

MOSHI CO-OPERATIVE UNIVERSITY

**COMMUNICATING AGRICULTURAL RESEARCH INFORMATION FOR
IMPROVED SORGHUM FARMING PRACTICES IN DODOMA, TANZANIA**

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**COMMUNICATING AGRICULTURAL RESEARCH INFORMATION FOR
IMPROVED SORGHUM FARMING PRACTICES IN DODOMA, TANZANIA**

BY

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**A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY OF MOSHI CO-OPERATIVE
UNIVERSITY, MOSHI TANZANIA**

DECEMBER, 2025

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I, **Peter Bedda Kadilikansimba**, declare that this thesis is my own original work and that it has not been presented and will not be presented to any other higher learning institution for a similar or any other academic award.

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by the Moshi Co-operative University the Thesis titled **“COMMUNICATING AGRICULTURAL RESEARCH INFORMATION FOR IMPROVED SORGHUM FARMING PRACTICES IN DODOMA, TANZANIA”** in fulfilment of the requirements for the award of the Degree of Doctor of Philosophy of Moshi Co-operative University (MoCU).

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ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of Variance
DOI	Diffusion of Innovation Theory
HSD	Tukey's Honestly Significant Difference
ICT	Information and Communication Technology
ISCM	Information Seeking and Communication Model
KII	Key Informant Interview
MoCU	Moshi Co-operative University
MRT	Media Richness Theory
SGDs	Sustainable Development Goals
SMM	Service-Marketing Model
SMS	Short Message Services
TARI	Tanzania Agricultural Research Institute
VEO	Village Executive Officer
WEO	Ward Executive Officer

EXTENDED ABSTRACT

Access to agricultural research information is essential for enabling smallholder farmers to adopt improved farming practices that enhance agricultural productivity. In Tanzania, despite the substantial body of agricultural information generated by research institutions, a significant gap exists between the availability of this information and its practical application by farmers. This gap is particularly evident in Dodoma Region, where sorghum is a staple crop and plays a vital role in local food security and rural economies. Farmers in the region face challenges in accessing, interpreting, and applying agricultural research findings. These challenges are largely attributed to ineffective communication, which impedes the translation of scientific knowledge into practical solutions. While efforts have been made to disseminate agricultural research information, the adoption of improved farming practices such as the use of improved seed varieties, fertiliser application, pest and disease control, weed management, and post-harvest handling remains low. This suggests that existing communication strategies may lack contextual relevance and effectiveness. Although previous studies acknowledge the importance of communication in agricultural innovation, many have approached communication elements in isolation without sufficiently examining their interrelated effects. Limited attention has been given to how elements such as source credibility, information repackaging, communication media effectiveness, and information-seeking behaviour of farmers interact to influence adoption. Understanding how these elements interact is essential for developing responsive and effective communication strategies that facilitate the uptake of research-based innovations. This study examined how agricultural research information is communicated to sorghum farmers in Dodoma and assessed the influence of selected communication variables on the adoption of improved practices. A cross-sectional design was used to collect data from 399 sorghum farmers through structured questionnaires and 15 key informant interviews with agricultural experts. Quantitative data were analysed using descriptive statistics and logistic regression, while qualitative data were analysed thematically. The findings indicate that farmers prefer credible information sources, particularly fellow farmers and extension officers, and value simplified, context-specific messages. Interpersonal communication and mobile phones emerged as effective channels for information delivery, and farmers with strong information-seeking tendencies were more likely to adopt improved

practices. The study concludes that addressing multiple communication factors collectively can significantly enhance the adoption of improved agricultural practices among farmers. It is recommended to strengthen extension systems, enhance the clarity of messages, promote digital literacy, and diversify communication approaches to better support agricultural transformation in Tanzania. These strategies will ensure that farmers have the necessary tools and information to implement effective practices, ultimately contributing to improved productivity and food security.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Information is fundamental to human development, shaping the way people learn, make decisions, and drive societal progress. It refers to processed, organised, and meaningful data that reduces uncertainty and enables individuals to make informed decisions. Information raises awareness, stimulates innovation, empowers communities, and fosters economic growth. In the rapidly changing world, access to accurate, timely, and relevant information is essential for individuals and institutions to make informed choices and actively participate in societal activities. In agriculture, information is as important as traditional factors of production such as land, labour, and capital. Bavorová *et al.* (2020a) and Makate *et al.* (2019) highlight the significant role of communication in raising awareness of new technologies, empowering farmers to make informed decisions, and encouraging the adoption of improved sorghum farming practices, all of which contribute to increased productivity.

Empirical evidence indicates that sorghum plays a substantial role in household food security and income generation in Dodoma. Sorghum contributes cereal-based household food consumption and accounts for household agricultural income among smallholder farmers in the region (Ndimbwa, 2018; Noel, 2015). Households cultivating sorghum on larger plots or adopting improved practices, such as certified seed varieties and recommended fertilizer regimes, realize higher yields and improved marketable surplus, which directly enhances both food availability and cash income. This demonstrates that promoting sorghum adoption through effective communication has both economic and nutritional benefits, providing a clear justification for adoption-focused interventions.

Farmers rely on a wide range of agricultural information, including weather forecasts, pest and disease control strategies, market dynamics, and agronomic best practices. When this information is communicated effectively, it empowers farmers to make well-informed decisions regarding key aspects of their farming activities, such as land preparation, appropriate use of fertilizers, integrated pest and weed management, selection of suitable seed varieties, and improved post-harvest handling. These

informed choices are critical for enhancing overall farm productivity and sustainability (Chandel *et al.*, 2024; Mutegi, 2020; Šūmane *et al.*, 2018). However, the availability of agricultural information alone does not guarantee its practical application. The extent to which farmers benefit from such information is strongly influenced by how effectively it is communicated. Communication effectiveness plays a fundamental role in ensuring that information is not only accessible but also understandable, relevant, and actionable for diverse farming communities. Farmers' adoption of improved practices is shaped not only by the content of information but also by its clarity, credibility, timeliness, and contextual relevance.

Effective communication ensures that information is not only accurately conveyed but also understood and tailored to the specific needs of diverse audiences. It is essential for translating complex agricultural research into practical, accessible formats that smallholder farmers can easily grasp and apply (Melaku *et al.*, 2024; Coggins *et al.*, 2022). This process involves adapting information to local languages, literacy levels, cultural contexts, and technological capacities, thereby making it more relevant and actionable. Furthermore, effective communication encourages feedback, enabling farmers to ask questions, share experiences, and deepen their understanding, which in turn promotes the adoption of improved farming practices (Verma and Dewani, 2021). However, even with deliberate efforts to simplify and contextualize agricultural information, a critical challenge persists, ensuring that research-based knowledge is effectively transferred from those who generate it to the smallholder farmers who depend on it for making informed agricultural decisions.

Despite the substantial body of agricultural research produced by research institutions, the effective transfer of this knowledge to farmers remains a persistent challenge (Cawley *et al.*, 2023; Prost *et al.*, 2023). According to Onasanya *et al.* (2006), the agricultural information system involves three main groups: researchers who develop new innovations, extension agents who share these innovations with farmers, and the farmers themselves who are expected to apply them. These groups vary significantly in their educational backgrounds. Researchers usually have advanced academic training, extension agents possess technical or professional education, while many farmers have limited formal schooling. This difference in education levels creates challenges in communication, as complex research findings are often difficult to translate into simple, practical information that farmers can easily understand and use. As a result, a

critical gap exists between the creation of agricultural research information and its effective application in the field. Scholars such as Funom and Soyemi (2019) and Taylor and Bhasme (2018) emphasise effective communication to ensure that agricultural innovations reach the farmers who need them. Addressing these communication gaps requires adopting varied approaches that are sensitive to local socio-economic and cultural conditions, enabling the effective delivery of agricultural information from research institutions to farming communities.

Nations worldwide have developed varied approaches to agricultural information communication, each of which is specific to their respective socio-economic, political, and cultural contexts. For instance, farmers in the Netherlands prefer farm magazines, agro-enterprises, and cooperatives as significant sources of information (Brătulescu, 2016). Pakistan, however, employs a blend of traditional and modern means of communication, utilising extension services, peer groups, and mass media to reach farmers (Raza *et al.*, 2019). China has leveraged information communication technologies (ICTs) to facilitate the sharing of knowledge (Zhang *et al.*, 2016), while Ethiopia relies on social events and community gatherings to share vital agricultural information (Melesse *et al.*, 2018). The different communication strategies demonstrate the necessity of customizing methods to fit the needs of the local population. Through the adoption and implementation of context-based strategies, countries can effectively spread agricultural information, boost productivity and promoting sustainable agricultural development worldwide. While numerous countries have successfully tailored agricultural communication to their local contexts, Tanzania continues to face significant challenges in effectively connecting smallholder farmers with vital research information, which has limited progress in adopting improved farming practices.

In Tanzania, various communication strategies are used in communicating agricultural research information to smallholder farmers. The communication methods used by extension services include, print media, mobile technology, radio and television broadcasts, agricultural exhibitions, and farmer-to-farmer networks (Ndimbwa *et al.*, 2020; Mwantimwa, 2020). Despite these interventions, adoption of improved farming practices, including for sorghum, remains low. The National Agricultural Policy (2013) recognises weak communication linkages among stakeholders as one of the key constraints to technology adoption, which limits the use of essential innovations such

as certified seeds, fertilisers, appropriate tools, rainwater harvesting technologies, and improved post-harvest handling practices (URT, 2013b). For instance, Tanzanian and Kenyan farmers, apply only 13 kg of fertiliser per hectare, in contrast with Brazilian and Indian farmers, who apply 175 and 165 kg per hectare (Michelson *et al.*, 2021). Additionally, post-harvest losses for cereals like sorghum range between 30% and 40% of the total output (Maziku, 2019). The National Bureau of Statistics (2021) further shows that 75.8% of the cultivated land in Tanzania still use local seeds, while only 2.1% uses a mixture of local and improved seeds (URT, 2021). These persistent communication challenges and low levels of technology adoption are mirrored in the underwhelming sorghum yields, emphasising the necessity to critically evaluate and strengthen agricultural research communication to better support farmers.

The low sorghum productivity, which stands at just 0.99 tons per hectare and falls far below the potential yield of 5.0 tons per hectare, can likely be attributed to ineffective communication of agricultural research information. Against this background, there is a need to assess the effectiveness of agricultural research communication in promoting the adoption of improved sorghum farming practices in Dodoma Region. Improving communication strategies would enhance farmers' access to relevant, timely, and actionable information, which would, in turn, enhance productivity, food security, and incomes. Thus, applying a structured communication framework is essential to address the challenges of low sorghum productivity through effective communication of agricultural research information.

Effective communication is a complex and dynamic process that requires strategic planning, clear messaging, and proactive outreach to intended audiences (Eze and Zacky-Eze, 2025; Martinelli, 2021; Samuel, 2019). Lasswell's communication model (1948) provides an effective framework for assessing communication success through the answering of five pertinent questions: who says what, through which media, to whom, and with what effects. This model highlights important factors such as the source, message, channel, receiver, and effect, stressing the importance of credible sources, clear messages, appropriate communication media, and a keen understanding of the audience if communication is to have the intended effects (Ma, 2015; Wenxiu, 2015). This understanding emphasises the necessity for a comprehensive approach to communication that incorporates these factors to facilitate the adoption of innovations in agricultural practices.

Scholars like Verma and Dewani (2021) and Lechermeier and Fassnacht (2018) argue that the efficacy of communication strategies relies on source credibility, message clarity, medium selection, audience characteristics, and feedback mechanisms. Rogers and Rahim (2021) highlight the critical role of communication in the diffusion of innovations, noting that the adoption process is inherently connected to how innovations are communicated through channels. For an innovation to be adopted, it must be effectively communicated, given the credibility of the source, the clarity of the message, and the communication channel used. In agricultural practice, especially in regions like Dodoma, Tanzania, the adoption of improved sorghum farming practices is dependent on these communication dynamics. Rogers (2003) further emphasises the importance of understanding the social systems within which intended adopters operate, as these social structures and relationships play a vital role in shaping how innovations are interpreted, accepted, and ultimately adopted. This highlights the need for more comprehensive research that explores the interplay among these elements to enhance agricultural communication effectiveness.

Despite numerous studies on agricultural communication, there is limited understanding of how different communication elements interact to influence farmers' adoption of innovations. Most research has focused on individual elements such as types of information, sources, and in most cases communication channels. For example, Chipango (2022) explored the role of radio and mobile platforms in disseminating agricultural messages, while Mwalukasa (2020) investigated the use of ICTs for knowledge sharing among smallholder farmers. Similarly, Isaya *et al.* (2018) and Nyamba (2017) highlighted how farmers access information through extension officers, research institutions, and farmer groups. Mtega (2021) examined the communication channels used for exchanging agricultural information among Tanzanian farmers, emphasizing the role of interpersonal and digital platforms in facilitating knowledge transfer. Channels are often studied because they are measurable and directly affect information delivery, yet this focus overlooks interactions with factors like source credibility, information repackaging and farmers' information-seeking behaviour that shape understanding, trust, and adoption.

Understanding the interplay of these communication elements becomes even more critical when viewed in the context of educational differences among the key actors involved, as these disparities directly impact how information is received and applied

on the ground. Researchers and extension agents typically possess higher levels of formal education and technical knowledge, while many smallholder farmers have limited formal education. These differences create challenges in communication, as complex agricultural research findings may not be easily understood or practically applied by farmers. Therefore, a holistic approach that recognises both the interconnected nature of communication components and the diverse educational backgrounds of those involved is essential. Adopting this approach can help create communication strategies that truly connect with farmers, making it easier for them to understand and apply new agricultural innovations. This perspective is central to the current study, which explores how different communication elements interact and influence farmers' adoption of improved sorghum farming practices. By addressing these complex interactions, the study aims to contribute to more effective communication methods that ultimately boost agricultural productivity and support rural development.

To evaluate and improve communication effectiveness, this study employs Lasswell's Communication Model, which examines the source, message, channel, receiver, and effect (Kapur, 2020; Wenxiu, 2015). Integrating Diffusion of Innovations (Rogers, 2003) allows assessment of how communication channels, source credibility, and message clarity influence the adoption of improved farming practices within the social system of Dodoma farmers. Complementary models, including the Information-Seeking Behaviour Model and Service Marketing Model, further support analysis of farmers' information access, repackaging of research outputs, and the perceived value of innovations.

By investigating these elements, the study provides a holistic understanding of how communication affects adoption, addressing knowledge gaps in both practice and literature. Specifically, it explores how effective communication strategies can enhance farmers' understanding, trust, and use of improved sorghum farming practices, ultimately contributing to increased yields, improved household income, and enhanced food security. The study's findings are relevant for national and international development frameworks, including Tanzania Development Vision 2025, the Five-Year Development Plan II, and Sustainable Development Goal 2 (Zero Hunger), which emphasise modernizing agriculture, reducing food insecurity, and improving rural livelihoods.

1.2 Problem Statement

Despite the indispensable role played by information in agricultural development, effective communication of agricultural research information from researchers to smallholder farmers in Tanzania remains a significant challenge (Sawe, 2022; Muhanguzi and Ngubiri, 2022; Mubofu and Malekani, 2020). While agricultural research yields valuable information on improved farming practices, there exists a significant gap between the availability of this knowledge and its practical application by farmers. Many smallholder farmers in Tanzania, including those in the Dodoma Region, experience similar challenges in effectively accessing, interpreting, and utilizing available agricultural research information (Ndibalema, 2019; Ndimbwa *et al.*, 2019; Masanyiwa *et al.*, 2019). These difficulties mirror a wider trend observed among farmers across various regions, where barriers such as inadequate communication, limited resources, and insufficient training impede the practical application of research findings in their farming practices. The existing communication methods used, including extension services, print and electronic media, are not necessarily effective in breaking down complex research outputs into understandable and usable knowledge that is specific to the educational levels, understanding, and farming context of farmers.

As a result, a majority of improved farming practices such as certified seeds, fertilisers, and effective pest control mechanisms remain underutilised, contributing to low productivity levels. In Tanzania, the average application rate of fertiliser is just 13 kg per hectare. This is significantly lower than the global average of 135 kg per hectare.(Michelson *et al.*, 2021). Additionally, post-harvest losses for cereals, such as sorghum, are between 30% and 40% of the entire production (Maziku, 2019). Ineffective communication and knowledge dissemination could be the reason for the low adoption of improved sorghum farming practices, which currently only produce 0.99 tons per hectare, much below the potential 5.0 tons per hectare.

Increasing smallholder farmers' access to and use of improved sorghum farming practices could substantially enhance household income, food security, and marketable surplus. Households that adopt certified seeds, balanced fertilization, and modern pest management can achieve higher yields, reducing reliance on local varieties and minimizing post-harvest losses. This would not only increase income from sales but

also improve household nutrition by ensuring a stable supply of sorghum for food consumption. On a broader scale, enhancing the adoption of improved sorghum practices contributes to national food security and agricultural productivity, supporting Tanzania's rural development and economic growth objectives.

While the existing body of literature has contributed valuable insights into agricultural communication, much of it tends to examine individual elements in isolation such as specific communication channels or message formats, without adequately exploring how these components interact. For example, studies by Mpehongwa (2024), Kiseni and Kwesigabo (2023), and Mtega (2021), provide important perspectives but fall short of capturing the collective influence of key variables such as source credibility, message repackaging, the effectiveness of communication media and the characteristics of the intended audience. However, it is the way variables interact that is required to create more impactful and effective communication strategies. These, in turn, may improve farmers' access to and use of agricultural research information and, subsequently, facilitate the adoption of improved farming practices. This may boost productivity, food security, and rural development in Tanzania. Therefore, there is a pressing need to examine the interconnected dynamics of communication variables in the agricultural context.

1.3 Research Objectives

1.3.1 Main Objective

The general objective of this study was to examine the role of communication in enhancing the adoption of improved sorghum farming practices among farmers in Dodoma region, Tanzania

1.3.2 Specific Objective

Specifically, this study intended to:

- (i) Determine the influence of source credibility on the adoption of improved farming practices among sorghum farmers;
- (ii) Investigate the impact of repackaging agricultural research information on the adoption of improved farming practices among sorghum farmers;
- (iii) Evaluate the effects of communication media on the adoption of improved farming practices among sorghum farmers; and

- (iv) Determine the influence of information seeking behaviour of sorghum farmers on the adoption of improved farming practices.

1.4 Research Hypotheses

- (i) Information source credibility has no influence on farmers' adoption of improved sorghum farming practices;
- (ii) Repackaging of agricultural research information has no influence on adoption of improved farming practices to sorghum farmers;
- (iii) Communication media have no effects on adoption of improved farming practices to sorghum farmers; and
- (iv) Information seeking behaviour of sorghum farmers have no influence on adoption of improved farming practices.

1.5 Scope of the Study

This study focused on the communication of agricultural research information and its impact on the adoption of improved sorghum farming practices in Dodoma, Tanzania. The geographical focus encompasses three districts: Kongwa, Kondoa, and Bahi, with specific attention to selected wards and villages within these districts. The study population consists of sorghum-farming households, with a particular emphasis on household heads, who serve as the primary decision-makers in agricultural activities. Conceptually, the research examines four key factors: source credibility, information repackaging, communication media, and farmers' information-seeking behaviour. The study analyses how these factors influence the adoption of improved farming practices, including seed selection, fertilizer application, pest and disease management, and post-harvest handling. To provide a comprehensive understanding of information dissemination and adoption, both primary data collected from farmers and secondary data sourced from official reports and agricultural policy documents were utilised. The study was conducted within the context of five-year agricultural seasons to ensure its relevance to current practices and policy frameworks.

1.6 Justification of the Study

The low adoption of improved farming technologies among sorghum farmers in Dodoma, Tanzania presents a major obstacle to agricultural productivity and rural development. Despite its potential as a drought-resilient crop essential for ensuring

food security in arid and semi-arid regions, sorghum yields in Dodoma remain considerably low, averaging only 0.99 tons per hectare, far below the attainable yield of 5.0 tons per hectare (JMT, 2022). This significant yield gap highlights systemic inefficiencies in knowledge dissemination and technology uptake, which constrain both household incomes and regional food supplies. A key factor contributing to this underperformance is ineffective communication between researchers, extension services, and farmers. Many smallholders remain unaware of or unable to apply modern farming techniques due to poorly tailored information, inaccessible training, or mistrust in new methods. Addressing this challenge is consistent with the objectives of Tanzania's National Agriculture Policy (URT, 2013a), which emphasises the role of agricultural extension in improving food security and farmer livelihoods. Nevertheless, without a thorough understanding of the underlying causes of communication breakdowns, efforts to promote adoption of improved practices risk falling short of their intended impact.

This study investigates key communication factors that shape the adoption of improved farming practices, focusing on source credibility, the repackaging of research information, dissemination channels, and farmers' information seeking behaviour. By exploring these dimensions, the study seeks to uncover limitations in current extension systems, identify adoption barriers, and determine which communication approaches most effectively engage farmers. The insights generated aim to inform policymakers and agricultural stakeholders in designing more inclusive and targeted communication strategies. Strengthening these knowledge sharing mechanisms has the potential to narrow the yield gap, enhance farmers' adaptability to climate variability, and contribute meaningfully to the socio-economic development of Dodoma region. In a context marked by climate vulnerability and persistent food insecurity, improving the communication of agricultural research information is not merely important, it is imperative.

The practical implications of this study are significant for agricultural extension services, policymakers, and researchers. Its findings provide evidence-based guidance on improving the communication of agricultural research to support informed decision-making and adoption of improved farming practices. The study aligns with SDG 2, emphasising the role of reliable agricultural information in achieving food security, and supports Tanzania Development Vision 2025, which aims for high-quality

livelihoods, food self-sufficiency, and sustainable economic growth. By addressing knowledge transfer and behaviour change gaps, the study informs sustainable development of the agricultural sector in Dodoma, enhancing productivity, rural livelihoods, and socio-economic well-being. It offers stakeholders insights into effective strategies for promoting adoption of improved sorghum farming practices.

1.7 Theoretical and Conceptual Frameworks of the Study

1.7.1 Theoretical Framework

A range of theories and models have been established over a period of time under various conditions and situations to describe the adoption of agricultural innovations and technologies. The Models and Theoretical Review of this study establish a framework and theoretical basis for comprehending the factors that affect the adoption of improved sorghum farming practices through effective communication. This section reviews relevant models and theories to describe the communication of agricultural research information for promoting the adoption of improved farming practices among sorghum farmers in Dodoma, Tanzania.

1.7.1.1 Lasswell's Model of Communication

Lasswell's Model of Communication (Lasswell, 1948), provides a structured approach to understanding the communication process by addressing five fundamental questions: Who says what, in which channel, to whom, and with what effect (Wenxiu, 2015). This model is widely recognised for its ability to analyse communication flow in various contexts, including mass communication, public relations, and knowledge dissemination (Saliu, 2020). It has been applied in agricultural extension services to assess how communication channels influence farmers' decision-making (Umehai *et al.*, 2025). For instance Sang (2021) used Lasswell's framework to evaluate the effectiveness of radio programmes in disseminating improved farming techniques among smallholder farmers, highlighting the role of mass media in agricultural information transfer.

Similarly, Kuhenga (2022) applied the model to examine the type of communication systems used between indigenous and modern systems for climate change adaptation among rural communities. In the context of this study, Lasswell's model serves as a framework for assessing how communication influences the adoption of improved

farming practices among sorghum farmers in Dodoma, Tanzania. The “who” element represents sources of agricultural information, including researchers, extension agents, and agricultural experts responsible for disseminating research-based farming knowledge. The “says what” component refers to the content of the messages delivered to farmers, covering key agronomic practices such as land preparation, improved seed varieties, pest and disease management, and post-harvest handling. The “in which channel” element pertains to the mediums through which agricultural information is transmitted, including interpersonal communication, mass media (radio, television, newspapers), digital platforms, and traditional knowledge-sharing forums such as farmer cooperatives and agricultural fairs. The “to whom” component represents the primary audience, sorghum farmers, who are expected to adopt the recommended farming techniques. Finally, the “with what effect” element evaluates the impact of communication on farmers, particularly whether it leads to increased adoption of improved sorghum farming practices, ultimately enhancing productivity, food security, and rural livelihoods.

Despite its suitability, Lasswell’s model has been critiqued for its linear approach, which does not fully account for feedback mechanisms, contextual influences, or the dynamic nature of communication (Rizal, 2020; Sapienza *et al.*, 2018). Critics argue that the model oversimplifies communication by treating it as a one-way process, ignoring how farmers actively interpret, modify, or even reject the information received (Prusty *et al.*, 2022). Additionally, the model does not explicitly incorporate socio-cultural, economic, and environmental factors that influence farmers’ decision-making processes (Singh *et al.*, 2016). However, Lasswell’s model remains highly relevant for this study due to its structured analytical framework. It provides a systematic approach to evaluating the effectiveness of different communication elements source credibility, message clarity, channel effectiveness, and audience engagement in influencing the adoption agricultural practice. By integrating insights from contemporary communication theories, such as the Diffusion of Innovations theory (Rogers and Williams, 1983), this study builds on Lasswell’s model to assess not only the transmission of information but also the interactive and contextual factors affecting adoption. Thus, while acknowledging its limitations, the model remains a valuable tool for analyzing how different communication elements interact to facilitate or hinder the uptake of improved sorghum farming practices in Dodoma, Tanzania.

1.7.1.2 Information Seeking and Communication Model (ISCM)

The Information Seeking and Communication Model (ISCM) (Robson and Robinson, 2013), integrates concepts from information behaviour and communication theories to provide a comprehensive understanding of how information is sought, shared, and used. Unlike traditional models that focus solely on either information-seeking or communication, the ISCM considers both information providers (sources) and information users (receivers) while incorporating key variables such as communication channels, feedback mechanisms, and the broader context of information exchange. The model also examines factors influencing information-seeking behaviour, including source credibility, information utility, and the constraints that may hinder effective communication.

The ISCM has been widely applied in various domains, including health communication, education, and agricultural extension. For instance, Tan and Goonawardene (2017) used the model to analyse how health professionals seek and share medical information with patients, emphasising the importance of clear messaging and trust in the information provider. Similarly, Spring (2023) applied ISCM in an educational setting to test its validity in higher education and identify insights into the provision of a framework for a more integrated and aligned module leader practice. In agriculture, Gebeyehu and Jira (2024) employed the ISCM to assess the levels of access of agricultural agents to agriculture-specific information from researchers and the media and its effect on their confidence in communicating with farmers.

In the context of this study, ISCM provides a structured framework for assessing how agricultural researchers (as information providers) communicate research-based farming practices to sorghum farmers (as information seekers) in Dodoma, Tanzania. The model enables an in-depth analysis of how farmers access, interpret, and use agricultural research information while considering the role of different communication channels such as radio, extension services, and digital platforms. Additionally, it helps identify barriers to effective information transfer, such as language barriers, limited access to reliable sources, and variations in farmers' information-seeking behaviour.

Despite its strengths, the ISCM has limitations. One notable critique is that it does not fully address the role of communication media in enhancing the receiver's understanding and engagement with the information provided (Baggs *et al.*, 2024). The model primarily focuses on the process of seeking and sharing information but does not account for the richness of communication channels and how different media formats impact message clarity, interactivity, and effectiveness. Recognising this gap, this study integrates the Media Richness Theory (Daft and Lengel, 1986) to examine how various communication media influence the dissemination and adoption of improved sorghum farming practices. By incorporating Media Richness Theory, the study explores how different media, ranging from face-to-face interactions to digital platforms, affect the effectiveness of agricultural communication, ensuring that farmers not only receive information but also understand and apply it effectively. Thus, while acknowledging the limitations of the ISCM, the model remains highly relevant for this study. It provides a robust analytical foundation for examining how sorghum farmers in Dodoma Region seek and use agricultural information. The integration of Media Richness Theory enhances the study by enabling a more comprehensive evaluation of communication effectiveness in promoting the adoption of improved farming practices.

1.7.1.3 Service-Marketing Model

The Service-Marketing Model (Booms, 1981), provides a useful way to understand how agricultural research information can be effectively communicated to encourage sorghum farmers in Dodoma Region to adopt improved farming practices. Originally designed for businesses, this model emphasises service quality, customer satisfaction, and accessibility, concepts that are equally important in agricultural communication. Just as businesses must ensure their services meet customer needs, agricultural information must be accurate, timely, and relevant to farmers' specific challenges, such as soil conditions, climate, and available resources. For farmers to adopt new practices, they must see the value and usefulness of the information they receive. Research shows that when farming advice is clear, practical, and easy to apply, adoption rates increase (Schulz *et al.*, 2022; Liu *et al.*, 2018). On the other hand, complex or poorly communicated messages often result in farmers disregarding the advice, even if it could improve their yields.

The way information is delivered also plays a crucial role. Farmers receive agricultural advice from different sources, including extension services, radio programmes, mobile platforms, and farmer cooperatives (Mapiye *et al.*, 2023). However, communication effectiveness depends on how well these channels match farmers' preferences and accessibility. For example, digital platforms can reach many farmers quickly, but low digital literacy and limited internet access can reduce their impact (Mokhtar *et al.*, 2022). Meanwhile, face-to-face interactions with extension officers and farmer-led training sessions often build trust and encourage adoption, as they allow for feedback and clarification. Beyond communication channels, the role of extension workers and agricultural institutions is vital. Just as good customer service strengthens business relationships, well-trained extension officers enhance trust and engagement among farmers (Adrupio, 2023). Studies show that farmers are more likely to adopt improved techniques when extension agents use participatory approaches rather than top-down instructions (Knook *et al.*, 2018). Institutions like TARI also play a key role in coordinating research dissemination and ensuring that farmers receive practical and actionable information (Bavorová *et al.*, 2020b). While the Service-Marketing Model does not fully capture factors like financial constraints, cultural beliefs, and peer influence, it offers valuable insights into making agricultural information more accessible, relevant, and impactful. By improving communication strategies, farmers can make informed decisions, boosting productivity and food security in Dodoma Region.

1.7.1.4 Media Richness Theory

The Media Richness Theory (Daft and Lengel, 1984) posits that the communication effectiveness is determined by the medium used, specifically its capacity to transmit information-rich cues such as verbal and non-verbal signals, provide immediate feedback, convey complex ideas, and express emotions. The theory asserts that individuals select communication channels based on their ability to handle uncertainty and equivocality, uncertainty being a lack of information, and equivocality being the ambiguity or complexity of the information. Media that are richer in cues, such as face-to-face communication, are better suited for situations involving high uncertainty or equivocality, while leaner media, like written text, work better in straightforward, less ambiguous communication situations.

This theoretical framework has been applied in various fields to understand how different communication channels influence decision-making and information processing. For example, in the context of agricultural communication, researchers have used the Media Richness theory to evaluate how different media can affect transfer of knowledge and the adoption of new agricultural practices. Rogers (2003), in his study of the Diffusion of Innovations, argued that effective communication is central to the spread of new technologies and practices. He highlighted that media richness, through its ability to convey complex messages and facilitate feedback, plays a key role in adoption, particularly when farmers face uncertainty or ambiguity about new techniques. In agricultural extension services, Izuchukwu *et al.* (2023) found that richer communication channels, such as interactive workshops or face-to-face meetings, significantly improved farmers' understanding and adoption of new farming practices. This highlights the theory's relevance to understanding how communication channels can reduce uncertainty and promote clearer, more effective dissemination of agricultural research information.

Despite its significance, the theory has been critiqued for oversimplifying media choice as a rational decision, overlooking social, cultural, and environmental factors that might influence media preferences. Mohammed and Ferraris (2021) argued that social pressures and community influences often play a critical role in how individuals choose media, especially in contexts like agricultural communication, where the norms and practices of the community can strongly impact media preferences. Nevertheless, the Media Richness theory remains a powerful tool for evaluating how communication channels can facilitate the understanding and adoption of new agricultural practices.

For this study, the Media Richness theory is particularly relevant as it provides a framework for assessing how different communication media, such as face-to-face extension services, radio, mobile platforms, and digital tools, can facilitate the effective transfer of agricultural research information to sorghum farmers in Dodoma, Tanzania. By evaluating these communication channels, the study aims to identify the most effective methods for reducing uncertainty, enhancing understanding, and ultimately promoting the adoption of improved farming practices. This study applies the theory to highlight the role of media richness in enhancing the communication of agricultural research information and fostering positive behavioural change among farmers.

1.7.1.5 Diffusion of Innovation Theory (DOI)

The Diffusion of Innovations (DOI) Theory provides a valuable framework for understanding how agricultural research information is communicated and adopted by sorghum farmers in Dodoma, Tanzania. Developed by Rogers (2003), this theory explains the process by which new ideas, such as improved farming practices, spread within a community through various communication channels. Adoption decisions are influenced by farmers' perceptions of innovations regarding relative advantage, whether the new practices offer clear benefits over traditional methods, compatibility with existing farming techniques, complexity or ease of understanding, trialability allowing farmers to test practices before full commitment, and observability where benefits are visible to others.

The effectiveness of the communication channels used to disseminate agricultural information plays a critical role in adoption. Channels such as mobile phones, radio programmes, extension services, and peer networks are essential in reaching farmers. The richness and credibility of these channels significantly affect farmers' willingness to adopt new practices. Farmers are more likely to embrace innovations when information is delivered through trustworthy and accessible media (Dilleen *et al.*, 2023; Steinke *et al.*, 2021). The adoption process occurs in stages: knowledge acquisition, persuasion, decision-making, implementation, and confirmation (Rogers, 2003). Recognising these stages helps tailor communication strategies to meet farmers at the appropriate phase of their decision-making process. The time it takes for farmers to move through these stages can vary, and understanding them allows for more targeted and effective interventions.

Moreover, farmers' decisions are influenced by their social systems, including culture, networks, and community norms. Opinion leaders within the farming community play a critical role in shaping the views and behaviours of other farmers, either facilitating or hindering the adoption of new practices. This highlights the importance of engaging local influencers and adapting communication strategies to suit the social context of Dodoma's farming community. Finally, farmers fall into different adopter categories, ranging from innovators to laggards. This variation in readiness to adopt implies that communication strategies should be flexible, reaching out to early adopters to create momentum while addressing the concerns of more reluctant groups (Rogers, 2003). By

applying the DOI Theory, this study aims to assess how communication factors such as source credibility, media richness, and information repackaging influence the spread and adoption of improved farming practices. Understanding these dynamics will ultimately support more effective agricultural communication, promote better practices and improve productivity among sorghum farmers in Dodoma Region.

Despite its strengths, the DOI Theory has limitations. Critics argue that it may oversimplify the adoption process by not fully accounting for the complexities of social interactions and the contextual factors that influence farmers' decisions (Leeuwis and Aarts, 2021; Peshin *et al.*, 2019). Additionally, while the theory emphasises the stages of adoption, it may not adequately capture the nuances of feedback mechanisms and the non-linear nature of communication in agricultural settings (Mambile and Ishengoma, 2024). Nevertheless, the DOI Theory remains highly relevant for this study due to its structured approach to understanding how innovations spread within agricultural communities. By integrating insights from contemporary communication theories, this study builds on the DOI framework to assess not only the transmission of information but also the interactive and contextual factors affecting adoption. Thus, while acknowledging its limitations, the DOI Theory serves as a valuable tool for analysing how different communication elements interact to facilitate or hinder the uptake of improved sorghum farming practices in Dodoma, Tanzania.

1.7.2 Conceptual Framework

This study's conceptual framework (Fig. 1) is based on a thorough review of theories and research on how agricultural information is shared to encourage the adoption of improved sorghum farming practices in Dodoma, Tanzania. The adoption of improved farming practices is shaped by a range of factors, including the availability of resources, affordability, compatibility with existing farming systems, and the support provided by extension services. Among these factors, four communication-related elements: namely, source credibility, information repackaging, communication media, and farmers' information-seeking behaviour, play a particularly important role in determining how farmers access, understand, and apply agricultural information. These elements contribute to the adoption of improved agricultural practices, including proper land preparation, the use of improved seed varieties, application of fertilizers,

effective weed management, pest and disease control, and post-harvest handling. Addressing these communication factors in combination with other contextual and structural considerations can enhance the effectiveness of knowledge dissemination and ultimately lead to higher adoption rates.

Source credibility plays a key role in adoption. Farmers are more likely to trust and implement farming recommendations when they come from reliable sources such as agricultural extension officers, research institutions like TARI, or experienced farmer groups. If a source lacks expertise or trustworthiness, farmers may disregard the information, reducing adoption rates. Strengthening the credibility of information providers is essential for successful knowledge transfer. Information repackaging ensures that complex agricultural research is presented in a format that farmers can easily understand and apply. Simplifying technical language, using visuals, and aligning messages with local farming conditions help farmers grasp key concepts. Well-packaged information is timely, clear, and actionable, increasing the likelihood of adopting improved practices. Communication media determine how effectively information reaches farmers. Various channels, radio, television, newspapers, mobile phones, extension services, agricultural fairs, and interpersonal interactions, offer different levels of accessibility and engagement. While radio covers a wide audience, extension services provide direct support, enabling farmers to apply knowledge effectively. A well-chosen mix of media enhances adoption by ensuring clear and practical communication. Farmers' information-seeking behaviour also affects adoption. Some actively seek information through extension services and digital platforms, while others rely on passive sources. Factors such as gender, marital status, experience, and farm size influence this behaviour. Encouraging proactive information seeking through trusted channels can significantly boost adoption.

When credible agricultural information is effectively repackaged, disseminated through appropriate media, and actively sought by farmers, the adoption of improved sorghum farming practices is significantly enhanced. This leads to higher crop yields, improved household livelihoods, and more sustainable sorghum production in the Dodoma Region. Increased production in the framework highlights the tangible outcomes of effective communication and aligns with Tanzania's Development Vision 2025, promoting high-quality livelihoods through food self-sufficiency and food security.

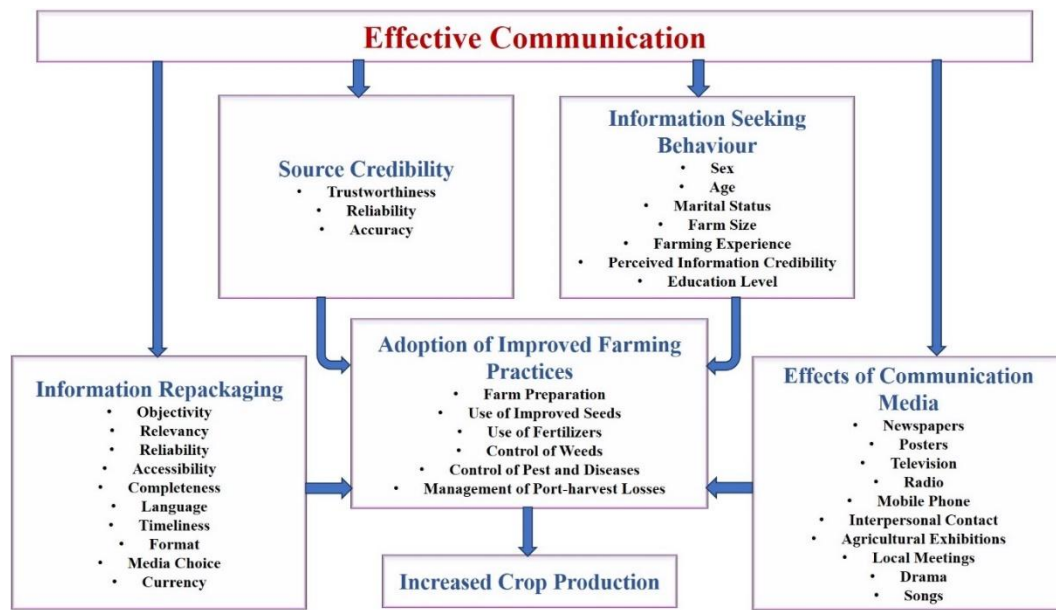


Figure 1: Conceptual Framework

1.8 General Methodology

1.8.1 Research Philosophy

Given the nature of this study, a pragmatic research paradigm was applied using multiple methods to gain a deeper understanding of complex issues. Pragmatism emphasises practical solutions by focusing on what works best to answer research questions while ensuring that the findings are relevant and beneficial to society (Kaushik and Walsh, 2019). This approach is particularly useful when a single research method is insufficient to effectively address the study's objectives (Allmark and Machaczek, 2018). Since this study explores how agricultural research information is communicated to promote the adoption of improved sorghum farming practices, it was essential to consider different viewpoints. On one hand, agricultural experts serve as sources of information, shaping how research findings are conveyed. On the other hand, sorghum farmers are the recipients, whose understanding and adoption of new farming practices depend on the clarity and accessibility of the information they receive. Given this dynamic interaction, a rigid, one-dimensional research approach would not have been sufficient to capture the full scope of the communication process.

Furthermore, the communication of agricultural research involves multiple interrelated factors, such as source credibility, information repackaging, the effectiveness of communication media, and farmers' information-seeking behaviour. Understanding

these elements required a combination of data collection techniques and analytical methods, aligning well with the flexibility of the pragmatic approach. Pragmatism allowed for methodological adaptability, ensuring that data collection and analysis were tailored to the study's objectives rather than constrained by a single research tradition. By embracing pragmatism, this study was able to integrate both qualitative and quantitative insights, leading to a more comprehensive and meaningful understanding of how agricultural research information is communicated and adopted among sorghum farmers in Dodoma, Tanzania. This inclusive and adaptable research paradigm ensured that the findings were practical, relevant, and applicable to real-world agricultural challenges.

1.8.2 Research Approach

This study employed a concurrent mixed-methods approach to gain a deeper and more comprehensive understanding of the research problem by integrating both quantitative and qualitative data. The study collected quantitative data through a questionnaire and gathered qualitative data via Key Informant Interviews, conducting both processes simultaneously. The data were then analysed separately, with the findings being integrated to provide a fuller picture of the phenomenon under study.

The use of this mixed-methods approach aligns with the work of Matović and Ovesni (2023), Taherdoost (2022), and Feters and Tajima (2022), who highlight the benefits of combining quantitative and qualitative data collection and analysis in the same phase of research. By doing so, this approach allowed the study to capitalise on the strengths of both methods, overcoming the limitations inherent in using only one approach. In line with this, Younas *et al.* (2023), Chang *et al.* (2021), and Garcia and Ramirez (2021) argue that mixed methods provide an opportunity to enrich the findings by comparing converging and diverging data, ultimately leading to a more nuanced understanding of the research problem.

However, Zhou and Wu (2022), Paoletti *et al.* (2021), and Izquierdo and Anguera (2021) emphasise that such an approach requires careful planning and coordination in terms of data collection, analysis, and integration strategies to ensure consistency and reliability. The concurrent mixed-methods approach is further supported by Khan (2024), Patil and Wagh (2023), and Dalton *et al.* (2021), who note the importance of employing dynamic and multidisciplinary methods to capture multiple realities and the

diverse perspectives of participants. A mixed-methods approach made it possible to leverage the strengths of both qualitative and quantitative research techniques (McBride *et al.*, 2019; Green *et al.*, 2015) This combination offered a holistic view of the research problem, ensuring that the findings are robust, well-rounded, and able to capture the complexity of the study's context.

1.8.3 Research design

A research design is essentially a plan for how a study will be conducted, outlining how, when, and where data will be collected and analysed. It helps organise the conditions for data collection and analysis in a way that aligns with the research purpose while ensuring the procedures are efficient (Karunarathna *et al.*, 2024). In simpler terms, the research design sets the framework for the research to unfold and, thus, determine which methods will be used for data collection, analysis, and interpretation. Depending on the specific research objectives quantitative, qualitative, or mixed approaches employed.

The quantitative approach focuses on collecting and analysing numerical data, typically through closed-ended questionnaires. It is often associated with large sample sizes and aims to measure and analyse causal or correlational relationships between variables (Creswell, 2009). In contrast, the qualitative approach explores problems from an open-ended perspective, aiming to understand naturally occurring events in real-life settings. This approach uses techniques such as observation, interviews, and document reviews to gather data. As Creswell and Poth (2016) explains, qualitative research is more concerned with describing individuals, organisations, settings, or phenomena, focusing on meanings, concepts, and characteristics.

A mixed approach combines both quantitative and qualitative methods within a single study, allowing researchers to benefit from the strengths of both approaches. In this study, a cross-sectional research design was chosen, given the complexity of communication and the constraints on time. This design enabled the researchers to examine the relationships between various factors, such as communication sources, repackaging, and channels, information-seeking behavior and how they influenced the adoption of improved farming practices. By collecting data at a single point in time, the design allowed for a comprehensive analysis of these connections, helping identify key factors that could inform future interventions.

Additionally, the study employed a dominant-less-dominant design, as suggested by Creswell and Hirose (2019). This design prioritised the quantitative approach while still incorporating the qualitative approach. The dominant-less-dominant design can be implemented either sequentially or concurrently, and in this study, both data types were collected at the same time. This decision was made to achieve a comprehensive understanding of the research topic, improve the validity and reliability of the findings through data triangulation, and make the most of the complementary strengths of both methods. A combination of these approaches, enhanced the study with an in-depth interpretation of the data and a holistic perspective on the factors influencing the adoption of improved farming practices.

1.8.4 Description of the Study Area

The study was carried out in Dodoma, Tanzania, which is known for its significant sorghum production (Mwamahonje and Maseta, 2018). Located in central Tanzania, the region encompasses diverse agro-ecological zones, including both highland and lowland areas. Dodoma has a predominantly rural population engaged in agriculture, with sorghum being a key crop cultivated by smallholder farmers. The socio-economic characteristics of the study area are important for understanding the research context. Dodoma Region is home to various ethnic groups, such as the Gogo, Rangi, and Sandawe, each with their own cultural practices and farming traditions. The region faces socio-economic challenges, including limited resources, inadequate infrastructure, and fluctuating market conditions, which can affect the adoption of improved farming practices.

Sorghum farming holds significant importance in Dodoma due to its suitable climate and soil conditions and is considered strategic for enhancing food security and improving farmers' livelihoods. Smallholder farmers rely on a combination of traditional and modern agricultural techniques. Communication in the region reflects this blend: farmers exchange information through face-to-face interactions in community gatherings, farmer group meetings, and peer-to-peer knowledge sharing. Local radio programs are also used to disseminate agricultural information, while mobile phones increasingly serve as channels for SMS and voice messages. Although ICT adoption is growing, access and use vary by age, education, and digital literacy, influencing how agricultural research information is received, interpreted, and applied.

By providing a detailed description of the study area, including its location, socio-economic characteristics, agricultural practices, and communication dynamics, this research captures the unique context in which agricultural research information is disseminated and the adoption of improved sorghum farming practices takes place. Studying Dodoma allows for an examination of how communication channels and practices influence farmers' understanding and use of research-based agricultural innovations.

1.8.5 Target Population

This study focused on sorghum farmers in Dodoma, Tanzania, who are key recipients of agricultural research information and play a central role in decision-making regarding farming methods. The study intentionally included smallholder farmers with varying levels of farming experience and education, ranging from no formal education to higher education. This selection was made to capture the diversity in farmers' access to, comprehension of, and use of agricultural research information, as education and experience influence how information is sought, interpreted, and applied. In addition to farmers, the study also targeted agricultural extension officers, researchers, and representatives from agricultural organisations who influence farming practices. The goal was to understand how communication impacts the adoption of improved sorghum farming practices across different stakeholder groups and farmer segments, ensuring that the findings are representative and relevant to the broader agricultural community in Dodoma.

1.8.6 Sampling Design

The sample size for this study was determined using Cochran's (1963) formula, which involved the following parameters: $Z = 1.96$, $q = 0.5$, $p = 0.5$ and $e = 0.05$. This calculation indicated that a minimum of 384 respondents was required, as shown in equation (1). However, to address potential challenges such as non-responses, missing data, and outliers, common issues in field-based research, the final sample was increased to 399 sorghum farmers. This adjustment aligns with the methodological recommendations of Mugenda and Mugenda (2003) and Saunders *et al.* (2003) who stress the importance of anticipating and mitigating limitations during data collection.

Moreover, as Bryman (2016) notes, an increased sample size enhances statistical power and improves the reliability of subgroup analyses. By selecting a sample of 399

respondents, the study not only strengthens the robustness of the findings but also enhances their reliability and overall validity, ensuring that the results reflect a more accurate picture of the agricultural practices among sorghum farmers.

$$n_o = \frac{Z^2 pq}{e^2} \quad (1)$$

$$n_o = \frac{(1.96^2 \times 0.5 \times 0.5)}{0.05^2} = 384$$

A multi-stage sampling approach was adopted to ensure a diverse and representative selection of sorghum-farming households in Dodoma. In the first stage, three districts Kongwa, Kondoa, and Bahi were randomly selected. From each district, three wards were then chosen using simple random sampling (SRS), followed by the selection of three villages from each ward through the same method. A sample frame was then constructed using village registers, which listed all sorghum-farming households in the selected villages. From this frame, households were randomly selected, with a specific focus on household heads, who are typically the primary decision-makers in agricultural activities in many African contexts (De Backer *et al.*, 2021). The sample frame thus ensured that all eligible households had a known and non-zero chance of selection, enhancing the representativeness and reliability of the study findings.

For the qualitative component, key informant interviews were conducted with nine ward extension officers and six agricultural experts from the Tanzania Agricultural Research Institute (TARI) Hombolo Centre. The nine extension officers were selected to represent each of the nine wards in the study area, ensuring coverage of local perspectives on farmer communication and information dissemination. The six TARI experts were all those available and actively involved in generating and packaging research-based information, including improved sorghum cultivation techniques. The selection used purposive, information-rich sampling to obtain detailed insights from individuals most knowledgeable and influential in agricultural communication (Yarber, 2024). These interviews offered deeper understanding of research dissemination and the credibility of information sources. Combining qualitative and quantitative methods strengthened the study's validity, while the multi-stage sampling approach enhanced efficiency by reducing costs and time (Liang *et al.*, 2023; Basti and Madadizadeh, 2021).

1.8.7 Data Collection Methods

The study utilised an interviewer-administered, structured questionnaire with closed and open-ended questions aligned with the study objectives. The questionnaire was organised into sections covering demographics and communication elements. According to Tian *et al.* (2021) and Svendsen *et al.* (2020), the number of sections in a questionnaire depends on the complexity of the study and the survey length. Each section included clear, concise, and specific questions grouped under thematic headings, making it easy for participants to respond and for the data to be coded and analysed. As noted by Bai *et al.* (2023) and Knott *et al.* (2022), the logical flow of questions and simple language encourages better responses and simplifies the analysis process. The use of closed-ended questions was favoured due to their ability to generate quantifiable data, which is easier to analyse statistically. Additionally, they reduce respondents' bias by providing predefined options, enhancing the reliability and validity of the findings (Neuert *et al.*, 2023; Alordiah and Ossai, 2023; Baburajan *et al.*, 2022). However, recognising the potential for valuable information beyond the scope of predefined options, open-ended questions were integrated into the questionnaire. These questions aimed to capture farmers' spontaneous thoughts, diverse opinions, and potentially unforeseen issues or insights related to communication and adoption of improved farming practices. These have offered a more holistic view than solely relying on pre-categorised responses. The questionnaire (Appendix I) was pretested on 38 respondents from Mlowa Barabarani, Mlowa Bwawani, and Mloda villages in Chamwino District. These villages were selected for their similarity to the main study area, ensuring relevant feedback. The pre-test aimed to assess the validity and reliability of the tool, with a sample size of 30 participants being considered ideal for instrument validation (Gunawan *et al.*, 2021). The questionnaire was because of its systematic approach to capturing quantitative data and analysis (Rashid *et al.*, 2021).

In addition to primary data, secondary data were used to provide context, inform the design of the questionnaire, and guide the study's analysis. These included the Agricultural Policy (2013), Mwongozo wa Uzalishaji Mazao kulingana na Kanda za Kikolojia (2017), and the TARI Communication Strategy (2019), which provided background information on agricultural communication and sorghum production practices in Tanzania, enhancing the rigor and relevance of the study. A document

review guide was employed to systematically extract relevant information from these sources, as well as from published research articles, government reports, policy documents, NGO and farmer association reports, and online databases. The guide focused on key variables aligned with the study objectives, including communication channels, source credibility, message repackaging, farmers' information-seeking behavior, and adoption of improved sorghum farming practices. This structured approach ensured that secondary data were relevant, consistent, and could be triangulated with primary data from surveys and interviews, thereby strengthening the validity and comprehensiveness of the study.

1.8.8 Key Informant Interview (KII)

The study employed Key Informant Interviews (KIIs) using a structured interview guide with open-ended questions designed to collect qualitative data (Appendix II). A total of 15 key informants were interviewed, including nine agricultural extension officers and six experts from TARI. This approach provided valuable, in-depth insights into the participants' experiences and knowledge, offering a more nuanced understanding of the topic (Osborne and Grant-Smith, 2021). A comprehensive view was captured by combining both local and institutional perspectives. The interviews were conducted face-to-face to gather detailed information. This method was chosen for its flexibility, allowing the interviewer to explore a wide range of topics in greater depth. Interviews were scheduled at times convenient for the key informants, with locations selected for privacy, comfort, and accessibility. Before beginning the interview, the purpose and objectives of the study were briefly explained, and consent for participation was obtained. The interview began with a broad question, followed by active listening and follow-up questions to ensure all relevant topics were addressed. The interviews were recorded using handwritten notes. KIIs were chosen for this study due to their ability to provide a deeper understanding of complex social phenomena (Pahwa *et al.*, 2023; Lokot, 2021).

1.9 Data Validity and Reliability

1.9.1 Data Reliability

This refers to the consistency and dependability of data over time and across different conditions or observers (Ahmed and Ishtiaq, 2021). In other words, data is considered reliable if it produces the same results when repeated under similar circumstances. In

this study, the reliability analysis of the constructs was used to assess internal consistency. The results showed that most constructs demonstrated acceptable reliability, confirming the effectiveness of the survey instrument. Cronbach's alpha was calculated for each construct containing Likert-scale questions, and the findings indicated good consistency, as all values exceeded the acceptable threshold of 0.7. This suggests that the measurement items were reliable and suitable for capturing the intended concepts.

1.9.2 Data Validity

To ensure content validity, the research instruments were developed based on a thorough review of relevant literature, theoretical frameworks, including the Diffusion of Innovations theory and the Information-Seeking Behaviour model, and the specific objectives of the study. The questionnaire items were designed to comprehensively capture key constructs such as source credibility, repackaging of agricultural research information, communication channels, and farmers' socio-demographic characteristics. To further strengthen content validity, experts in agricultural communication and rural development to assess the relevance, clarity, and completeness of the items reviewed the instruments. Feedback from these experts informed the refinement of the tools, ensuring they adequately represented the constructs under investigation.

1.9.3 Data Analysis

The collected data were preprocessed by cleaning them to address missing values, outliers, and inconsistencies. The process was aided by the use of STATA software (version 17) to ensure that the data were accurate and reliable. According to Vertsel and RumiantSau (2024) and Luengo *et al.* (2020), preprocessing lays the foundation for effective data analysis to ensure that the intended data are in a suitable format. After the preprocessing of the data, exploratory data analysis was done to understand the underlying patterns, relationships, and trends. This process is important to identify and correct problems in the data that subsequently affect the study conclusion. Graser (2021) and (Rao *et al.*, 2021), argue that exploratory data analysis helps to identify potential patterns and outliers in the data. The collected data were analysed descriptively (percentage, frequencies, mean, and standard deviation) and inferentially through binary logistic regressions and linear mixed model.

To assess how source credibility influences the adoption of improved sorghum farming practices, the study employed both qualitative and quantitative methods. The qualitative data were analysed thematically by identifying and summarising key patterns and viewpoints from interviews. This offered a nuanced understanding of how farmers perceive the credibility of agricultural information sources, particularly in terms of trustworthiness, reliability, and accuracy. For the quantitative analysis, descriptive statistics were first used to present an overview of the data, followed by inferential statistical methods. A Two-way ANOVA model was used to examine variations in credibility perceptions among six different agricultural information sources while accounting for individual farmer effects. The model is specified in equation (2).

$$Y_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij} \quad (2)$$

where:

Y_{ij} represents the credibility index for information received from source i by individual farmer j , measured as the natural logarithm of the average trustworthiness, reliability, and accuracy scores. μ is the overall mean credibility, α_i represents the source's effect on credibility, β_j represents the individual farmer's effect, and ε_{ij} is the error term. Post ANOVA, Tukey's HSD tests were used for pairwise comparisons to identify specific differences in perceived credibility among the six agricultural information sources in the study. Post-hoc analysis using Tukey's HSD test was conducted to identify significant pairwise differences in credibility perceptions among the sources (Hosmer Jr *et al.*, 2013b).

To explore what determines the perceived credibility of information sources, a multiple logistic regression model was used. The credibility index was categorised into binary outcomes: high credibility (index > 3) and low credibility (index ≤ 3). The model is presented in equation (3).

$$\begin{aligned} \text{Logit}[\pi(X)] = & \alpha + \beta_1 \times \text{Sex} + \beta_2 \times \text{Age} + \beta_3 \times \text{Education} + \beta_4 \times \text{Farm Size} \\ & + \beta_5 \times \text{Farming Experience} + \beta_6 \times \text{Household Size} \\ & + \beta_7 \times \text{Information Seeking} + \varepsilon \end{aligned} \quad (3)$$

Where:

$\text{Logit}(\pi(x))$ represents the natural logarithm of the odds of perceiving high credibility of the information source. The parameter α is the intercept or constant term in the model while β_1 to β_7 are the regression coefficients associated with specific predictor variables which included gender, age, education level, farm size, farming experience, household size, and information-seeking behaviour.

To determine the influence of source credibility on the adoption of improved sorghum farming practices, a series of binary logistic regression models were developed. Adoption was treated as a binary outcome (adopted or not). Four models were estimated, three based on the components of credibility (trustworthiness, reliability, and accuracy) and one on overall credibility. The general form of the model is given by equation (4).

$$\left. \begin{aligned} \text{Model 1: } \text{Logit}[\pi(x)] &= \alpha + \beta \times \text{Trustworthiness} + \varepsilon_i \\ \text{Model 2: } \text{Logit}[\pi(x)] &= \alpha + \beta \times \text{Reliability} + \varepsilon_i \\ \text{Model 3: } \text{Logit}[\pi(x)] &= \alpha + \beta \times \text{Accuracy} + \varepsilon_i \\ \text{Model 4: } \text{Logit}[\pi(x)] &= \alpha + \beta \times \text{Credibility} + \varepsilon_i \end{aligned} \right\} i = 1, 2, 3, \dots, 399 \quad (4)$$

In the models, α represents the “log (odds)” of adopting an improved sorghum farming practice regardless of source credibility. β represents the change in the “log (odds)” of adopting an improved practice for every unit change in the source credibility index (trustworthiness, reliability, or accuracy). ε_i is the error term, and $\pi(x)$ represents the probability of adopting an improved sorghum farming practice for farmer i . $\text{Logit}(\pi(x))$ represents the “log (odds)” of adopting an improved practice for farmer i . The Hosmer-Lemeshow goodness-of-fit test was used to assess the adequacy of the logistic regression models. This test evaluates how well the observed outcomes of the dependent variable match the predicted outcomes from the logistic regression models, providing insights into the model’s goodness-of-fit (Hosmer Jr *et al.*, 2013a). This mixed-method approach provided robust evidence linking perceived source credibility to both trust in agricultural information and the likelihood of adopting improved sorghum practices.

To assess how repackaging agricultural research information influences the adoption of improved sorghum farming practices, both quantitative and qualitative methods were used to gain a comprehensive understanding of the issue. Qualitative data were

analysed thematically. Transcripts were coded and grouped into themes such as language use, media formats, and information accessibility. This revealed practical insights into how repackaging strategies influence farmers' understanding, trust, and eventual adoption of improved practices.

Quantitative analysis began with frequencies and percentages to summarise farmers' language preferences. Means, standard deviations, and ranks were then calculated to assess how farmers rated the quality of repackaged information. A One-way ANOVA was used to determine whether adoption levels differed significantly across groups based on language preference. The model is defined as in equation (5).

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij} \quad \begin{cases} i=1,2,3 \\ j=1,2,\dots,399 \end{cases} \quad (5)$$

where:

Y_{ij} is the dependent variable (the adoption index), μ is an overall mean, τ_i is the effect of the language preference, and ε_{ij} is the random error term which is normally identically distributed $(0, \sigma^2)$.

A Turkey's HSD (Honestly Significant Difference) test was performed after an ANOVA model with the aim of identifying groups (language preference) that were significantly different from each other in terms of adoption.

To further explore how different aspects of repackaging affect the quality of information, a Two-way ANOVA was used. The outcome variable, quality index, was rated on a 1 to 5 Likert scale. Attributes evaluated included objectivity, relevance, reliability, accessibility, completeness, language, timeliness, format, media choice, and currency. The model is presented in equation (6).

$$Y_{ij} = \mu + \tau_i + \beta_j + \varepsilon_{ij} \quad \begin{cases} i=1,2,3 \\ j=1,2,\dots,399 \end{cases} \quad (6)$$

where:

Y_{ij} is the dependent variable (information quality index), μ is an overall mean, τ_i is the attribute effect, β_j is the j th individual farmer perception effect and ε_{ij} is the random error term which is normally identically distributed $(0, \sigma^2)$.

To understand how these attributes influence adoption, a binary logistic regression model was employed. Adoption was treated as a binary variable (0 = no adoption, 1 = adoption). Each of the ten attributes of repackaged information served as independent variables. The model is expressed as shown in equation (7).

$$\begin{aligned} \log it(\pi(x)) = & \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 \\ & + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} \end{aligned} \quad (7)$$

Where;

x_1 =Objectivity, x_2 =Relevancy, x_3 =Reliability, x_4 =Accessibility,
 x_5 =Completeness, x_6 =Language, x_7 =Timeliness, x_8 =Format,
 x_9 =Media Choice, x_{10} =Currency

To assess how different communication media influence the adoption of improved sorghum farming practices, a combination of qualitative and quantitative approaches was used to provide a well-rounded analysis. Qualitative data were drawn from open-ended questions and key informant interviews. These were analysed through thematic analysis, which involved identifying recurring patterns and insights related to how farmers receive and interpret agricultural messages. This helped capture the real-life experiences of farmers in using different media channels.

On the quantitative side, descriptive statistics, including frequencies, means, standard deviations, and ranks, were used to summarize how various media were used. To examine whether usage varied significantly across different media types, a two-way ANOVA was applied. The outcome variable was the media usage index, rated from 0 (not used) to 4 (frequently used). The model, given in equation (8), measured both the effect of media type and individual farmer behaviour.

$$Y_{ij} = \mu + \tau_i + \beta_j + \varepsilon_{ij} \quad \begin{cases} i=1,2,\dots,10 \\ j=1,2,\dots,399 \end{cases} \quad (8)$$

where:

Y_{ij} is the dependent variable (usage of the media), μ is an overall mean, τ_i is a media effect, β_j is the j th individual farmer effect in usage and ε_{ij} is the random error term which is normally identically distributed $(0, \sigma^2)$.

To examine how each communication medium affected adoption, binary logistic regression models, in the form in equation (9), were run. For every component of

improved farming practices (such as use of improved seeds, weed control, or fertilizer application), a separate regression model was fitted. Each model estimated the probability of adoption based on exposure to different media types, including newspapers, posters, TV, radio, mobile phones, interpersonal contact, agricultural exhibitions, local meetings, drama, and songs.

$$\text{Logit}[\pi(X)] = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_{10} X_{10} + \varepsilon \quad (9)$$

Where the X 's denotes the use of communication channels to access agricultural information.

X_1 = newspapers, X_2 = posters, X_3 = television, X_4 = radio, X_5 = mobile phone, X_6 = interpersonal contact, X_7 = agricultural exhibitions, X_8 = local meeting, X_9 = drama, and X_{10} = songs. The parameter α is the overall “log (odd)” of adopting an improved sorghum farming practice for a farmer regardless of the communication media used in accessing agricultural information. Together, these methods provided both statistical and contextual insights into how communication media shape farmers’ decisions to adopt improved practices.

To evaluate the association between information-seeking behaviour and the adoption of improved sorghum farming practices, both qualitative and quantitative methods were used. Thematic analysis guided the interpretation of qualitative data. Interviews were transcribed, and key phrases were extracted, coded, and grouped into themes reflecting patterns in how farmers seek agricultural information. These emerging themes were compared across respondents, providing insight into how farmers’ information-seeking behaviours shape their farming decisions. According to Gao *et al.* (2023) and Williams and Moser (2019), open coding is useful for breaking down the collected data into meaningful units to allow categorisation and analysis. Thematic analysis offers a rigorous and systematic approach to comprehensively understand complex phenomena for complementing quantitative methods (DeJonckheere *et al.*, 2024; Mwinami *et al.*, 2023).

Quantitative analysis involved both descriptive and inferential approaches. A frequency table was used to show how farmers differed in their information-seeking behaviour, categorizing them as either seekers or non-seekers. To identify the factors that influence this behaviour, a Linear Mixed Model (LMM), presented in equation

(10), was applied. The model predicted the level of information-seeking behaviour, measured on a 1 to 5 scale, using farmers' sex, age, education, marital status, farm size, farming experience, and ownership of communication tools as fixed effects. The model also accounted for district-level differences by including random effects.

$$Y_{ij} = \beta_o + \beta_1 S + \beta_2 A + \beta_3 E + \beta_4 MS + \beta_5 FS + \beta_6 FE + \beta_7 CA + u_j + \varepsilon_{ij} \quad (10)$$

Where:

Y_{ij} = Information seeking score represents the level of information-seeking behaviour measured on a scale of 1 to 5. It is the outcome variable for the i -th individual in the j -th district. S (Sex), A (Age), E (Education), MA (Marital Status), FS (Farm Size), FE (Farming Experience), CA (Ownership of communication assets) u_j is the random effect for the district, accounting for variability between districts and ε_{ij} is the residual error term for individual-level variability.

To assess whether information-seeking behaviour is associated with the adoption of improved practices, a Binary Logistic Regression Model, equation (11), was fitted. The dependent variable was adoption status (adopter vs. non-adopter), while the main predictor was information-seeking behaviour (seeker vs. non-seeker). Other control variables included sex, age, marital status, farm size, farming experience, and perceived credibility of the information.

$$\text{logit}(\pi(x)) = \beta_o + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \varepsilon_i \quad (11)$$

Where;

$\text{Logit}(\pi(x))$ is the logarithm of the odd of a farmer to adopt improved farming practices given covariate (independent variable) x and

x_1 =Sex, x_2 =Age, x_3 =Marital Status, x_4 =Farm Size,

x_5 =Farming Experience, x_6 =Perceived Information Credibility, x_7 =Information Seeking Behavior

ε_i = error term

The odds ratios and their 95% confidence intervals were estimated for each predictor to assess the likelihood of adopting improved farming practices. The primary interest was in the odds ratio associated with information-seeking behaviour, which indicated

how the odds of adoption differed between information seekers and non-seekers. The statistical significance of each predictor was tested using Wald tests. The results were presented in a table showing the odds ratios, standard errors, z-values, and p-values for each covariate.

1.9.4 Measurement of the Study Variables

The study variables were selected and measured based on Lasswell's Model of Communication (1948), Diffusion of Innovation Theory (Rogers, 2003), Media Richness Theory (Daft and Lengel, 1986), and the Information Seeking and Communication Model (Wilson, 1999). These frameworks provided a structured approach to understanding how agricultural research information is communicated, accessed, and adopted by sorghum farmers. Source credibility was assessed in terms of trustworthiness, reliability, and accuracy, which significantly influence farmers' trust in agricultural information. Information repackaging was evaluated based on objectivity, relevance, timeliness, accessibility, completeness, language, format, accuracy, reliability, and media choice. Well-packaged information enhances comprehension and adoption of innovations by tailoring content to farmers' needs (Onyango, 2021; Mtega *et al.*, 2016). Communication media were examined for effectiveness, accessibility, and frequency of use, including newspapers, posters, television, radio, mobile phones, interpersonal communication, agricultural exhibitions, local meetings, drama, and songs. Different media channels impact how farmers access and utilize agricultural information (Tegene *et al.*, 2022; Mtega, 2021). Information-seeking behaviour enhances adoption as noted by Carter (2019) and Jalali *et al.* (2020), and it was measured by demographic and farming-related factors that influence information use. The adoption of improved sorghum farming practices was assessed based on farmers' implementation of recommended techniques, which are crucial for productivity. Accurate measurement of variables ensures validity and reliability, strengthening the study's findings and contributing to a deeper understanding of how communication supports agricultural innovation. A summary of the descriptions and measurements of variables is provided in **Error! Reference source not found..**

Table 1. 1: Descriptions and Measurements of Variables

Variables	Description	Measurement
Dependent Variable (Y)		
Adoption of Improved Farming Practices	Extent to which farmers implement improved farming practices	Binary: Y = 1 if farmers adopt improved practices, 0 otherwise.
Independent Variables (X)		
Source Credibility	Perceived trustworthiness, reliability, and accuracy of agricultural information	Likert: 1=SD, 2=D, 3=N, 4=A, 5=SA
Information Repackaging	Perceived quality of information in terms of objectivity, relevance, timeliness, accessibility, completeness, language, format, accuracy, reliability, and media choice	Likert: 1=SD, 2=D, 3=N, 4=A, 5=SA
Communication Media	Effectiveness of various media in disseminating agricultural research information	Likert: 1=SD, 2=D, 3=N, 4=A, 5=SA
Information-Seeking Behaviour	Frequency and means through which farmers actively seek agricultural information	Likert: 1=Never, 2=Rarely, 3=Occasionally, 4=Frequently, 5=Very frequently
Demographic Characteristics		
Sex	Sex of respondents	1=Female, 0=Male
Age	Age of respondents	Number of years
Marital Status	Respondents' marital status	0=Single, 1=Married
Education Level	Level of formal education	0=No formal education, 1=Primary, 2=Secondary, 3=College/University
Household Size	Number of permanent household members	Number of household members
Farming Experience	Number of years in farming	Number of years
Farm Size	Total land area cultivated	Acres
Ownership of Communication Assets	Possession of communication devices such as radio, television or mobile phone	radio, television or mobile phone

Note(s): SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree.

1.9.5 Ethical Consideration

The study obtained a research permit from Moshi Cooperative University (MoCU) and the office of Regional Administrative Secretary in Dodoma Region before pre-testing the data collection tools and during actual data collection. The permit was presented to the local government authorities (Ward Executive Officers, Village Executive Officers and TARI) for permission to access sorghum farmers and extension officers. Prior to pre-testing of data collection tools and actual data collection, the study objectives, purposes, procedures, and benefits were fully explained to the respondents and asked to provide their consent to participate in filling out the questionnaire and participating in the exercise. The principles of voluntary participation, confidentiality, and anonymity of respondents were highly maintained. Respondents had the right to withdraw from the study at any time without facing any negative consequences. Respondents were informed on how the necessary data were collected and how they would be used and shared with other researchers, institutions, farmers, and the general public. All the collected data were treated with strict confidentiality by storing them securely and ensuring that participants could not be identified. Finally, the study was conducted honestly, with integrity, and with scientific rigour. The findings were appropriately placed in the context of prior and existing studies, and all sources used were properly and correctly cited.

1.9.6 Organization of the Study

The study is organised into six chapters, with chapter one presenting the introductory strand of the study. This chapter focuses on providing information related to the background of the study, problem statement, research objectives, research questions, justification of the study, theoretical underpinning, and general methodology. Chapter two presents a manuscript on source credibility, while chapter three presents a manuscript on repackaging agricultural research information. Similarly, chapters four manuscripts on effects of communication media and chapter five present manuscripts on information seeking. Finally, the last chapter presents a summary of the whole study, conclusions, recommendations, implications, and directions for future studies.

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CHAPTER TWO

PAPER ONE

Source Credibility and Adoption of Improved Sorghum Farming Practices in Dodoma, Tanzania

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Abstract

Purpose

Despite continued efforts by the government and development partners to promote improved sorghum farming practices, many sorghum farmers in Dodoma, Tanzania, have not yet adopted these methods. This study investigated how farmers' perceptions of the credibility of information sources influence their adoption of practices like proper farm preparation, using improved seeds, fertilizers, effective weed, pest and disease control as well as post-harvest management.

Design/Methodology/Approach

A cross-sectional research design was employed, utilizing a multi-stage and simple random sampling to collect data from 399 sorghum farmers in Dodoma, Tanzania. Data analysis involved both qualitative and quantitative methods. Qualitative data were thematically summarized, while descriptive statistics and inferential analysis were used for quantitative data

Findings

Fellow farmers attained higher credibility status being influenced by trust, shared experiences, and local knowledge. Farmers' perceptions of source credibility were significantly impacted by gender and information-seeking behaviour. Adopting

improved sorghum farming practices was linked to higher perception of information source credibility.

Practical implication

The study offers important communication insights for agricultural researchers, extensionists, and stakeholders, with the goal of promoting the adoption of improved farming practices.

Theoretical implications

Grounded in the Diffusion of Innovations Theory and the Information-Seeking Behaviour Model, this study illustrates how perceptions of credibility shape farmers' decisions. It sheds light on why certain messages resonate more effectively than others in promoting adoption.

Originality/Value

The study assesses credibility in agricultural information sources, providing a practical solution for adoption. It can potentially reshape perspectives and promote adoption of improved farming practices among farmers, extensionists, and agricultural researchers.

Key words: source credibility, agricultural information, adoption, sorghum, improved farming practices, Dodoma.

1. Introduction

Source credibility is the perceived level of believability, or reliability and trustworthiness attributed to an information provider (Gehrau *et al.*, 2021; Kang and Namkung, 2019). According to source credibility theory, people are more inclined to accept information from sources they consider credible (Hovland *et al.*, 1953). This perception of credibility is vital, as it depends on how recipients evaluate a communicator's trustworthiness, which directly influences message acceptance. The credibility of an information source serves as a weight that enhances its value during communication (Kington *et al.*, 2021; Sinatra and Lombardi, 2020). As such, the persuasiveness of agricultural messages is therefore closely tied to the credibility of the source; the more credible the source, the more likely farmers are to consider and implement the recommended practices (Ecker and Antonio, 2021; Schaewitz *et al.*,

2020). This is particularly relevant in the case of sorghum farming, where practices such as proper farm preparation, the use of improved seed varieties, proper fertilizer application, weed, pest and diseases management as well as efficient post-harvest handling can significantly improve productivity.

Perceived source credibility is shaped by several factors including expertise, trustworthiness, likability, reliability, accuracy, objectivity, authority, and completeness of the information (Serman and Sims, 2022; Jenkins *et al.*, 2020; Robson and Robinson, 2015). Expertise refers to the knowledge a source holds, while trustworthiness ensures the information is unbiased and accurate. Likability matters too; people tend to trust sources they find relatable. Reliability means the information is consistent over time, and accuracy confirms it is factually correct. Objectivity ensures impartiality, while authority reflects the source's credibility. Farmers judge these qualities based on their experience with the source and how well it aligns with their own practices. But credibility alone is not enough. Farmers also need information that is accessible, clear, and delivered through familiar channels, with their information-seeking behaviour and personal factors influencing adoption decisions.

In Dodoma, Tanzania, where sorghum farming plays a vital role in food security and resilience to climate change, adopting improved farming practices goes beyond just sharing information. It is about building trust, making sure the information is clear, and ensuring farmers can access reliable sources. Farmers here use a variety of information sources, such as extension officers, local leaders, NGOs, faith-based organizations, agricultural research institutes and fellow farmers. However, these sources are often seen with different levels of trust, which affects farmers' decisions on whether to adopt new practices. Farmers also face mixed messages, some of which may clash with their traditional methods. In these situations, the credibility of the information source becomes key to guiding their decisions.

Given the high risks and uncertainties inherent in agriculture, credible information sources help reduce perceived risks associated with new technologies and practices. The trustworthiness of these sources significantly affects farmers' willingness to try and sustain improved farming methods (Yalakonda and Chandrasekaran, 2023; Roth-Cohen *et al.*, 2021). When faced with conflicting or unfamiliar messages, farmers are

more likely to rely on sources they find credible, those that reinforce their confidence in decision-making. Thus, credibility not only guides choices but also contributes to achieving positive agricultural outcomes.

Building on these insights, this study examined how farmers view the credibility of different agricultural information sources, how these perceptions are formed, and how they affect the adoption of improved sorghum farming practices. By understanding these relationships, we can create more effective communication strategies that better support farmers in their decision-making and ultimately boost the adoption of beneficial innovations. This knowledge can help ensure that farmers receive reliable information, leading to improved outcomes in their farming practices.

2. Literature Review and Hypotheses Development

2.1. Variations in the Perceived Credibility of Agricultural Information Sources

Variations in how smallholder farmers perceive the credibility of agricultural information sources are often influenced by various factors including personal interactions. Sawe (2022) points out that farmers prioritize trust-based relationships when evaluating the reliability of information, highlighting the importance of interpersonal trust. Rahman *et al.* (2016) found that farmers typically trust their neighbours and fellow farmers more than formal sources like extension officers. Muui *et al.* (2023) reinforce this notion, showing that peer discussions frequently take precedence over formal advisory services. Kansiime *et al.* (2021) also indicate that perceived credibility can vary by crop type, with agro-dealers often seen as the most trustworthy for specific crops like cassava and vegetables.

However, despite these claims of variation, empirical studies suggest that the factors influencing farmers' credibility assessments may not lead to significant differences. For example, Ma *et al.* (2022) reveal that peer trust affects how farmers evaluate information sources, while Zhou *et al.* (2023) note that farmers are more inclined to trust sources endorsed by community members. Traberg and van der Linden (2022) confirm that credible sources foster positive perceptions.

Despite these insights, the existing literature has yet to establish clear and significant variations in how smallholder farmers assess the credibility of agricultural information sources. While informal networks are widely recognized as influential, there remains a

lack of consensus on how factors such as farming experience and access to extension services interact to shape farmers' perceptions. Further research is needed to better understand these dynamics, ensuring that agricultural information is communicated effectively and credibly to enhance farmers' decision-making and adoption of improved practices.

2.2. Factors Influencing Variations in the Perceived Credibility of Agricultural Information Sources

Perceived variations in the credibility of information sources stem from a complex interplay of factors. Evaluating the credibility of these sources is influenced by local relevance, peer relationships, and cultural backgrounds. Studies by Rahman *et al.* (2020) show that agricultural information is often deemed more credible when it aligns with local contexts and cultural practices. Similarly, Curry *et al.* (2021) found that culturally relevant content enhances the acceptance of agricultural innovations, making them more likely to be adopted. Peer influence is critical in shaping these credibility perceptions. Research indicates that farmers trust information from fellow farmers or community members, as these sources are believed to have firsthand experience and a better understanding of local conditions. Dilleen *et al.* (2023) emphasized the importance of social networks in the diffusion of agricultural technologies, demonstrating that trusted peers play a key role in promoting best practices.

The role of education in shaping credibility perceptions is more contentious. While Alotaibi *et al.* (2021) found a positive relationship between education and perceived credibility, Verma *et al.* (2019) reported no significant connection. Demographic factors, such as age, gender, experience, and household size, also influence how credibility is perceived. Albizua *et al.* (2021) noted that younger farmers may trust digital or formal sources more, while older farmers might lean on traditional knowledge. Gender dynamics can create barriers for women, leading them to prioritize more accessible and relatable sources as noted by Theeuwes *et al.* (2021). Experienced farmers often rely on peer-based knowledge exchange and prefer traditional extension services for face-to-face interaction (Quinn, 2021).

Household size adds another layer of influence. Larger households, with more labour, are more open to experimenting with new techniques and often turn to trusted local

leaders and extension services (de Roo *et al.*, 2023). Conversely, smallholder households prefer cost-effective sources like radio programs and mobile advisory services (Ragasa *et al.*, 2021). Understanding these factors can help tailor effective communication strategies for different farmer demographics.

In conclusion, perceived credibility is shaped by various factors, including locality, peer relationships, education, and culture. However, their impact may vary in specific agricultural settings, such as sorghum farming communities. While research has highlighted several influencing factors, gaps remain in understanding which specific attributes, like local relevance or source expertise, most affect farmers' trust. This lack of detail hinders the development of strategies aimed at enhancing credibility in agricultural information dissemination.

2.3. Influence of Source Credibility on the Adoption of Improved Sorghum Farming Practices

Farmers rely on trusted information sources when making decisions and acquiring knowledge about improved farming practices. The credibility of these sources plays a vital role in the adoption of agricultural innovations. Studies have consistently shown that farmers who perceive their information sources as credible are more likely to embrace new techniques (Raza *et al.*, 2019; Pivoto *et al.*, 2019). Similarly, research by Sapbamrer and Thammachai (2021) emphasizes the importance of trust in influencing farmers' willingness to adopt improved farming practices. However, the way credibility is perceived varies across different agricultural contexts, influenced by social, cultural, and economic factors. This makes it difficult to generalize findings across farming communities. The agricultural information landscape is also complex, consisting of formal sources like extension services and research institutions, as well as informal ones such as peer networks and local community knowledge. In some cases, informal networks can be just as influential as formal institutions in shaping farmers' decisions.

Rogers (2003) explains that credibility is shaped by two main aspects: competence credibility, which reflects the perceived expertise of the source, and safety credibility, which relates to trustworthiness. Farmers assess agricultural information based on a balance of these factors whether they believe the source is knowledgeable and whether

they trust the intentions behind the message. This balance ultimately influences their decision to adopt new farming practices. For instance, lead farmers or community-based extension workers may have lower technical expertise but compensate with strong social trust, making smallholder farmers more receptive to their advice (Kabirigi *et al.*, 2022). On the other hand, while professional extension officers and researchers are often seen as highly skilled, they sometimes find it challenging to connect with farmers due to perceived social distance, which can create barriers in communication and understanding. Farmers tend to trust sources with whom they share social and economic characteristics, which influences the effectiveness of communication. Measuring credibility is also challenging because it is shaped by subjective factors such as trustworthiness, expertise, and past experiences with information sources. These perceptions can differ significantly among farmers, impacting their readiness to adopt new practices. Given this complexity, accurately assessing the impact of credibility on farmers' decision-making remains difficult.

While studies from various agricultural contexts highlight the importance of source credibility in adopting new farming technologies, there is limited research specifically focusing on sorghum farming in Dodoma, Tanzania. The Tanzanian government has made efforts to improve farmers' access to agricultural information through government agencies, research institutions, NGOs, and peer networks. The Tanzania Agricultural Research Institute (TARI)-Hombolo Centre, established in 1972, has played a key role in providing reliable agricultural information, particularly for farmers in drought-prone areas like Dodoma. Despite these efforts, sorghum yields remain low, averaging just 0.99 tons per hectare compared to a potential of five tons per hectare (JMT, 2022). This gap suggests that various factors, including the credibility of agricultural information sources, may hinder the adoption of improved farming practices. The 2013 agricultural policy acknowledges that many farmers struggle to access reliable information, highlighting the need for more effective communication strategies to increase adoption rates.

Several factors influence the adoption of agricultural technologies, including economic considerations like profitability, credit access, and farm size (Yoon *et al.*, 2020). Social and cultural influences and institutional factors also play significant roles. Additionally, farmers' personality traits can shape their willingness to adopt new

technologies. However, there is limited research on how communication factors, particularly source credibility, affect the adoption of agricultural innovations in different farming contexts. While studies acknowledge the role of communication in technology adoption, more research is needed to identify specific communication-related factors influencing sorghum farming practices in Dodoma's semi-arid region. In Tanzania, most research has focused on the availability and accessibility of agricultural information (Mtega, 2021; Mwantimwa, 2020; Isaya *et al.*, 2018). However, the role of source credibility in adoption decisions remains underexplored.

This study sought to bridge this gap by exploring how source credibility influences sorghum farmers' adoption of improved farming practices in Dodoma, examining how farmers assess credibility and the factors shaping their perceptions. Understanding these dynamics will contribute to more effective agricultural communication strategies, ensuring that farmers receive reliable, trusted, and actionable information to enhance productivity and sustainability. Based on the reviewed empirical evidence, the study proposes the following null hypotheses:

H₀: There are no significant variations in how smallholder farmers assess the credibility of agricultural information sources.

H₀: There are no factors that influence perceived variations in the credibility of agricultural information sources.

H₀: Source credibility has no significant influence on the adoption of improved sorghum farming practices.

3. Theoretical Review

This study integrated the Information Seeking and Communication Model (ISCM) by (Robson and Robinson, 2015) with the Diffusion of Innovation theory by (Rogers, 2003) to investigate the adoption of improved sorghum farming practices. According to Rogers, adoption refers to fully utilizing an innovation as the best available course of action, while diffusion is the process of communicating the innovation over time through specific channels. Communication involves sharing information to achieve mutual understanding. In this study, communication takes place through channels between sources, where a source originates a message and a channel delivers it to the

receiver. While the Diffusion of Innovation theory provides insights into the spread and adoption of innovations, it does not directly address how farmers evaluate the credibility of information sources and its role in decision-making. To address this gap, the study incorporates the Information Seeking and Communication Model. The ISCM emphasizes that individuals actively seek or receive information and evaluate source credibility based on attributes such as trustworthiness, expertise, accuracy, and reliability. It recognizes the influence of source credibility on decision-making.

4. Methodology

4.1. Study Area

This study was conducted in Dodoma, Tanzania, chosen for its semi-arid conditions and frequent food insecurity. Sorghum cultivation is recommended as a resilient, nutritious, and sustainable option for farmers, promoting food security and livelihoods (JMT, 2022). Given the region's vulnerability and sorghum's potential to improve food security (Mwamahonje *et al.*, 2021), it serves as an ideal context for investigating the adoption of improved farming practices and the role of source credibility in agricultural decision-making.

4.2. Research Design, Sampling Procedure and Sample Size Determination

A cross-sectional research design was employed to collect data at a single point in time from sorghum farming households in the study area. This approach allowed for the examination of the relationship between source credibility and the adoption of improved sorghum farming practices. Using a mixed-methods strategy, the research combined quantitative and qualitative data to provide a comprehensive understanding of how farmers access and utilize agricultural information. The quantitative data revealed measurable trends, while qualitative insights shed light on farmers' experiences and perceptions.

For the quantitative aspect, a cross-sectional survey was conducted to assess the link between source credibility and adoption levels. A multi-stage sampling approach ensured a diverse representation of sorghum farming households. Initially, three districts: Kongwa, Kondoa, and Bahi were randomly selected. Next, three wards from each district and three villages from each ward were chosen. Finally, households were randomly selected from village lists, focusing on household heads, who often serve as

primary decision-makers in many African communities (Acosta *et al.*, 2020) this approach provided insights into decision-making processes related to sorghum farming practices. The qualitative component included key informant interviews with nine ward extension officers and six TARI agricultural experts, who provided deeper insights into the dissemination of agricultural research and the credibility of various sources. Combining qualitative and quantitative methods strengthened the study's validity, providing a deeper understanding of source credibility in agricultural decision-making. The sample size was determined using the Cochran (1963) formula (equation (1)) employing the parameters $Z=1.96$, $q=0.5$, $p=0.5$, and $e=0.05$. It was calculated that a minimum of 384 respondents was required as shown in equation (2). However, a sample size of 399 respondents was selected because it was the number of respondents obtained during data collection. The decision to select a sample size of 399 respondents, which exceeds the minimum requirement of 384, was based on statistical considerations to account for potential non-responses, missing data, or outliers, which may affect the reliability of the findings.

$$n_o = \frac{Z^2 pq}{e^2} \quad (1)$$

$$n_o = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = 384 \quad (2)$$

4.3. Data Collection

Quantitative data were collected using a structured questionnaire administered by the researcher, pretested with 38 respondents from Mlowa Barabarani, Mlowa Bwawani, and Mloda villages in the Chamwino District. These villages were chosen for their similarity to the main study area, ensuring relevant feedback. The pretest aimed to assess the accuracy and reliability of the data collection tool, with a sample size of 30 considered ideal for validating research instruments (Mohd Yusoff and Tengku Ariffin, 2023). The questionnaire method was selected for its systematic approach to quantitative analysis (Rashid *et al.*, 2021). Qualitative data were gathered through interviews with 15 key informants, including nine extension officers and six agricultural experts from the TARI. This approach allowed for in-depth insights into participants' knowledge and experiences (Creswell *et al.*, 2014). The combination of

local and institutional perspectives enriched the study, providing a comprehensive understanding of the topic.

4.4. Data Analysis

The study employed both qualitative and quantitative methods for data analysis. Qualitative data underwent thematic analysis, where key phrases were transcribed, coded, and categorized into themes related to source credibility and sorghum farming. These themes were refined and compared across interviews to identify patterns in communication strategies and credibility's role in adopting improved practices. Quantitative analysis used descriptive statistics to highlight key trends, while inferential techniques like ANOVA and binary logistic regression examined credibility variations across sources. A Two-way ANOVA considered farmers' perceptions for accuracy, providing insights into factors influencing credibility in agricultural information sources. as shown in equation (3).

$$Y_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij} \quad (3)$$

where:

Y_{ij} represents the credibility index for information received from source i by individual farmer j . The credibility of agricultural information sources was assessed based on three key aspects: trustworthiness, reliability, and accuracy, using a 5-point Likert scale. Trustworthiness refers to the extent to which farmers believe the information source is honest, impartial, and free from bias. Reliability relates to how consistently the source provides dependable and steady information over time. Accuracy involves the degree to which the information shared is correct, factual, and free from errors. To determine overall credibility, the average score across these aspects was calculated, and its natural logarithm was taken to create a credibility index. The analysis accounted for variations among sources, individual farmers' perceptions, and potential errors. After conducting ANOVA, Tukey's HSD tests were used to compare credibility perceptions among the six information sources in the study. To explore the factors influencing perceived credibility, a multiple logistic regression model was applied. The credibility index was categorized into two groups: high credibility (scores above 3) and low credibility (scores below 3). Several factors were

analysed for their influence on credibility, including gender, age, education level, farm size, farming experience, household size, and information-seeking behaviour. By incorporating these variables, the study aimed to identify key factors shaping farmers' trust in agricultural information sources. By incorporating these variables into the model, we aimed to identify any significant associations between these factors and the perceived credibility of the agricultural information sources as indicated in equation (4).

$$\begin{aligned} \text{Logit}[\pi(X)] = & \alpha + \beta_1 \times \text{Sex} + \beta_2 \times \text{Age} + \beta_3 \times \text{Education} + \beta_4 \times \text{Farm Size} \\ & + \beta_5 \times \text{Farming Experience} + \beta_6 \times \text{Household Size} \\ & + \beta_7 \times \text{Information Seeking} + \varepsilon \end{aligned} \quad (4)$$

Where:

$\text{Logit}(\pi(x))$ represents the natural logarithm of the odds of perceiving high credibility of the information source. The parameter α is the intercept or constant term in the model while β_1 to β_7 are the regression coefficients associated with specific predictor variables.

To assess how source credibility influences the adoption of improved sorghum farming practices, a binary logistic regression model was used. Adoption was categorized as a binary variable whether or not farmers adopted the technology (Njuguna *et al.*, 2015). Six improved sorghum management practices were consolidated into an adoption index. This index combined different practices into a single score based on the extent of their adoption by farmers, where each practice is assigned a binary score (1 for adopted, 0 for not adopted), and these scores are summed to generate an overall adoption score. Four logistic models were developed: three focusing on trustworthiness, reliability, and accuracy, and one assessing overall credibility. Logistic regression was chosen for its suitability in adoption studies, as it provides a better fit than probit models due to its slightly flatter tails (Weldesentbet, 2020). The models were formulated as shown in equation (5).

$$\left. \begin{aligned} \text{Model 1: } \text{Logit}[\pi(x)] &= \alpha + \beta \times \text{Trustworthiness} + \varepsilon_i \\ \text{Model 2: } \text{Logit}[\pi(x)] &= \alpha + \beta \times \text{Reliability} + \varepsilon_i \\ \text{Model 3: } \text{Logit}[\pi(x)] &= \alpha + \beta \times \text{Accuracy} + \varepsilon_i \\ \text{Model 4: } \text{Logit}[\pi(x)] &= \alpha + \beta \times \text{Credibility} + \varepsilon_i \end{aligned} \right\} i = 1, 2, 3, \dots, 399 \quad (5)$$

In the models, α represents the "log (odds)" of adopting an improved sorghum farming practice regardless of source credibility. β represents the change in the "log (odds)" of adopting an improved practice for every unit change in the source credibility index (trustworthiness, reliability, or accuracy). ε_i is the error term, and $\pi(x)$ represents the probability of adopting an improved sorghum farming practice for farmer i . $\text{Logit}(\pi(x))$ represents the "log (odds)" of adopting an improved practice for farmer i . The Hosmer-Lemeshow goodness-of-fit test was used to assess the adequacy of the logistic regression models. This test evaluates how well the observed outcomes of the dependent variable match the predicted outcomes from the logistic regression models, providing insights into the model's goodness-of-fit (Hosmer Jr *et al.*, 2013).

5. Findings and Discussions

5.1. Adoption of Improved Sorghum Farming Practices

The findings from

Table 0-1 reveals that overall adoption rates of improved sorghum farming practices among respondents were markedly below 50%, with the highest adoption rate at 45.86% for improved seed varieties. The low adoption suggests barriers preventing farmers from fully embracing improved farming practices. Research highlights constraints such as limited resources, high costs, and insufficient information dissemination (Mapiye *et al.*, 2023; Lee and Gambiza, 2022). Despite recognizing the benefits of improved farming practices, many farmers face challenges that hinder their adoption. Key informant interviews revealed that financial constraints, limited access to quality inputs, and inadequate extension support remain major barriers. Additionally, reliance on informal, sometimes unreliable, information sources foster scepticism. Another informant noted concerns about industrial fertilizers, as farmers fear long-term soil degradation and dependency. Moderate adoption rates suggest a gap between available technologies and practical implementation.

Table 0-1: Adoption of Improved Sorghum Farming Practices (n = 399).

Farming practices	No. of respondents	Percent (%)	Rank
Proper farm preparation	181	45.36	2
Use of improved seed varieties	183	45.86	1
Application of fertilizers/manure	173	43.36	3
Control of weeds	172	43.11	4
Control of pests and diseases	167	41.85	6
Management of post-harvest losses	171	42.86	5

5.2. Credibility Variations of Agricultural Information Sources

The results from Table 0-2 reveal significant variations in the perceived credibility of agricultural information sources among the 399 respondents, leading to the rejection of the null hypothesis that there are no significant differences in how sorghum farmers assess these sources. Fellow farmers ranked highest in perceived credibility with a mean score of 2.38, followed by extension officers at 2.34 and local leaders at 2.27. In contrast, the low credibility ranking of formal government institutions like TARI 2.19 can be attributed to homophily. Farmers tend to trust peers who share similar experiences and backgrounds, finding their advice more relatable and relevant. Formal institutions, like TARI, may be seen as distant or disconnected from farmers' everyday realities. As Rogers (2003) suggests, communication is more effective when individuals are homophilious, meaning the lack of shared experiences with formal sources can hinder the adoption of their advice.

Key informant interviews highlighted this trend. One local farmer shared that they preferred asking their neighbour for advice, as they felt understood and connected. Similarly, a regional extension officer mentioned that limited time for one-on-one engagement made it challenging for farmers to fully trust the information provided.

This contrasts with studies from regions with more robust institutional frameworks, such as those by Rust *et al.* (2022) and Antwi-Agyei and Stringer (2021), where expert sources often rank higher due to better training, communication, and resource availability. These differences highlight the contextual factors influencing credibility assessments, suggesting that in less institutionalized environments, farmers may rely more heavily on peer support. The rejection of the null hypothesis confirms that

significant variations exist in how sorghum farmers assess the credibility of agricultural information sources, emphasizing the critical role of context, accessibility, and interpersonal trust in shaping these perceptions.

Table 0-2: Perceived Credibility Variations of Agricultural Information Sources (n = 399).

Information Source	Mean	Std. dev	Rank
TARI agricultural experts	2.19	0.22	6
Agro-dealers	2.22	0.22	5
Extension officers	2.34	0.23	2
NGOs, CBOs and FBOs	2.26	0.22	4
Local leaders	2.27	0.19	3
Fellow farmers	2.38	0.15	1

The findings in Table 0-3 from the two-way ANOVA reveal significant variations in how farmers perceive the credibility of agricultural information, influenced by both the source and individual characteristics. The high F-statistic (81.21) and p-value (<0.001) for 'Information Source' indicate substantial differences in credibility across sources, while the F-statistic for 'Farmers' (4.51) and p-value (<0.001) suggest that personal factors also play a role. This aligns with the study by Walten and Wiedmann (2023) which emphasizes that familiarity and accessibility significantly impact perceptions. Farmers generally trust local, peer-based sources, like fellow farmers, more than institutional ones due to shared cultural contexts and practical relevance, as seen in Table 2. Individual factors, such as education and experience, further influence these assessments, highlighting the need for tailored communication strategies in agricultural extension to effectively promote improved farming practices.

Table 0-3: ANOVA Results Showing Variations in Perceived Credibility among Agricultural Information Sources

Source of Variation	Sum of Squares	Degree of freedom	Mean Square	F-statistic	P-value
Information Source	10.8935	5	2.1787	81.21	<0.001
Farmers	48.1304	398	0.1209	4.51	<0.001
Residual	53.3849	1,990	0.0268		
Total	112.4089	2,393	0.0470		

The findings in Table 0-4 reveal significant variations in how farmers perceive the credibility of agricultural information sources. Agro-dealers and TARI have similar, lower credibility ratings compared to other sources. In contrast, extension officers and fellow farmers stand out as the most trusted sources, consistently ranking above NGOs, CBOs, FBOs, and local leaders. While these organizations are viewed as more credible than TARI and agro-dealers, they do not match the trust placed in extension officers and fellow farmers.

The high credibility of extension officers aligns with (Mwania, 2021), which attributes this trust to frequent engagement and practical demonstrations that resonate with farmers. Similarly, fellow farmers gain trust through shared experiences and cultural understanding, as noted by Teye and Quarshie (2022). The lower ratings for TARI and agro-dealers may stem from limited farmer interaction and concerns over commercial motives (Quddus and Kropp, 2020). NGOs, CBOs, and FBOs occupy a middle ground, providing valuable services but often facing challenges due to their project-based approaches (Sanderson, 2021).

These results suggest that agricultural communication strategies should prioritize engagement with extension officers and fellow farmers, enhancing the visibility of institutional sources like TARI and agro-dealers to build trust and improve adoption of best practices among farmers.

Table 0-4: Pairwise Comparison of Agricultural Information Sources on Perceived Credibility.

Information Sources	Contrast	T	P> t 	95% CI
Agro-dealer vs TARI	0.0278	1.90	0.401	-0.0139, 0.0694
Extension officer vs TARI	0.1558	10.67	<0.001	0.1142, 0.1975
NGOs, CBOs and FBOs vs TARI	0.0734	5.03	<0.001	0.0318, 0.1151
Local-leaders vs TARI	0.0803	5.50	<0.001	0.0387, 0.1219
Fellow farmers vs TARI	0.1932	13.23	<0.001	0.1515, 0.2348
Extension officer vs Agro-dealers	0.1281	8.77	<0.001	0.0864, 0.1697
NGOs, CBOs and FBOs vs Agro-dealers	0.0457	3.13	0.022	0.0040, 0.0873
Local-leaders vs Agro-dealers	0.0525	3.60	0.004	0.0109, 0.0942
Fellow farmers vs Agro-dealers	0.1654	11.33	<0.001	0.1238, 0.2070
NGOs, CBOs and FBOs vs Extension officers	-0.0824	-5.64	<0.001	-0.1240, -0.0408
Local-leaders vs Extension officers	-0.0755	-5.17	<0.001	-0.1172, -0.0339
Fellow farmers vs Extension officers	0.0373	2.56	0.108	-0.0043, 0.0790
Local-leaders vs NGOs, CBOs and FBOs	0.0069	0.47	0.997	-0.0348, 0.0480
Fellow farmers vs NGOs, CBOs and FBOs	0.1197	8.20	<0.001	0.0781, 0.1617
Fellow farmers vs Local-leaders	0.1129	7.73	<0.001	0.0712, 0.1545

5.3. Factors Influencing Perceived Variations of Credibility of Agricultural Information Sources

The findings in Table 0-5, derived from a Multiple Logistic Regression Model, examined factors influencing the perceived credibility of agricultural information sources. The null hypothesis that no factors affect credibility perceptions was rejected. Among the variables analysed (gender, age, education, farm size, farming experience, household size, and information-seeking behaviour), gender and information-seeking behaviour had statistically significant effects.

Male farmers were 3.04 times more likely to perceive agricultural information sources as highly credible than female farmers (95% CI: 1.63, 5.66; $p < 0.001$). Additionally, higher levels of information-seeking behaviour increased credibility perception, with each unit increase raising the likelihood by 1.38 times (95% CI: 1.04, 1.83; $p = 0.024$). These results confirm that perceived variations in credibility are influenced by specific factors.

Key informant interviews reinforced these findings. Agricultural extension officers and local leaders noted that men often have greater access to formal agricultural training and advisory services, which strengthens their trust in institutional sources. In contrast, female farmers, due to cultural and logistical constraints, rely more on informal networks and peer-to-peer exchanges, which they sometimes perceive as less authoritative. This aligns with Ngigi and Muange (2022) and Aliyu *et al.* (2021), who highlight gender-based disparities in agricultural information access. Kaasa and Andriani (2021), further suggest that frequent interactions with formal institutions enhance men's trust in these sources, whereas women's engagement is often limited. Atsbeha and Gebre (2021), also points out that logistical challenges, such as mobility restrictions and household responsibilities, further constrain women's participation in extension activities.

The strong link between information-seeking behaviour and credibility perception was also emphasized by key informants. Extension officers reported that farmers who actively seek information, particularly those engaging with multiple sources such as agricultural fairs, radio programmes, and digital platforms, tend to develop greater discernment in assessing credibility. This aligns with Maqbool *et al.* (2023), who argue that active information seekers critically evaluate sources based on reliability and past experience. Cawley *et al.* (2023) emphasize that proactive farmers refine their ability to distinguish credible sources, while Barghusen *et al.* (2021) highlight the role of motivation and effort in shaping trust in agricultural information.

These findings highlight the need for inclusive, gender-sensitive communication strategies in agricultural extension. Strengthening farmers' information literacy, increasing outreach to female farmers, and leveraging multiple information channels

can enhance trust in agricultural information, supporting the adoption of improved farming practices and better agricultural outcomes.

Table 0-5: Factors Influencing Perceived Variations in the Credibility of Agricultural Information Sources (n= 399)

Sex	OR (95% Confidence interval)	P-value
Female	Ref	-
Male	3.04 (1.63, 5.66)	<0.001
Age	1.00 (0.97, 1.03)	0.938
Education	1.47 (0.8, 2.72)	0.215
Farm size	1.08 (0.93, 1.26)	0.308
Farming experience	1.01 (0.98, 1.04)	0.560
Household size	1.22 (0.78, 1.89)	0.386
Information Seeking Behaviour	1.38 (1.04, 1.83)	0.024

5.4. Influence of Source Credibility on Adoption of Improved Sorghum Farming Practices (N=399)

The findings in

Table 0-6, derived from Binary Logistic Regression models, examined the influence of trustworthiness, reliability, and accuracy both individually and as an aggregated credibility index on the adoption of improved sorghum farming practices. The models showed a good fit ($p > 0.05$), confirming the significance of all credibility dimensions. Thus, the null hypothesis that ‘source credibility has no significant influence on the adoption of improved sorghum farming practices in Dodoma, Tanzania’ was rejected. Specifically, trustworthiness increased the likelihood of adoption by 1.15 times (95% CI: 1.03, 1.28; $p = 0.012$), reliability by 1.18 times (95% CI: 1.08, 1.29; $p < 0.001$), and accuracy by 1.12 times (95% CI: 1.03, 1.23; $p = 0.011$). The aggregated credibility index further demonstrated a 1.06-fold increase in adoption likelihood (95% CI: 1.03, 1.10; $p = 0.001$), underscoring the central role of credibility in promoting the adoption of improved farming practices. These results align with existing literature highlighting source credibility as a key determinant of behavioural change. Arslan *et al.* (2022) argue that credible sources enhance message persuasiveness, leading to higher adoption rates. Similarly, Jennings *et al.* (2021) found that trust in the source increases the likelihood of acting on information. Antwi-Agyei and Stringer (2021) found that smallholder farmers were more likely to adopt improved farming techniques when information was delivered by extension agents perceived as knowledgeable and reliable.

Key informant interviews reinforce these findings. Extension officers indicated that farmers are more likely to adopt new techniques when information is disseminated by trusted sources, such as experienced extension agents and peer farmers with proven success in implementing new practices. These insights align with Hovland *et al.* (1953) and the Source Credibility Theory, which highlights that the credibility of the information source can significantly influence the rate of adoption. The findings also align with Diffusion of Innovation Theory (Rogers, 2003), especially during the persuasion stage, where the credibility of change agents determines whether farmers accept or reject innovations. In similar vein, the findings resonate with the Information-Seeking Behaviour model, indicating that credibility drives how and from whom farmers seek information. Farmers tend to engage more with sources they perceive as trustworthy, shaping their willingness to adopt new practices. However,

these findings contrast slightly with Srimulyo (2021), who argue that while credibility is vital, accessibility and cultural relevance also shape adoption.

These findings suggest that agricultural extension services should focus not only on disseminating information but also on building trust. Strengthening credibility in agricultural communication will boost adoption rates, leading to better farming practices and increased productivity. As Rogers (2003) highlights, a change agent's credibility hinges on recommending innovations that truly benefit adopters. While heterophilous sources (such as professional change agents) are viewed as competent, homophilous sources (like peers) are valued for their safety credibility. The ideal change agent would strike a balance between competence and safety credibility, blending technical expertise with social relatability.

Table 0-6: Influence of Source Credibility on Adoption of Improved Sorghum Farming Practices (N=399)

Credibility Aspect	OR (95% CI) **	P-value
Trustworthiness	1.15 (1.03,1.28)	0.012
Reliability	1.18 (1.08,1.29)	<0.001
Accuracy	1.12 (1.03,1.23)	0.011
Overall credibility	1.06 (1.03,1.10)	0.001

***Odds ratio (OR) for a unit change in source credibility*

6. Conclusion and Recommendations

6.1. Conclusion

The findings of this study reveal that adoption rates for improved sorghum farming practices are alarmingly low, with none exceeding 50%. This suggests that barriers like limited resources, high costs, and poor information dissemination hinder farmers from fully embracing these methods. The gap between available practices and their actual use on farms is evident. Farmers' perceptions of information credibility vary widely, influenced by the source and individual characteristics. They place greater trust in fellow farmers and extension officers, ranking them higher than NGOs, CBOs, FBOs, local leaders, TARI, and agro-dealers. This highlights the importance of social networks and hands-on engagement in building trust.

Additionally, factors such as gender and information-seeking behaviour significantly impact credibility perceptions. Male farmers tend to trust agricultural information sources more than female farmers, while those actively seeking information are more likely to perceive sources as credible. Overall, farmers are more inclined to adopt new practices when they view the information source as trustworthy. This stresses the need for agricultural stakeholders to enhance trust in information sources, ensuring research-backed innovations are effectively communicated.

6.2. Recommendations

To boost the adoption of improved sorghum farming practices, a collaborative approach involving various stakeholders is essential. Farmers should be encouraged to seek information from diverse sources like agricultural fairs, radio programs, and digital platforms, helping them assess credibility. Strengthening peer networks and engaging with extension services will bridge gaps between farmers and formal sources.

Extension services should focus on trust-building, personalized interactions, and using locally relevant language. Research institutions like TARI must enhance communication through accessible platforms such as mobile technology and community meetings. Collaboration with extension officers ensures timely, relevant research dissemination. NGOs, CBOs, and FBOs should adopt community-based approaches, fostering farmer participation in learning and decision-making. Policymakers should invest in communication infrastructure, enabling equitable access to resources and supporting local knowledge networks to drive adoption.

7. Implications, limitations, and future studies

7.1. Theoretical implications

The theoretical implications of this study align with the Diffusion of Innovations Theory, emphasizing that the credibility of information sources trustworthiness, reliability, and accuracy plays a key role in influencing farmers' adoption decisions. Additionally, the Information Seeking and Communication Model emphasises that farmers actively evaluate and seek credible information before adopting improved sorghum farming practices. This suggests that effective agricultural communication strategies should prioritize trusted, accessible, and farmer-preferred sources to enhance the dissemination and adoption of innovations.

7.2. Practical implications

This study offers insights to enhance agricultural extension in Dodoma by boosting information source credibility. Tailoring communication to various demographics, using both traditional and digital channels, and fostering farmer networks can increase trust. Policymakers should support multi-channel approaches to improve sorghum productivity. The findings emphasize the need for credible lead farmers and user-friendly AI technologies for successful adoption and greater trust in farming innovations.

7.3. Policy implications

This study emphasises the importance of policies that boost the credibility of agricultural information sources, especially government and donor-funded ones. Policymakers should improve extension services' reliability and accessibility, integrate

both traditional and digital channels, and strengthen farmer-extension relationships through training and support to encourage peer knowledge sharing.

7.4. Limitation and future studies

This study has limitations, including a potentially unrepresentative sample and reliance on self-reported data, which may introduce bias. Future research should involve a more diverse participant pool, track credibility changes over time, and explore community dynamics, especially for marginalized groups like women.

Availability of data

The corresponding author can provide the data used to support the findings of this study upon reasonable request.

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CHAPTER THREE

PAPER TWO

Repackaging Agricultural Research Information for Adoption of Improved Farming Practices among Sorghum Farmers in Dodoma Region, Tanzania

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Abstract

Promoting the adoption of improved farming practices hinges on making agricultural research understandable and accessible to smallholder farmers. However, effectively repackaging and disseminating this knowledge remains a global challenge. This study explored how language preference affects adoption, evaluated the quality attributes of repackaged information, and examined these relationships among 399 sorghum farmers in Dodoma, selected through a multi-stage sampling technique.

Data were analysed using descriptive statistics to identify key patterns, while Analysis of Variance (ANOVA) assessed variations in perceived quality attributes. Additionally, binary logistic regression estimated the likelihood of adoption based on these attributes. The findings revealed that 91% of farmers preferred Kiswahili, and this language preference significantly affected adoption ($p < 0.001$). Among the quality attributes of repackaged information, language, format, and completeness ranked highest. Regression analysis indicated that language, objectivity, and completeness were crucial in influencing adoption.

The study concludes that repackaging agricultural research in accessible language and formats tailored to local preferences can enhance the uptake of improved practices. Recommendations include using visual aids, providing hands-on training, and employing local languages to promote inclusivity. Building trust through community leaders and fostering collaboration among researchers, extension workers, and policymakers can help translate research findings into practical solutions, ultimately benefiting local communities and facilitating the adoption of better farming practices.

Keywords: adoption, agricultural research, information repackaging, Language Preference, sorghum farming

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1. Introduction

Information repackaging involves reprocessing and reshaping content to make it more practical and usable for specific audiences. For smallholder farmers, this is particularly important, as they often struggle with the technical language and abstract ideas presented in agricultural research. Given their generally low and diverse levels of formal education, simplifying complex information is essential for effective communication between researchers, extension officers, and farmers (Mushi *et al.*, 2023; Nugroho, 2021). When research is translated into clear, culturally relevant language and formats, it becomes more relatable and easier for farmers to apply in their daily practices (Panda *et al.*, 2023; Azubuike and Aji, 2021).

While tailoring agricultural information to match farmers' educational and cultural contexts is essential, these efforts are often challenged by Africa's vast linguistic diversity and institutional structures that shape information delivery. Smallholder farmers frequently struggle to adopt improved practices such as timely fertilizer use or effective pest control, due to technical jargon and language barriers (Autio *et al.*, 2021; Deguine *et al.*, 2021). With over 2,300 languages spoken across the continent, research published in English or French often remains inaccessible (Hannah *et al.*, 2024; Ariom *et al.*, 2022). These language barriers, combined with weak institutional coordination, limit farmers' access to vital knowledge, undermining their ability to benefit from innovations and improve their farming outcomes.

In Tanzania, decentralization has reshaped how agricultural information is shared by shifting communication and extension responsibilities to local authorities under the Local Government Reform Programme (Msuya, 2021; Masanyiwa *et al.*, 2019). This approach holds promise for making agricultural messages more responsive to farmers' realities. However, implementation faces hurdles such as weak coordination, limited funding, and the underuse of local languages in official communication. These challenges hinder efforts to reach all farmers effectively. Addressing them requires stronger institutional linkages, improved local capacity, and communication strategies

that embrace farmers' languages and cultural contexts to support meaningful participation and learning.

These communication challenges are especially visible in contexts like sorghum farming in Dodoma, Tanzania, where there is a clear gap between research dissemination and actual on-farm adoption. Sorghum is a key crop for food security and income among smallholder farmers, yet yields remain around one ton per hectare, far below the crop's potential of five tons (Mundia *et al.*, 2019; Mrema *et al.*, 2017). Although institutions like TARI have introduced improved practices, adoption remains low. This suggests that communication strategies have not effectively bridged the gap between research and farmers' needs, leaving many unable to access or apply the information in practice. This situation highlights the importance of not only making agricultural information available but also ensuring it is communicated in ways that reflect farmers' local realities, languages, and preferences.

While the importance of agricultural communication is increasingly recognized, there are still gaps in how effectively current strategies support the adoption of improved practices. Studies emphasize the need to repackage agricultural research for better clarity and usability (Fortner, 2022; Azubuike and Aji, 2021). However, specific quality attributes like completeness, clarity, relevance, and reliability, which impact communication effectiveness, are often overlooked, particularly in sorghum farming. Additionally, the influence of farmers' language preferences on understanding and applying repackaged content has not been thoroughly explored, especially in linguistically diverse, low-literacy areas like Dodoma. Empirical research is needed to assess how these factors affect farmers' engagement and adoption of improved practices.

This study aimed to assess how repackaged agricultural research information influences the adoption of improved sorghum farming practices among farmers in Dodoma, Tanzania. It examined the impact of farmers' language preferences on information accessibility, evaluate quality attributes such as clarity and relevance, and determine how these factors affect understanding and actual adoption behaviour.

1.1. Research Objectives

The study was guided by the following objectives:

- i. To assess how farmers' language preferences influence the adoption of improved sorghum farming practices.
- ii. To evaluate the quality attributes of repackaged agricultural research information, such as clarity, completeness, and format.
- iii. To determine the relationship between these quality attributes and the adoption of improved sorghum farming practices.

1.2. Research Questions

To achieve the above objectives, the study addressed the following research questions:

- i. How does farmers' language preference affect their understanding and adoption of improved sorghum farming practices?
- ii. What are the perceived quality attributes of repackaged agricultural research information, and how do these vary among farmers?
- iii. To what extent do attributes such as clarity, completeness, and language influence the adoption of improved farming practices?

1.3. Theoretical Framework

This study draws on two complementary theoretical frameworks: Diffusion of Innovations by Rogers (2003) and the Service Marketing Model (SMM) by Irons (1997). Together, they offer a comprehensive foundation for understanding how communication influences the adoption of improved sorghum farming practices among smallholder farmers. The Diffusion of Innovations Theory explains how new ideas and technologies are communicated and adopted within a social system. It emphasizes that adoption depends not only on the innovation itself but also on how it is communicated, considering factors such as message clarity, language, media choice, and compatibility with existing practices. In this study, language preference is treated as a key element of compatibility, reflecting how well the innovation aligns with farmers' socio-cultural contexts. Similarly, the repackaged information's attributes such as clarity, objectivity, and completeness, relate to DOI's concepts of simplicity and observability, which affect the rate of adoption.

The Service Marketing Model complements DOI by focusing on how agricultural information functions as a service. It highlights that the perceived value of information depends on how well it meets users' needs and expectations. From this perspective, farmers evaluate agricultural information much like consumers evaluate services, considering aspects such as credibility, accessibility, and responsiveness. By integrating these two frameworks, the study offers an understanding of adoption behaviour. While DOI highlights the pathways through which innovations spread, SMM emphasizes the quality of the communication process itself. This dual lens emphasises the importance of user-centred, linguistically appropriate, and clearly structured information in promoting adoption in resource-constrained settings like Dodoma.

1.4. Literature Review and Hypothesis Development

Effective communication of agricultural research information is widely recognized as essential for fostering the adoption of improved farming practices, particularly among smallholder farmers in developing regions. A growing body of empirical evidence highlights the significance of language preference in determining farmers' comprehension and application of agricultural innovations. For instance, Waithera (2021) reported that adoption rates significantly increased when agricultural information was delivered in languages preferred by farmers and aligned with their educational levels. This finding highlights the critical role of linguistic alignment in enhancing farmers' engagement with new technologies. Similarly, Gupta *et al.* (2024) and Sharma *et al.* (2020) found that language barriers inhibited the uptake of modern agricultural technologies, particularly among farmers with limited formal education. These findings suggest that language preference not only facilitates understanding but also promotes a sense of ownership and relevance regarding agricultural innovations. Further supporting this perspective, Bello *et al.* (2021) observed that language challenges significantly undermined the effectiveness of extension services, while Kirui *et al.* (2022) demonstrated that localized SMS communication improved the uptake of agronomic recommendations. Collectively, these studies, conducted across diverse African and Asian contexts, highlight that the use of farmers' preferred languages is not a peripheral issue but a fundamental determinant of adoption behaviour. However, it is noteworthy that many of these investigations focus on digital

communication platforms or general extension services without specifically examining the interaction between language preference and the repackaging of research-based agricultural information.

In addition to language, the quality of repackaged agricultural information plays a pivotal role in influencing farmers' decisions. Attributes such as clarity, relevance, timeliness, accessibility, and consistency have been consistently identified as essential in shaping the perceived utility of agricultural messages. For example, Ndimbwa *et al.* (2022) found that timely and contextually relevant information was positively associated with higher satisfaction levels among farmers. Njenga (2021) emphasized the value of repetition in reinforcing key messages, thereby supporting sustained behavioural change. Dilleen *et al.* (2023) noted that accuracy and contextual appropriateness significantly enhance the effectiveness of technology transfer efforts. Conversely, Sigigaba *et al.* (2022) highlighted that delayed or inadequately structured information delivery, particularly through overstretched extension systems, discouraged adoption and eroded farmers' trust in agricultural institutions. Furthermore, although digital media offer new opportunities, their efficacy is inconsistent. Mnzava and Jacobs (2023) observed that while some farmers benefitted from interactive and accessible digital formats, others were constrained by outdated content and overly technical language. These findings collectively emphasize the necessity of tailoring information to the cognitive, linguistic, and technological contexts of target audiences. Nevertheless, most existing studies treat these quality dimensions in isolation, with limited empirical attention devoted to understanding how their combination, particularly within repackaged research materials, affects adoption outcomes in low-resource rural settings.

Literature has also illuminated the effectiveness of various repackaging strategies, including visual, digital, and customized formats, in enhancing the comprehensibility and appeal of agricultural information. For instance, Laroche *et al.* (2019) reported that personalized SMS messages contributed to increased adoption of pest management practices. Bello *et al.* (2021) found that incorporating visual aids such as photographs and illustrations improved comprehension and stimulated interest in new technologies. Van Campenhout *et al.* (2021) concluded that brief instructional videos were more effective than conventional advice, particularly for low-literacy audiences.

Similarly, Mokhtar *et al.* (2022) demonstrated that interactive digital platforms were particularly beneficial for literate users when the content was designed to be engaging and accessible. While these studies affirm the value of tailored communication strategies, they tend to generalize across agricultural contexts and crops. Few specifically address the unique challenges of sorghum production in semi-arid regions such as Dodoma, Tanzania, where low literacy levels, infrastructural constraints, and linguistic diversity converge to create significant barriers to information uptake. Thus, there remains a notable gap in the literature concerning the combined influence of language preference and repackaged information quality on the adoption of improved sorghum farming practices.

This study aimed to assess how repackaged agricultural research influences the adoption of improved sorghum farming practices among smallholder farmers in Dodoma. It focused on the impact of language preference on accessibility and assessed qualities like clarity and relevance, aiming to develop more inclusive communication strategies for resource-constrained rural areas. Based on the theoretical framework and reviewed literature, the following null hypotheses were proposed:

H₀: There is no significant difference in the adoption of improved farming practices among farmers based on their language preference.

H₀: There are no statistically significant variations in the quality attributes associated with repackaged agricultural research information

H₀: There is no statistically significant relationship between agricultural research information repackaging and the adoption of improved sorghum farming practices.

1.5. Conceptual Framework

This study's conceptual framework explores how farmers' language preferences and the quality of repackaged agricultural research information influence the adoption of improved sorghum farming practices. Key independent variables include language preference and quality attributes like clarity, relevance, and timeliness. The dependent variable focuses on practices such as land preparation, improved seed use, and pest control. The framework suggests that adoption is shaped not just by information availability but also by its effective communication tailored to farmers' socio-cultural

and linguistic contexts. By emphasising the importance of user-centred communication, it highlights that well-adapted, clearly repackaged information enhances understanding and uptake, making agricultural innovations more relevant in rural communities.

2. Methodology

2.1. Study Area

The study was conducted in Dodoma Region, located in Tanzania's semi-arid central zone, where low and erratic rainfall (500–800 mm annually) and high temperatures favour drought-tolerant crops such as sorghum. As a major sorghum-producing area, Dodoma relies heavily on this crop for both food security and smallholder livelihoods. Sorghum's resilience to climate variability and its nutritional and economic value makes it a strategic crop in addressing regional food insecurity (Amede *et al.*, 2023; Mwamahonje *et al.*, 2021). This context provides a suitable setting to examine how repackaged agricultural research information influences the adoption of improved sorghum farming practices and decision-making.

2.2. Research Design

This study used a mixed-methods approach within a cross-sectional survey design to gain a comprehensive view of sorghum farming practices. By combining quantitative and qualitative data collected at one point in time, it aimed to understand how repackaging agricultural research information affects farmers' adoption of improved practices. This method captures measurable trends while offering insights into farmers' experiences and decision-making processes (Clark, 2019). The cross-sectional design also enables efficient data collection and examination of the relationships between communication variables and adoption behaviours (Mugenda and Mugenda, 2003).

2.3. Population and Sampling Techniques

The target population for this study comprised smallholder sorghum farmers in Dodoma, Tanzania. To ensure a representative sample, a multi-stage sampling technique was employed. The process began with the random selection of three districts namely, Kongwa, Kondoa, and Bahi, from a total of seven districts in the region. Next, three wards were randomly chosen within each of the selected districts.

Following this, three villages were selected at random from each ward. In the final stage, households were identified from lists within the chosen villages, focusing specifically on heads of households, who typically act as the primary decision-makers in farming activities.

The sample size was calculated using Cochran's formula, as shown in equation (1), which recommends a minimum of 384 respondents. However, to account for possible non-responses, incomplete questionnaires, and data inconsistencies, common occurrences in field-based research, the final sample was slightly increased to 399 sorghum farmers. This adjustment is consistent with methodological guidance provided by Mugenda and Mugenda (2003) and Saunders *et al.* (2003), who emphasize the importance of anticipating and mitigating such limitations during data collection. Furthermore, as Bryman (2016) asserts, increasing the sample size enhances statistical power and improves the reliability of subgroup analyses. Increasing sample size contributes to the robustness, reliability, and overall validity of the study's findings.

$$n_o = \frac{Z^2 pq}{e^2} \quad (1)$$

$$n_0 = \frac{(1.96^2 \times 0.5 \times 0.5)}{0.05^2} = 384$$

2.4. Data Collection Methods

Quantitative data were collected using a structured questionnaire administered by the researcher. This instrument captured key variables such as language preference, perceptions of information repackaging, including clarity, simplicity, and completeness, and indicators of adoption of improved sorghum farming practices. To enhance reliability and validity, the questionnaire was pre-tested with 38 respondents. This pretest sample size aligns with recommendations for instrument validation (Gunawan *et al.*, 2021). Complementing the quantitative data, qualitative insights were obtained through interviews with 15 key informants, including nine extension officers from nine wards and six agricultural experts from TARI, enriching the understanding of participants' knowledge and experiences.

2.5. Variables and Measurement

This study measured adoption of improved sorghum farming practices such as land preparation, fertilizer use, weed and pest control, and post-harvest handling as the dependent variable. These practices represent key stages in sorghum production. Independent variables included language preference (the language respondents best understood agricultural information in), repackaging attributes (clarity, format, completeness), and perceived information quality, all of which reflect how effectively the content was tailored to meet farmers' communication needs. These variables are described in Table 0-1.

Table 0-1: Variables and Measurement Methods

Variable	Type	Definition/ Description	Measurement Method
Adoption of Improved Sorghum Farming Practices	Dependent	Adoption status or level of improved sorghum farming techniques	Binary (0 = not adopted, 1 = adopted); also measured as an index for ANOVA analysis
Language Preference	Independent	Language in which the farmer best understands agricultural information	Categorical (e.g., Kiswahili, local language, English); analysed using ANOVA
Information Repackaging Attributes	Independent	Perceived quality of information based on multiple communication attributes	Likert scale (1–5) for each of 10 attributes: clarity, completeness, relevance, etc.
Information Quality Index	Intermediate	Composite measure reflecting the perceived quality of repackaged agricultural information	Computed using average scores across ten attributes; analysed with two-way ANOVA

2.6. Data Analysis

The analysis employed both quantitative and qualitative methods to explore how language preference and the quality of repackaged agricultural research information

influence the adoption of improved sorghum farming practices. Descriptive statistics, such as frequencies and percentages, summarized farmers' language preferences, while means and standard deviations highlighted variations in their perceptions of information attributes. A one-way ANOVA assessed whether adoption levels differed based on language preferences and perceived quality. Additionally, binary logistic regression identified key factors affecting adoption likelihood. Qualitative data from interviews were thematically analysed, revealing insights into communication strategies, language use, and barriers to adoption, enriching our understanding of farmers' preferences and behaviours.

2.7. Language Preference and Adoption of Improved Farming Practices

ANOVA model was employed to evaluate differences in the adoption of improved farming practices among farmers, categorized by their language preference. This allowed for the comparison of means across multiple groups (in this case, different language preferences) to determine if there were statistically significant differences in adoption. The formulation of the model is presented in equation (2).

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij} \quad \begin{cases} i=1,2,3 \\ j=1,2,\dots,399 \end{cases} \quad (2)$$

where:

Y_{ij} is the dependent variable (the adoption index), μ is an overall mean, τ_i is the effect of the language preference, and ε_{ij} is the random error term which is normally identically distributed $(0, \sigma^2)$. A Turkey's HSD (Honestly Significant Difference) test was performed after an ANOVA model with the aim of identifying groups (language preference) that were significantly different from each other in terms of adoption.

To validate the ANOVA model used, a diagnostic test was conducted. Normality of residuals was evaluated using the Shapiro-Wilk Test while Levene's test was performed to assess homogeneity of variances, with results indicating no significant violation of these assumptions ($p > 0.05$).

2.8. Variation in Repackaged Agricultural Research Information Attributes

A two-way analysis of variance was conducted to assess variations in the quality of repackaged agricultural information. This quality was measured using a 1-5 Likert

scale, where respondents rated various attributes based on specific criteria. Higher scores indicated better quality. The independent variable included attributes like objectivity, relevance, reliability, and accessibility, chosen for their importance in enhancing agricultural communication effectiveness. The Model formulation is as presented in equation (3).

$$Y_{ij} = \mu + \tau_i + \beta_j + \varepsilon_{ij} \begin{cases} i=1,2,3 \\ j=1,2,\dots,399 \end{cases} \quad (3)$$

where:

Y_{ij} is the dependent variable (information quality index), μ is an overall mean, τ_i is the attribute effect, β_j is the j th individual farmer perception effect and ε_{ij} is the random error term which is normally identically distributed $(0, \sigma^2)$.

2.9. Information Repackaging and Adoption of Improved Farming Practices

A binary logistic regression model was employed to examine the influence of repackaging agricultural information on the adoption of improved farming practices. The dependent variable represented the adoption status, measured as a binary outcome (0 for no adoption, 1 for adoption). The ten attributes related to repackaging (measured in a scale from 1 to 5, the higher the value implying higher level of attribute) were treated as independent variables within the model formulation as shown in the equation (4).

$$\begin{aligned} \logit(\pi(x)) = & \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 \\ & + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} \end{aligned} \quad (4)$$

Where;

$x_1 = \text{Objectivity}$, $x_2 = \text{Relevancy}$, $x_3 = \text{Reliability}$, $x_4 = \text{Accessibility}$,
 $x_5 = \text{Completeness}$, $x_6 = \text{Language}$, $x_7 = \text{Timeliness}$, $x_8 = \text{Format}$,
 $x_9 = \text{Media Choice}$, $x_{10} = \text{Currency}$

2.10. Model Specification, Robustness Checks, and Goodness of Fit

As part of model specification, socio-demographic variables such as gender, age, marital status, education level, farm size, and household size were examined to assess their role as control variables. However, none significantly influenced the relationship between repackaging attributes and adoption, leading to their exclusion to maintain

model parsimony. Robustness checks confirmed model stability, with all repackaging variables showing Variance Inflation Factor (VIF) values below 2.9, indicating no multicollinearity concerns. Additionally, the model's predictive accuracy was evaluated using the Area Under the ROC Curve (AUC), which yielded a value of 0.78, demonstrating strong discriminative power in identifying adoption behaviour.

3. Findings

3.1. Language Preference and Adoption of Improved Sorghum Farming Practices

The study findings indicate that 91% of respondents preferred accessing agricultural information in Kiswahili, while only 6% favoured a specific local language, as shown in (Table 0-2). This indicates a strong preference for Kiswahili as a means of communicating agricultural research information.

Table 0-2: Farmers' Language Preference (n = 399)

Language Preference	Frequency (n)	Percentage (%)
Local languages	24	6.0
Kiswahili	363	91.0
Both Kiswahili and Local Language	12	3.0

ANOVA analysis in (Table 0-3) demonstrated a significant relationship between language preference and the adoption of improved farming practices, with a p-value less than 0.001. Thus, the null hypothesis, that there is no significant difference in the adoption of improved farming practices among farmers based on their language preference, was rejected. This suggests a clear connection between the language in which agricultural information is communicated and its subsequent adoption by farmers.

Table 0-3: Association between Language Preference and Adoption of Improved Farming Practices

Source Variation	of Sum Squares	of DF	Mean Square	F-statistic	P-value
Language preference	7.7849	2	3.8924	14.04	<0.001
Residual	109.7993	396	0.2773		
Total	117.5841	398			

The ANOVA results revealed significant differences in how farmers adopt improved practices based on their language preferences for agricultural information. According to Table 0-4, farmers who preferred Kiswahili had an adoption level 0.5797 units higher than those favouring local languages, with a t-statistic of 5.22 and a p-value under 0.001, indicating a highly significant difference. This supports rejecting the null hypothesis that no differences exist. Furthermore, farmers using both Kiswahili and local languages showed even greater adoption, increasing by 0.681 units compared to those preferring only local languages. However, the comparison between those favouring both languages and only Kiswahili was less clear, showing no significant difference.

Table 0-4: Comparison of Adoption for Improved Farming Practices Based on Language Preference

Language preference	Contrast	T	P> t	95% Confidence Interval
Kiswahili vs Local language	0.5797	5.22	<0.001	0.3186, 0.8408
Both Kiswahili and Local language vs Local language	0.681	3.66	<0.001	0.2430, 1.1189
Both Kiswahili and Local language vs Kiswahili	0.1012	0.66	0.789	-0.2622, 0.4647

3.2. Agricultural Research Information Repackaging Quality Attributes

The analysis of repackaged agricultural research information attributes showed that language emerged as the most critical factor, receiving a mean score of 2.97. The format of the information followed, with a mean score of 2.83, emphasizing the need for user-friendly presentation. Completeness ranked third, with a mean score of 2.66. The ANOVA results revealed significant differences in how farmers adopt improved practices based on their language preferences for agricultural information. According to Table 4, farmers who preferred Kiswahili had an adoption level 0.5797 units higher than those favouring local languages, with a t-statistic of 5.22 and a p-value under 0.001, indicating a highly significant difference. This provides evidence for rejecting the null hypothesis, suggesting that differences do exist. Furthermore, farmers using both Kiswahili and local languages showed even greater adoption, increasing by 0.681

units compared to those preferring only local languages. However, the comparison between those favouring both languages and only Kiswahili was less clear, showing no significant difference as shown in Table 0-5.

Table 0-5: Ranking of Repackaged Agricultural Research Information Attributes by Farmers

Attributes	Mean	Std. dev	Rank
Objectivity	2.63	0.75	7
Relevancy	2.66	0.82	4
Reliability	2.63	0.82	6
Accessibility	2.41	0.84	10
Completeness	2.66	0.83	3
Language	2.97	0.94	1
Timeliness	2.59	0.88	9
Format	2.83	0.87	2
Media choice	2.64	0.82	5
Currency	2.62	0.82	8

The two-way ANOVA results (Table 0-6) indicated significant differences in farmers' perceptions of these attributes, with an F-statistic of 27.36 and a p-value less than 0.001. Consequently, the null hypothesis stating that there are no statistically significant variations in the quality attributes associated with repackaged agricultural research information was also rejected. This variability highlights the importance of optimizing communication strategies to address diverse farmer needs effectively.

Table 0-6: Analysis of Variance for Agricultural Research Information Repackaging Quality Attributes

Source of Variation	Sum of Squares	DF	Mean Square	F-statistic	P-value
Information Attributes	79.037845	9	8.7820	27.36	<0.001
Farmers	1660.0877	398	4.1711	12.99	<0.001
Residual	1149.8622	3582	0.3210		
Total	2888.9877	3989			

Table 0-7 illustrates the impact of various information repackaging attributes on the adoption of improved farming practices. The results indicate that language, format, and accessibility are significantly more influential than other factors. Language emerged as the strongest predictor, with notable differences compared to attributes like objectivity and reliability ($p < 0.001$). In contrast, aspects such as completeness and currency showed minimal variation. Overall, clear language and accessibility are vital for encouraging adoption, surpassing other attributes.

Table 0-7: Comparison of Adoption for Improved Farming Practices Based on Information Repackaging Quality Attributes

Information Repackaging Quality Attributes	Contrast	SD	T	P> t
Relevancy vs Objectivity	0.0301	0.0595	0.51	1.000
Reliability vs Objectivity	0.0025	0.0595	0.04	1.000
Accessibility vs Objectivity	-0.218	0.0595	-3.67	0.009
Completeness vs Objectivity	0.0351	0.0595	0.59	1.000
Language vs Objectivity	0.3434	0.0595	5.77	<0.001
Timeliness vs Objectivity	-0.0426	0.0595	-0.72	0.999
Format vs Objectivity	0.203	0.0595	3.41	0.023
Variate media vs Objectivity	0.015	0.0595	0.25	1.000
Currency vs Objectivity	-0.01	0.0595	-0.17	1.000
Reliability vs Relevancy	-0.0276	0.0595	-0.46	1.000
Accessibility vs Relevancy	-0.2481	0.0595	-4.17	0.001
Completeness vs Relevancy	0.005	0.0595	0.08	1.000
Language vs Relevancy	0.3133	0.0595	5.27	<0.001
Timeliness vs Relevancy	-0.0727	0.0595	-1.22	0.969
Format vs Relevancy	0.1729	0.0595	2.91	0.104
Variate media vs Relevancy	-0.015	0.0595	-0.25	1.000
Currency vs Relevancy	-0.0401	0.0595	-0.67	1.000
Accessibility vs Reliability	-0.2206	0.0595	-3.71	0.008
Completeness vs Reliability	0.0326	0.0595	0.55	1.000
Language vs Reliability	0.3409	0.0595	5.73	<0.001
Timeliness vs Reliability	-0.0451	0.0595	-0.76	0.999
Format vs Reliability	0.2005	0.0595	3.37	0.026
Variate media vs Reliability	0.0125	0.0595	0.21	1.000
Currency vs Reliability	-0.0125	0.0595	-0.21	1.000
Completeness vs Accessibility	0.2531	0.0595	4.26	0.001
Language vs Accessibility	0.5614	0.0595	9.44	<0.001
Timeliness vs Accessibility	0.1754	0.0595	2.95	0.093
Format vs Accessibility	0.4211	0.0595	7.08	<0.001
Variate media vs Accessibility	0.2331	0.0595	3.92	0.004
Currency vs Accessibility	0.208	0.0595	3.5	0.017
Language vs Completeness	0.3083	0.0595	5.18	<0.001

Timeliness vs Completeness	-0.0777	0.0595	-1.31	0.953
Format vs Completeness	0.1679	0.0595	2.82	0.129
Variate media vs Completeness	-0.0201	0.0595	-0.34	1.000
Currency vs Completeness	-0.0451	0.0595	-0.76	0.999
Timeliness vs Language	-0.386	0.0595	-6.49	<0.001
Format vs Language	-0.1404	0.0595	-2.36	0.351
Variate media vs Language	-0.3283	0.0595	-5.52	<0.001
Currency vs Language	-0.3534	0.0595	-5.94	<0.001
Format vs Timeliness	0.2456	0.0595	4.13	0.002
Variate media vs Timeliness	0.0576	0.0595	0.97	0.994
Currency vs Timeliness	0.0326	0.0595	0.55	1.000
Variate media vs Format	-0.188	0.0595	-3.16	0.051
Currency vs Format	-0.213	0.0595	-3.58	0.013
Currency vs Variate media	-0.0251	0.0595	-0.42	1.000

3.3. Agricultural Information Repackaging on Adoption of Improved Farming Practices

Binary logistic regression analysis in

Table **0-8** revealed a strong link between the quality of repackaged information and the adoption of improved farming practices. Key attributes like language (OR = 2.93, $p < 0.001$), objectivity (OR = 2.64, $p = 0.001$), and completeness (OR = 2.10, $p = 0.009$) significantly increased the likelihood of adoption. The model demonstrated good discriminatory power, with an area under the curve (AUC) of 0.727. This evidence led to rejecting the null hypothesis of no significant relationship between information repackaging and improved sorghum farming practices.

Table 0-8: The influence of Agricultural Research Information Repackaging on Adoption of Improved Farming Practices

ARI Attribute	Odds Ratio	Std. error	Z	P> z	95% conf. Interval
Objectivity	2.6395	0.7607	3.37	0.001*	1.5003, 4.6435
Relevancy	1.5615	0.4424	1.57	0.116	0.8962, 2.7209
Reliability	1.8132	0.5157	2.09	0.036*	1.0383, 3.1664
Accessibility	1.2809	0.3723	0.85	0.394	0.7247, 2.2642
Completeness	2.1022	0.5994	2.61	0.009*	1.2022, 3.6759
Language	2.9309	0.8557	3.68	<0.001*	1.6539, 5.1941
Timeliness	1.6214	0.4644	1.69	0.092	0.9249, 2.8424
Format	2.2243	0.6359	2.80	0.005*	1.2701, 3.8954
Media Choice	2.4972	0.7223	3.16	0.002*	1.4165, 4.4022
Currency	2.1609	0.6205	2.68	0.007*	1.2308, 3.7937

* Indicates significant results

4. Discussion

The findings of this study reveal the vital role that language preference plays in adopting improved sorghum farming practices. An impressive 91% of respondents indicated that Kiswahili was their preferred language for receiving agricultural information. This preference highlights the importance of linguistic accessibility, ensuring that messages are not only delivered but also understood and acted upon effectively. Research by Ojo and Koledoye (2022) supports this idea, emphasizing that agricultural communication is most impactful when conveyed in a language familiar to the audience. Similarly, Abubakar (2024) pointed out that communication in a shared language enhances both comprehension and farmers' confidence, particularly in areas with varying levels of educational attainment.

The significant relationship between language preference and the adoption of improved practices was confirmed by ANOVA results ($p < 0.001$). This indicates that language functions not just as a means of communication but also as a critical factor in establishing clarity and trust. According to Rogers' Diffusion of Innovations Theory, the likelihood of adopting innovations increases when they are communicated in ways that resonate with the cultural and social contexts of potential adopters (Rogers, 2003). Therefore, agricultural research institutions and extension agents should prioritize

Kiswahili in their communication efforts to enhance message reception and adoption rates among smallholder farmers. A key informant reinforced this finding, noting that messages delivered in English were often overlooked due to limited comprehension. In contrast, those delivered in Kiswahili led to significantly better participation in training and follow-up activities. This suggests that using an accessible language not only fosters inclusivity but also boosts farmers' confidence in the information, enhancing their willingness to adopt new practices. Thus, grounding agricultural communication in suitable linguistic frameworks is essential for meaningful farmer engagement.

The study also revealed that farmers who received information in both Kiswahili and local dialects exhibited higher adoption rates than those exposed to messages in only one language. This finding aligns with Arshad (2024), who highlighted the advantages of integrating national and indigenous languages to broaden the reach and relevance of agricultural information. Interestingly, while previous research often focused on local languages, this study found Kiswahili to be perceived as more authoritative and suitable for technical content, while local languages enhanced contextual understanding. This indicates that bilingual approaches can effectively bridge scientific content with local realities, improving communication effectiveness. Extension systems should, therefore, utilize both Kiswahili and local dialects to enhance comprehension and cultural relevance.

Additionally, the study examined farmers' perceptions of the repackaging of agricultural information, specifically its clarity, format, and completeness. Statistically significant differences in perceptions (ANOVA $F = 27.36$, $p < 0.001$) suggest that farmers actively evaluate the quality of the information they receive. This aligns with the Service Marketing Model, which posits that users assess services, including information, based on expectations and perceived value. Information that is clearly presented, well-structured, and complete is more likely to be trusted and acted upon. Conversely, overly technical or poorly organized messages can hinder comprehension and limit utility. A key informant noted that repackaging messages into visual formats, narratives, or simple dialogues, especially in Kiswahili, greatly improved engagement. Farmers found this type of content more relatable and easier to understand. These findings affirm the work of Ellefson (2023), who found that repackaged messages reflecting real-life contexts are more likely to influence behavioural change. This

highlights the necessity for communication strategies that extend beyond mere translation to ensure cognitive and experiential alignment with farmers' realities.

Logistic regression analysis further validated the importance of specific repackaging attributes. Language (Odds Ratio = 2.93), objectivity (OR = 2.64), and completeness (OR = 2.10) emerged as strong predictors of adoption. These elements not only influence usability but also the credibility of agricultural information. This supports the assertions of Thomas *et al.* (2023), who emphasized that the credibility and completeness of information are vital for acceptance, particularly in agriculture where decisions can have significant implications. A key informant corroborated that farmers are more responsive to messages perceived as factual, unbiased, and complete.

Therefore, the adoption of improved sorghum farming practices in Dodoma is greatly influenced by how agricultural information is communicated and repackaged. Kiswahili acts as a crucial medium for clarity and engagement, while the quality of repackaging, especially in terms of language, objectivity, and completeness, significantly affects farmers' decisions to adopt innovations. These findings support the principles of Diffusion of Innovations Theory and the Service Marketing Model, highlighting the need for linguistically appropriate and user-centred communication strategies to drive agricultural transformation in semi-arid regions like Dodoma and beyond.

5. Conclusion and Recommendations

5.1 Conclusion

The findings of this study highlight the vital importance of language preference and the quality of repackaged agricultural information in promoting improved sorghum farming practices among farmers in Dodoma, Tanzania. With 91% of respondents preferring Kiswahili, using a familiar language significantly enhances communication. Statistical analyses reveal a strong link between language choice and the adoption of innovative practices. Key attributes like objectivity and completeness help build trust among farmers, encouraging them to embrace new methods. These results align with Rogers' Diffusion of Innovations Theory, emphasizing the need for communication strategies tailored to farmers' linguistic and cultural contexts. By focusing on clear language and user-friendly formats, agricultural extension services can engage farmers

more effectively, fostering the adoption of improved practices and promoting inclusive development in semi-arid regions like Dodoma and beyond.

5.2 Recommendations

Based on the study findings, it is recommended that extension workers communicate agricultural research in Kiswahili. Incorporating visual aids like charts, videos, and illustrated guides can enhance clarity and help farmers adopt new practices more easily. TARI should present information in relatable formats for smallholder farmers. Collaborating with extension workers ensures vital content is available in Kiswahili and local dialects, catering to diverse needs. NGOs can fund training programs to help agricultural officers simplify complex concepts. Partnering with media organizations for engaging campaigns can also reach fewer literate farmers. Additionally, organizing peer-to-peer training can strengthen community ties, allowing farmers to share experiences in a comfortable language, which fosters a supportive learning environment and improves farming outcomes.

6. Implications, Limitations, and Future Studies

6.1. Practical Implication

This paper evidences the critical role of making agricultural research more accessible to smallholder farmers by simplifying technical messages. Tailored information for their level of understanding would enhance the adoption of better farming practices that drive broader agricultural transformations through improved communication and application of innovative techniques.

6.2. Policy Implications

The study suggests that agricultural policy should prioritize Kiswahili and local languages in communication to improve understanding and adoption of better farming practices. Policies should promote farmer-centered strategies in extension programs, focusing on clear, complete, and objective information tailored to farmers' backgrounds. Additionally, training for extension officers on effective communication and resources for multilingual materials will strengthen the connection between research and practice, enhancing productivity and resilience among smallholder farmers.

6.3. Theoretical Implications

This study enhances the use of Diffusion of Innovations Theory and the Service Marketing Model in agricultural communication. It highlights that compatibility, particularly in linguistic and cultural contexts, is crucial for adoption. Farmers' preference for Kiswahili and effective information repackaging improves their decision-making. Smallholder farmers assess agricultural messages based on clarity, completeness, and objectivity, which fosters trust and influences their actions. These insights highlight the need for user-centered communication and pave the way for further research on tailored messaging strategies to support rural agricultural innovation.

6.4. Limitations of the Study and Future Research

This study offers valuable insights but has limitations. It focused solely on smallholder farmers in Dodoma, which may not represent other regions. Self-reported data could introduce bias, and the study did not consider factors like market access or extension support. Future research should expand geographically and use longitudinal methods to better understand how communication influences the adoption of improved farming practices.

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CHAPTER FOUR

PAPER THREE

Effects of Communication Media on Adoption of Improved Sorghum Farming Practices in Dodoma Region, Tanzania

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Abstract

The adoption of improved sorghum farming practices holds great significance for enhancing food security and improving the livelihoods of smallholder farmers, particularly in drought-prone regions like Dodoma, Tanzania. However, the effects of different communication media on promoting the adoption of these practices are not well understood. This study examined the effects of various communication media on smallholder farmers' adoption of improved sorghum farming practices. Results indicate that interpersonal contact emerged as the most widely used communication medium, with an average score of 2.78, while newspapers, songs, and drama were the least utilized media, with average scores of 1.01, 1.02, and 1.03, respectively. ANOVA analysis demonstrated a significant difference in the use of communication media for accessing agricultural information, supported by an F-statistic of 253.11 and a corresponding p-value of <0.001, providing strong evidence for the observed variations in communication media usage. Binary logistic regression results revealed that interpersonal interactions were the primary source of agricultural information, strongly correlated with higher adoption. Direct interpersonal communication facilitated information exchange, encompassing both verbal and non-verbal cues as suggested by Media Richness Theory. Additionally, mobile phones and

television had a significant positive effect on the adoption of all six improved sorghum farming practices. These findings emphasise the key role of communication media in adoption and recommend a flexible approach that incorporates interpersonal communication, mobile phone technology, and television tailored to local contexts to enhance the adoption of improved sorghum farming practices among smallholder farmers.

Keywords: Communication, Media, Adoption, Sorghum, Farming Practices

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1. INTRODUCTION

Communication media play a significant role in the transmission of information, serving as pathways through which messages are communicated and understood. They are important communication tools for disseminating knowledge, sharing ideas, and fostering understanding among individuals and groups (Lee *et al.*, 2021; Oltarzhevskiy, 2019). However, it is important to acknowledge that the effectiveness of communication media is not always and universally the same. The effectiveness of communication media may vary due to their ability to carry and convey information, differences in audience, context, and situations. Soedarsono *et al.* (2020) and Hyland-Wood *et al.* (2021), posit that different situations and audiences necessitate the use of specific media to ensure effective communication. Therefore, selecting and using communication media appropriately can improve the conveyance of information and efficiently support knowledge exchange.

In the realm of disseminating agricultural information, the selection and use of appropriate communication media is of paramount importance. Farmers depend on the media to acquire information that can enhance their farming methods, mitigate risks, and boost productivity and livelihoods (Mansoor, 2021; Sonmez Cakir and Adiguzel, 2020). Communication media grant farmers access to knowledge, information, and updates on available novel farming practices and technologies (Omulo and Kumeh, 2020; Subejo *et al.*, 2019). They bridge information gap, offer new perspectives to farmers, and contribute to the betterment of agriculture in terms of livelihoods and sustainability. To enhance information exchange, Mwinami *et al.* (2023), suggest that appropriate communication media are required. Similarly, Mtega (2021), argues that

selecting the appropriate communication channels is essential for achieving effective communication. The criteria on the selection and use of appropriate communication media differ among individuals. This is associated with differences in preferences, accessibility, context and technology proficiency. Thus, recognizing the effectiveness of communication media and understanding the diverse needs of smallholder farmers is vital in promoting the adoption.

Globally, several studies have been conducted to explore the impact of communication media on the adoption of agricultural practices and technologies . Akhter *et al.* (2021) and Tucker *et al.* (2022) highlighted how interpersonal media had a significant impact on farmers' decisions to adopt new farming methods in both Asia and North America. According to Erjavec *et al.* (2021), digital platforms, mobile phones, and televisions were found to be beneficial in sharing knowledge and promoting the adoption of improved agricultural techniques in Europe. Short films had a significant impact in encouraging adoption of improved farming methods among Ugandan farmers, as shown by Van Campenhout *et al.* (2020). According to Tambo *et al.* (2019), radio and drama had a beneficial impact on Rwandans' adoption of ecologically friendly management practices.

In Tanzania, agricultural research institutes and stakeholders have made concerted efforts to disseminate agricultural information to smallholder farmers through various media. The most commonly used communication media by farmers in Tanzania include print media (such as newspapers and posters), electronic media (including radio, television, and mobile phones), and interpersonal interactions (such as face-to-face communication) (Benard *et al.*, 2020; (Mtega, 2021; Ndimbwa *et al.*, 2021; Peter *et al.*, 2021; Silvestri *et al.*, 2021; Benard *et al.*, 2020). Additionally, the TARI communication strategy acknowledges the significance of using a variety of communication media for sharing agricultural information. It emphasizes a blend of traditional methods such as farm visits and Farmer Field Schools with modern or hybrid media such as web platforms, robotics, radios, and TV programs. The strategy emphasises the value of integrating digital tools as a key opportunity for transferring technology from the source to end users (TARI, 2019).

However, despite these efforts, there is a noticeable low adoption rate of various improved sorghum farming practices among farmers in Dodoma, Tanzania. This is also noted by Tanzania Agricultural Policy (2013) which states that a significant majority of smallholder farmers have not yet adopted the recommended agricultural technologies and practices, such as the use of improved seeds, fertilizers, suitable farm tools, rainwater harvesting, and post-harvest technologies (URT, 2013). This lack of adoption poses a threat to food security and rural livelihoods. The existing research on the effects of communication media on promoting the adoption of improved sorghum farming practices in Dodoma, Tanzania is limited. While studies by (Tegene *et al.*, 2023; Atser *et al.*, 2022; Ndimbwa *et al.*, 2019; Moyo and Salawu, 2018) have explored the use of different communication media in agricultural contexts, there is a lack of specific research focusing on the effectiveness of communication media in promoting the adoption of improved sorghum farming practices in Dodoma. This knowledge gap hampers the development of effective strategies to address barriers to adoption which undermines the optimal sorghum production in the region. Therefore, on the basis of the literature reviewed it was hypothesised that;

- i. Ho: There are no variations in the use of communication media in accessing agricultural information pertaining sorghum farming
- ii. Ho: There is no significant relationship between the use of different communication media and the adoption of improved sorghum farming practices.

2. Theoretical Review

2.1. Media Richness Theory

In this study, both Diffusion of Innovation theory (Rogers, 1995) and the Media Richness Theory (MRT) (Daft and Lengel, 1983) were utilized to examine the adoption of improved sorghum farming practices. The diffusion or spread of an innovation relies on communication channels, which refer to the means through which a message is transmitted from the source to the receiver. While the Diffusion of Innovation theory provides valuable insights into the communication and adoption of innovations through various media, it does not directly consider the effectiveness of the communication media used to promote innovation adoption. To address this gap, the study incorporated the Media Richness Theory into its analysis. The Media

Richness Theory suggests that different communication media vary in their effectiveness in conveying information. This theory identifies four important dimensions that determine the richness of a medium: its ability to convey multiple cues (both verbal and nonverbal), provide immediate feedback, accommodate natural language use, and convey personalised emotions and feelings. In this particular study, the Media Richness Theory was used to assess the effects of various communication media, such as radio, television, mobile phones, newspapers, posters, drama, songs, and interpersonal contacts, on the adoption of improved sorghum farming practices. By applying this theory, the study aimed to understand how the richness of a communication medium aligned with the information being conveyed and the preferences of the intended audience.

3. METHODOLOGY

3.1. Study Area

The study took place in Dodoma, Tanzania purposefully chosen for its agro-ecological conditions highly recommended for sorghum cultivation, which is recognised as staple food crop in the region (JMT, 2022). The selection of the region was also driven by the potential of sorghum farming to contribute to improving food security in the area (Mwamahonje *et al.*, 2021). Food security is a major concern in the region, and sorghum, being a staple food crop, holds significant importance.

3.2. Research Design, Sampling Procedure and Sample Size

A cross-sectional analytical research design was used as it allowed the collection of data from a wide range of individuals at a single point in time and the data were used to test hypotheses. A multi-stage sampling approach was employed to obtain study participants. At first, three districts were randomly selected out of seven in the region ensuring an equal probability of representation for each district. These were Kongwa, Kondoa and Bahi. In the second stage of sampling, a list of all wards in the selected districts was compiled to create a sampling frame, with three wards randomly selected from each district. In the third stage, three villages were randomly designated from each of the previously selected wards. During the fourth stage, households were randomly picked from the lists of households within the chosen villages. Data were then collected from the heads of these selected households. Key informants included

nine ward extension officers and six TARI agricultural experts, who were purposively chosen.

The sample size was calculated using the Cochran (1963) formula appropriate for large or infinite populations (see equation (1)), with parameters $Z=1.96$, $q=0.5$, $p=0.5$, and $e=0.05$. The calculation indicated a minimum requirement of 384 respondents (equation (2)). However, a sample size of 399 respondents was obtained. This decision to exceed the minimum requirement was driven by statistical considerations, accounting for potential non-responses, missing data, or outliers that could impact the reliability of the findings.

$$n_o = \frac{Z^2 pq}{e^2} \quad (1)$$

$$n_o = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = 384 \quad (2)$$

3.3. Data Collection

Primary data were the key source of information for this paper and were collected through interview with sorghum farmers using a structured questionnaire. Qualitative data were collected using interview guide from nine extension officers and six TARI agricultural experts. Secondary data were also considered, they were collected from different reports, published and unpublished documents from Ministry of Agriculture, the National Bureau of Statistics, TARI and the websites. The information collected included sorghum cultivation.

3.4. Data Analysis

Qualitative and quantitative methods were employed for analysis. Thematic analysis was used to analyse qualitative data obtained from open-ended questions in the questionnaire, and key informant interviews. Quantitative data were analysed using descriptive statistics (frequencies, mean standard deviation and ranks) and inferential analysis (ANOVA and binary logistic regression). To investigate the significant variations in the utilization of communication media for accessing agricultural information, a two-way analysis of variance was employed. The outcome of interest was the usage of communication media gauged on an index ranging from 0 to 4. The

independent variable encompassed various communication channels, specifically: posters, newspapers, television, radio, mobile phones, interpersonal contact, agricultural exhibitions, local meetings, drama, and songs. The model formulation is outlined in equation (3).

$$Y_{ij} = \mu + \tau_i + \beta_j + \varepsilon_{ij} \quad \begin{cases} i=1,2,\dots,10 \\ j=1,2,\dots,399 \end{cases} \quad (3)$$

where:

Y_{ij} is the dependent variable (usage of the media), μ is an overall mean, τ_i is a media effect, β_j is the j th individual farmer effect in usage and ε_{ij} is the random error term which is normally identically distributed $(0, \sigma^2)$.

Binary logistic regression models were used to assess the effects of communication media on the adoption of improved sorghum farming practices. For each component of an improved farming practice, separate models were fitted, and the results were presented in a table using adjusted odds ratios and the corresponding p-values. The general form of the model is as given in equation (4).

$$\text{Logit}[\pi(X)] = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_{10} X_{10} + \varepsilon \quad (4)$$

Where the X 's denotes the use of communication channels to access agricultural information.

X_1 = newspapers, X_2 = posters, X_3 = television, X_4 = radio, X_5 = mobile phone, X_6 = interpersonal contact, X_7 = agricultural exhibitions, X_8 = local meeting, X_9 = drama, and X_{10} = songs. The parameter α is the overall “log (odd)” of adopting an improved sorghum farming practice for a farmer regardless of the communication media used in accessing agricultural information.

4. Results and Discussions

4.1. Adoption of Improved Sorghum farming Practices

The results from Table 0-1 indicates that among the 399 sorghum farmers surveyed, 59 individuals, accounting for 14.79% of the total, did not adopt any of the six recommended practices. On the other hand, 340 farmers, constituting 85.21% of the sample, adopted at least one of the recommended practices. These findings are

consistent with the prevailing pattern of limited adoption of recommended farming practices among smallholder farmers in developing nations. The adoption of improved sorghum farming practices is influenced by various factors. These include the availability and accessibility of information, affordability of implementation, compatibility with existing farming systems, perceived risk, and the level of support provided by agricultural extension services. These results align with the findings of Kaliba et al. (2018), who also associated low adoption rates with factors such as lack of awareness, inadequate resources (such as land and capital), and the absence of subsidies. Similarly, Kimbi et al. (2020) argue that the adoption of improved sorghum technologies among smallholder farmers in Tanzania remains low, often due to difficulties in accessing high-quality inputs for various reasons.

Table 0-1: Adoption of Improved Sorghum Farming Practices

Adoption status	No. of respondents (n)	Percent (%)
Non-adopter	59	14.79
Adopters	340	85.21

4.2. Use of Communication Media in Accessing Agricultural Information on Improved Sorghum Farming Practices

The data presented in Table 0-2 offers an overview of communication media usage by sorghum farmers to access agricultural information. A range of media, including posters, newspapers, television, radio, mobile phones, interpersonal contact, agricultural exhibitions, local meetings, drama, and songs were examined. Within the table, the "mean" column showcases the average usage levels, rated on a scale of 0 to 4. The "Std. dev" column highlights the variability (standard deviation) observed in farmers' ratings concerning the usage extent of specific communication medium. Moreover, the "rank" column demonstrates the descending order of media usage. These findings distinctly portray the diverse landscape of communication channel preferences for accessing agricultural research information. The results indicate that interpersonal contact ranks as the most utilized medium, recording an average of 2.78, whereas newspapers, songs, and drama stand as the least utilized media, averaging 1.01, 1.02, and 1.03 respectively. The lower usage of traditional media such as songs and drama might be attributed to the increasing prominence of contemporary media

such as mobile phones, television, and radios. This suggests that traditional media typically rely more on verbal communication compared to other medium, while modern communication predominantly focuses on employing technology for effective communication. The findings are also supported by key informants who argued that:

“.... the choice and use of communication media in rural setting is determined by various factors such as education, affordability and accessibility. Education limits smallholder farmers to make use of digital platforms and print media such as the internet and farm magazines...other media platforms are both costly and inaccessible...as result, face to face is mostly used in rural settings...” (Interview, Kondo, 28 June 2022).

The key informant interview underscores the intricate factors affecting the use of communication media in rural settings, suggesting that education is vital in shaping media choices. The limited educational opportunities for smallholder farmers can impede their effective use of digital platforms and print media, like the internet and farm magazines, due to challenges in affordability and accessibility. It emphasizes affordability and accessibility as key factors influencing the selection of communication media, noting that, aside from face-to-face interactions, other media platforms are often seen as expensive and hard to access in rural areas.

Table 0-2: Utilization of Communication Media in Accessing Agricultural Information

Communication Media	Mean	Std. dev	Rank
Posters	1.33	0.78	5
Newspapers	1.01	0.14	10
Television	1.28	0.75	6
Radio	1.66	0.96	4
Mobile phone	2.04	1.07	2
Interpersonal contact	2.78	0.98	1
Agricultural exhibitions	1.08	0.39	7
Local meeting	1.73	1.02	3
Drama	1.03	0.27	8
Songs	1.02	0.21	9

Additionally, a two-way Analysis of Variance (ANOVA) was performed to evaluate the statistical significance of the differences in communication media usage for accessing

agricultural information. The results of the ANOVA analysis are outlined in Table 0-3. A disparity in the utilization of communication media for accessing agricultural information was identified. This significant difference is substantiated by an F-statistic of 253.11 with an associated p-value of <0.001, providing compelling evidence for the observed variations in communication media usage.

Table 0-3: ANOVA Results Showing Variations in the Use of Communication Media in Accessing Agricultural Information

Source of Variation	Sum of Squares	DF	Mean Square	F-statistic	P-value
Communication Media	1179.5541	9	131.0616	253.11	<0.001
Farmers	345.1639	398	0.8672	1.67	<0.001
Residual	1854.7459	3582	0.5178		
Total	3379.4639	3989	0.8472		

4.3. Effects of Communication Media on Adoption of Improved Sorghum Farming Practices

Also, the study sought to investigate how the use of various communication media influences the adoption of improved sorghum farming practices among smallholder farmers in Dodoma region. Binary logistic regression models were utilized to assess the effects of communication media on the adoption of improved sorghum farming practices, as summarized in Table 0-4. The adjusted odds ratios for each communication medium's effect on specific farming practices are presented, along with their respective p-values in parentheses. Interpersonal contact had a significantly positive influence on the adoption of all analysed farming practices: farm preparation (OR = 1.49, $p < 0.001$), improved seed varieties (OR = 1.57, $p < 0.001$), fertilizer/manure application (OR = 1.54, $p < 0.001$), weed control (OR = 1.48, $p < 0.001$), pest and disease control (OR = 1.58, $p < 0.001$), and post-harvest loss management (OR = 1.53, $p < 0.001$). These results indicate that interpersonal interactions were the primary source of agricultural information and strongly correlated with higher extent adoption. Immediate feedback through interpersonal networks proved highly effective for driving changes. Direct interpersonal communication facilitated the exchange of information, encompassing both verbal and

non-verbal cues, aligning with findings from Skaalsveen *et al.* (2020) and Unay-Gailhard and Simões (2022). The findings are also in line with MRT. These theories help explain why certain media, such as interpersonal may be more effective in specific contexts or for specific audiences, based on its ability to convey information effectively and satisfy individuals' needs and motivations.

Regarding mobile phones, the results revealed a significant positive effect with odds ratios of 1.27 ($p = 0.015$) for farm preparation, 1.30 ($p = 0.012$) for improved seed varieties, 1.32 ($p = 0.008$) for fertilizers/manure application, 1.29 ($p = 0.015$) for weed control, 1.33 ($p = 0.007$) for pest and disease control, and 1.27 ($p = 0.022$) for post-harvest management. Contrary to the hypothesis, electronic media, specifically mobile phones and TV, demonstrated a significant positive relationship with the adoption of improved sorghum farming practices. Farmers accessing information through these media were more inclined to adopt these practices. This positive influence can be attributed to the widespread accessibility and effective audio-visual communication capabilities of mobile phones and television. Mobile phones, as a widely used communication tool, reach diverse and dispersed farming communities, while television, with its audio-visual features, effectively conveys information and elicits emotional responses. These findings are in line with research by Cole and Fernando (2021), illustrating the impact of mobile phone voice-based consulting services on encouraging recommended farming practices among smallholder cotton farmers in rural India. Similarly, Sousa (2019) emphasized the substantial role of mobile phone videos in facilitating information exchange among farmers and promoting the adoption of agronomic technologies in South Africa. This is supported by key informants:

“.... the use of mobile phones has significantly enhanced communication with farmers, reducing the need for in-person meetings. Mobile phones are versatile, allowing the use of both audiovisual and text-based content, making them an efficient communication channel suitable for both literate and illiterate farmers...., on the other hand, the use of the radio primarily relies on verbal communication and lacks the capability for simultaneous feedback. This limitation hinders its effectiveness in conveying agricultural information.....” (Interview, Kongwa, 23 June 2022).

Another key interviewee at TARI Hombolo Centre commented that:

“.... the use of mobile phone has revolutionised the communication between farmers and agricultural experts in sharing agricultural information and knowledge. Mobile

phones are increasingly being used by both rural farmers and extension personnel. This has reduced the need for physical visits or even face to face interactions”

The effects of television on adoption of all six improved sorghum farming practices were positively significant with odds ratios of 1.70 ($p=0.001$) for farm preparation, 1.61 ($p=0.002$) for use of improved seed varieties, 1.52 ($p=0.005$) for application of fertilizers/manure, 1.42 ($p=0.018$) for control of weeds, 1.60 ($p=0.002$) for control of pests and diseases, and 1.50 ($p=0.007$) for post-harvest management. The results are consistent with those of Tambo *et al.* (2019), who discovered that among the three ICT channels, television had a larger influence on people's decision to employ pest control because it allowed people to combine verbal and visual communication aspects. Similar findings are also noted by Waaswa *et al.* (2021) in Kenya. In view of this observation, the use of modern ICT media, such as television, according to Norton and Alwang (2020), could assist extensionists and farmers in disseminating a variety of innovative agricultural technologies. This is also supported by the key informants during data collection.

“.... Television is very effective in disseminating agricultural research information and promoting adoption to smallholder farmers who are largely semi-illiterate. Unlike other media, it has the ability to display visual images which enhances comprehension and memory retention, capturing farmers' emotional connections and promoting a deeper understanding of the communicated concepts.... This is based on the assumption that seeing is believing” (Interview, Bahi, 25 June 2022).

It was predicted that print media would not significantly impact adoption, and the findings support this hypothesis. Newspapers and posters were rarely used and had minimal influence as they lack interactivity and feedback mechanisms. They primarily convey information through static text and basic images, limiting cues and language diversity. This contrasts with Kigatiira *et al.* (2018) findings, which highlighted the role of print media among Irish potato farmers in Kenya, particularly due to a high literacy level. Similarly, traditional media was expected to have no significant effect on adoption, and the results align with this hypothesis. Songs and drama, among other traditional media, were infrequently used and had little impact. This differs from Ekerete and Ufot (2017) findings, which emphasized the effectiveness of traditional folk media in conveying agricultural information to rural farmers.

The results shed light on how different media align with or deviate from the hypotheses. It is clear that only interactive media, like interpersonal communication, phone usage, and television, effectively enhance understanding and implementation of modern methods, in line with the Media Richness Theory (MRT). This stresses the fundamental role of these multimedia platforms in promoting broader adoption, addressing the central research question.

Table 0-4: Effects of Communication Media on Adoption of Improved Sorghum Farming Practices (n = 399)

Media	Adoption of Improved Sorghum Farming Practices					
	Farm preparation	Improved seed	Fertilizers application	Pests/diseases control	Weed control	Post-harvest management
Newspapers	1.29(0.723)	1.15(0.843)	1.43(0.633)	1.34(0.693)	1.43(0.635)	1.21(0.791)
Posters	0.80(0.127)	0.77(0.075)	0.83(0.202)	0.90(0.436)	0.83(0.186)	0.86(0.298)
Television	1.70(0.001)	1.61(0.002)	1.52(0.005)	1.42(0.018)	1.60(0.002)	1.50(0.007)
Radio	0.84(0.134)	0.85(0.167)	0.81(0.081)	0.85(0.16)	0.81(0.076)	0.83(0.104)
Mobile phone	1.27(0.015)	1.30(0.012)	1.32(0.008)	1.29(0.015)	1.33(0.007)	1.27(0.022)
Interpersonal contact	1.49(0.001)	1.57(<0.001)	1.54(<0.001)	1.48(0.001)	1.58(<0.001)	1.53(0.001)
Agricultural exhibitions	0.64(0.148)	0.74(0.31)	0.51(0.052)	0.59(0.099)	0.51(0.051)	0.70(0.241)
Local meeting,	0.95(0.624)	0.99(0.934)	1.03(0.779)	1.07(0.490)	1.06(0.588)	1.08(0.439)
Drama	0.83(0.708)	0.83(0.701)	0.91(0.852)	0.84(0.733)	0.91(0.849)	0.80(0.654)
Songs	1.77(0.373)	1.58(0.471)	1.93(0.307)	1.19(0.799)	1.95(0.301)	1.08(0.906)

5. Conclusion and Recommendations

The key findings emphasize variations in the effectiveness of communication media in encouraging the adoption of improved sorghum farming practices. Face-to-face interactions within interpersonal networks, mobile phones, and television are identified as significant drivers of adoption, aligning with the principles of the Media Richness Theory. This theory suggests that communication channels differ in their effectiveness

in conveying information, with face-to-face communication considered the richest, followed by written documents, telephone conversations, and so on. The results suggest that the adoption of improved farming practices could be enhanced through the appropriate choice and use of communication media. In contrast, traditional media like songs and print media have limited impact due to their one-way nature and restricted circulation, respectively.

Recommendations:

To effectively promote better sorghum farming practices among smallholder farmers, it is advisable for agricultural research institutes and stakeholders to adopt a holistic media strategy. This involves promoting interpersonal communication through local workshops, farmer field schools, and community-based extension services for face-to-face interactions and feedback. Additionally, utilizing mobile phones and television for tailored audio-visual content, such as videos and infographics, can offer user-friendly agricultural information, enhancing farmers' knowledge. Embracing technological innovations like mobile apps and farmer-centric TV ensures convenient access to personalized agricultural guidance. Recognizing the value of both traditional and modern methods, involving farmers in material design ensures ownership and effective information dissemination. Implementing these strategies comprehensively can effectively bring about behavioural change and encourage the adoption of improved sorghum farming practices.

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CHAPTER FIVE

PAPER FOUR

Information Seeking Behaviour and Adoption of Improved Farming Practices among Sorghum Farmers in Dodoma, Tanzania

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Abstract

Information-seeking behaviour of farmers shapes how farmers access, interpret, and apply information to improve their practices. In Dodoma, Tanzania, low adoption of improved farming practices persists despite the availability of agricultural innovations. This study examined the factors influencing information-seeking behaviour of sorghum farmers and its effect on the adoption of improved farming practices. A cross-sectional research design was employed, and data were collected from household heads selected through a multi-stage sampling. Descriptive statistics were used alongside a linear mixed model to determine predictors of information-seeking behaviour, while binary logistic regression assessed its influence on adoption. Findings show that farmers with higher education levels and access to communication tools were more likely to actively seek agricultural information. Conversely, demographic factors such as age, sex, marital status, farm size, and farming experience did not significantly influence information-seeking. The analysis further revealed that farmers who frequently sought information were substantially more likely to adopt improved farming practices, and trust in credible information sources enhanced adoption likelihood. These findings highlight the need to promote information-seeking behaviours and ensure the availability of trustworthy agricultural information. To enhance the adoption of improved sorghum farming practices, it is recommended to enhance farmers' education, expand access to communication tools,

ensure credible information delivery, encourage proactive information-seeking through community initiatives, support experienced farmers as role models, and consider community dynamics in future interventions.

Keywords: Adoption, Dodoma, Farming practices, Information-seeking behaviour, Sorghum

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1. Introduction

Often, people exhibit a variety of actions and patterns when seeking out information to meet their needs or gaps in their knowledge. Such information-seeking behaviours range from purposeful searches to more passive or unintentional activities. Farmers typically seek information to reduce their uncertainty about markets, weather, agricultural inputs, and adopting novel agricultural innovations. By actively looking for reliable and actionable information, they aim to navigate the uncertainties that come with unfamiliar or challenging agricultural innovations. This quest for knowledge helps them feel more secure in their choices, allowing them to confidently tackle obstacles and improve their farming outcomes.

Farmers exhibit varying information-seeking behaviours to access information essential for adopting improved farming practices. Such behaviours involve the deliberate effort to obtain specific information to address agricultural challenges and optimise productivity. Information-seeking behaviour of farmers is often influenced by push factors, such as declining yields, pest infestations, and economic pressures, which drive farmers to seek solutions for sustaining their livelihoods. It is also shaped by pull factors, including the availability of credible, accessible information and the demonstrated benefits of innovative practices (Wann *et al.*, 2024; Nyamekye *et al.*, 2021). Social influences and community norms can further reinforce information-seeking behaviour by encouraging alignment with prevailing agricultural trends (Constantino *et al.*, 2022).

The kind of information-seeking behaviour exhibited by farmers can enable or deny them access to timely and relevant information that supports the adoption of improved farming practices, such as the use of certified seed varieties, adopting efficient pest,

disease and weed management, and control of post-harvest losses (Mdoda *et al.*, 2024; Nausher *et al.*, 2023). This ability to seek and apply relevant information becomes even more critical in the face of challenges like climate change and shifting market demands, which require farmers to remain adaptable and resilient. In Dodoma, Tanzania, sorghum farmers rely on diverse information sources including extension services, radio programmes, and interpersonal networks, to gain insights into modern farming methods that enhance productivity and livelihoods (Ndimbwa *et al.*, 2021; Sennuga *et al.*, 2020; Thuo and Njoroge, 2018). Adamsone-Fiskovica and Grivins (2022) reported that farmers who actively looked for information tended to be more productive. Those who tapped into different sources of advice and knowledge were better at putting effective farming methods into practice.

Colussi *et al.* (2022) reported that several factors influence how farmers seek and use information, including their background, experience, age, education, gender, income and access to communication tools. For example, younger and more educated farmers might turn to digital platforms, while older farmers may prefer traditional methods like radio or speaking with others in their community. This generational divide is supported by Wayagi (2024), who found that younger farmers were more inclined to use mobile apps and online forums, whereas older farmers often relied on established methods. Farming experience also plays a key role, and experienced farmers tend to rely on the knowledge they have gathered over time, making them more selective about the new information they adopt. On the other hand, less experienced farmers are more likely to seek out new information to improve their practices actively (Kerneck *et al.*, 2020). Ownership of communication tools such as mobile phones, radios, and internet-enabled devices also affects how farmers access agricultural information. Mobile phones, for instance, offer easy access to services like weather updates, market information, and expert advice, while radios are a low-cost way to share new farming methods with farmers in remote areas (Kamal and Bablu, 2023; Awuor and Rambim, 2022). Farmers with these tools are more likely to actively seek out and use information to improve their farming practices (Malik and Rathi, 2020). However, limited ownership of communication assets remains a barrier, constraining farmers' decision-making capabilities (Nausher *et al.*, 2023).

Understanding the differences in information-seeking behaviour is especially important when considering crops like sorghum, which plays a vital role in food security and livelihoods in drought-prone regions such as Dodoma (Yusuph *et al.*, 2023; Kangile *et al.*, 2020). Despite its significance and adaptability to semi-arid conditions, sorghum yields in Dodoma remain low, averaging only one ton per hectare, far below the potential five tons. This persistent gap points to the limited uptake of improved farming practices and underuse of available research-based information (Mwamahonje *et al.*, 2021; Simtowe and Mausch, 2019). While existing studies have examined general information-seeking behaviour and agricultural innovation adoption (Bano and Dahiya, 2023; Shukla *et al.*, 2022), there is a pressing need to understand how these dynamics play out in the unique context of Dodoma's sorghum farmers, where climate risks and resource limitations intensify the struggle for improved productivity.

This study examined the information-seeking behaviour of sorghum farmers in Dodoma, Tanzania and its influence on the adoption of improved farming practices. It specifically examined the determinants of information-seeking and how this behaviour affects the uptake of improved sorghum farming methods. The findings provide insights for designing targeted interventions and communication strategies to promote sustainable agricultural development and enhance productivity among sorghum farmers in Dodoma and similar contexts.

2. Literature Review and Hypotheses Development

2.1. Factors influencing information-seeking behaviour of farmers

Several factors influence how farmers seek information, including their sex, age, education level, marital status, farm size, farming experience, and access to communication tools. These elements significantly shape their ability to find and use agricultural information effectively. In reviewing how age shapes information-seeking behaviour, Zhang *et al.* (2024) and Fabregas *et al.* (2019) agree that younger farmers generally show a stronger inclination towards exploring new technologies and using digital tools to gather agricultural information. Zhang *et al.* (2024) note that younger farmers are more likely to actively seek out innovative information sources, which can directly influence their adoption of improved farming practices. Fabregas *et al.* (2019) support this view, adding that younger farmers often leverage smartphones and online

platforms to access agricultural research information, suggesting that age does not merely determine whether farmers seek information but also how they do so. The role of education in information-seeking behaviour is widely supported, and Chang and Huang (2020) who observe that higher education correlates with greater information literacy. Educated farmers can navigate various communication channels more effectively, which broadens their access to relevant information. Creissen *et al.* (2021) highlight that educated farmers seek out information and tend to be more open to scientifically validated farming practices. Yet, while education often makes a farmer more receptive to new methods. Magesa *et al.* (2023) and Rahman *et al.* (2020) suggest that other barriers, such as limited resources or lack of internet access, can still restrict educated farmers from fully engaging with diverse information sources.

Marital status emerges as another factor that influences how farmers access information. Giroux *et al.* (2023) note that married farmers benefit from joint decision-making and shared resources, making information-seeking easier and more collaborative. Rahman *et al.* (2020) add that having a supportive family environment, especially with the involvement of spouses, often increases farmers' engagement in seeking agricultural information. However, other authors (Mesfin *et al.*, 2023; Haumba and Kaddu, 2021) argue that while family support is helpful, individual motivation and access to resources are just as critical in driving information-seeking behaviours among farmers, regardless of marital status. Farm size is also a factor such that larger farms have greater resources, which often translates into higher motivation and capacity for seeking agricultural information (Magesa *et al.* (2020). Tiftonell *et al.* (2020) and Das *et al.* (2022) agree that large-scale farmers often prioritise staying informed about innovations to enhance productivity. However, Diemer *et al.* (2020) caution that this is not always the case, as even smallholder farmers can be motivated to seek information if it directly relates to overcoming their resource limitations. In fact, smallholders often demonstrate remarkable resourcefulness and can access information through informal networks and community interactions (Parks, 2022; Freeman and Qin, 2020).

The discussion around farming experience bring a mix of perspectives. Kumar *et al.* (2020) observe that experienced farmers may be less open to new information, preferring tried-and-true practices. However, Acheampong *et al.* (2021), offer a

nuanced view, noting that while experienced farmers can be initially hesitant, they are more likely to adopt new practices when they see credible evidence of success, such as through field demonstrations. This suggests that while experience may make some farmers more cautious, it does not necessarily prevent them from being receptive to innovation, particularly when reliable sources are involved. Finally, the importance of owning communication tools like mobile phones is widely acknowledged across the literature. Coggins *et al.* (2022) argue that digital access enables farmers to quickly connect with extension services and stay informed, particularly in rural areas where access to in-person agricultural offices may be limited. Sennuga *et al.* (2023) add that mobile platforms are important for timely decision-making, as they can provide real-time information on weather and market prices. However, McCampbell *et al.* (2023) point out that while digital tools have increased information access, not all farmers have equal access to these resources, which creates a digital divide that could limit the effectiveness of mobile-based interventions.

Across this discussion, it is clear that several factors can shape the information-seeking behaviour of farmers, yet their influence varies depending on the context and individual circumstances. There are arguments that with digital tools becoming accessible, traditional barriers to information-seeking may be decreasing. Nonetheless, the literature also highlights ongoing challenges, such as resource limitations and digital inequities that particularly impact smallholder and rural farmers. The diverse factors influencing information-seeking behaviour, as discussed in the literature, highlight the complexity of how farmers access agricultural information. As a result, it was necessary to assess the impact of these factors on information-seeking behaviour in the context of sorghum farmers in Dodoma. Based on this evidence, the following null hypothesis is proposed:

Hypothesis 1: Sex, age, education, marital status, farm size, farming experience, and ownership of communication assets do not influence the information-seeking behaviour of sorghum farmers.

2.2. Association between information-seeking behaviour and the adoption of improved farming practices among farmers

The study's central focus is the relationship between how farmers seek information and their adoption of agricultural technologies. It is well-established that actively seeking information equips farmers with the knowledge and confidence to adopt new practices. However, the way smallholder farmers engage with and apply agricultural information is influenced by several factors. Scholars such as Sutherland and Marchand (2021) and Cook *et al.* (2021) highlight that farmers actively seeking information through extension services, peer interactions, and agricultural fairs are likelier to experiment with new practices. By diversifying their information sources, they become better informed about potential benefits, which increases their willingness to adopt innovations that could improve productivity.

Furthermore, Slijper *et al.* (2023) emphasise that proactively seeking information about modern farming techniques is decisive in increasing adoption. They suggest that the active pursuit of knowledge is vital in increasing the likelihood of adoption among farmers. However, Zheng *et al.* (2022) caution that access to information alone does not guarantee adoption of agricultural innovations. Cultural beliefs and past experiences play a significant role in determining whether a farmer is open to adopting new farming practices, regardless of how much information they receive. This highlights the importance of communicating information and whether it resonates with the farmer's specific context.

The dynamics of push and pull factors also add complexity to the relationship between information-seeking behaviour and adoption. On the one hand, push factors such as economic pressures and dissatisfaction with existing agricultural practices, often drive farmers to seek alternatives (Acharya and Lillywhite, 2021; Kassie *et al.*, 2018). Surendran *et al.* (2024) note that challenging conditions can prompt farmers to explore new practices that might offer better outcomes, like a sorghum farmer seeking improved farming techniques due to declining yields. On the other hand, pull factors such as the attractiveness and accessibility of information sources also influence farmers' willingness to engage. Yu and Gambrah (2024) underline that when farmers

perceive the information as credible and relevant to their needs, they are more inclined to act on it, emphasising the importance of the quality of information and its source.

Social networks also play a key role in information -seeking behaviour. Thomas *et al.* (2020) argue that well-connected farmers within strong social networks significantly benefit from shared knowledge and encouragement, which positively impacts their decisions to adopt new practices. Conversely, Dhillon and Moncur (2023) shed light on the challenges faced by farmers lacking these social connections, revealing how isolation can severely hinder their ability to adopt new farming techniques, even when information is available. This emphasises the vital role of social capital and community support in the adoption process, alongside more formal information channels. Moreover, technological advancements, particularly mobile technology, have transformed how farmers access agricultural information, although challenges such as digital illiteracy and limited access to technology persist. Kumar *et al.* (2020) affirm that while mobile phones and online resources have opened new doors for information dissemination, digital literacy and infrastructure disparities remain significant barriers.

The literature highlights a strong connection between information-seeking behaviour and adopting improved farming practices, demonstrating that actively seeking agricultural information can increase farmers' confidence and willingness to adopt new farming practices. However, this association is influenced by various factors that shape how information is accessed and applied. Given these complexities, the following null hypothesis is proposed:

Hypothesis 2: *There is no significant association between information-seeking behaviour and adopting improved farming practices among sorghum farmers.*

2.3. Theoretical Framework

This study employed the Diffusion of Innovations (DOI) theory alongside the Information-Seeking Behaviour and Communication Model (ISCM) to examine how smallholder sorghum farmers in Dodoma access and adopt improved farming practices. The DOI theory is valuable for understanding the communication process through which new ideas, like improved sorghum techniques, are introduced and spread among farmers (Okour *et al.*, 2021). Its strength lies in outlining the stages of adoption (knowledge, persuasion, decision, implementation, and confirmation) and

emphasizing the role of communication channels in influencing uptake. However, a key limitation of DOI is its broad focus, which may overlook the individual and contextual factors that drive active information seeking. To address this gap, the ISCM Robson and Robinson (2013) was adopted to offer a more nuanced view of how farmers recognise their information needs, seek relevant sources, and evaluate what they find. This model helps explain real-world behaviours, such as how farmers respond to poor yields or how limited resources can hinder access to information. Together, DOI and ISCM provide a complementary framework that aligns well with the study's objective of assessing how farmers' information-seeking behaviour influences their adoption of improved farming practices. By combining both models, the study captures both the communication flow of innovation and the individual search processes that shape adoption decisions.

3. Methodology

3.1. Description of the Study Area

This study was conducted in Dodoma, Tanzania, a region known for its semi-arid conditions and frequent food insecurity. Sorghum farming is seen as a resilient, nutritious, and sustainable choice for farmers, helping to strengthen food security and livelihoods (Amede et al., 2023). Given the region's challenges and sorghum's potential to address food security issues (Mwamahonje et al., 2021), it provides a perfect setting to explore how information-seeking behaviour influences the adoption of improved farming practices and contributes to better agricultural decision-making.

3.2. Research Design, Sampling Procedure, and Sample Size

This study adopted a mixed-methods approach with a cross-sectional design to capture a snapshot of the current situation and examine the relationship between information-seeking behaviour and the adoption of improved sorghum farming practices. Quantitative and qualitative data were collected to allow for a more comprehensive understanding of the research problem. A multi-stage and simple random sampling method was used to ensure a diverse and representative sample. First, three districts, Kongwa, Kondoa, and Bahi, were randomly selected from a pool of seven districts. In the next stage, three wards were randomly chosen from each selected district. Then, three villages were randomly selected from each ward. Finally, households were

randomly picked from the lists of households within the chosen villages. Data were gathered from household heads, who are typically the primary decision-makers in most African communities. This multi-stage, random sampling approach ensured that the sample was representative and unbiased, capturing a broad range of local contexts.

The sample size was determined using Cochran's (1963) formula, equation (1), that is suitable for calculating sample size in large populations. This formula is widely accepted for its statistical reliability when estimating proportions with a desired level of precision (Israel, 1992). The parameters used were a confidence level of 95% ($Z = 1.96$), an assumed proportion ($p = 0.5$) which yields the maximum variability, and a margin of error ($e = 0.05$). These values ensure that the results would be generalizable within a 5% margin of error and a high degree of confidence.

$$n_o = \frac{Z^2 pq}{e^2} \quad (1)$$

$$n_o = \frac{(1.96^2 \times 0.5 \times 0.5)}{0.05^2} = 384$$

The minimum recommended sample size was 384 respondents. However, the final number was increased slightly to 389 to account for possible non-responses, incomplete questionnaires, or data errors, which are common in field research (Mugenda and Mugenda, 2003; Saunders et al., 2003). This small increase helps ensure the study remains reliable and valid. Additionally, Bryman (2016) advises that a slightly larger sample improves statistical power and strengthens subgroup analysis, making this adjustment both practical and methodologically sound.

3.3. Data Collection and Analysis

Quantitative data were collected using a structured questionnaire administered by the researcher, pretested with 38 respondents from Mlowa Barabarani, Mlowa Bwawani, and Mloda villages in the Chamwino District. These villages were selected for their similarity to the main study area. The pretest evaluated the questionnaire's accuracy and reliability, with a sample size of 30 considered ideal for validation (Gunawan *et al.*, 2021). Additionally, qualitative data were gathered through interviews with 15 key informants, including extension officers and agricultural experts from TARI, providing valuable insights into participants' knowledge and experiences (Creswell *et al.*, 2014).

Quantitative data analysis involved descriptive and inferential analyses. The distribution of information-seeking behaviour was summarised using frequency table. A table was generated to show the proportion of farmers categorised as information seekers and non-information seekers. A linear mixed model was used for inferential analysis to determine the factors influencing information-seeking behaviour. A linear mixed model with sex, age, education level, marital status, farm size, farming experience, and ownership of communication assets as predictors was fitted with information-seeking behaviour as the dependent variable. The model estimated the coefficients for each predictor by treating their effect as fixed effects.

Furthermore, the model accounted for the potential clustering of farmers within districts by including district-level random effects. This helped to control for unobserved district-level characteristics that could influence information-seeking behaviour. Variance components for the district-level random effects were estimated, and the intraclass correlation (ICC) was calculated to determine the proportion of variability in information-seeking behaviour attributable to district-level factors. The linear mixed model used to assess the factors influencing information-seeking behaviour among sorghum farmers is given in equation (2).

$$Y_{ij} = \beta_o + \beta_1 S + \beta_2 A + \beta_3 E + \beta_4 MS + \beta_5 FS + \beta_6 FE + \beta_7 CA + u_j + \varepsilon_{ij} \quad (2)$$

Where:

Y_{ij} = Information-seeking score represents the level of information-seeking behaviour measured on a scale of 1 to 5. It is the outcome variable for the i -th individual in the j -th district. S (Sex), A (Age), E (Education), MA (Marital Status), FS (Farm Size), FE (Farming Experience), CA (Ownership of communication assets) u_j is the random effect for the district, accounting for variability between districts and ε_{ij} is the residual error term for individual-level variability.

A binary logistic regression model was employed to evaluate the association between information-seeking behaviour and the adoption of improved farming practices. The binary outcome variable (adoption vs. non-adoption) was regressed on the key predictor (information seeker vs. non-information seeker) while controlling for covariates such as sex, age, marital status, farm size, farming experience, and

perceived credibility of information. In the equation (3), the binary logistic regression model was used to assess the association between information-seeking behaviour and the adoption of improved farming practices.

$$\text{logit}(\pi(x)) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \varepsilon_i \quad (3)$$

Where;

$\text{Logit}(\pi(x))$ is the logarithm of the odd of a farmer to adopt improved farming practices given covariate (independent variable) x and

x_1 =Sex, x_2 =Age, x_3 =Marital Status, x_4 =Farm Size,

x_5 =Farming Experience, x_6 =Perceived Information Credibility, x_7 =Information Seeking Behavior

ε_i = error term

The odds ratios and their 95% confidence intervals were estimated for each predictor to assess the likelihood of adopting improved farming practices. The primary interest was in the odds ratio associated with information-seeking behaviour, which indicated how the odds of adoption differed between information-seekers and non-seekers. The statistical significance of each predictor was tested using Wald tests. The results were presented in a table showing each covariate's odds ratios, standard errors, z-values, and p-values.

Thematic analysis was used to process the qualitative data. First, the data were transcribed, and key phrases were identified and coded. These phrases were then grouped into themes that related to sorghum farming practices. The emerging themes were refined and compared across different interviewees as the analysis progressed. This process helped identify patterns in communication strategies and provided valuable insights into how farmers' information-seeking behaviours influence their farming practices.

4. Findings and Discussions

4.1. Socio-demographic characteristics and information-seeking behaviour

The study findings in Table 0-1 indicate that 57.14% of respondents were male, and the majority (83.46%) were married. Most farmers (75.44%) had primary education, which may influence their ability to interpret agricultural information. A large

proportion (83.21%) owned at least one communication asset, such as a mobile phone, television, or radio, facilitating agricultural information access. The mean age was 46.89 years (SD = 13.46), indicating a predominantly middle-aged population. The average farm size was 2.16 acres (SD = 0.62), reflecting small-scale farming operations. Respondents had an average of 17.43 years (SD = 11.79) of farming experience, suggesting extensive practical knowledge. A notable proportion (81.20%) of sorghum farmers actively sought agricultural information, highlighting their awareness of its role in improving farming practices and decision-making.

Table 0-1: Socio-demographic characteristics and information-seeking behaviour

Characteristics		Frequency (n)	Percentage (%)
Sex	Male	228	57.14
	Female	171	42.86
Marital Status	Single/divorced/separated/widowed	66	16.54
	Married	333	83.46
Education Level	No formal education	69	17.29
	Primary education	301	75.44
	Secondary education and above	29	7.27
Communication assets ownership	Yes	332	83.21
	No	67	16.79
Information seeking behaviour	Non-information seeker	75	18.80
	Information seekers	324	81.20
		Mean	Std.Dev
Age (in years)		46.89	13.46
Farm Size (in acres)		2.16	0.62
Farming Experience (in years)		17.43	11.79

4.2. Factors influencing information-seeking behaviour among sorghum farmers

The findings in Table 0-2 provide key insights into the factors shaping information-seeking behaviour among sorghum farmers. Education level and ownership of communication assets emerged as the strongest predictors. Farmers with higher education levels were significantly more likely to seek agricultural information ($\beta = 0.296$; $p = 0.008$), leading to the rejection of the null hypothesis that education does not influence information-seeking behaviour. It aligns with earlier studies by Nchimbi *et al.* (2024) and Babu and Glendenning (2019), which argue that education enhances farmers' ability to understand and evaluate new technologies, ultimately improving their information-seeking capacities. The Diffusion of Innovations (DOI) theory helps explain this. Education supports farmers in navigating the stages from knowledge to

adoption, positioning them as potential early adopters. Similarly, the information-seeking behaviour model (ISCM) emphasises that educated individuals are more aware of their information needs and are better equipped to identify and assess credible sources. Insights from key informants echoed these points, more educated farmers were not only more engaged with extension services but also made greater use of digital platforms.

Possessing communication assets, such as mobile phones, radios, or televisions, had a strong positive effect on information-seeking behaviour ($\beta = 0.749$; $p < 0.001$). This stresses the vital role of communication tools in accessing agricultural information. This finding supports rejecting the null hypothesis that owning communication assets does not influence the information-seeking behaviour of sorghum farmers. This finding reinforces the idea from the ISCM model that communication tools reduce access barriers and enable farmers to engage with a broader range of information. The DOI theory also stresses the importance of mass media and interpersonal channels in spreading innovations, making communication tools vital in bridging knowledge gaps. Krell *et al.* (2021) also reported that mobile phones improved farmers' access to various agricultural information. Similarly, Király *et al.* (2023) and Mbaya (2023) showed that digital platforms empower farmers to connect with agricultural experts, further enhancing their information-seeking capabilities. Key informants noted that mobile ownership has transformed how farmers receive updates and make decisions, faster, more informed, and more confidently. In contrast, demographic factors like gender, age, marital status, farm size, and farming experience showed no significant impact on information-seeking in this context. While other studies (Balayar and Mazur, 2022; Rahman *et al.*, 2020) found these traits influential in different settings, they appeared less important than structural enablers like education and communication access in Dodoma.

Random effects revealed minimal variation across districts ($\sigma^2 = 0.059$, 95% CI: 0.003, 1.004), with an intraclass correlation coefficient (ICC) of 0.003. This suggests that district-level factors had little impact on the information-seeking behaviour of sorghum farmers. Instead, individual factors like education and communication tools appeared more critical. Contrastively, Liu *et al.* (2021) and Zheng *et al.* (2021) reported that geographical location can influence access to agricultural information. Farmers in

remote areas often face challenges like poor infrastructure and limited connectivity, while those in urban or peri-urban regions benefit from proximity to research institutions and extension officers. The minimal geographical variation found in this study could reflect relatively uniform access to communication assets and education across the study area or indicate a predominance of individual over regional factors. This finding highlights the need for targeted interventions to improve individual access to education and communication technologies.

Table 0-2: Linear Mixed Model Results on Factors Influencing Information-Seeking Behaviour Among Sorghum Farmers (N = 399)

Fixed effect		Coefficient	Std. error	t	P>t	95% Conf. Int.
Sex	Female	Ref	-	-	-	-
	Male	-0.109	0.114	-0.95	0.341	-0.333, 0.115
Age		-0.001	0.005	-0.18	0.860	-0.011, 0.009
Education level		0.296	0.111	2.67	0.008	0.079, 0.514
Marital status	Not Married	Ref	-	-	-	-
	Married	0.205	0.149	1.38	0.169	-0.087, 0.496
Farm size (in acres)		0.021	0.02	1.08	0.279	-0.017, 0.06
Farming experience (in years)		0.004	0.006	0.75	0.451	-0.007, 0.016
Communication assets ownership	No	Ref	-	-	-	-
	Yes	0.749	0.146	5.13	<0.001	0.463, 1.035
Random effect		Estimate	Std. err	95% Conf. Int.		
Var (Districts), σ_u^2		0.059	0.085	0.003, 1.004		
Var (Residual), σ_e^2		0.993	0.035	0.927, 1.065		
Intraclass correlation (ICC)		0.003	0.010	0.000, 0.508		

4.3. Association between information-seeking behaviour and the adoption of improved farming practices among sorghum farmers

The findings in Table 0-3 reveal a strong association between information-seeking behaviour and the adoption of improved farming practices, evidenced by a notable odds ratio of 4.03 (95% CI: 2.116, 7.678; $p < 0.001$). This indicates that farmers who tend to seek agricultural information had four times odds of adopting improved practices compared to those who had no tendency to seek information. This result aligns with Maqbool *et al.* (2023), who found a similar trend where proactive

information-seeking enhances farmers' awareness of innovative agricultural technologies and their associated benefits. Furthermore, Diemer *et al.* (2020) corroborate this finding, demonstrating that actively seeking information increases the likelihood of adopting modern farming techniques. Insights from key informants reinforced these findings. Agricultural extension officers reported that farmers who frequently visit their offices or reach out with questions tend to be among the first to try out newly introduced techniques. These officers noted that such farmers demonstrate eagerness to learn, which often translates into successful adoption of innovations. Similarly, local government officials observed that farmers who attend field schools or agricultural exhibitions are generally more open to embracing improved practices, mainly due to the exposure and interaction they experience during such events.

This connection is clearly supported by the Diffusion of Innovations theory and the Information-Seeking and Communication model. The DOI theory shows that adopting new ideas starts with gaining knowledge, where actively seeking information is key. Farmers who look for information confidently progress through deciding and trying new practices. The ISCM model adds that farmers recognize what they need to know, find useful information, and judge its trustworthiness, essential steps that help them adopt innovations.

The credibility of the information received also plays a key role in influencing adoption. The study reports that a high degree of perceived information credibility significantly increases the odds of adoption (OR = 2.79, 95% CI: 1.338, 5.822; $p = 0.006$). This finding is consistent with the work of Skaalsveen *et al.* (2020), who highlighted that farmers are more inclined to adopt practices when they trust their information sources. Additionally, Rust *et al.* (2022) and (Bavorová *et al.*, 2020) support this notion, indicating that credible information sources enhance farmers' confidence in new practices, thereby promoting adoption. Key informants shared that farmers tend to be careful and are more open to trying new ideas when the information comes from people they trust, such as fellow farmers or familiar extension agents. They pointed out that farmers often find learning from their peers more convincing and relatable than reading official documents or listening to media messages. This aligns with the persuasion stage in DOI theory, where trust in both the message and the

source is critical. ISCM also regards credibility as a key factor in how farmers filter and prioritize information.

Farming experience also had a modest but significant positive effect (OR = 1.06, 95% CI: 1.022–1.096; $p = 0.001$), suggesting that experienced farmers draw on accumulated knowledge to assess the relevance and applicability of new practices. This is consistent with Landini (2021) and Nettle *et al.* (2022), who observed that experienced farmers are better positioned to integrate new knowledge into practice, often acting as opinion leaders in their communities which is an important category in DOI theory.

On the contrary, variables such as sex, age, marital status, and farm size were not significantly associated with adoption. While Giua *et al.* (2022) and Dapilah *et al.* (2020), suggest that these demographics may influence adoption via access or social dynamics, their insignificance here may indicate the overriding influence of behavioural and structural factors, namely information-seeking tendencies and credible communication, over demographic characteristics. The DOI theory also acknowledges that while personal attributes matter, the communication of innovation and the perceived attributes of the innovation often carry more weight in influencing adoption.

This study highlights the critical role of information-seeking behaviour and the credibility of information in driving the adoption of improved farming practices. Insights from key informants emphasise that farmers who seek out reliable information, especially from trusted sources like extension officers or peers, are more likely to embrace new practices. While some demographic and regional factors appeared less influential in this study, the findings suggest that further research is needed to understand better the complex factors influencing the adoption of improved sorghum farming practices, particularly in areas with distinct socio-economic challenges.

Table 0-3: Binary Logistic Model Results on the Association Between Information-Seeking Behaviour and Adoption of Improved Farming Practices Among Sorghum Farmers (N = 399)

Factor		Odds ratio	Std. err	z	P>z	95% Conf. Int.
Sex	Female	Ref	-	-	-	-
	Male	1.16	0.393	0.44	0.657	0.599, 2.255
Age		0.98	0.014	-1.49	0.138	0.953, 1.007
Marital status	Not married	Ref	-	-	-	-
	Married	0.43	0.209	-1.73	0.083	0.168, 1.116
Farm size (in acre)		0.97	0.058	-0.52	0.6	0.861, 1.09
Farming experience (in years)		1.06	0.019	3.19	0.001	1.022, 1.096
Perceived information credibility	Low	Ref	-	-	-	-
	High	2.79	1.047	2.74	0.006	1.338, 5.822
Information seeking behaviour	Non-seekers	Ref	-	-	-	-
	Seekers	4.03	1.325	4.24	0	2.116, 7.678

5. Conclusion and Recommendations

5.1. Conclusion

This study highlights the fundamental role of information-seeking behaviour in the adoption of improved farming practices among sorghum farmers. Key findings indicate that higher education levels and ownership of communication assets significantly enhance farmers' propensity to seek agricultural information. These findings led to the rejection of the first null hypothesis, confirming that while some personal and farm characteristics may not determine information-seeking behaviour, factors such as education and access to communication tools are particularly influential. Furthermore, the study found that farmers who actively sought information were substantially more likely to adopt improved farming practices, especially when the information was obtained from credible sources. This finding resulted in the rejection of the second hypothesis, affirming a significant positive association between information-seeking behaviour and the adoption of improved practices. Farmers who engaged with agricultural information were more inclined to implement improved farming practices. The credibility of information sources further strengthens this relationship, with trusted information increasing the likelihood of adoption. The findings suggest that, beyond demographic factors, community dynamics and access to reliable information may play a more critical role than previously recognised. Therefore, the study highlights the importance of targeted educational and

communication interventions that promote active information-seeking and trust in information sources. Such efforts are essential for empowering sorghum farmers and enhancing agricultural productivity and sustainability in Dodoma and similar contexts.

5.2. Recommendations

To enhance the adoption of improved sorghum farming practices, several key actions are recommended. First, strengthening farmer education through adult literacy and training programmes is essential, as education empowers farmers to understand and apply new ideas more effectively. Equally important is expanding access to communication tools like mobile phones, radios, and televisions, which help farmers seek out timely and relevant information. Information must also be presented in clear, simple formats and delivered by trusted sources such as extension officers or fellow farmers, as credibility greatly influences adoption. Encouraging proactive information-seeking through farmer groups, mobile advisory services, or community-based learning can further build awareness and confidence. Additionally, experienced farmers should be recognised and supported as role models who can guide others in adopting innovations. Lastly, while demographic factors may appear less influential, community dynamics and social networks remain vital and should be considered in future interventions aimed at improving farming outcomes in rural areas

6. . Implications, limitations, and future studies

6.1. Theoretical implications

The findings of this study contribute to the theoretical discourse by reaffirming the relevance of the Diffusion of Innovation Theory, Information Seeking Behaviour Model, and Source Credibility Theory within the context of agricultural communication. The results highlight that source credibility, characterized by trustworthiness, reliability, and accuracy, plays a pivotal role in the persuasion stage of the innovation-decision process. Furthermore, the distinction between homophilous and heterophilous information sources emphasises the importance of balancing technical expertise with social relatability.

6.2. Practical implications

The findings suggest that enhancing the credibility of agricultural information sources is essential for improving the adoption of recommended sorghum farming practices. Extension services should focus on strengthening both the technical competence and interpersonal communication skills of their officers. Moreover, integrating trusted peer farmers into information dissemination efforts may increase message acceptance, as farmers tend to adopt innovations more readily when the source is both knowledgeable and socially relatable. This approach can contribute to more effective agricultural communication and improved productivity among smallholder farmers.

6.3. Policy implications

The study highlights the need for policies that prioritize the credibility of agricultural information sources within extension systems. Policymakers should invest in capacity-building programs for extension officers, promote farmer-to-farmer knowledge exchange, and institutionalize credibility standards in agricultural communication strategies. Strengthening these areas can foster trust, enhance adoption, and support national food security goals.

6.4. Limitation and future studies

The study's limitations include reliance on self-reported data, potentially introducing bias, and a focus on sorghum, which may limit generalizability to other crops. Its cross-sectional design restricts causal inferences, and unmeasured factors like social networks and community dynamics may also affect adoption. Future research should investigate the long-term effects of information-seeking behaviour on adopting agricultural practices across various crops and regions. Longitudinal studies and qualitative methods, like interviews, could reveal deeper insights into barriers to information access. Additionally, examining social networks and including diverse demographics will enhance understanding of the adoption process.

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CHAPTER SIX

SUMMARY, CONCLUSIONS, RECOMMENDATIONS, IMPLICATIONS, AND AREAS FOR FURTHER RESEARCH

1.10 Overview

This study investigated how the communication of agricultural research information influences the adoption of improved farming practices among sorghum farmers in Dodoma, Tanzania. Specifically, it focused on four key objectives: assessing the influence of source credibility, examining the effects of repackaging agricultural research information, evaluating the role of communication channels, and exploring the impact of farmers' information-seeking behaviour on the uptake of improved sorghum farming practices. These objectives formed the foundation for the development of four standalone manuscripts, each corresponding to one of the study's core areas. The chapters present key findings and interpretations, from which overarching conclusions are drawn. In addition, they offer practical recommendations, outline theoretical and policy implications, and suggest directions for future research.

1.11 Summary of the Findings

1.11.1 Source Credibility and the Adoption of Improved Sorghum Farming Practices

The findings regarding source credibility and its impact on the adoption of improved farming practices among sorghum farmers were detailed in Chapter Two and correspond to the first research objective. The results indicated that the majority of sorghum farmers were middle-aged men with moderate farming experience and limited formal education, typically having attained only a primary school level. For these farmers, agriculture served as their primary livelihood, making access to reliable information crucial for enhancing productivity. The study revealed that farmers were more inclined to adopt improved farming practices when the information originated from sources they deemed credible, such as experienced fellow farmers and agricultural extension officers. Key factors influencing perceptions of credibility included trustworthiness, reliability, and accuracy of the information provided. Specifically, trustworthiness increased the likelihood of adoption by 1.15 times (95%

CI: 1.03, 1.28; $p = 0.012$), reliability by 1.18 times (95% CI: 1.08, 1.29; $p < 0.001$), and accuracy by 1.12 times (95% CI: 1.03, 1.23; $p = 0.011$). The aggregated credibility index further demonstrated a 1.06-fold increase in adoption likelihood (95% CI: 1.03, 1.10; $p = 0.001$), underscoring the central role of credibility in promoting the adoption of improved farming practices. Additionally, socio-demographic factors such as education level, farming experience, and the frequency of contact with credible sources significantly affected the degree to which farmers embraced these improved practices. This emphasises the importance of establishing trustworthy communication channels to facilitate the adoption of innovative agricultural techniques.

1.11.2 Repackaging Agricultural Research Information for Adopting Improved Sorghum Farming Practices

The findings on repackaging agricultural research information and the adoption of improved farming practices are presented in Chapter Three and are based on the second objective. The results revealed that repackaging agricultural research information into simpler and more accessible formats such as Kiswahili translations, radio broadcasts, visual aids, and farmer-friendly brochures enhanced farmers' comprehension and practical application of recommended sorghum farming practices. This improved clarity helped bridge the gap between research institutions and smallholder farmers, enabling them to make more informed decisions at the farm level. In particular, the study found that linguistic accessibility was a key determinant of how farmers received and acted upon information. An overwhelming 91 percent of respondents indicated a preference for receiving agricultural information in Kiswahili, which they found easier to understand and more relevant to their needs. ANOVA results ($p < 0.001$) confirmed a statistically significant relationship between language preference and the adoption of improved farming practices. Moreover, farmers who received information in both Kiswahili and their local dialects demonstrated higher adoption rates than those exposed to messages in only one language. This suggests that bilingual communication strategies enhance comprehension and better connect formal knowledge to local contexts. The study also revealed that farmers actively assess the quality of agricultural information based on clarity, format, and completeness. Statistically significant differences in perceptions were observed (ANOVA $F = 27.36$, $p < 0.001$), indicating that well-packaged information that is clear, structured, and

complete is more likely to be accepted and used. Logistic regression analysis showed that language (Odds Ratio = 2.93), objectivity (OR = 2.64), and completeness (OR = 2.10) were strong predictors of adoption. These attributes increased the information's perceived credibility and practical relevance. Additionally, the findings indicated that farmers' education levels, access to repackaged materials, and frequency of interaction with extension agents significantly influenced their ability to understand and adopt improved sorghum farming practices. Overall, the results demonstrate that repackaging agricultural research information into farmer-friendly formats, especially when delivered in familiar languages, can substantially improve the uptake of improved farming techniques in semi-arid areas such as Dodoma.

1.11.3 Effects of Communication Media on Adoption of Improved Sorghum Farming Practices

The findings on the effects of communication media on the adoption of improved sorghum farming practices are presented in Chapter Four and are based on the third objective. Among the 399 surveyed farmers, 14.79% (59 farmers) had not adopted any of the six recommended practices, while 85.21% (340 farmers) reported adopting at least one. This pattern is consistent with broader trends observed among smallholder farmers in developing countries, where adoption of improved agricultural practices remains modest despite ongoing extension efforts. A two-way ANOVA revealed statistically significant variations in the usage of different communication media for accessing agricultural information, with an F-statistic of 253.11 ($p < 0.001$). Further analysis using binary logistic regression demonstrated that interpersonal communication had a consistently strong influence on the adoption of all six farming practices, with odds ratios ranging from 1.48 to 1.58. Mobile phones and television also showed significant positive effects, with odds ratios between 1.27 and 1.70, underscoring their value as accessible and effective platforms for disseminating agricultural research information. Farmers who received information through interactive and locally relevant media, particularly face-to-face interactions, mobile phones, and television, were more likely to adopt improved sorghum farming techniques. In contrast, print media such as newspapers had little influence on adoption, reflecting the limitations of non-interactive channels, especially in rural contexts where literacy and access may be limited. Overall, the findings highlight the

critical role of interactive communication strategies in supporting technology uptake among smallholder farmers. Enhancing access to media that encourage engagement, feedback, and contextual understanding can significantly improve the reach and effectiveness of agricultural innovations.

1.11.4 Information seeking Behaviour and its Influence on Adoption of Improved Farming Practices among Sorghum Farmers in Dodoma, Tanzania

The findings on information-seeking behaviour and the adoption of improved sorghum farming practices, presented in Chapter Five and based on the study's fourth objective, highlight the significant impact of individual and contextual factors on farmers' decisions. The majority of respondents were male (57.14%) and married (83.46%), indicating strong household decision-making structures and potential social support for embracing new practices. However, most farmers (75.44%) had only primary education, which may limit their ability to engage with more technical agricultural content. Despite this, a notable 83.21% of farmers owned communication assets like mobile phones and televisions, suggesting that both mass and digital media can effectively disseminate agricultural information. The average age of the farmers was 46.89 years, reflecting a demographic that balances considerable practical experience with a willingness to adopt innovative approaches. Encouragingly, 81.20% of respondents actively sought agricultural information, often turning to peer farmers and extension officers, sources that are highly valued for their interactivity and local relevance. Statistical analysis revealed that higher education levels ($\beta = 0.296$; $p = 0.008$) and ownership of communication tools ($\beta = 0.749$; $p < 0.001$) significantly enhanced information-seeking behaviour. Moreover, those who actively sought information were four times more likely to adopt improved practices ($OR = 4.03$; $p < 0.001$), especially when the information was perceived as credible ($OR = 2.79$; $p = 0.006$). Farming experience also played a positive role in adoption decisions. The random effects analysis showed minimal variation across districts ($\sigma^2 = 0.059$; $ICC = 0.003$), indicating that individual-level factors had a more substantial influence on adoption behaviour than district-level characteristics. This suggests that empowering farmers through education and access to communication tools could significantly enhance their ability to adopt improved farming practices. Overall, the findings

emphasize the importance of tailored information dissemination and support networks in fostering agricultural innovation among sorghum farmers.

1.12 Conclusions

This study highlights the fundamental role of communication in enhancing the adoption of improved sorghum farming practices among smallholder farmers in Dodoma, Tanzania. The findings consistently reveal that adoption is not merely a function of availability of information but of how that information is delivered, perceived, and internalised by farmers. Credibility of the source emerged as a key determinant. Farmers were more responsive to information disseminated by trusted actors such as knowledgeable fellow farmers and agricultural extension officers and. This trust, coupled with consistent, relevant, and accurate messaging, significantly increased the likelihood of adoption.

Equally important was the manner in which agricultural research information was repackaged and conveyed. When information was presented in familiar languages, notably Kiswahili, and adapted into user-friendly formats such as visual aids, radio programs, and brochures, farmers demonstrated better understanding and application of the practices. Communication media also influenced adoption levels. Interactive channels, particularly interpersonal contact, mobile phones, and television, proved to be the most effective in facilitating information flow, feedback, and behavioural change. Information-seeking behaviour was another critical factor. Farmers who actively pursued agricultural information, especially those with higher education levels and access to communication tools, were significantly more likely to adopt improved practices. The minimal variation between districts suggests that individual-level attributes rather than location-specific factors played a more decisive role in shaping adoption behaviours.

Importantly, the study contributes methodologically by applying an integrated communication–adoption model tailored to the Tanzanian context. This model offers a structured framework for evaluating how communication processes influence the uptake of agricultural innovations, providing a tool that can guide future research and the design of more effective communication strategies for smallholder farmers. Generally, the study highlights the need for farmer-centred communication approaches

that combine credible sources, accessible language, interactive media, and supportive infrastructures to promote meaningful adoption of agricultural innovations in semi-arid rural settings.

1.13 Recommendations

Based on the findings, several key recommendations are proposed to improve the communication of agricultural research information and foster the adoption of improved sorghum farming practices among smallholder farmers in Dodoma, Tanzania. Farmers are encouraged to actively seek credible agricultural information from reliable sources such as agricultural extension officers, and experienced fellow farmers. They should also utilize accessible communication tools including mobile phones and local radio programmes, and participate in farmer field schools, community training sessions, and peer exchange visits to enhance knowledge sharing and practical skills. Agricultural research institutes, including the Tanzania Agricultural Research Institute, are advised to repackage research findings into formats that are accessible and relevant to farmers. This includes translating materials into Kiswahili, incorporating visual aids, and aligning content with local farming contexts. Researchers are encouraged to adopt participatory approaches by involving farmers in technology development and validation processes, thereby enhancing the relevance and applicability of innovations. Extension officers should increase their presence in rural areas by conducting regular field visits and facilitating interactive learning platforms. Policy makers in the ministries responsible for agriculture, information, and education are urged to invest in inclusive and accessible communication strategies that address literacy barriers and consider farmers' media preferences such as interpersonal communication, mobile phones and television. Additionally, targeted interventions should be implemented to support marginalized groups, including women, elderly farmers, and those with limited education. Development partners and communication strategists are encouraged to establish rural information centres, strengthen feedback mechanisms between farmers and researchers, and promote continuous capacity-building efforts. These initiatives will enhance information access, trust, and practical application, ultimately supporting widespread adoption of improved sorghum farming practices.

1.14 Contribution of the Study

1.14.1 Theoretical Contribution

This study contributes meaningfully to the theoretical advancement of communication and innovation adoption by building on and extending five established models: Lasswell's Model of Communication, the Diffusion of Innovations (DOI) Theory, the Information-Seeking and Communication Model (ISCM), the Service Marketing Model, and Media Richness Theory. Each model provided a conceptual lens, but this study moves beyond their traditional applications by offering context-specific insights relevant to smallholder agricultural systems. First, the study advances the DOI theory by demonstrating how the perceived credibility of information sources and the repackaging of messages in familiar, accessible formats significantly enhance the adoption of innovations among farmers. It shows that innovation adoption is not solely determined by the characteristics of the innovation but is also shaped by how the information is communicated and by whom. Second, the study enriches the ISCM by revealing that farmers' information-seeking behaviour is not only motivated by the perceived utility of information, but also by its clarity, cultural relevance, and mode of delivery, factors often overlooked in previous applications. Third, this research contributes to Media Richness Theory by empirically showing that richer, more interactive media (e.g., face-to-face extension services, radio) are more effective in reducing ambiguity and promoting understanding of agricultural practices than leaner channels such as newspapers. Fourth, the study adapts the Service Marketing Model to the agricultural context, showing that farmers' trust and satisfaction with information services influence their willingness to adopt new practices. Finally, while Lasswell's model provided a foundational framework, the study extends its applicability by integrating contextual feedback loops and farmer engagement dynamics. Collectively, these contributions demonstrate that effective agricultural communication is an interactive, multidimensional process, thus enriching the theoretical discourse on rural innovation adoption.

1.14.2 Empirical Implications

The empirical implications of this study provide valuable insights into how agricultural communication strategies can be refined to enhance the adoption of improved farming

practices among smallholder sorghum farmers in Dodoma, Tanzania. The findings highlight the critical role of source credibility in influencing farmers' adoption decisions. Information perceived as trustworthy, particularly when delivered by extension officers and experienced peer farmers, significantly increases the likelihood of adoption. This highlights the need to strengthen farmer to extensionist engagement and build the capacity of local actors to serve as credible sources of agricultural information. The study also illustrates the effectiveness of repackaging agricultural research information into farmer-friendly formats. When technical content is simplified, translated into Kiswahili, and supplemented with visual aids or radio broadcasts, it becomes more accessible and actionable. These findings point to the importance of designing communication materials that align with farmers' literacy levels, language preferences, and local contexts. Moreover, the study reveals that interactive communication media such as interpersonal communication, mobile phones, and community radio are more impactful than print media in rural settings. This suggests that investments should prioritize media that promote dialogue and contextual engagement, especially where literacy barriers persist. Finally, the results indicate that information-seeking behaviour is significantly shaped by individual attributes including education and access to communication tools. Farmers who actively seek information are substantially more likely to adopt improved practices. This emphasizes the importance of enhancing farmers' digital and informational capacities through education, training, and infrastructure development. Collectively, these empirical insights provide a strong foundation for evidence-based policymaking and more inclusive extension strategies.

1.14.3 Practical implications

The findings of this study offer several practical implications for enhancing the adoption of improved sorghum farming practices through more effective communication strategies in Dodoma, Tanzania. First, the study stresses the need to prioritize the credibility of information sources. Agricultural stakeholders, including government extension officers, researchers, and non-governmental organizations, should invest in building trust with farmers by maintaining consistency, transparency, and professionalism when communicating agricultural innovations.

Secondly, the study highlights the importance of repackaging agricultural research information into farmer-friendly formats. Practitioners should simplify technical content by using Kiswahili, integrating visual aids such as diagrams and illustrations, and providing real-life examples that align with local farming experiences. This will help bridge the knowledge gap caused by low literacy levels and improve understanding and application of the information.

Thirdly, the effective use of communication media is vital. Practical efforts should be made to expand access to affordable, familiar, and interactive communication channels such as community radio, mobile phones, and village meetings. These platforms are not only accessible but also culturally acceptable and effective in reaching large numbers of farmers with timely and actionable messages.

Additionally, promoting active information-seeking behaviour among farmers can greatly enhance adoption. This requires practical interventions such as training sessions, farmer field schools, and peer-to-peer learning to encourage farmers to proactively seek out, evaluate, and apply new information. Support systems should also be established to help overcome barriers such as digital illiteracy, high communication costs, and infrastructural limitations. Overall, these practical measures improve the communication of agricultural information, thereby increasing the adoption of improved farming practices and enhancing food security and rural livelihoods in the region. These measures provide stakeholders such as agricultural extension officers, research institutions, and mobile service providers with evidence-based guidance to improve productivity, livelihoods, and the sustainability of sorghum farming, in alignment with the objectives of Tanzania's Development Vision 2025.

1.15 Study Limitations and Direction for Future Studies

Despite the valuable insights provided by this study, several limitations must be acknowledged. First, the study focused solely on sorghum farmers in Dodoma, Tanzania, which may limit the generalizability of the findings to other regions or crop sectors. The socio-economic, cultural, and environmental contexts in different regions may influence the adoption of agricultural innovations differently, so further studies in other regions or with other crops would be valuable to assess the broader applicability of these findings.

Second, the study relied primarily on self-reported data from farmers, which may be subject to biases such as social desirability or recall bias. Future research could benefit from using a mixed-methods approach that incorporates both quantitative and qualitative data, as well as observations or experiments that allow for a more objective assessment of farming practices and information-seeking behaviour.

Another limitation is the focus on certain communication channels, particularly mobile phones and radio programmes. While these channels were found to be important, other less explored media such as social media platforms, community-based extension networks, and mobile apps could also be significant in fostering information exchange and the adoption of improved practices. Future studies should examine these emerging communication channels and their impact on smallholder farmers' information-seeking behaviour.

Additionally, the study did not assess the long-term effects of communication interventions on the sustained adoption of improved farming practices. Future research could explore how the continuous availability of agricultural information, coupled with ongoing communication strategies, influences the longevity of adoption and the eventual impact on productivity.

Finally, the study primarily focused on information-related factors, but future studies could investigate how socio-political factors, such as government policies and local agricultural extension systems, shape the adoption of improved farming practices. Examining the role of policy frameworks, subsidies, and institutional support can provide deeper insights into how systemic factors influence farmers' adoption decisions.

By addressing these limitations and exploring the suggested avenues for future research, scholars can further enhance our understanding of the complex dynamics between communication, information-seeking behaviour, and the adoption of agricultural innovations.

APPENDICES

Appendix I: Questionnaire

Communicating Agricultural Research Information for Improved Sorghum Farming Practices in Dodoma, Tanzania

The purpose of this study is to examine how agricultural research information is communicated and accessed by sorghum farmers, and how such processes influence the adoption of improved sorghum farming practices in Dodoma, Tanzania. Specifically, the study focuses on the roles of source credibility, repackaging of information, communication media effectiveness, and farmers' information-seeking behaviour in shaping the adoption of improved practices. The successful completion of this study will generate insights into how communication and access to agricultural research information can be strengthened to improve sorghum productivity. The information collected through this questionnaire will be used solely for academic research purposes related to this study.

Questionnaires Identification

S/N	Item	Response
1	Date questionnaires filled	
2	Name of interviewer (optional)	
3	Name of District	
4	Ward	
5	Village	
6	Kitongoji	

PART A: Socio-Demographic information of sorghum farmers (provide appropriate answers)

S/N	Item	Response
1	Sex	
2	Age in years	
3	Marital status	
4	Education level	
5	Farm Size	
6	Farming Experience	
7	Household size	
8	Ownership of communication assets	
10	Productivity Trend over the past five years	
11	Membership in agriculturally based organization	

Codes:

Sex: 1= Male, 2= Female

Marital status: 1= Single, 2= Married, 3= Divorced, 4= Separated, 5= Widow/Widower

Education level: 1= No formal education 2= Primary education, 3= Secondary education, 4= Vocational, 6= Higher education (certificate, diploma, & degree)

Ownership of communication assets; 1=radio, 2= mobile phone, 3=television

Productivity Trend: 1= declining, 2= constant 3= varied, 4=increasing

What do you think is the reason behind your production trend(s) over the past five years?.....

.....

.....

.....

Membership of agriculturally based organization: 1= member, 0= non-member

PART B: The influence of Source credibility on adoption of improved sorghum farming practices

1. Do you receive agricultural information on improved sorghum farming practices in your village? I. YES [] II. NO []
2. Which source(s) do you use to access agricultural research information in your sorghum farming? (Circle appropriate answer (s))
 - (a) TARI researchers (b) Agro-dealers (c) Extension officers (d) Religious leaders
 - (e) Local leaders (f) Fellow farmers (g) Others, specify.....
3. What kind of agricultural research information on improved sorghum farming practices do you receive from your source? (Put a tick to the appropriate kind of information and its source

S/ N	Kind of Agricultural Information	Sources of Agricultural Information						
		TARI resear chers	Agro - deale rs	Extensi on officers	Religio us leaders	Local leade rs	Fello w farme rs	Othe rs
1	Information on preparation of farms							
2	Information on the use of improved seed varieties							
3	Information on application of fertilizers/manure							
4	Information on management of weeds							

5	Information on control of pests and diseases							
6	Information on management of post-harvest losses							
7	Others, specify							

4. How often do you receive agricultural information on improved sorghum farming practices from your source(s)? (a) At least once per week [] (b). Daily [] (c). Once per month [] (d). Once after every three months [] (e). Twice per year []
5. How would you evaluate each source of information in terms of trustworthiness, reliability and accuracy of information? Please, indicate a score for each source where 1= Strongly disagree 2= Disagree, 3=, Neutral 4= Agree, 5= Strongly agree

S/N	SOURCE CREDIBILITY					
	TRUSTWORTHINESS	1	2	3	4	5
1	Agricultural information from TARI is trustworthy					
2.	Agricultural information from Agro-dealers is trustworthy					
3.	Agricultural information from Extension Officers is trustworthy					
4	Agricultural information from Religious Leaders is not trustworthy					
5.	Agricultural information from Local Leaders is not trustworthy					
6.	Agricultural information from Fellow Farmers is trustworthy					

S/N	RELIABILITY	1	2	3	4	5
1.	Agricultural information from TARI is more reliable					
2.	Agricultural information from Agro-dealers is more reliable					
3.	Agricultural information from Extension Officers is more reliable					
4.	Agricultural information from Religious Leaders is not more reliable					
5.	Agricultural information from Local Leaders is not reliable					
6	Agricultural information from Fellow Farmers is not reliable					
S/N	ACCURACY	1	2	3	4	5
1.	Agricultural information from TARI is more accurate					
2.	Agricultural information from Agro-dealers is more accurate					
3.	Agricultural information from Extension Officers is more accurate					
4.	Agricultural information from Religious Leaders is not accurate					
5.	Agricultural information from Local Leaders is not accurate					
6	Agricultural information from Fellow Farmers is not accurate					

6. To what extent does communicated ARI help you adopt improved sorghum farming practices? (Please tick where is appropriate) Use scale 1= Not at all; 2=Neutral 3=To moderate extent; 4=To small extent; 5= To large extent

S/N	Improved Sorghum farming practices					
	Preparation of farms	1	2	3	4	5
1	I usually check on soil qualities as recommended before planting					
2.	I usually clear my farm as recommended before tillage					
3.	I usually observe recommended proper land tillage techniques					
4	I usually use recommended proper farm implements					
S/N	Use of improved seed varieties	1	2	3	4	5
1.	I regularly use recommended sorghum seed varieties because they drought-tolerant					
2.	I use improved seeds because they are pests resistant					
3.	I observe planting sorghum in recommended depth					
4.	I use improved seeds because they give better yields					
S/N	Application of fertilizers/manure	1	2	3	4	5

1.	I often consult experts on the use of fertilizers/manure					
2.	I often use recommended amount of fertilizers/manure					
3.	I often use of fertilizers/manure at recommended time schedule					
4.	I often use manure when I cannot afford industrial fertilizers					
S/N	Control of weeds	1	2	3	4	5
1.	I usually seek advices on weed control techniques from experts					
2.	I usually weed my farm two times as advised by experts					
3.	I usually use herbicides (weed killer) on my farm					
4.	I usually keep my farm clean to avoid nutrient competition with weeds					
S/N	Control of pests and diseases	1	2	3	4	5
1.	I regularly seek advice on common pests affecting sorghum crops					
2.	I regularly seek advice on common diseases affecting sorghum crops					
3.	I regularly use seed varieties which are resistant to diseases					

4.	I regularly spray pesticides to control disease					
S/N	Management of post-harvest losses	1	2	3	4	5
1.	I normally observe time of harvesting and threshing of sorghum as recommended by experts					
2.	I normally dry sorghum as recommended by experts					
3.	I normally use recommended sorghum storage techniques to avoid loss					
4.	I normally use recommended sorghum pesticides to control pests					

PART C: The influence of agricultural research information repackaging on adoption of improved sorghum farming.

1. Which language do agricultural research experts use to communicate ARI to you?
(a) Kiswahili (b) local language (c) English (d) Code mixing/switching. (Circle the appropriate answer)
2. Which of the above language would you consider as the most appropriate to communicate ARI?.....(mention one)
3. How would you rate the quality of the repackaged agricultural information on improved sorghum farming practices communicated to you? Use scale 1= Very poor 2=Poor 3=Good 4= Very Good 5= Excellent

S/N	INFORMATION ATTRIBUTE	RATING				
		Very Poor	Poor	Good	Very Good	Excellent
1	Objectivity; the extent to which information is unbiased, true and credible					
2	Relevancy: The extent to which information is applicable and helpful for your daily farming activities/ task at hand					
3	Reliability: The extent to which information is dependable and free					

	of error					
4	Accessibility: The extent to which information is available and quickly retrievable					
5	Completeness: The extent to which the volume and coverage of information is sufficient to address the information needs of a farmer					
6	Language Use: the extent to which appropriate and familiar language is used					
7	Timeliness: the extent to which information is communicated at favourable and useful time					
8	Format: the extent to which information is set in a user-friendly manner					

9	Media Choice: the extent to which information is communicated through a variety of communication channels					
10	Currency: The extent to which information is sufficiently up to date for the task for the task at hand/ information requirement of the farmer					

PART D: Effects of communication media on adoption of improved sorghum farming.

1. How often do you use these communication channels to access agricultural information on improved sorghum farming practices in your village? (You may have more than one option: Use scale 1= Never 2=Occasionally 3=Monthly 4= Weekly 5= Daily

S/N	Communication media	Frequency				
		Never	Occasionally	Monthly	Weekly	Daily
1	Newspapers					
2	brochures					
3	posters					
4	Television					
5	Radio					
6	Mobile phone					
7	Interpersonal contact					
8	Agricultural exhibitions					
9	Local meeting,					
10	Town-crier					
11	drama					
12	songs					
13	Others, specify.....					

2. How would you rank the capacity and ability of communication channels that you frequently use to access agricultural information in satisfying your information needs on adoption of improved sorghum farming practices?

S/N	Communication channels	Level of Satisfaction				
		Never used	Not at all Satisfied	Somewhat Satisfied	Satisfied	Very Much Satisfied
1	Newspapers					
2	brochures					
3	posters					
4	television					
5	Radio					
6	Mobile phone					
7	Interpersonal contact					
8	Agricultural exhibitions					
9	Local meeting,					
10	Town-crier					
11	drama					
12	songs					
13	Others, specify.....					

3. Give any three reasons for your responses in question No.2.....

.....

.....

PART E: Institutional factors affecting communication and adoption of improved sorghum farming.

1. Have you been given policy guideline that recommend cultivation of drought-tolerant crops in Dodoma region in relation to agro-ecological condition? (a) Yes, (b) No...if no skip to question 4
2. Where did you get from.....?
3. Do you observe the recommended sorghum cultivation guidelines(a) Yes (b) No
4. Do you have any interaction with agricultural extension officer/s in your farming activities? (a) Yes (b) No
5. If no, what are possible reasons? Mention
 - (a)
 - (b)
 - (c)
6. How would you evaluate the availability of agricultural information through various communication channels in your surroundings? (Please tick the appropriate response)

S/N	Communication Channels	Responses		
		Always available	Rarely available	Not available at all
1	Radio			
2	Television			
3	Mobile phone			
4	News papers			
5	Brochures			
6	Farm Magazine			

Thank you for your cooperation

Appendix II: Key Informant Interview Guide (Ward Extension Officers)

Communicating Agricultural Research Information for Improved Sorghum Farming Practices in Dodoma, Tanzania

1. What are the main methods you use to communicate agricultural research information to sorghum farmers in your ward?
2. How do farmers respond to different communication channels such as meetings, radio programs, mobile phones, or printed materials?
3. In your experience, how credible do farmers consider the sources of information such as TARI, radio, or extension officers?
4. Are research messages usually simplified or translated into Kiswahili before being shared with farmers? If yes, how?
5. What challenges do you face in delivering research information to sorghum farmers?
6. How do you assess farmers' understanding of the information they receive?
7. What role do mobile phones play in accessing and sharing sorghum-related farming information among farmers?
8. How often do farmers seek information from you, and what kind of sorghum-related information do they request most?
9. What factors do you believe influence the adoption of improved sorghum farming practices in your area?
10. What recommendations would you suggest to improve communication and increase adoption of improved sorghum practices?

Appendix III: Key Informant Interview Guide (TARI-Hombolo)

Communicating Agricultural Research Information for Improved Sorghum Farming Practices in Dodoma, Tanzania

- 1.What strategies does TARI use to communicate improved sorghum farming practices to farmers in Dodoma?
- 2.How do you ensure that the agricultural research information you generate is accessible and understandable to smallholder farmers?
- 3.To what extent do you collaborate with extension officers and local government in disseminating sorghum-related research information?
- 4.How do you assess the credibility and trustworthiness of the sources through which TARI disseminates agricultural research information?
- 5.What efforts are made to repackage technical research findings into farmer-friendly formats or local languages?
- 6.What challenges does TARI face in effectively communicating research findings to sorghum farmers in rural areas?
- 7.How do you incorporate feedback from farmers and extension officers into future research or communication strategies?
- 8.In your view, what is the role of mobile phones, community radios, or other ICT tools in enhancing information flow to farmers?
- 9.What is your assessment of farmers' information-seeking behavior and how does it influence the uptake of improved farming practices?
- 10.What improvements or innovations would you recommend to strengthen the communication of sorghum research information to farmers?