International Journal of
Advances in Scientific Research and Engineering (ijasre)

E-ISSN : 2454-8006

DOI: 10.31695/IJASRE.2021.34094

Volume 7, Issue 11
November - 2021

Development of Mobile Application for Enhancing Agro-Vet Services Accessibility to Poultry Farmers, of Tanzania

Evelyn M. Mshana[1*] and Dina Z. Machuve[2]

School of Computational and Communication Science and Engineering

The Nelson Mandela African Institution of Science and Technology, Arusha Tanzania

ABSTRACT

Agro-vet services such as animal feeds, vaccinations, drugs, feeders, drinkers, technical assistance and extension services play an essential role in poultry farming sector productivity. However, poultry farmers face a challenge in accessing these services, such as nearby agro-vet shops and extension services, since they rely on word of mouth and their own husbandry experience, which is inaccurate and unreliable. Developing a mobile application for enhancing agro-vet services accessibility to poultry farmers is very important for improving poultry production, and that is the focus of this paper. Data were collected from 115 poultry farmers in Arusha and Dar es Salaam regions; a simple random sampling method was used. 70% of the respondents declared to depend on word of mouth from family members, other farmers and neighbors, while 30% relied on their own experience in farming. The reason was that the agro-vet services (agro-vet shops and extension officers) are far from their localities, mainly found in towns and marketplaces. In this study, Poultry Service Tanzania, a mobile application, was developed to ensure the easy accessibility of these agro-vet services to poultry farmers. Therefore, the mobile application saves time and cost and provides farmers with easiness and accurate information for poultry improvement.

Key Words: Poultry Farmers, Agro-vet services, Mobile Application, Extension Officers.

1. INTRODUCTION

Poultry farming is among the developing livestock sector in Tanzania, which contributes to the country's economy [1]. Not only that, but also it helps in improving the income of different households and provision of food, mainly protein [2]**.** Poultry farming involves keeping species, namely chickens, ducks, turkeys, geese and pigeons. This study focuses on chickens because chicken occupies 96% of the total livestock kept in Tanzania [3]**.** Therefore, for this sector to foster, there is a need for the availability of agro-vet services which are accurate and reliable to poultry farmers.

Agro-vet services under the Ministry of Agriculture and fisheries in Tanzania monitors and coordinates the veterinary services. Agro-vet services play an essential role to poultry farmers since it involves the presence of nearby agro-vet shops and extension services. Agro-vet shops are mostly private business shops that sell animal feeds, vaccination, drugs, and poultry equipment, including feeders and drinkers, and provide technical assistance [4]. Extension services are also offered where extension officers offer practical and reliable information to the poultry farmers to improve poultry farming [5].

However, poultry farmers face a challenge in accessing these nearby agro-vet shops and extension services. Farmers don't know the exact location of nearby agro-vet shops because they are unevenly distributed. They don't get reliable information for their poultry keeping from the extension officers since they are inadequate in number and scattered.

Currently, poultry farmers rely on word of mouth, friends and family members [6], while others use their own experience in farming [7]. This method makes farmers use lots of effort in trial and error methods to improve their production from what they hear and from other farmers' experience, and others use drugs without proper prescription from the officers.

The objective of this study was to develop a mobile application for enhancing agro-vet services availability to poultry farmers within their locality in order to improve the production of the poultry sector.

Through this proposed Poultry Service Tanzania (PST) mobile application, farmers will be able to know the location of the nearby agro-vet shops within their locality by using the latitudes and longitudes coordinates of both the agro-vet shops and poultry farmers; also, they will get reliable and appropriate information from the extension officers through the provision of the extension officers directory in the system whereby they can call or message the extension officer at any time they need any information.

The organization of this paper is as follows; it includes an introduction, related works, methodology, results and discussion, and conclusion sections.

2. RELATED WORKS

Different studies have developed mobile applications which involve farmers in getting services to improve their production. http://www.wefarm.co.tz is a link to access wefarmtz Business Company dealing with livestock farming, crop farming and marketing of agricultural products. In livestock farming, poultry is the primary livestock kept due to its large population. This platform mainly focuses on marketing day-old chick from hatchery units and poultry products (chicken eggs and meat); they also provide training from extension officers to limited poultry farmers who buy the day-old chicks from them. They don't focus on easy accessibility of the agro-vet services to all poultry farmers.

Poultry Site application is an online link accessed widely through http://www.thepoultrysite.com focusing on genetics and breeding together with knowing the health of the poultry and providing the necessary treatment to the diseased ones. It helps improve productivity, but it is limited to delivering agro-vet services to the farmers.

Another study was conducted in Kenya on the use of ICT to link agricultural information and the extension services to farmers through Virtual Agricultural Community (VAC) using voice channels and short messages [8]. This study recommended that extension officers undergo training to acquire proper and timely information and knowledge to help the farmers on suitable techniques to use to increase agricultural productivity. In turn, this could, therefore, enable farmers to utilize the innovative platforms fully. It is limited to linking farmers to the agro-vet shop products.

UshauriKilimo is another platform involving mobile and web applications that provides access to poultry farmers' needs and agricultural extension officers. It involved an Agro-Advisory mobile application that enabled poultry farmers to ask for advice through short messages to the extension officers and respond. Although the responses could not be quick, especially when the questions are challenging to answer, they must be forwarded to different extension officers. So farmers could at times miss the advice as required [6]. This application also has some limitations in the provision of nearby agro-vet shops.

Research in [9] indicated web application use in linking poultry farmers and potential buyers. The study focused on simplifying the issue of market problems to poultry farmers. Poultry farmers were able to access market information online using a web application. Through this study, farmers were able to sell their products such as meat and eggs to the potential buyers on time upon request, which were made online. The research also recommended the use of the mobile application in linking poultry farmers and the potential buyers. Still, also it didn't provide a link to poultry farmers and agro-vet services.

Therefore, this paper aims to develop a mobile application that will link poultry farmers to the agro-vet services and enable the farmers to get reliable and accurate products from the agro-vet shops and services from the extension officers quickly.

3. MATERIALS AND METHODS

3.1 Study area

The research study was carried out in Arusha and Dar es Salaam regions in Tanzania. These two regions were selected due to the adequate number of poultry present where Dar es salaam has 918 chickens/square kilometer, income generation compared to other regions and the advancement of Information Communication and Technology (ICT) development within the country [10].

3.2 Sample size

The participants of this study comprised poultry farmers, agro-vet shops owners and extension officers who were selected using a simple random sampling method. The simple random sampling method involves each member of the sample designated from the gathering of the population in such a way that the probability of being chosen for all individuals in the group is equivalent [11]. We selected a total sample size of 200 respondents, whereby poultry farmers were 115, respondents from the agro-vet shops were 82 and 3 extension officers.

We used Cochran's formula to determine the required sample size because the population was unknown. The formula below (1) was used to determine the sample size of the unknown population as proposed by [12].

$$\frac{n=z^2(p)(1-p)}{c^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The standard deviation for this study was 95%, confidence level of 1.96, the Percentage in picking a choice or response of 50%, and the confidence interval of (0.05=+0.5)

Where:

z = Standard normal deviation set at 95% confidence level

DOI: 10.31695/IJASRE.2021.34094

p = Percentage picking a choice or response

c = Confidence interval

n = Sample size

3.3 System Requirements

Before the development of the tool, requirements were gathered. The methods involved in data collection were structured questionnaires for the elicitation process and Interviews for user acceptance testing results. A structured questionnaire was developed using Open Data Kit (ODK) tool through an excel sheet. ODK is an electronic platform for data collection which works both online and offline, easy to use and involves no major technical issues [13]. Questions were divided into modules, and responses were stored in Google drive. The modules are as follows: demographic information for farmers, ownership of smartphones (Smartphone usage, smartphone's effects on poultry productivity), Location of agro-vet services, agro-vet services accessibility difficultness, Latitudes and longitudes coordinates of the agro-vet shops, and directory of the extension officers.

3.4 System development methodology

The software development methodology is the framework used to describe the tasks that have to be utilized in each step of the development process of the software. This study used Rapid Application Development (RAD) from elicitation to system implementation and testing process, as shown in figure 1 below. This model was used because it involved a two-way communication between developer and user, leading to user's satisfaction, speedy and the fact that it delivers the system on required time at low cost compared to other models [14].

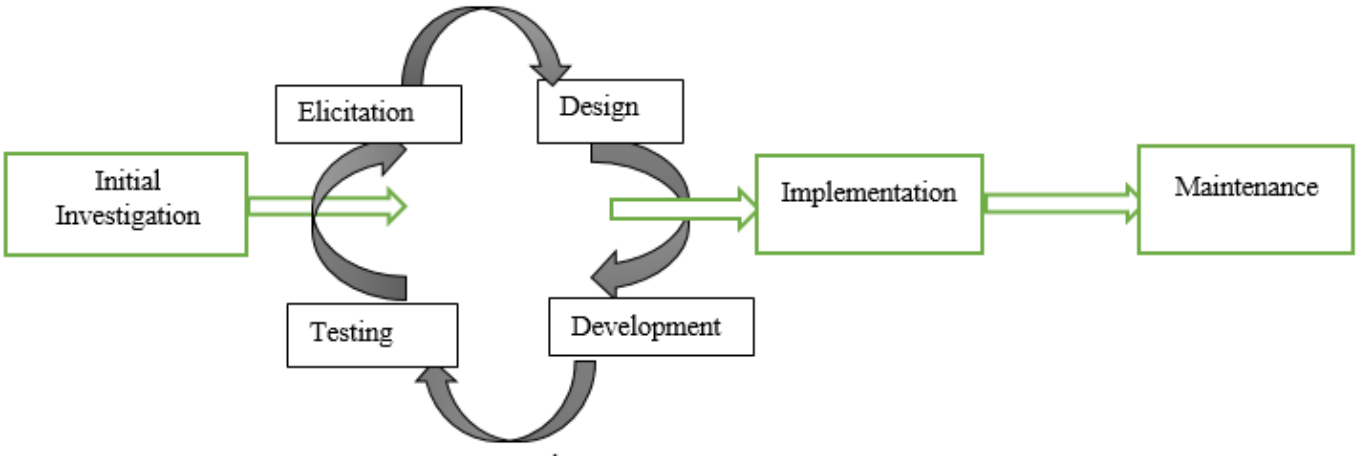

Figure 1: RAD model

Our study also identified two primary actors (Poultry Farmer and Admin) involved in the system, where the use case diagram is represented in figure 2**.** The core functions of the Poultry farmer are to search the nearby agro-vet shop, view the nearby agro-vet shop information and nearby extension officer details. While the core functions of the Admin are to search for agro-vet shops and upload them in the system, view their information, edit and delete the shops also to upload, view, edit and delete the extension officer's information. We developed a mobile application using the Android studio platform and Java language, and SQLite for database management using this use case diagram.

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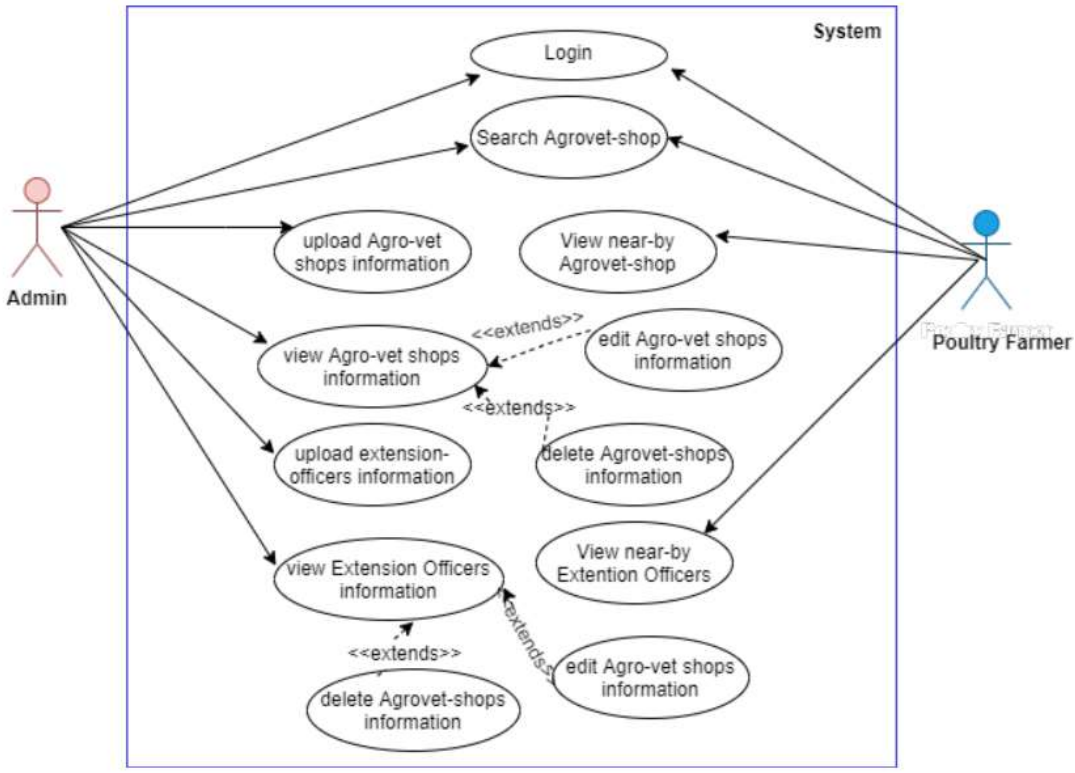

Figure 2: Use case diagram

3.5 The proposed framework

Figure 3 below shows the proposed solution framework of the system Poultry Service Tanzania (PST) mobile application. All the information needed by both actors is stored in the online database; thus, through the internet, both the poultry farmer and Admin can access the information stored using the user-friendly interface deployed in the smartphone. Admin is responsible for uploading information concerning the agro-vet services such as longitude and latitudes, names of shops, addresses and services offered. At the same time, through their smartphones, poultry farmers can search and view agro-vet shops and the nearby extension officers within their locality.

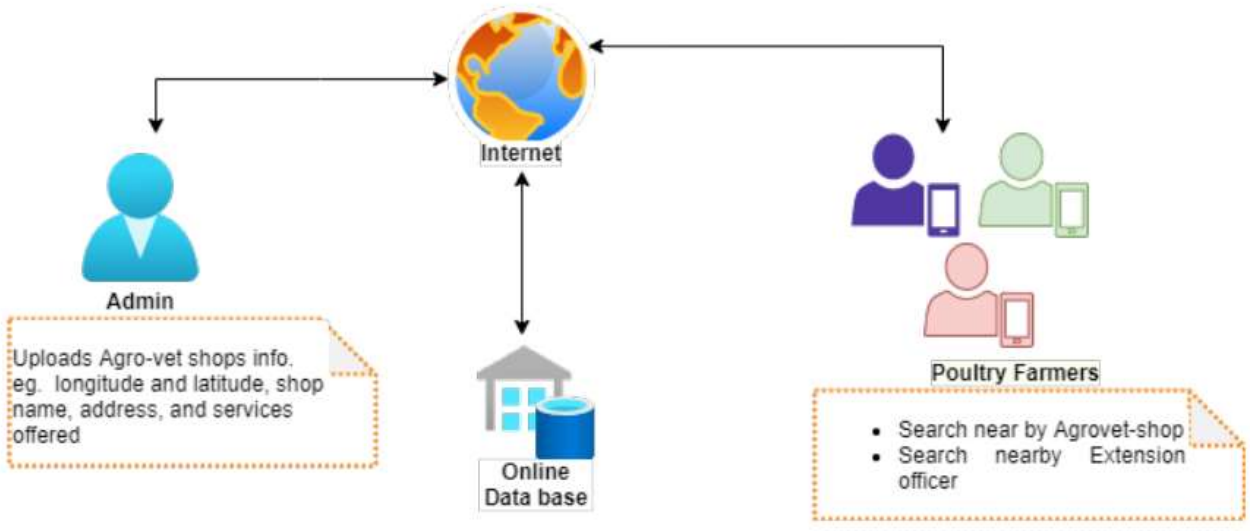

Figure 3: Proposed framework

After developing the application, the tool was tested in four different testing phases, including unit testing, integrated testing, system testing, and user acceptance testing. The testing process was done to make sure that all errors and bugs from the system are removed and that the tool fulfils what it is designed for while meeting the user requirements. A face-to-face interview was

DOI: 10.31695/IJASRE.2021.34094

performed after the mobile application was used for one month by 15 poultry farmers who owned smartphones to validate the performance of the tool and the user's satisfaction. The qualitative method was used to analyze the interview responses, and the results are shown in the Results and discussion section.

4. RESULTS AND DISCUSSION

4.1 Demographic and other characteristics results

As indicated in Table 1 below, the demographic of poultry farmers and other characteristics were gathered. The results showed that females (61%) were more interested in poultry keeping compared to males (39%), mostly aged from 30-50 years equivalent to 52%, followed by the old aged ones from 50 years and above approximated to be 35%. Regarding poultry farmers education level, 10% had no formal education, 62% had primary school level, 19% of them had high school level, and 9% had university-level education. In terms of where the agro-vet shops are located, poultry farmers declared that 57% of the agro-vet shops are found in their center points in places such as towns and markets, 39% of the agro-vet shops are located where there are adequate farmers, and only 5% are located where rent is affordable. 64% of poultry farmers owned smartphones in which they mainly use for calling, chatting and surfing through social media, while 36% own featured phones. 70% of poultry farmers declared to depend on the word of mouth to improve their poultry production and 30% use their own experience.

Table 1: Social demographics of the poultry farmers and other characteristics (n=115)

Characteristics	Frequency	Percentage
Gender		
Male	45	39%
Female	70	61%
Age		
<30 years	15	13%
30 – 50 years	60	52%
>50 years	40	35%
Education level		
No formal education	10	10%
Primary school	73	62%
High school	22	19%
University level	10	9%
Agro-vet shops location		
Center point	67	57%
Affordable rent	5	4%
Adequate farmers	43	39%
Smartphone ownership		
Yes	74	64%
No	41	36%
Ways of accessing agro-vet services		
Word of mouth	80	70%
Own experience	35	30%

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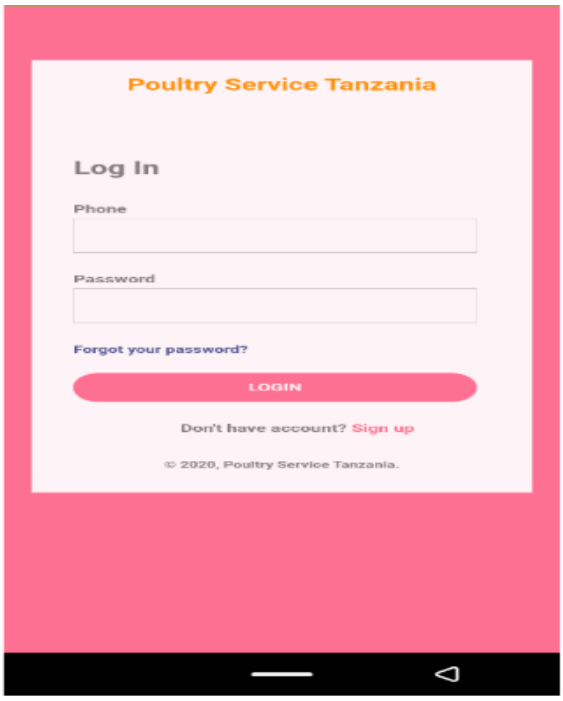
4.2 Developed mobile application results

The Poultry Service Tanzania (PST) mobile application results are as shown below. First and far, the users are required to sign up by creating accounts before further steps. Figure 4 shows a login panel where the user supplies credentials (username and password) to log into the portal after successfully signing up if it is a new user. The user (poultry farmer) is then presented to the main dashboard in (figure 5) upon successful login. The main dashboard contains functionalities that allow a user to view or search the nearby agro-vet shops.



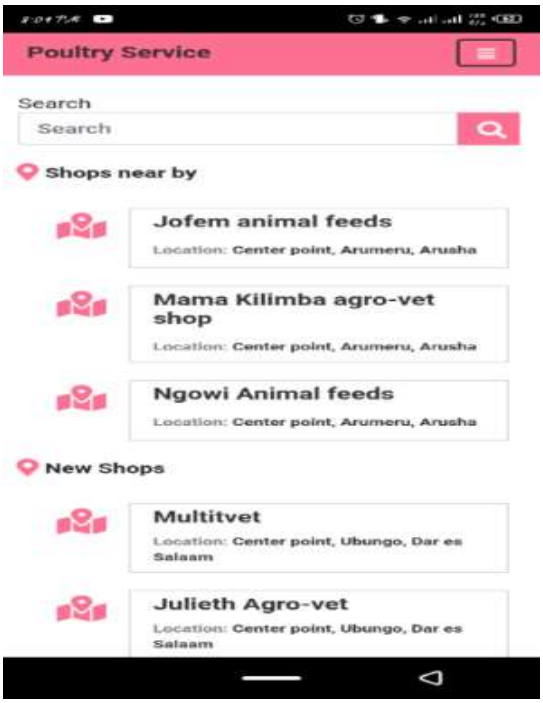
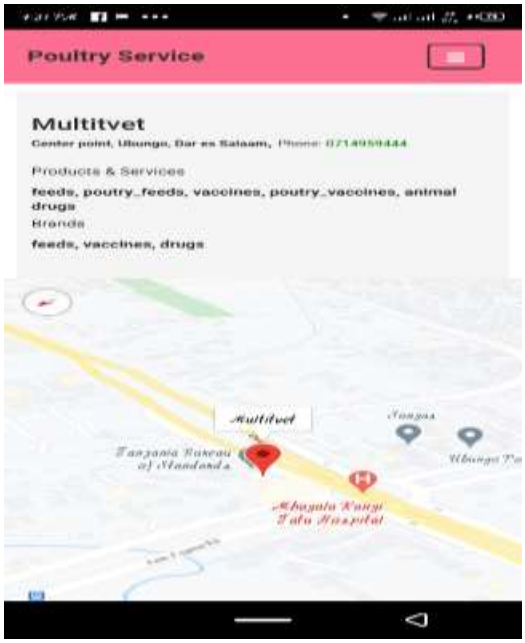


Figure 4: Log in User Interface **Figure 5: Agro-vet shops Interface**

Once the poultry farmer selects a particular agro-vet shop, they can view the contact phone number, products sold at that agro-vet shop and services offered, and a map indicating the geographical location of the agro-vet shop as shown in figure 6.

Lastly, poultry farmers can also view the available extension officers in their localities by viewing the extension officer's directory as indicated in figure 7. Through that, they will call or send messages to the extension officer for any poultry information, advice or technical assistance.



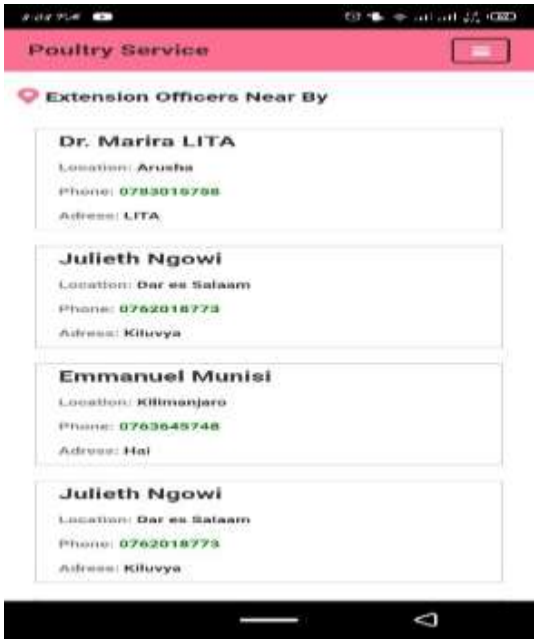


Figure 6: Map showing the location of the Agro-vet s **Figure 7: Extension Officer directory Shop**

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4.3 User acceptance results

As shown in Table 2**,** Poultry farmers reported that the tool was user friendly, useful and it could simplify their means of getting the product/goods and services effortlessly. They also commented that the mobile application would help them to save cost and time rather than going directly to the shop and not getting the required products; rather, they will be able to call through the phone contacts available in the mobile application for the particular closest agro-vet shop and ask first before taking further steps. They also found it productive to their poultry farming activity since the mobile application contains the products available at the agro-vet shop, such as feeds, drugs, vaccines and other related products available at the intended shop. Three (3) respondents stated that the tool should also be in-cooperated with a forum where different discussions are conducted and whatever actions needed should be taken accordingly. The respondents recommended other poultry farmers use it to improve their poultry production. They declared that the system is beneficial not only to poultry farmers also to the agro-vet owners in marketing their products. Moreover, the extension officers will be able to get phone calls from the poultry farmers to attend their poultry and earn income through the directory present in the application.

Table 1: User Acceptance test results

Validation aspects	Number of respondents					Mean score
	Strong disagree	Disagree	Not sure	Agree	Strong agree	
The system interface is user friendly	0	0	1	5	9	4.53
The system in more interactive and attractive	0	0	0	3	12	4.80
The system contents are easy to learn and understandable	0	1	1	3	10	4.47
The system is useful on improving household income	0	0	0	5	10	4.67
The system provides savings in terms of cost and time	0	0	0	3	12	4.80
Forum should be deployed in the system for easy sharing of information	0	0	3	5	7	4.27
I will use the system for easy accessibility of services and products	0	0	1	4	10	4.60
I will recommend others to use the system for improving productivity	0	0	0	5	10	4.67

5. CONCLUSION

The PST mobile application was successfully designed, developed and tested to ensure it meets the user requirements as it was expected. The government can also use this PST mobile application, investors in poultry, decision-makers, extension officers, and agro-vet shop owners. This application helped fulfil the key priority actions of improving the poultry industry as declared in [15] Tanzania Livestock Modernization Initiative, which is the easy accessibility of high quality improved feeds from the registered agro-vet shops and access to extension officers.

This study recommends further research in widening the geographical coverage, including more agro-vet shops and extension officers in other regions of Tanzania and an online forum where different discussions will be conducted. This will enable poultry farmers to benefit more from the agro-vet services to improve their productivity.

ACKNOWLEDGMENT

The authors of this work would like to acknowledge DAAD for funding this research.

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Evelyn M. Mshana is a Master's candidate in Information Communication Science and Engineering at Nelson Mandela African Institution of Science and Technology. She did her research under the sponsorship of DAAD Germany. She completed her Bachelor Degree at St Joseph University in Tanzania in 2015.

Email: mshanae@nm-aist.ac.tz

Dina Machuve is a senior Lecturer and researcher at The Nelson Mandela African Institution of Science and Technology. She received her PHD at the Institute of Nelson Mandela African Institution of Science and Technology in 2016. Her interests are in Data Science, Artificial Intelligence, and Bioinformatics and in Science, Technology, Engineering and Mathematics (STEM).

Email: dina.machuve @nm-aist.ac.tz

DOI: 10.31695/IJASRE.2021.34094