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Factors influencing the use of mobile technologies in communicating agricultural information among extension officers in Tanzania: A case study of M-Kilimo

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ABSTRACT

This study was carried out at Mpanda Municipal Council in Katavi Region. The study aimed at assessing the factors influencing the use of M-Kilimo, an interactive mobile agriculture platform in communicating agricultural information among extension workers. The specific objectives were to determine the characteristics of Agricultural Extension Officers in the study area, their perception toward M-Kilimo, their level of use of the M-Kilimo programme and the factors influencing the use of M-Kilimo in the study area. A sample of 21 respondents were interviewed of which 17 were male and 4 were female. Data were collected by interviews and focus group discussion and were analyzed using the Statistical Package for the Social Sciences (SPSS) programme. This study found shortage of tablets, low motivation of some buyers to register and provide market information in the system, high cost of some Internet bundles and low clarity of some features influenced the use of M-Kilimo. However, most extension workers were intrinsically motivated to use the technologies. We recommend on-going training for extension workers and subsidizing the Internet cost. We also recommend a specific campaign to include business actors in the system to offer diversity of the information disseminated.

Keywords: *M-Kilimo; extension officers; Mpanda; agricultural information*

BACKGROUND

Agricultural extension services are critical in the growth and development of the Agricultural sector and have remained a key strategy in the rural development efforts in many developing countries. Through agricultural extension, farmers can be assisted to use modern farming methods that increase agricultural production. In this way the Tanzanian government has committed itself to ensuring that quality extension services are available for every farmer in the country. Through the Agricultural Sector Development Strategy II, for example, the government wanted to ensure that every village has one extension worker through the recruitment and training of new extension officers. Still achieving this target is far from being realized.

Authors have noted the declining ratio of extension officers per farmer. For example, one extension field worker serves 1,000 farm families, which means that the extension worker cannot be realistically expected to work with all the farmers under his/her jurisdiction. This problem is compounded by the poor working conditions of the field staff where means of travel are available and funds to pay for travel expenses are non-existent (Task Force on National Agricultural Policy, 1982; Mattee, 1989; Moris, 1989). On top of that ineffective means of extension communication add to the existing problems with a shortage of training extension staff. The body of knowledge indicates that the mode of communication between extension workers and farmers is normally very formalistic, relying on circulars and reports, most of which are never read. As a result, extension workers in the field are not always up to date on new technologies or extension policies, and feedback rarely reaches the top levels of the organization where decisions are then made based on wrong assumptions and without a full understanding of the problems and concerns of farmers.

To address the challenges in extension service delivery, the use of Information and Communication Technologies (ICT) seems relevant. ICT can address the shortage of extension staff and improve

communication. The use of ICTs such as mobile phones and the Internet has thus increased significantly since the creation of e-Agriculture. The aim is to utilize the potential of 6.8 billion mobile connections available worldwide and particularly the 1 billion connections that involve the poorest socioeconomic group working in small scale substance agriculture The opportunity that the increased availability of mobile connections provides in delivering information services to the people involved in agriculture is phenomenal. Access to the right information at the right time has helped to make informed decisions (WSIS, 2015).

Although mobile communication has quickly become an important part of activities for the rural population, its applications are not so good for farmers because most of these applications are not related to livelihood and environment of rural areas farmers. These mobile phone applications have not followed any generic blueprint and design for a specific target market and the required localized content (Hentschel, J., Lanjouw, J.O., Lanjouw, p., & Poggi, J. 2000)

Most mobile agriculture applications are not user-friendly, and we should consider the illiteracy of farmers whenever developing such mobile applications. The information such as agriculture, marketing, and weather advice should be local based and in the local language. There are also educational and social barriers which need to be broken by academic institutions and in the proper interest of religion, government, NGOs, mobile phone companies and development participants. Infrastructure and cost are also big issues to consider in mobile phone ICT technology. Smart phones and mobile phone applications with high Internet bandwidth have not been affordable (Qiang et al., 2011; Hatt et al. 2013; FAO, 2013, 2015).

Scaling up is challenging and plans for doing it need to be integrated in the formulation and implementation of initiatives. The sustainability of pilot initiatives is an issue; whether economic, social or environmental. Too often after the pilot phase, projects cease because of financial, human and other constraints. (FAO 2015). To date, agricultural m-services are still far from fulfilling their assumed potential. According to an earlier review by the GSM Association, they have made up only a very small share of development-related m-services at 8 per cent (Metcalfe, 2015). Further, many have struggled to reach scale and financial sustainability (Qiang et al., 2011; Hatt et al., 2013; FAO, 2013, 2015;). The shortage of funds has affected development of the Agricultural sector and as noted by Kennedy (2005) all the constraints were frequently emphasized by the lack of capital which is fundamental for agricultural development.

Mobile Kilimo (M-Kilimo) is an interactive mobile agriculture platform designed to improve communication between Agricultural Extension Officers in rural areas. Once registered for the service, farmers, fishermen, breeders, and businesspeople can meet online and do business. The platform was implemented in 2018 with two components first to help farmers, fishermen, breeders, and businesspeople to access markets using mobile phones and the second registered as M-Kilimo is to provide extension services to farmers, livestock keepers and fishermen by connecting them electronically with Extension officers in their geographical areas. In Tanzania, livestock producers used their mobile phones during drought to interact with veterinarians hosting radio shows on a local community radio station, thus stimulating community conversations on how to better manage dwindling water resources while preventing cattle deaths. (IGSMA, 2006).

Although mobile communication has quickly become an important part of the aspects of life of the rural population, its applications have not benefitted farmers directly because most of these applications are not related to the livelihood and environment of the farmers in the rural areas. These mobile phone applications have not followed any generic blueprint and design for specific target markets with the localized content (Hentschel, J., Lanjouw, J.O., Lanjouw, p., & Poggi, J. 2000).

Problem Statement

Despite the government efforts at solving farmer's problems by introducing the M-Kilimo program, the effectiveness of M-Kilimo in communicating agricultural information is not known. While the constraints on delivery of agricultural information through mobile phones has been observed in other studies, Sanga et al. (2016) noted the concern faced for effective delivery of outreach services due to lack of enough instructors; inadequate teaching or learning materials; few extension materials; and lack of infrastructure. To ensure the effectiveness and success of mobile agricultural information, Ally et.al. (2005) noted the need for new courses to be developed or existing courses revised for delivery via mobile devices. Agricultural Extension workers would have a major frontline role to explain the benefits of using mobile phones in agricultural information dissemination. Other studies on mobile phone technology in Agricultural development have noted the need to improve provision of agricultural extension services, and some countries such as Pakistan, India, Brazil, and the United States of America have opted for the use of Information and Communication Technology (ICT) (Katz, 2002; Hassan & Semkwiji, 2011). Hassan & Semkwiji (2011) have observed that the agricultural sector improved in those countries through the introduction of ICT in the Agricultural Extension Services.

General Objective

The general objective of this study is to assess the factors influencing the use of M-Kilimo in communicating agricultural information among extension workers.

Specific Objectives

This study will focus on four specific objectives as follows:

1. To determine the characteristics of Agricultural Extension Officers in the study area.
2. To determine the extension workers perception toward M-Kilimo
3. To determine the level of use of M-Kilimo programme in the study area.
4. To identify the factors influencing the use of M-kilimo

LITERATURE REVIEW

According to Frokjaer, Hertzum, & Hornboen (2000), the working location and shortage of Extension Officers talking about usability of mobile phones comprised the aspects of effectiveness, efficiency and satisfaction. With the implementation of various innovative solutions such as mobile based information systems in economic activities in agriculture in Kenya, Gichamba & Lukandu (2012) in a case study on the frameworks for developing mobile agricultural solutions that designers and developers use to create solutions, noted that Agriculture is one of the key economic activities of the people in Kenya as is the case in most African countries, and the most active agricultural activity in Kenya is dairy farming.

Even though agriculture is one of the backbone economic activities in Africa, many farmers encounter problems such as effective ways to record farm input expenses, farm produce data, tracking expenditure on farm chemicals and livestock medicals, and receive information from various stakeholders. All the stated problems can be solved using technology such as mobile phone solutions. Poulton & Kanyinga, (2014) have noted that if the Government in Kenya improved the telecommunications sector it will improve the adoption and development of solutions that will utilize the technology

In a review by Aker (2011), it was noted that Agriculture may serve as a vital means for improving the economic wellbeing of developing countries but yields in the countries have lagged far behind

those of the developed countries for decades. One potential explanation for this stagnating growth in yields is the underutilization of improved agricultural technologies, which has remained low in developing countries.

The use of mobile technology can be seen as an addition of work to Agricultural Officers with applications that have failed to consider their target users' literacy level. These were also likely to be abandoned, where the target farmers have a low literacy level and struggle to interact with the application. A text-based application may be severely limited for success despite the good intentions if the target users find it difficult to understand the content (Emeana et al., 2020).

On the other hand, a limitation in Agricultural development is the low quality of services provided by the companies and lack of interest by the private sector to participate in developing ICT programs for rural areas, which has been a big issue for the development of agricultural development in rural areas of developing countries (Hosseini et al., 2009).

RESEARCH METHODOLOGY

Area of Study

The study was conducted at Mpanda Municipal Council in Katavi Region. This is one of the three Districts for Katavi Region of Tanzania, which comprises 15 Ward, 43 streets and 89 villages. The population according to the census of the People and the Housing in 2012 indicated that the Mpanda Municipal Council had a total of their population of 118,150 and 24,275 households. In 2021, the Mpanda Municipal Council estimated the population to be 162,431 persons, among them 79,897 men, and 82,534 women. The estimated number of households was 33,373**.** This represents an increase of 3.6 percent per annum and 85% of their income sources come from the Agriculture sector, for household food and economic purpose. The Mpanda Municipality has a potential area for agriculture of 32,887 hectors and about 84,245 residents are directly engaged in agriculture activities.

A situation analysis is the process of gathering information on the internal and external environments to assess current strengths, weaknesses, opportunities and threats and to guide the goals and objectives. The situation analysis for this study was conducted between August - September 2021, in the Mpanda District, Katavi Region, and information was collected from farmers in Nsemlwa ward. The study used the Observation, Farm and Home visit approach to gather information, to assess the gap in effective use of mobile phones (M-Kilimo) to deliver agricultural services.

The research design is the proposed way to solve a particular problem which comprises data collection and analysis. According to Bryman & Bell (2011), selection of the research design depends on information intended, and information collected for the purpose of identifying specific aspects in an area. In this study a cross sectional research design was used to collect data at a single point in time (Kothari, 2004).

The population under study was all Agricultural Officers in Mpanda Municipal Council who use mobile phones to deliver Agricultural Services through the M-Kilimo program.

Data Collection Procedures

In this study primary data were collected from Ward and Village Agricultural Officers and secondary data collected from the District Agricultural Officer.

Methods and Instruments for data collection

Interviews (face to face/phone) and questionnaires were used for data collection. These methods were used because of their cost effectiveness and time saving characteristics.

Data Processing and Analysis

The data were processed, error corrected, coded, classified and tabulated and a method of mixed analysis of qualitative and quantitative methods employed. SPSS was used to establish counts of frequency distribution, mean and standard deviation. After the quantitative data processing, qualitative data was used to supplement the quantitative information and draw inferences to arrive at the conclusion.

RESULTS AND DISCUSSION

The data below presents interpretation and discussion of the results for the study on establishing the effectiveness of M-Kilimo program in Mpanda Municipal Council for agricultural improvement. General information on the respondents are shown in Table 1 below.

Table 1: *General information on respondents*

Variable		**F (N=21)**	**%**
Sex	Male	17	80.95
	Female	4	19.04^
Education	Certificate or Diploma	17	80.95
	Bachelor degree	4	19.04
Attended M-Kilimo training	Yes	13	61.9
	No	8	38.1
Work experience	<10 years	9	42.8
	>10 years	12	57.2
Access to mobile phone	Yes	21	100
	No	0	0
Access to a computer	Yes	1	95.2
	No	20	4.8
Access to cable electricity	Yes	21	100
	No	0	0
Employer	Government	21	100
	Private organization	0	0

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The data in Table 1 shows that 80.95 percent of the respondents were male compared to 19.04 percent who were female. The distribution reflects a reality in the gender pattern across science based professions in Tanzania, where males tends to outnumber female workers. In terms of education, most of the respondents (80.9%) were either certificate or diploma holders compared with 19.04 percent who held a bachelor degree. The results show that most workers in the region still hold lower educational qualification contrary to government expectations in accordance with the MOAC (1997) in which it was indicated that while village extension officers will have certificates or diplomas, they will be required to have a degree to serve at the division and district levels. In terms of work experience, 42.8 percent had over 10 years of work experience. Although the M-Kilimo has been introduced and widely promoted, it was noted that a significant number of workers

in the study area did not get specific training in the use of the M-Kilimo programme. About 38.1 percent had not attended any training compared to 61.9 who had attended training. In terms of Mobile phone ownership, almost every participant had a mobile phone. Mobile phone ownership and use in agricultural extension has been widely reported in the early studies (Sife et al., 2010; Sanga et al., 2013; Sanga et al., 2014).

The level of use M-Kilimo

Use of M-Kilimo among the respondents is shown in Table 2 below.

Table 2: *The use of M-Kilimo*

Whether using M-Kilimo	F	%
Yes	18	85.7
No	3	14.3
Type of agricultural information communicated through M-Kilimo		
Production information	21	100
Marketing information	21	100

Interestingly, respondents reported that they disseminated production and marketing information to their farmers equally through M-Kilimo as 100 percent reported that they provide both production and marketing information. This is interesting as Extension programmes have been for quite some time biased towards production information. The use of M-Kilimo seems to have transformed agricultural information by diversifying the services. The use of mobile phones seems to be empowering farmers in communicating production and marketing information. According to Hans (2004) M-Kilimo has helped extension officers to avoid geographical barriers and spatial immobility.

Extension workers' perception of M-Kilimo

Participants perceived the M-Kilimo positively in all the opinions statements. However, a higher positive evaluation was noted in the statement related to saving time (100%), coverage of farmers and cheapness of the technology (81%). The findings correspond with the real study context, where very few extension officers seem to save many farmers. The findings support the importance of the M-kilimo technology to empower extension workers and farmers in the study area.

Table 3: *Perception of benefits of using M-kilimo*

Opinion	**F**	**%**
M-Kilimo has saved time	21	100
M-Kilimo reduced cost of extension visit	17	81
M-Kilimo has increased the efficiency	17	81
M-Kilimo increased the coverage farmers	21	100
M-Kilimo has simplified extension work	15	71.4
M-kilimo has increased the credibility of extension workers information	15	71.4

The importance of mobile technologies have been widely reported. In their sample of extension workers drawn for rural communities in Tanzania with limited accessed of extension services, Sanga et al., (2013) found that most of the extension workers supported the introduction of mobile

technologies including mobile phones and community radio to supplement the shortage of extension staff. They recommended the use of mobile technology for the delivery of agricultural extension services to improve the agricultural sector in developing countries. Sanga (2016) further established that the ICT solution lowered the costs of extension service provision and enhanced agricultural productivity and food security in Tanzania. Several studies have indicated that the low number of extension workers and financial constraints have led to irregular visits (Sanga et al., 2013). In this study the use of M-Kilimo has further improved farmers' records as one of the key informants reported:

> *'M-kilimo has helped the district to improve farmer's notebook information (Daftari la mkulima) and simplify the monitoring and implementation of extension programme through the collecting and analysis of data'*

Despite the reports on the benefits, challenges were also reported and discussed

Factors influencing the use of M-Kilimo

The use of M-Kilimo seems to be influenced by several factors. Most important are the shortage of tablets, low motivation of some buyers to register and share market information, cost of Internet buddle and the lack clarity of some features.

Table 4: *Factors influencing use of M-Kilimo*

Factor	**F**	**%**
Lack of supervision to extension officers	5	23.8
Shortage or faulty tablets	21	100
Low level of farmer's awareness of M-Kilimo features.	12	57.1
Lack of technical support to extension officers on M-Kilimo	21	100
Cost of internet Providing bundles to the officers.	18	85.7
Low motivation of buyers to participate in M-Kilimo	21	100
Low literacy of farmers	12	57.1
Low clarity of some M-kilimo features	21	100

M-Kilimo implementation can be achieved if the necessary infrastructure is available. In this study, tablets were the most important determinant. In most cases tablets have more features for the technology than phones. Unfortunately, most people might not own these types of mobile devices due to the cost implications. The inability to meet the cost of the Internet was also a challenge for most of the extension workers. Moreover, technical support to extension officers is crucial. Maiti & Singh (2019) and Sanga (2016) noted the low technical support for extension officers in their studies. Farmers and buyers are the key target group in the M-Kilimo program but in this study, there was no engagement of buyers, and the awareness of farmers was low at 57.1%. As noted by Sanga (2013) for the success of M-Kilimo, the integration of experts in participatory ways is very important. Furthermore, the results shows that 100 percent of extension officers lack technical support on the M-Kilimo program, while there is a low literacy rate among farmers (57.1%). Extension officers are therefore constrained to facilitate the use of the M-Kilimo program because of the lack of training and availability of devices and tools for their work.

The findings of this study demonstrate the many challenges in using these technologies, even though the extension workers rated the technologies positively, probably due to the utility and ease of use of the technologies. The study area with its few extension workers created the room for adopting the technologies to simplify the work of helping farmers and achieving farmer information. Therefore, although the technology might be challenging due to contextual factors, the nature and relevance of the technology might still promote adoption of the technologies. The adoption is

specifically more important when the technology is modern and matches well with the changing workforce in the extension sector. Most of the extension workers are youths who may be better disposed to use the technology (Mlozi et al., 2016).

CONCLUSION

The results show that on average one extension officer works in 4 villages/streets with an average distance of 10 km, where the agriculture policy says that each village should have an extension officer. According to geographical location it's not possible for them to meet with all farmers to demonstrate techniques face to face, but through the M-Kilimo program an extension officer may serve many farmers at once over a shorter period.

Together with the benefits of M-Kilimo in educating and delivering information to the farmers there are some weaknesses that need to be worked on to improve the intended output. Challenges such as the lack of equipment including tablets, lack of know-how on the part of officers and farmers, lack of bundles (own cost), lack of linkage of all components in a program were noted. Solving these problems will help to improve output in the agriculture sector.

RECOMMENDATIONS

According to the findings of the study, recommendations are indicated as follows:

- The Government and other stakeholders in the agriculture sector should design training programs to train all parts and required components in M-Kilimo program including extension officers, farmers, buyers, and processors.
- The government provide working tools such as tablets and bundles to facilitate the applicability of the program.
- Improving supervision to ensure the intended output is achieved
- Government encourage businesspeople to use M-Kilimo

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