no. 4 of 2013; Children's Act no. 38 of 2005 and the National Health Act, no. 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date of **15 January 2024**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **2019-DIS-0001** should be clearly indicated on all forms of communication with the intended research participants, as well as the Committee.*

Yours sincerely



Dr Isabel Schellnack-Kelly
Department of Information Science: Ethics Committee



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APPENDIX E: TURNITIN RECEIPT

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APPENDIX F: SIMILARITY INDEX



KNOWLEDGE SHARING PRACTICES AMONG RICE FARMERS IN THE EASTERN REGION OF GHANA

BY

RANDY EMMANUEL KOMMEY

ID NO. 63807021

DOCTOR OF PHILOSOPHY AND LITERATURE

in the subject

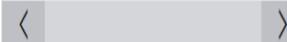
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