

**ONLINE PLATFORM FOR LINKING FARMERS AND AGRO-VET  
SERVICES IN TANZANIA. CASE STUDY: POULTRY**

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**A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of  
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## ABSTRACT

Poultry farming is a rapidly, growing livestock sector in Tanzania that supports rural and urban households on income and source of information. In addition to poultry being a source of food, it provides manure which is used for improving crop farming. Currently, there is still a high demand of poultry in Tanzania. However, there are challenges that lead to low productivity in the sector. The uneven distribution of the Agro-vet shops/ Veterinary centers that provide poultry farming inputs such as feeds, drugs, vaccines, and other poultry equipment is a challenge to poultry farmers. The inadequate and lack of extension officers who are the potential information providers to the poultry farmers is another challenge. The objective of this paper is to help improvement of poultry production by linking poultry farmers to these poultry services. A sample size of 200 respondents comprised of poultry farmers, agro-vet owners and extension officers were selected using Cochran's Formula from three regions in Tanzania. We found that there are areas where these poultry services are not found at all and others are very far from the poultry farmer's locality. Thus, poultry farmers walk long distance accessing products and services from agro-vet shops and at times fail to get extension services rather they use their experience in husbandry and through word of mouth to improve production. However, poultry farmers try to address their problems either by asking their friends or neighbors due to inaccessibility of the poultry services within their locality. Therefore, in order to address these challenges, this study contributes a mobile and web based application that provides poultry farmers' insight on the locations of the agro-vet services within their locality. Furthermore, the application facilitates the provision of extension services in addition to the agro-vet services. The contacts of the extension workers and the veterinarians within the location are provided on the application. The information provides direction for decision makers and investors about the areas where there are lack of Agro-vet shops/ Vet centers and to the need for Extension services. . The study concludes that through the proposed system, it can be a panacea to improving and accessing poultry services through linking the poultry farmers to the poultry services using both mobile application and web based application.

## DECLARATION

I, Evelyn Mshana hereby declare to the Senate of the Nelson Mandela African Institution of Science and Technology that this dissertation titled “*Online platform for linking farmers and agro-vet services in Tanzania. Case study: Poultry*” is my own original work and that it has neither been submitted nor being concurrently submitted for degree award in any other institution.

Evelyn Mshana



22/11/2021

Name and Signature of Candidate

Date

The declaration above is confirmed by:

Dr. Dina Machuve



22/11/2021

Name and Signature of Supervisor

Date

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## CERTIFICATION

I, the undersigned certify that, I have read and found the dissertation acceptable by the Nelson Mandela African Institution of Science and Technology, a dissertation entitled *"Online platform for linking farmers and agro-vet services in Tanzania. Case study: Poultry"* in partial fulfillment of the requirements for award of the degree of Masters in Information Communication Science and Engineering.

Dr. Dina Machuve



Name and Signature of Supervisor

22/11/2021

Date

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May the blessings of the Most High be with us all.

## **DEDICATION**

This work is humbly dedicated to my beloved parents to be whom I am today. Also to the love of my life Vincent Ngowi for his firm love, prayers care, support and encouragement.

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## **LIST OF ABBREVIATIONS AND SYMBOLS**

API	Application Processing Interface
CBES	Community Based Extension System
CMD	Command Prompt Directory
CSS	Cascade Styling Sheet
DFD	Data Flow Diagram
HTML	Hyper Text Mark-up Language
ILRI	International Livestock Research Institute
ICT	Information and Communication Technology
IOS	iPhone Operating System
JS	JavaScript
GDP	Gross Domestic Product
GPS	Global Positioning System
GSMA	Global S Mobile Association
NPM	Node Packet Manager
ODK	Open Data Kit
PST	Poultry Service in Tanzania
RAD	Rapid Application Development
SDLC	Software Development Life Cycle
TCRA	Tanzania Communication Regulatory Authority
TLMI	Tanzania Livestock Modernization Initiative
UML	Unified Modelling Language
VAC	Virtual Agricultural Community
URT	United Republic of Tanzania

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the Problem

Agriculture is a substantial segment on the economy of Tanzania contributing up to about 30% of the Gross Domestic Product (GDP) whereby about 80% of the Tanzanian's depend on agriculture as the main activity which supports their living since it has been a way forward in any national economic approach to fight poverty (United Republic of Tanzania [URT], 2017). Agriculture, as a result comprises of both crops farming and livestock keeping. The National Development Vision of 2025 in Tanzania put emphasis on making over the country to a semi-industrialized economy, which will focus on modern technology aiming at improving productivity (URT, 2010). Therefore, in-order for the National Development Vision to reach out its goals, it aligned with the Tanzania Livestock Modernization Initiative on improving productivity in livestock sector also (URT, 2015).

Livestock husbandry being among the major agricultural segments in Tanzania contributes to basic needs, mitigation, nourishment security improvement, business creation and condition preservation which has promoted about 7.7% of the country GDP. Livestock is defined as the process of keeping domesticated animals. The livestock population in Tanzania constitutes of 28.8 million cattle, 98% of which are indigenous breeds, 16.7 million goats, 8 million sheep, 2.4 million pigs, and 72 million chickens of which 40 million are indigenous chicken and 32 are exotic chicken (Ringo & Mwenda, 2018; URT, 2017). The growth of livestock is expected to continue rising, as a result the demand for animal-food delivery will also be high, thus there is a need for further investment on the livestock sector (Mottet & Tempio, 2017).

Poultry farming is currently the largest livestock husbandry sub-sector that involves keeping various poultry species such as chickens, ducks, turkeys, geese, pigeons (Silva *et al.*, 2017). Poultry provides three main products of eggs, meat and manure. It is predicted, by 2050 the global statistics demand for poultry meat is expected to grow by 121% than any other type of meat and eggs by 65% (Mottet & Tempio, 2017). According to Adebola *et al.* (2018) areas where there is low soil fertility, poultry manure can act as a chemical agent in bringing into high yield of crops. This is all due to rich nutrient concentrations present in it. In Tanzania, the GDP for chicken will rise from 21 310.6 to 54 355.1 million for eggs and 153 326.93 to 275 188.72 million for meat in the year 2021/2022 (International Livestock Research Institute [ILRI], 2018).



Poultry farming is practiced by all societies regardless of their status both rich and common people, and 3.7 million people in Tanzania keep chicken as one of the poultry species (Ringo & Mwenda, 2018). Small scale poultry farming alleviates poverty, improves nutrition and food security and upturns household income for smallholders (Astill *et al.*, 2018). However, due to prodigious increase of poultry farmers, there are also numerous challenges which face and hinders them from continuous high yields bringing about low productivity. These challenging factors include uneven distribution of agro-vet shops causing unreliable availability of poultry feeds, vaccines, drugs and products, inadequate number of extension officers and veterinarians leading to unreliable information (Ringo & Mwenda, 2018).

Currently, majority of poultry farmers rely on getting information concerning poultry services from friends, fellow civilians, media such as television and radio (Msoffe & Ngulube, 2016). Also almost 82.5% of them do not get enough information on the poultry services within their locality, which might help them in getting reliable information and surges poultry production (Temba *et al.*, 2016).

The use of Information and Communication Technologies (ICT) tools as enablers for poultry farmers is used to improve efficiency (Kimwetich & Reuben, 2019). Online portal can therefore, be used to indicate accessibility to poultry services within the farmer's locality. Thus, a farmer will then, be able to know the Agro-vet shops present within his/her locality and details of products available at the agro-vet shop, and the extension services through an online directory. The proposed solution furthermore promises to provide pace for the decision makers and investors to invest more in areas where there are few or no Agro-vet shops and to provide more Extension officers.

## **1.2 Statement of the Problem**

Poultry farming requires various poultry services which are reliable and accurate to flourish, that involve both agro-vet and extension services. Agro-vet services are offered in the agro-vet shops or vet centers and extension services are accessible from extension officers and veterinarians (Msoffe *et al.*, 2018). Agro-vet shops are shops which provide various products and services such as feeds, vaccines, drugs, equipment and technical advice to famers. They are presently available in different places however, very unevenly distributed, some areas have lot of them yet the number of poultry farmers are few. While in areas where farmers are many, insufficient services are allocated or not present. Due to this situation, farmers are forced to walk long distances to acquire these products and services (Ringo & Mwenda, 2018; Lwoga *et al.*, 2010). One of the priority

actions in developing the poultry industry as stated in the Tanzania Livestock Modernization Initiative is to be able to support concentrated delivery of high quality feeds as well as veterinary and extension services (URT, 2015).

Adequate number of extension officers within the farmer's locality is another challenge currently facing the poultry farming sector (Msoffe & Ngulube, 2016). Since numerous number of smallholder farmers are present in the rural areas they get unreliable delivery of these extension services. For the time being, only 20% of the livestock producers are able to access the extension services (URT, 2015). According to Bruinsma (2017) extension services helps farmers to solve different farming problems by being provided with accurate and reliable information similarly up surging their living standard and improving productivity.

Currently, farmers get all these information from families, friends, neighbors or they either use their experience in husbandry (Msoffe *et al.*, 2018). Failure to get these services efficiently, there is a high decrease of production in poultry industry (URT, 2015). Therefore, this study provides an online platform for linking poultry services consisting of Agro-vet services and Extension services with poultry farmers which will overcome the problems that currently face the poultry farmers.

The research therefore pursued to develop an online platform to link the poultry farmers and the agro-vet services in Tanzania. It is also expected to add value to planning at regional and national level. Hence, the development of mobile and web application proves to be appropriate mechanism since it provides timely and trustworthy poultry services information and data to poultry farmers.

### **1.3 Rationale of the Study**

Poultry farming is practiced by all societies regardless of their status both rich and common people, and 3.7 million people in Tanzania keep chicken as one of the poultry species (Ringo & Mwenda, 2018). Small scale poultry farming alleviates poverty, improves nutrition and food security and upturns household income for smallholders (Astill *et al.*, 2018). However, due to prodigious increase of poultry farmers, there are also numerous challenges which face and hinders them from continuous high yields bringing about low productivity. These challenging factors include uneven distribution of agro-vet shops causing unreliable availability of poultry feeds, vaccines, drugs and products, inadequate number of extension officers and veterinarians leading to unreliable information (Ringo & Mwenda, 2018). According to Bruinsma (2017) extension services helps farmers to solve different farming problems by being provided with accurate and reliable

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## **1.4 Research Objectives**

### **1.4.1 Main Objective**

The main objective of this research is to develop an online platform for linking poultry farmers and agro-vet services.

### **1.4.2 Specific Objectives**

- (i) To identify the requirements needed for developing an online platform for linking poultry farmers and agro-vet services.
- (ii) To develop an online platform for linking poultry farmers and agro-vet services.
- (iii) To validate the developed platform.

## **1.5 Research Questions**

The study reported in this dissertation answers the following research questions to endeavor and undertake the objectives of the research.

- (i) What requirements are needed for developing the online platform for linking poultry farmers and agro-vet services?
- (ii) How will the online platform be developed to improve the provision of Agro-vet services and extension services to the poultry farmers?
- (iii) What are the suitable approaches to validate the proposed platform?

## **1.6 Significance of the Study**

Online platform has great impact to the communities and to the government as whole. The output of the research aims at improving and increasing poultry production which will precede to contributing to the national economy. Furthermore, to add value to planning and investing at regional and national level. The study will assist on providing an online platform linkage between the poultry farmers and the poultry services providers enabling ease in getting the services (feeds, vaccines, extension services) needed by the poultry farmer for surge production. Also it will be beneficial for investor to locate more agro-vet shops in places where there is lack or few shops to surge the production process. Furthermore, the study will provide an online directory for the extension officers, whereby the poultry farmer will be able to access this information any time by communicating with the extension officers available at their localities. Since the government has a high demand on the poultry production, through this study, the government should invest in training more extension officers and locate them in areas where there are few or no at all. Also, the presence of more investors will boost up the economy of the country.

## **1.7 Delineation of the Study**

this study provides an online platform for linking poultry services consisting of Agro-vet services and Extension services with poultry farmers which will overcome the problems that currently face the poultry farmers. The limitation of this research is the availability of smartphones to poultry farmers who live in the most interior rural area, since the system will be deployed in smartphones.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Information Needs of Poultry Farming

Information is an important tool for developmental efforts, not only is information needed but accurate and reliable information ( Khobragade *et al.*, 2019). As stated by Kusyama *et al.* (2020) information is an authority when it is acquired, transferred and disbursed from the right sources. Poultry farming which is approximated to grow rapidly in 2022 by 182% Silva *et al.* (2017) it really needs precise knowledge and information to improve productivity and to fill out the gap (Msoffe & Ngulube, 2016). Studies have been done on knowing the information needs of the poultry farmers which helps the poultry farmers in improving their productivity though they vary from location to location or farmer to farmer (Msoffe *et al.*, 2018).

Realizing and highlighting the needs by the poultry farmers is very low and thus produces negative effects in poultry productivity, since the farmers themselves tend to use their experience in coming up with different solutions based on their needs. Information needs obtained by Msoffe and Ngulube (2016) based on knowing what farmers should do to increase productivity through the feeds they give to their poultry and supervision from the extension officers. They also claimed that poultry famers should be provided more knowledge on disease control and protection from wild animals, dogs, cats and thieves.

It was recommended from the study by Msoffe and Ngulube (2016) that the availability of the extension officers in nearby locality of the poultry farmers will greatly increase productivity since all the services they require will be easily accessible. Feeds and feeding being one of the most important information needs by poultry farmers, health management on knowing the symptoms, transmission, treatment and control of diseases together with egg production and marketing (Msoffe *et al.*, 2018).

Khobragade *et al.* (2019) indicated some information needs which farmers are currently in fond of are feeding management process and health management of the poultry. All these needs are essential to poultry farmers since they will give the farmers a better approach on how to increase productivity and overcome challenges facing them smoothly.

## **2.2 Mobile Penetration in Tanzania**

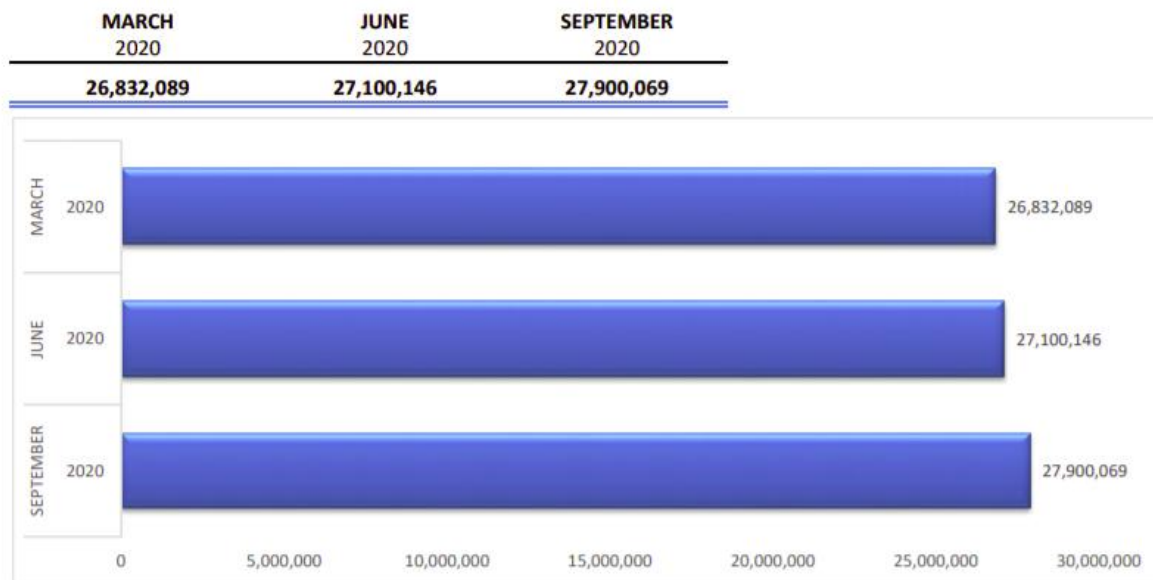
Improvements in technology have made great uprising in agriculture Technologies *et al.* (2012) in which the use of mobile phones and internet have tremendously increased thus leading to increase of economic growth (Quandt *et al.*, 2020). Tanzania has invested in internet activities which is currently accessed by 43% of their users through mobile phone.

Currently, according to Tanzania Communication Regulatory Authority (TCRA), there are 43.62 million mobile phone subscriptions in Tanzania, thus there is a great increase of mobile phone as usage, one of the tools for Information and Communication Technology (ICT) (Quandt *et al.*, 2020). Adaption of ICT enables Tanzania to be a knowledge-based society (National ICT policy, 2016). Through this upturn of mobile usage it is approximated also to rise the economic growth to 7.9% GDP by 2022.

Smartphone are also likely to increase from 34% in 2017 to 67% by 2025 due to low-cost of the devices. The increase of smartphone users is growing everyday whereby it is approximated to reach 690 million users by 2025 in Sub-Saharan countries (Global S Mobile Association [GSMA], 2018) hence development of mobile apps will therefore transforms the lives of people by improving the efficiency of livelihood activities (Technologies *et al.*, 2012).

## **2.3 Internet Penetration in Tanzania**

Currently, internet users in Tanzania is 14.72 million since January 2020 according to data reportal.com whereby the number of users has increased by 3% between year 2019 and 2020 for that reason internet in Tanzania has risen to 25% in 2020. Figure 1 indicates the statistics that in September 2020 the number of internet users is rapidly increased compared to March 2020. Most of the users in Tanzania accessing internet services uses smart mobile phones.



**Figure 1: Estimate of Internet users in Tanzania**

The ICT has been acknowledged vital to growth of the agricultural sector in the world, whereby technology is regarded as a major driver of a modernizing national livestock sector (URT, 2015). The ICT plays an important role in making decision, knowledge sharing, improving livelihood and household income (Maginga & Ally, 2019). As a result, the development of online platform application has potential to provide timely and reliable information to poultry farmers for accessing the agro-vet and extension services easily.

## 2.4 Related Works

The study conducted by Akuku *et al.* (2014) in Kenya focused on the use of ICT to link agricultural knowledge base and the extension services to farmers on Virtual Agricultural Community (VAC) platform that utilizes voice channel and short messages. In this study, they recommended that extension officers should undergo trainings to acquire true and timely information and knowledge so as to help farmers on suitable techniques to use to increase agricultural productivity. In-turn, this could therefore, enable farmers to utilize fully the innovative platforms.

Another research study was conducted in Tanzania focusing on adapting of the extension support system comprising of agricultural experts and extension officers to help farmers in vegetable crop production. The study introduced the ICT enabled extension support system which helped the farmers to acquire weather data (temperature and precipitation) and other requirements like information on the pests and diseases that will affect or cause negative effects to their crops production so as they can take early measures and further actions (Maginga & Ally, 2019).

Local community-based extension system (CBES) is another platform that was used to convey information skills and services to farmers and livestock keepers who have limited or restricted access to government and commercial extension services. According to Warburton *et al.* (2010) the CBES platform helped the underprivileged farmers who lacked assets to reach out to those services by filling the gap that existed between them. The research study definitely helped the livestock keepers to improve their animal health, promote good husbandry practices and breeding. Also, they got courage to become problem solvers using the information they gained from the extension officers leading to strengthening their productive capabilities.

For that reason, the studies above indicated the extension services are important in disseminating knowledge and skills to farmers in order to increase income, productivity and improve their living standards. The motivation for developing new technologies has potential on improving their farming activities and productivity. This study, therefore, extends the efforts by linking of poultry farmers and the agro-vet services in a platform for access to poultry products and services. These include information on high quality feeds, vaccines, and drugs, poultry products such as feeders and drinkers and technical assistance together with the extension services.

The online based platform indicates the location of both the poultry farmers and the Agro-vet shops to locate the nearest available Agro-vet shops within their locality. Moreover, the system will also provide details of the products sold in the shops and the online directory for the Extension officers. The added advantage of it is that it will help decision makers, investors and the government to invest more in poultry industry since it increases the gross domestic product.



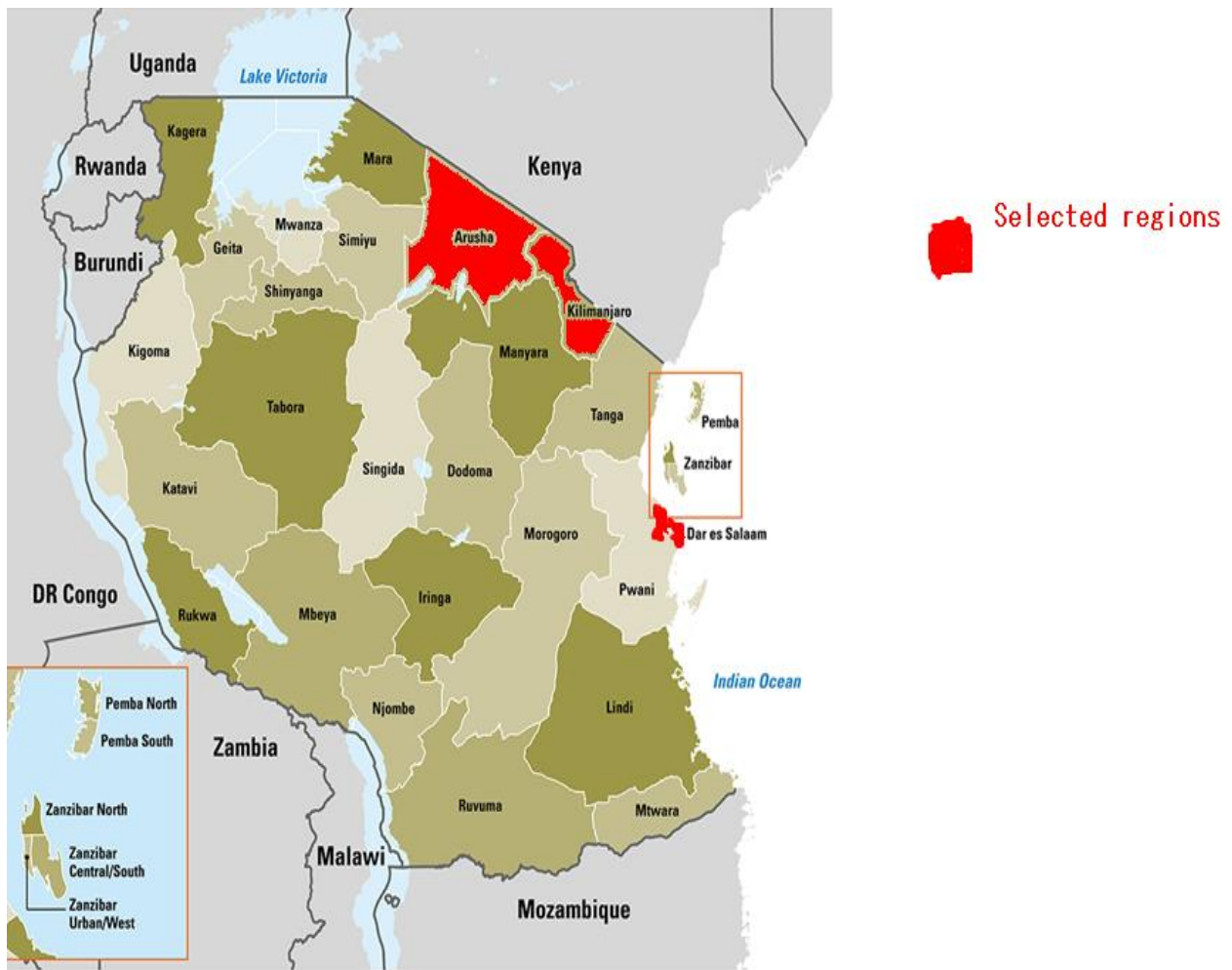
## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1 Study Area

The study was conducted in Tanzania in three different regions of Arusha, Kilimanjaro and Dar es Salaam. Arusha region is located in the north eastern part of Tanzania with latitude of 3° 22' S and longitude of 36° 38'E with an altitude 1387 m (Rivas-Martínez *et al.*, 2011). Data collection in Arusha region was done in two districts which are Arumeru and Arusha districts. While in Kilimanjaro latitude is 3.0674°S and Longitude is 37.3556°E, and data collection took place in Hai and Moshi districts. Moreover, Arusha and Kilimanjaro are among the regions that depend on livestock keeping such as poultry farming to raise their income (Ringo & Mwenda, 2018). In Dar es Salaam region, the data was collected in Ubungo district.

The research study focused on three stakeholders which are poultry farmers, the owners of the Agro-vet shops/ Vet centers and the Extension Officers. The whole process of collecting data based on obtaining of the Global Positioning System (GPS) of both the Agro-vet shops and the poultry farmers' locality. The details of the products sold in the agro-vets hops/ vet centers together with the contacts of the shop owners. Furthermore, information from the extension officers collected included names, location and phone contact so as to come up with an online directory. Figure 2 below represents the study area in the map of Tanzania.



**Figure 2: Map showing study area**

### **3.2 Methods of Data Collection**

The data was acquired from primary and secondary sources. The primary data was collected through the field survey that was conducted in the three regions respectively using questionnaires and the secondary data was obtained from desk review process.

#### **3.2.1 Questionnaires**

Questions were prepared using excel spread sheet and later embedded in the mobile data collection tool which is Open Data Kit (ODK). The ODK is an open and free source tool for collecting data electronically using mobile phone device which is simple compared to paper-based data collection (Borriello, 2014). The questions were then divided into some sections which included the following: Demographic section (name, gender, education level, age), poultry product information (what products are sold, the most frequently sold out compared to others), accessibility of customers to the agro-vet owners, where do poultry farmers get advice and the global positioning

system (GPS) of both the poultry farmers and the agro-vet shops by considering the latitudes and longitudes.

The type of questionnaire used in data collection was in-house survey, where the researchers manually visit the respondents at their work places or home to get information that is the primary data from the field. This survey helped the researcher to be more focused although there were some challenges like being refused to be listened and sometimes not welcomed at all. The solution to the challenges was to try to explain to the respondents in a polite and wise manner so as to attract them. Thus, the overall questionnaire consisted of demographic questions, open-ended questions, dichotomous questions and multiple-choice questions.

### **3.2.2 Desk Review Process**

In-order to obtain the secondary data the desk review process was conducted which is also called literature review. Google scholar and semantic scholar were the platforms that were used in searching for different related papers and later stored in a referencing software called Mendeley. A total of 20 papers were reviewed in this study with the aim to understand the existing system and to build up on the proposed system regarding the poultry sector. Through this, information needs by the poultry farmers were analyzed and some were addressed.

### **3.3 Data Analysis**

Data analysis involves the process of cleaning, examining and merging the data that has been collected to get valuable data from it for further uses. After the collection of data then, Python programming language was used to analyze using the package called Pandas.

Python pandas is an open source, powerful, quick, adaptable and free data analysis tool to use (McKinney, 2012). The excel spread sheet was used in the process of storing the collected data online using google drive platform, through which the ODK tool stored all its data there. During analysis then jupyter notebook was used as a platform to perform the analysis.

The snapshot below explains the analysis of the agro-vet shops and the company feeds they sell, which could ease the information to the poultry farmers. Through this analysis farmers will get to know the feeds sold in the agro-vet shops from different companies which depends on the farmer's users. Figure 3 indicates the snapshot of the summary statistics on the data in Python.

```
In [30]: > from itertools import chain

# return list from series of comma-separated strings
def chainer(s):
    return list(chain.from_iterable(s.str.split(',')))

# calculate lengths of splits
lens = df['COMPANY_FEEDS'].str.split(',').map(len)

# create new dataframe, repeating or chaining as appropriate
cmpnydf = pd.DataFrame({'Shop_name': np.repeat(df['AGRO-VET SHOP'], lens),
                        'Company_feeds': chainer(df['COMPANY_FEEDS'])})

cmpnydf.head(31)
```

Out[30]:

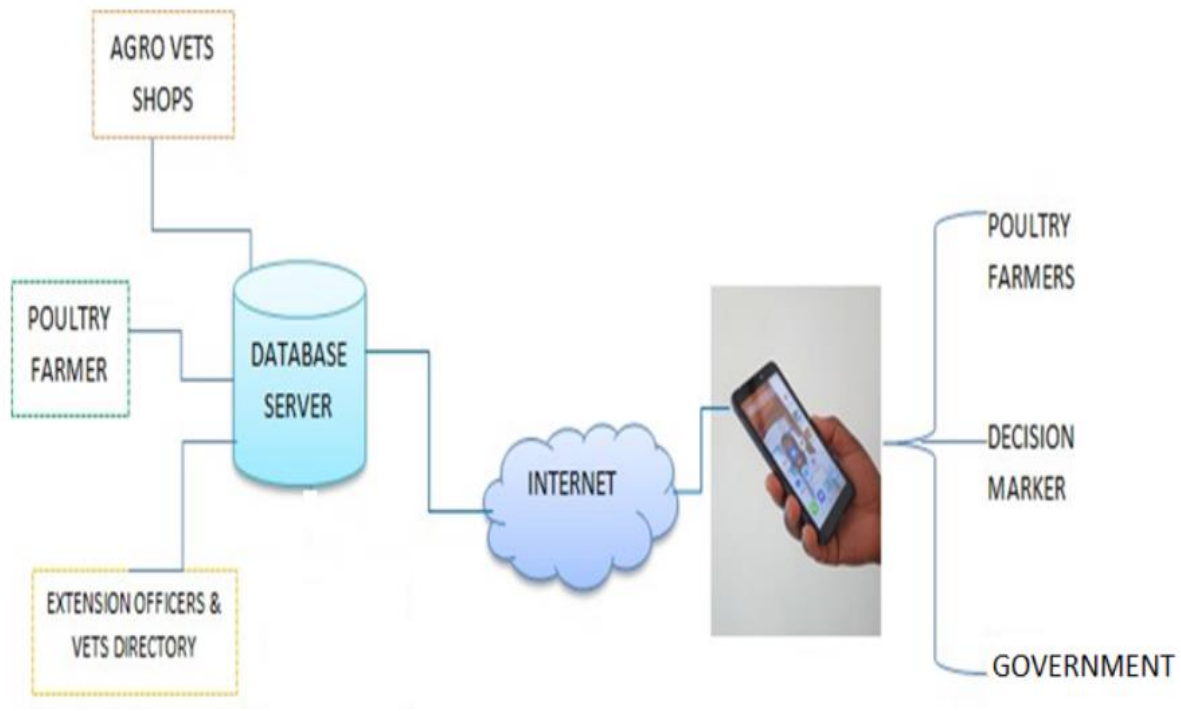
	Shop_name	Company_feeds
0	Lekei B	Marenga and Kibosho
1	Harsho Group	Harsho Group
2	Semira Agro-vet	Interchick and Silverland
3	Lekei A	Marenga and Kibosho
4	Jons Agro-vet	Marenga and Kibosho
5	Maki Enterprises	Marenga
6	Nasau Agro-vet	Harsho and Silverland
7	Kifaru Agro-vet	Silverland
8	Wastara	Marenga and Kibosho
9	K.D	No feeds
10	Kiroro VetAgri	Laprovvet
11	Jofem Animal feeds	Jofem feeds
12	Mama Kilimba	Laprovvet

**Figure 3: Snapshot of the summary statistics on the data in Python**

### 3.4 Architectural Design

#### 3.4.1 Conceptual Framework

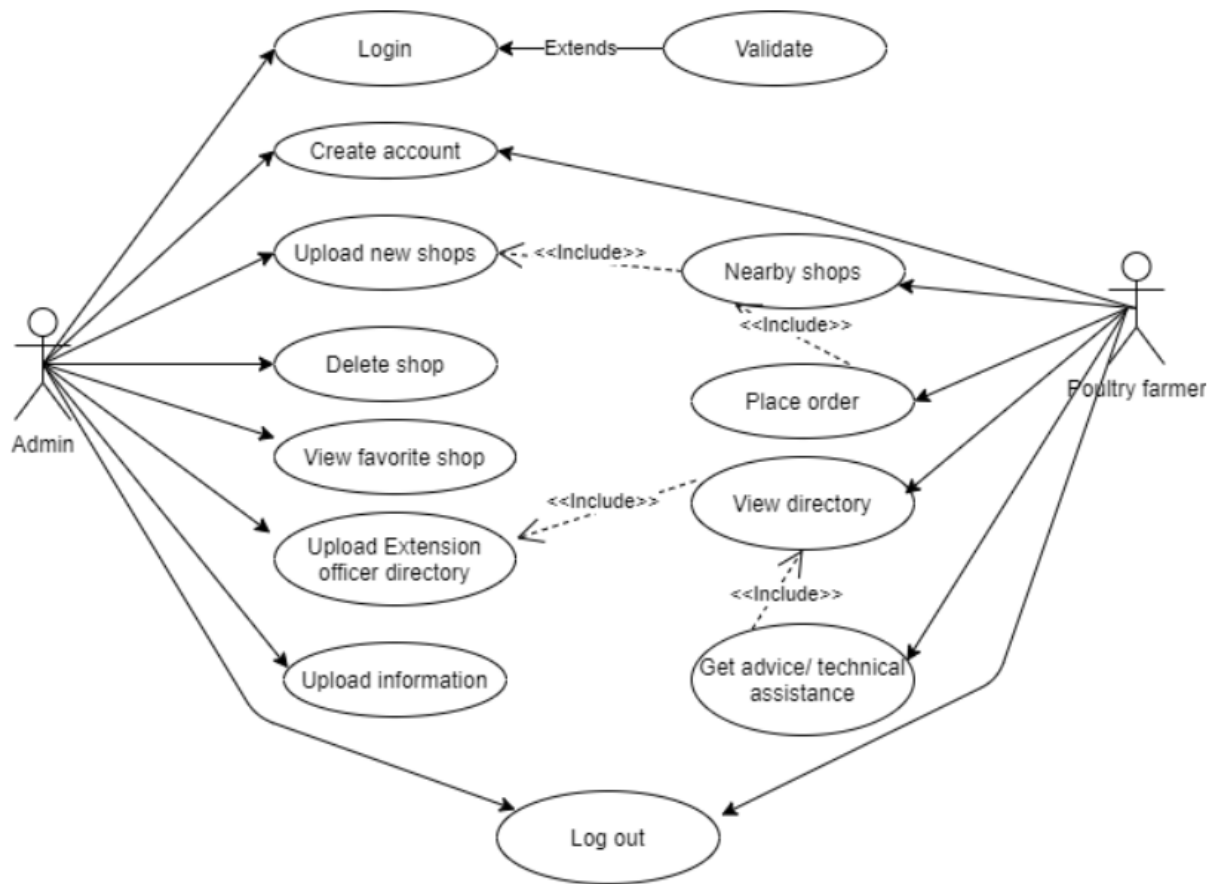
The proposed conceptual framework of the system will comprise of information from the poultry farmers, agro-vet shops and the extension officer. This information will be fed into the database server so as they can be processed for further use of the system development. After the development process a mobile application and web application will be the output which will be used by the poultry farmers to access and know the nearby shops, view the extension officers' directory and it will help the decision makers together with the government to invest more in poultry sector.



**Figure 4: Conceptual framework**

### 3.4.2 Use Case Diagram

Use case diagrams is one among the diagrams present in the Unified Modelling Language (UML). UML is the graphical language for specifying, visualizing, constructing, documenting and communicating the artifacts of a software system. Use-case diagrams consist of actors and set of use cases. It explains how a user interacts with the system. The Use-case diagram below indicates the actors' interaction with the system depending on the actions they perform as represented in the cases.



**Figure 5: Use case diagram**

**(i) Description of the Use Case Diagram**

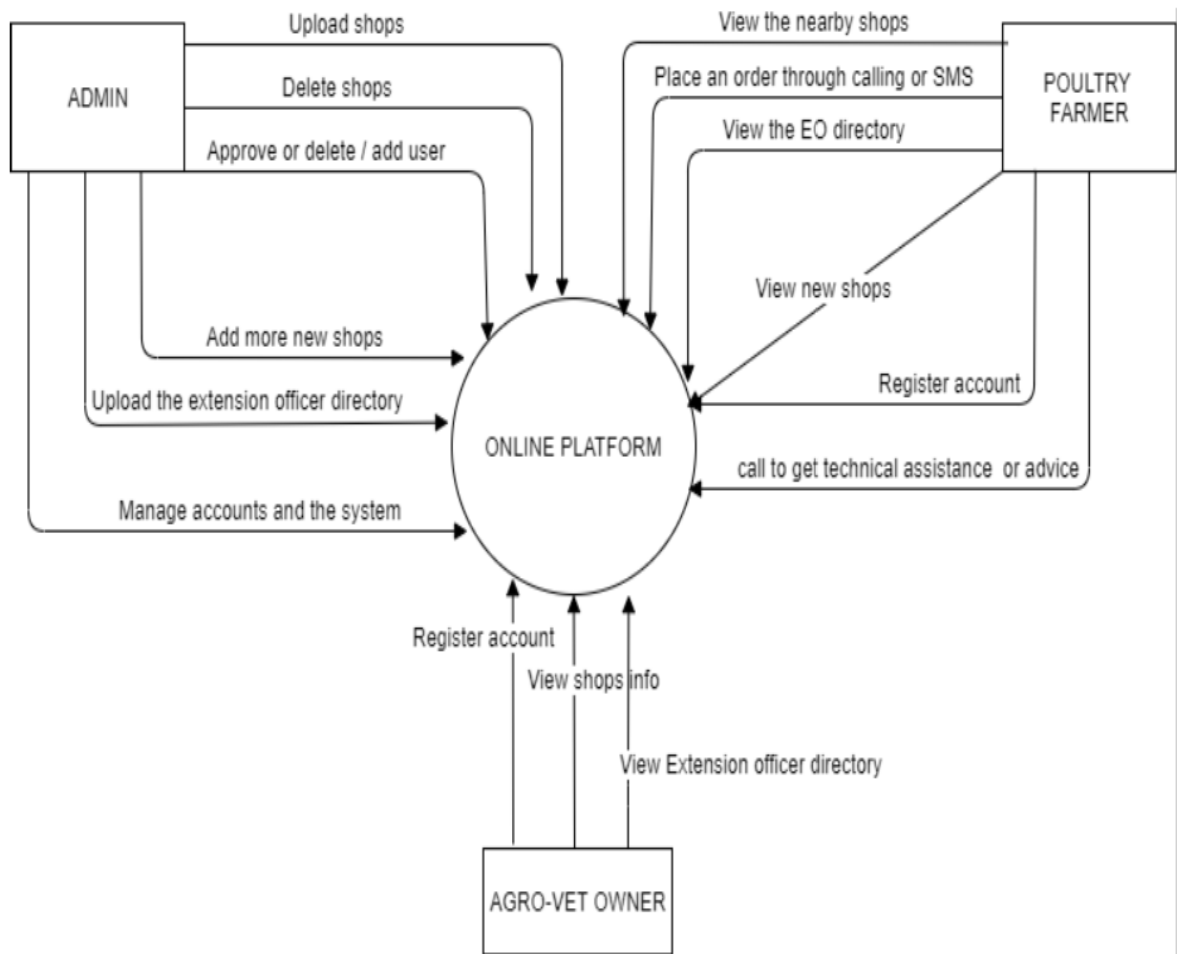
The Table 1 below explains well the description of the way the interaction takes place within the system which is represented in the Use case diagram above. The left-hand side explains the action which the user or actor has to perform and the right-hand side explain in details what is done.

**Table 1: Description of the Use case diagram**

User	Use case
<b>Create account</b>	Both the admin and the poultry farmers need to register by creating an account in the system
<b>Login</b>	Once the users have created account will be able to login in the system with correct credentials
<b>Validate</b>	Once the users input their credentials validation process must take place for authorization
<b>Upload new shops</b>	The admin as one of the users will be able to upload new shops after successful login
<b>Search nearby shops</b>	The poultry farmers are able to search the nearby shops after the admin has uploaded all the new shops in the system
<b>Delete shops</b>	Only the admin is the one who can delete shops information
<b>Update information</b>	The admin is required to do updates on the system
<b>Place order</b>	The poultry farmer as one of the users is able to call or send text to the nearby shops after the admin upload and update information of the shops to place an order or ask for advice
<b>Upload extension officer directory</b>	Admin is required to upload the extension officer directory in the system
<b>View directory</b>	Poultry farmer is able to access the directory.
<b>Get advice/ technical assistance</b>	After viewing the directory, the poultry farmer can either call for advice or technical advice from the extension officer selected
<b>Log out</b>	Both users are required to log out after

### 3.4.3 Context Diagram

Context diagram level 0 is among the UML diagrams which is also called the data flow diagram (DFD). This context diagram as indicated in Figure 6 simply shows the data system as a whole and how the interaction process with the external entities takes place. Generally, it shows the system functionality to the users. This context diagram level 0 shows the top-level view of the system.



**Figure 6: Context Diagram**

### 3.5 Developmental Approach

In developing the poultry services online platform, software development life cycle (SDLC) framework was used. The SDLC is a software development framework which describes the tasks that have to be performed in each and every step during the development process (Ruparelia, 2010). There are various system development models with different characteristics as listed below in Table 2.

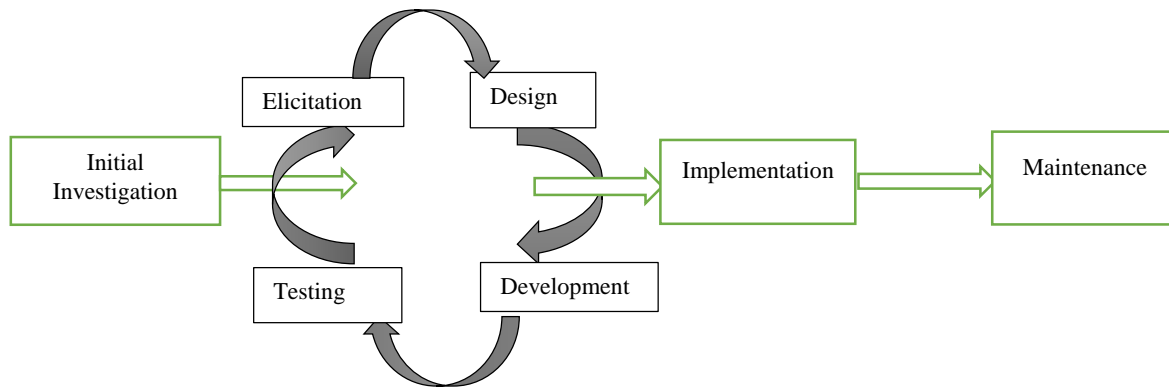


**Table 2: Comparison of the System Development models in software development life cycle**

Model	Features		
	Financial cost	Time	Functionality
Waterfall	High	Long	Static system
Incremental	High	Short	Static system
Spiral	High	Long	Dynamic system
Rapid Application Development (RAD)	Low	Short	Dynamic and interactive system
Agile	Low	Short	Dynamic system

### **3.5.1 Rapid Application Prototype**

This study adopted the Rapid Application Development (RAD) model from elicitation to the system implementation and testing process. This research study decided to use RAD model simply because it is speedy and delivers the system on time, within the given time frame as shown in Table 2 above. The RAD puts more prominence by providing a quality system within a short period on time and at low cost compared to other models. This model involves the two way communication that is developer – customer communication from the beginning till the end, in-turn leads to customer satisfaction (Ruparelia, 2010).



**Figure 7: Rapid Application Development Prototype**

### 3.5.2 System Implementation

The implementation of the system involves the process of accomplishing the development of a system to be used by the intended users. In this research study our system was implemented through the use of Apache Cordova. The requirements needed for the development of the system were the following programming languages.

#### (i) Apache Cordova

Apache Cordova formerly called Phone-gap is a mobile application development framework which was bought by Adobe systems from a developer called NITObI. It is used to develop cross and hybrid applications using the Phone-gap framework supporting different mobile platform. This mobile framework uses Hyper-text Markup Language (HTML), Cascade Styling Sheet (CSS) and Java Script (JS) (Bosnic *et al.*, 2017).

Apache Cordova have access to native mobile applications through the set of Application Programming Interface (API), thereby it supports interaction of the plugins through JavaScript. The application developed using Apache Cordova can run in different mobile platforms such as UIWebView in IOS, WebBrowser in windows phone and WebView in Android (Shehab & Aljarrah, 2014).

Steps to install Apache Cordova on windows using Command Prompt (CMD):

- (a) Install first the node.js.
- (b) Check the version to have assurance of its installation. (npm - -version)
- (c) After that now install Cordova by typing npm install -g Cordova.
- (d) Then run Cordova -version to check the version you are using.

## **(ii) Hypertext Markup Language**

The HTML is not a programming language but a Markup language that is mainly used to structure the content and create web pages. Therefore, HTML tells the browser the meaning of every part in the website. There are different tags used in HTML, <p> .....</p> this indicated the starting and ending of a paragraph. Other tags are <head> ..... </head>, <title> ..... </title> etc. The HTML therefore creates interfaces which allows users to interact with the system in a simple manner. One of the front-end languages in web pages is HTML.

## **(iii) Cascade Styling Sheet**

The CSS is a style sheet language and the other front-end language in developing web pages alongside with HTML and JavaScript. Cascade Style Sheet is mainly used to perform styling issues in the HTML document, where it can either be internal CSS, external CSS or Inline CSS. Therefore, CSS, is used to control and set different styles in a web page. Example font family, background colors, font size.

## **(iv) JAVASCRIPT**

Javascript is a lightweight programming language helps in scripting purposes. It has dynamic typing, object-oriented language, syntax with curly bracket and first-class functions. Example of the method used in Javascript is alert (), this is the method that usually displays an alert dialog box on top of the current window carrying a specific message.

## CHAPTER FOUR

### RESULTS AND DISCUSSION

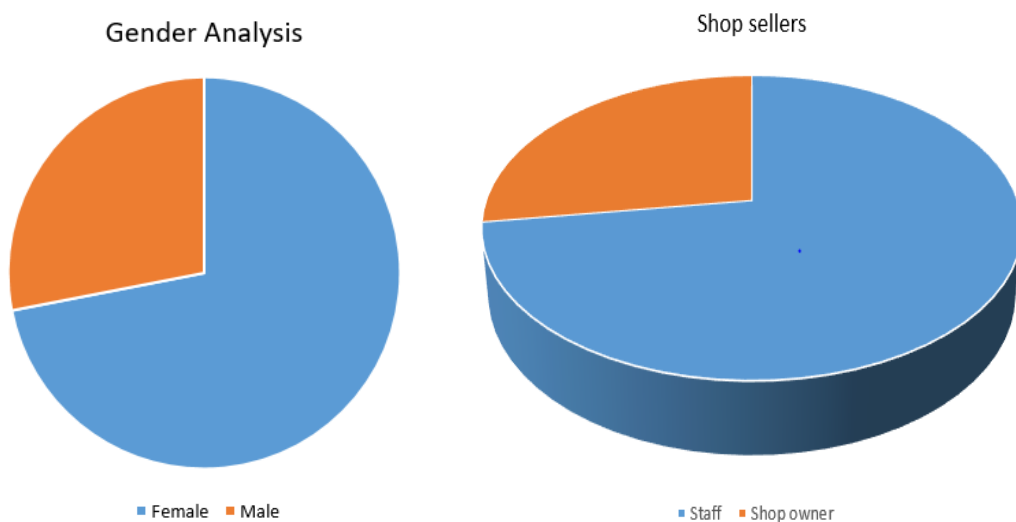
#### 4.1 Results

A survey which was conducted using questionnaires involved poultry farmers and agro-vet owners of the shops. Different questions were asked and below is the output of their response.

##### 4.1.1 Findings from the Agro-vet shops

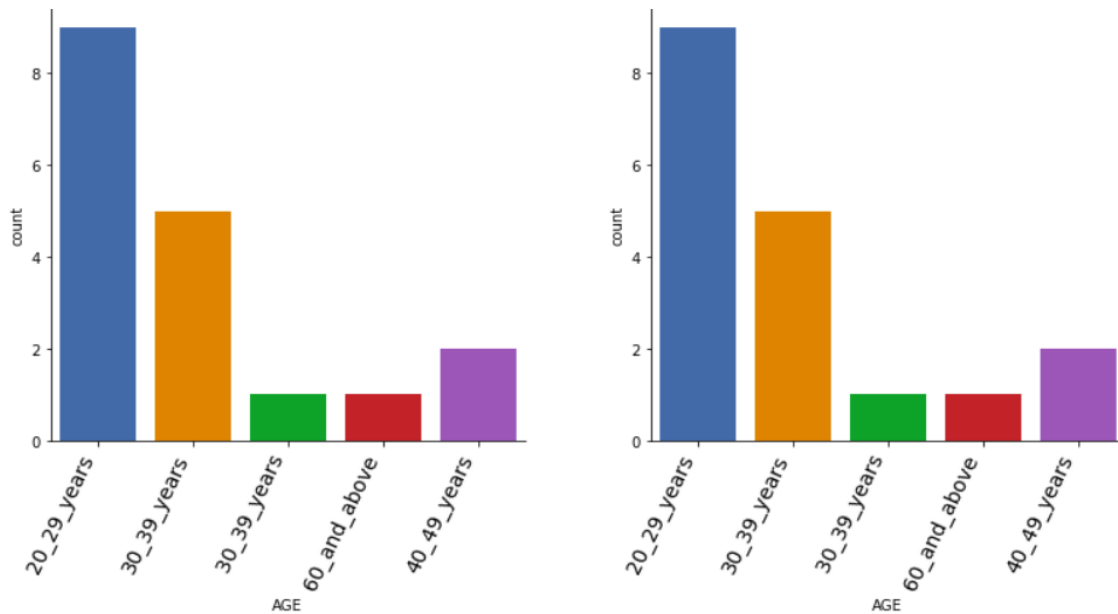
###### (i) Demographics from the Agro-vet shops

From the findings of the shop owners and the staffs who were not owners but the shop sellers, the analysis conducted showed that there were lot of females involved in selling poultry products in the agro-vet shops compared to male. Again, the results showed that the staffs are the ones who provide daily poultry services by selling all day compared to the shop owners. This is simply because many shop owners have more than one activity to perform to earn their living.



**Figure 8: Analysis of gender and shop sellers**

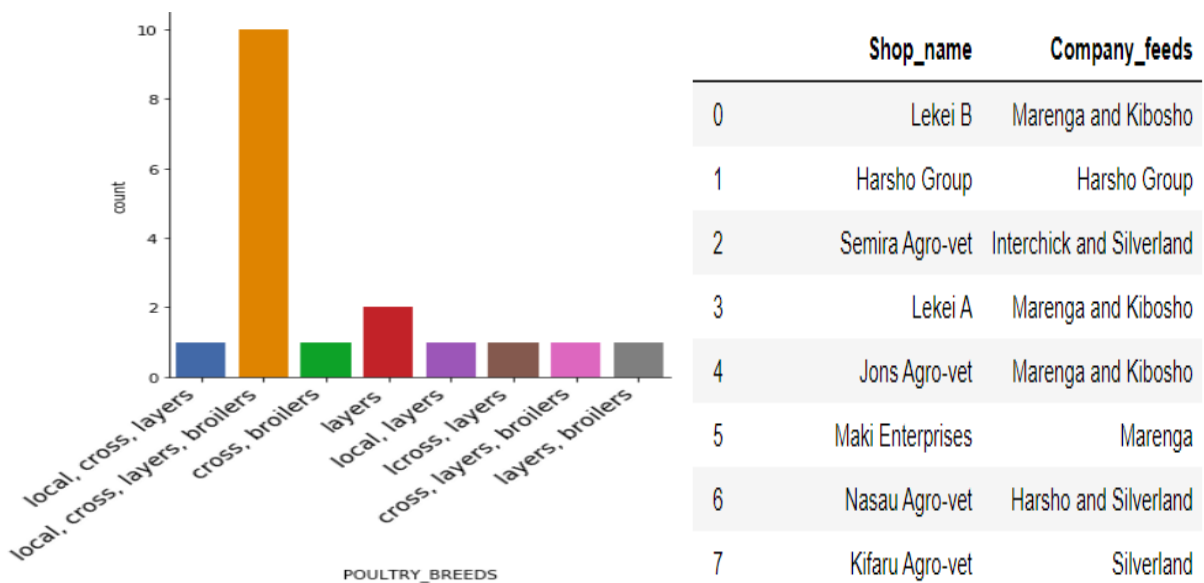
The study also conducted a research based on the age of the shop sellers, knowing what age they are ranging in. This is because, the shop sellers must have at least more than 18 years old to be considered for this task since they are regarded as matured. The study found that a lot of shop sellers in the agro-vet shops age from 20-29 years as they are considered to complete their secondary education and university studies likely to be certificate, diploma and first-degree holders.



**Figure 9: Analysis of age and education level**

**(ii) Poultry Breeds and the Type of Feeds Sold in the Shops**

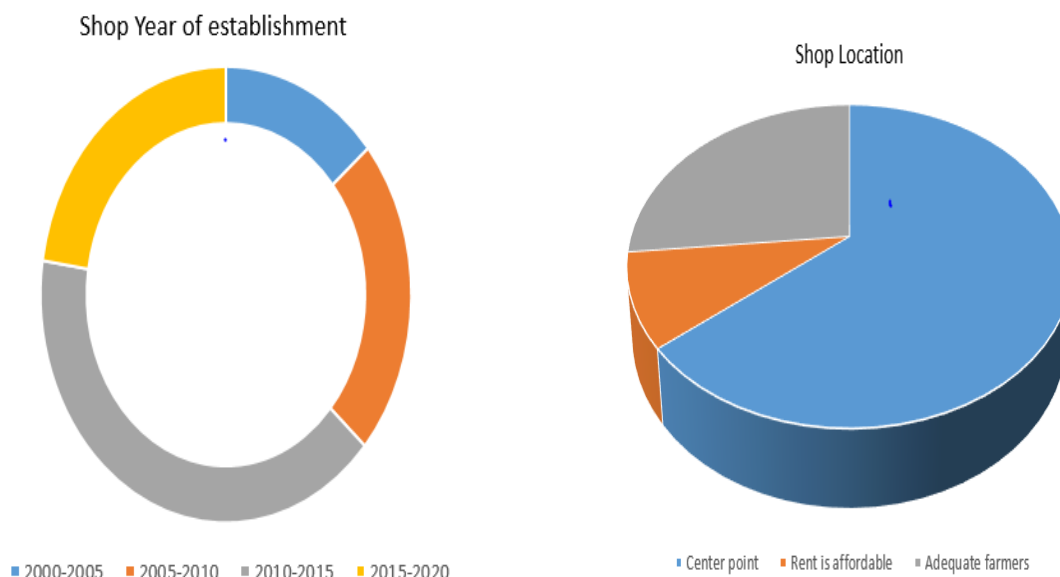
Mostly all shops based on providing feeds to all types of poultry breeds which are layers, broilers, local or indigenous and cross breeds. Depending on the shops there are different kinds of feeds which these poultry breeds are given. Simply depending on the choice of poultry farmers. The analysis therefore, showed that Marenga and Kibosho in Arusha and Kilimanjaro are the poultry feeds that are mostly used compared to others followed by Silverland feeds.



**Figure 10: Poultry breeds and the feeds from different companies**

### (iii) Analysis on the Year that the Agro-vet Shops were Established and their Location

The 2010-2015 years according to the study done in the three regions, was the period of time when many agro-vet shops were established in different locations. The locations which mostly favored them are the center points.

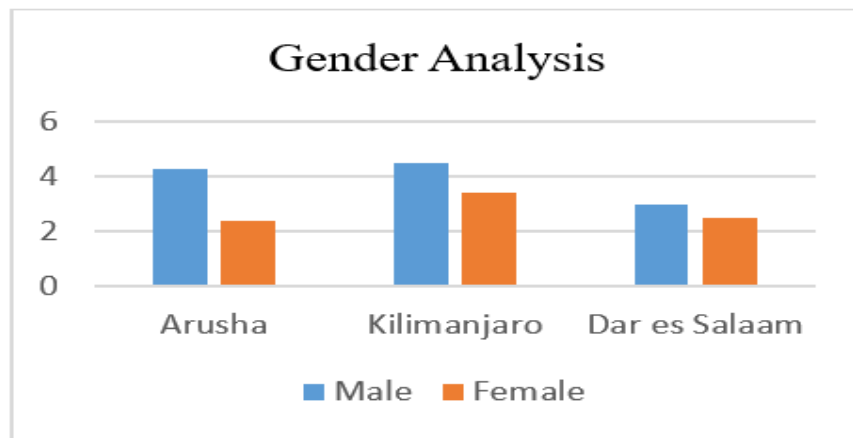


**Figure 11: Analysis on the year of shop establishment and their location**

#### 4.1.2 Findings from the Poultry Farmers

##### (i) Demographics of poultry farmers

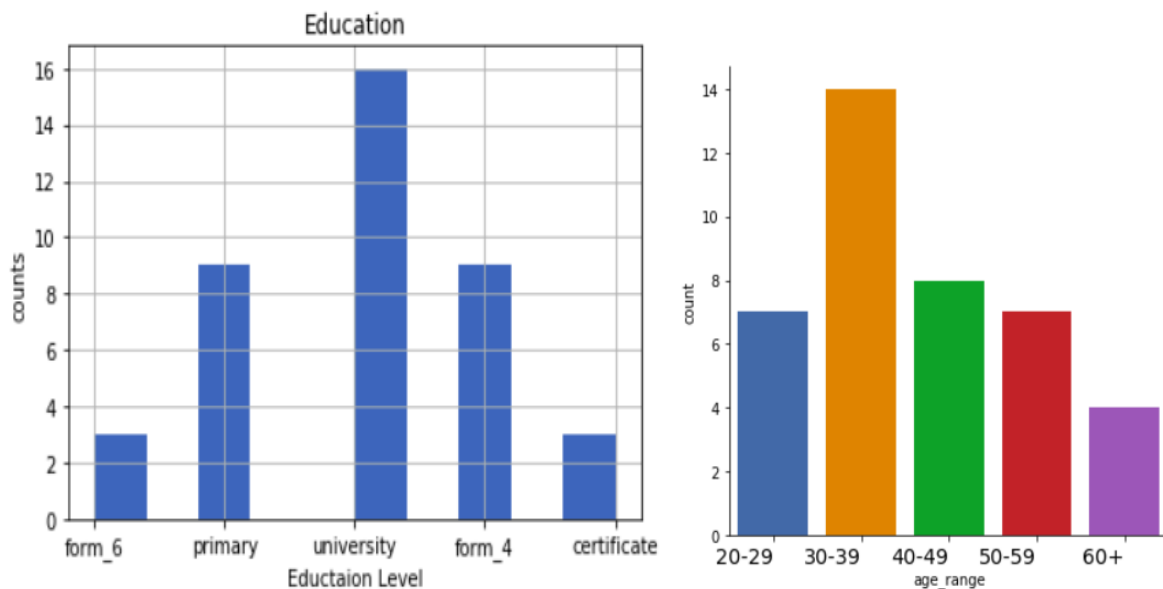
According to the findings done in the three regions the number of male poultry farmers were more compared to the number of females indicated in Fig. 12. But since many farmers are spouses, it is concluded that females are there to assist their husbands in farming activities. Although in Tanzania many activities are regarded as males and thus women do not have anything of theirs.



**Figure 13: Gender Analysis**

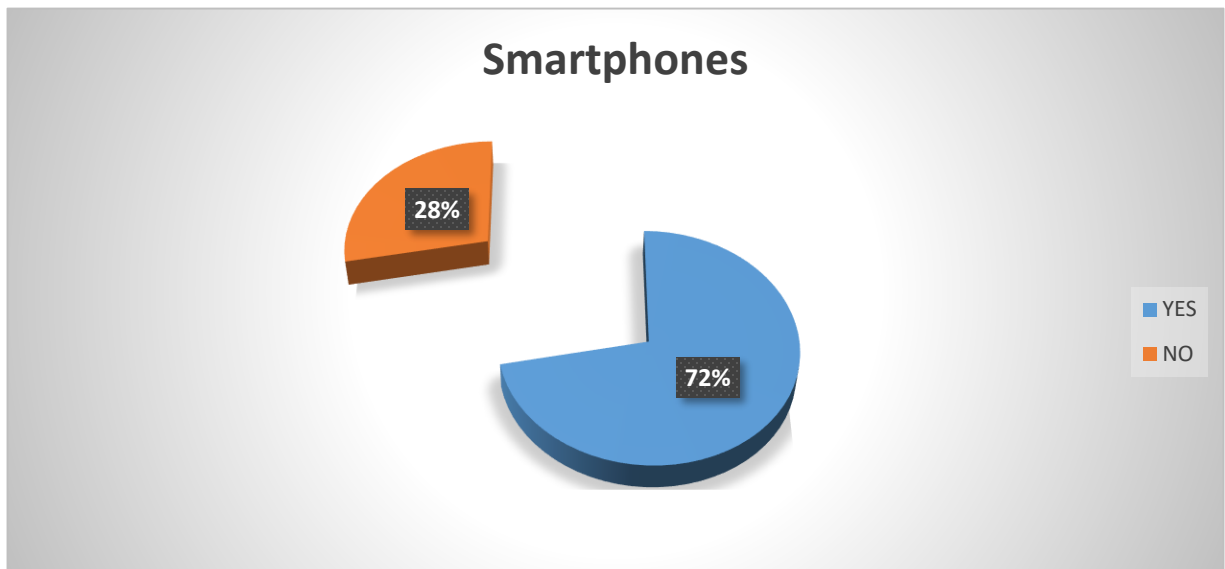
Since most poultry farmers are male, the study shows that the education level they possess is high education level especially in diploma and bachelor degree and few are form 6 and certificate holders. Form 4 and primary has the same range of holders as shown in Fig. 13.

Despite of that, the range in ages in which mostly pursue the poultry farming activity is between 30-39 years, this is because they now have lots of activities to handle thus, they really need to start other sources of getting income as we all know that fathers are the head of the family. The other age group is of 40's to 60's were most of them are in preparation of quitting their jobs and coming back home. Due to that they find that the easiest farming activity they can be involved with while enjoying their old age is by keeping poultry within their home campus.



**Figure 14: Analysis of educational level and age range of poultry farmers**

The proposed solution will be implemented on mobile smartphones. Therefore, the ownership of mobile phones by poultry farmers was assessed. The 72% of poultry farmers have smartphones which will enable them to access and interact with the system to get the services and products for their poultry easily. This will help them to improve their productivity due to easy accessibility of poultry products and services within their palms.



**Figure 15: Smartphone possession of poultry farmers**

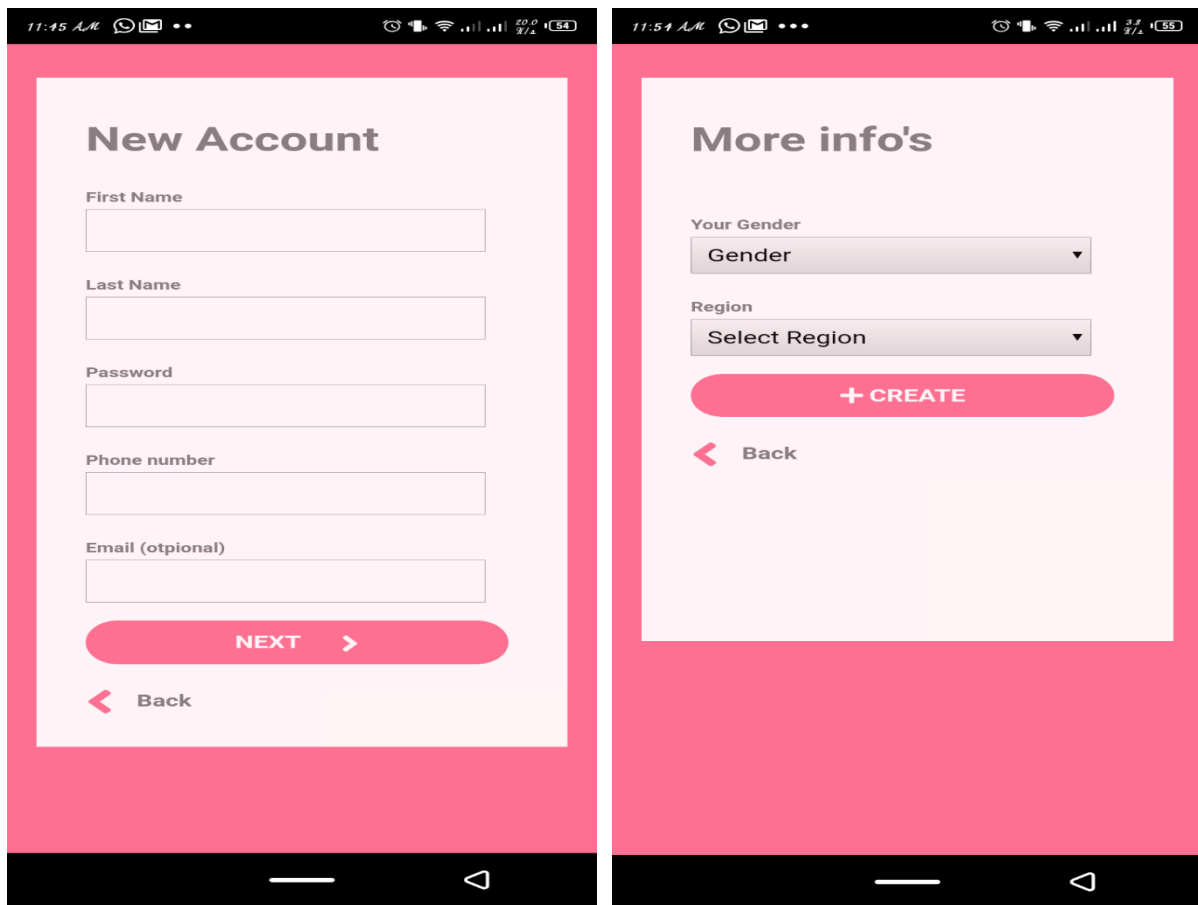
#### **4.1.3 Results and Discussion of the Developed System**

##### **(i) Mobile Application System Development**

Mobile application was developed using Apache Cordova. It is user- friendly and it provides easy interaction between the user and the system. This mobile application is targeting the poultry service providers which are required to provide poultry services to poultry farmers. The poultry services providers include both agro-vet shops and extension services mostly used by poultry farmers. Below are the screen shots that indicates the mobile application.

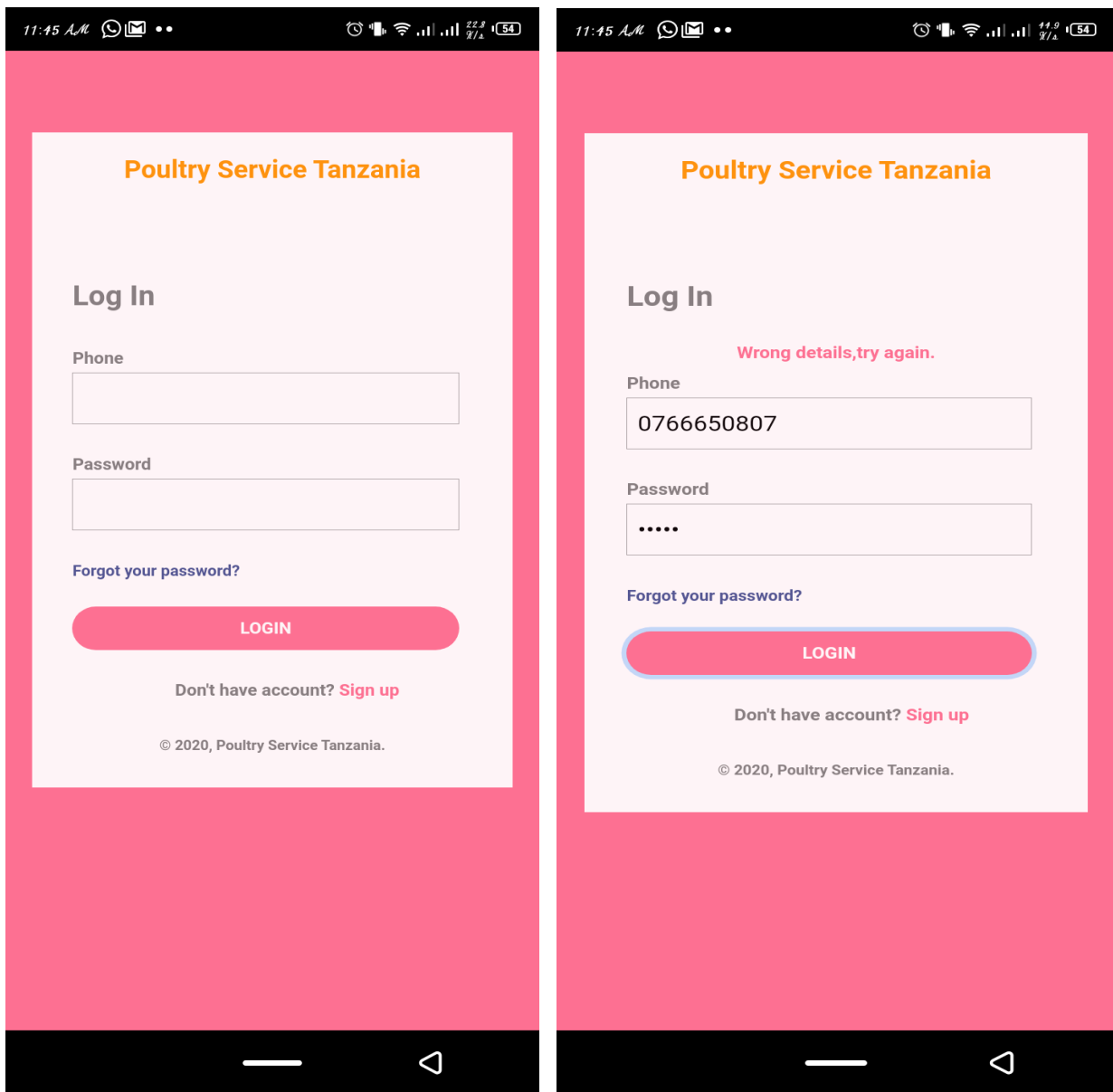
Figure 15 shows the registration process after the user installs the poultry service in Tanzania (PST) mobile application in his/her smartphone. The system first requires the user to create an account and provide all the personal credentials needed such as name, password, phone number, gender and region.





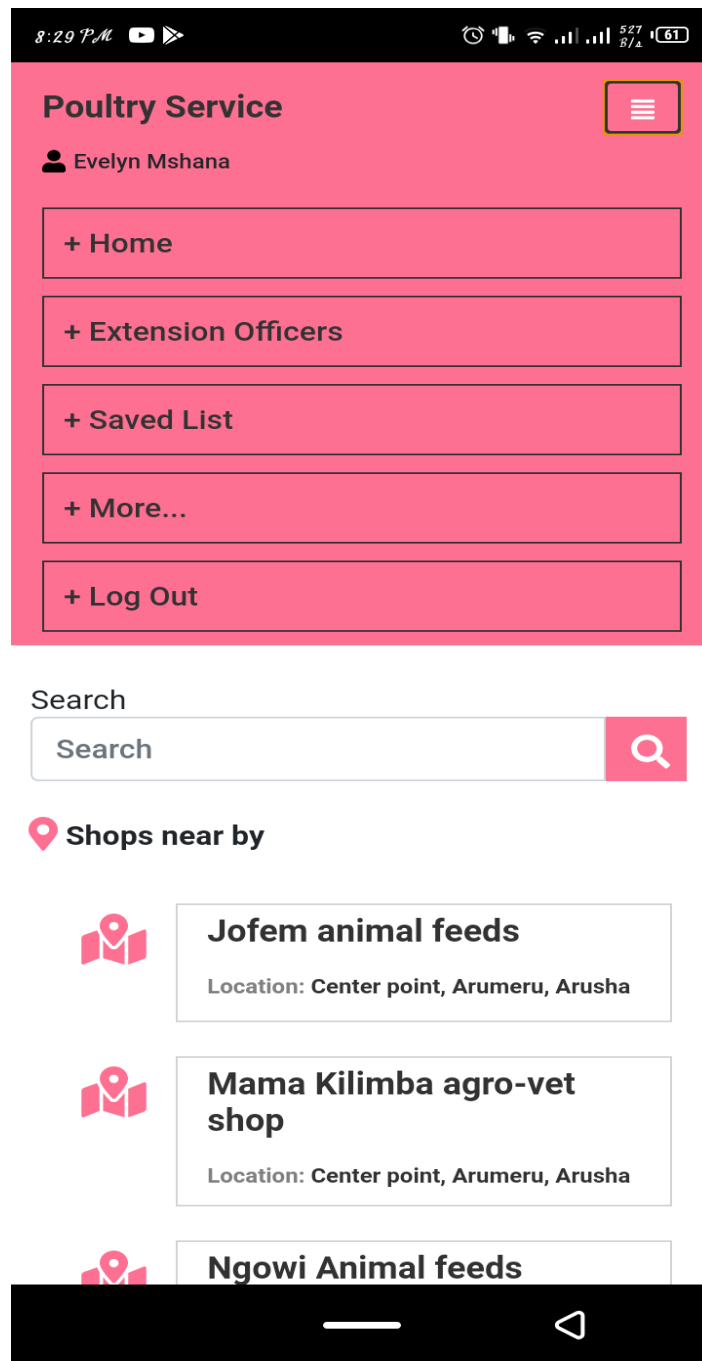
**Figure 16: Registration UI screen**

Once the user have successfully created a new account he/she will be directed to the login page whereby the registered user will be required to put the phone number and the password which he/she used during the registration process. And if the credentials will not match a toast message will be displayed to alert the user “wrong details, Try again”. Figure 16 shows the login page.



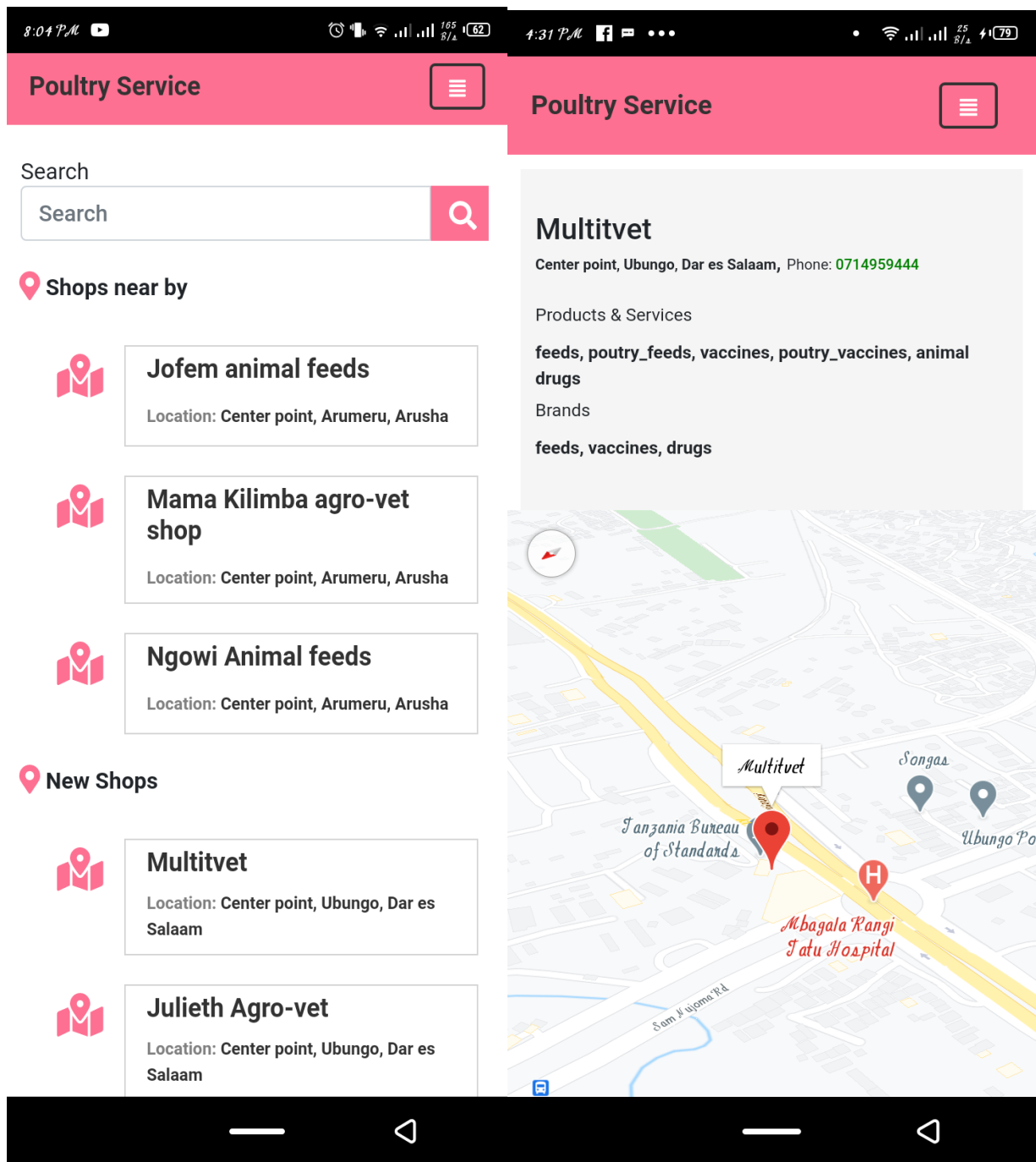
**Figure 17: Login screen**

After the successful login the app will display the menu where the user will choose what to view first and the user will either decide to remain in the home page which consists of the agro-vet shops or either choose another tab maybe the extension officer tab to view their directory. All these options depend on the user's choice after logging in Fig. 17 shows the menu present in the PST app.



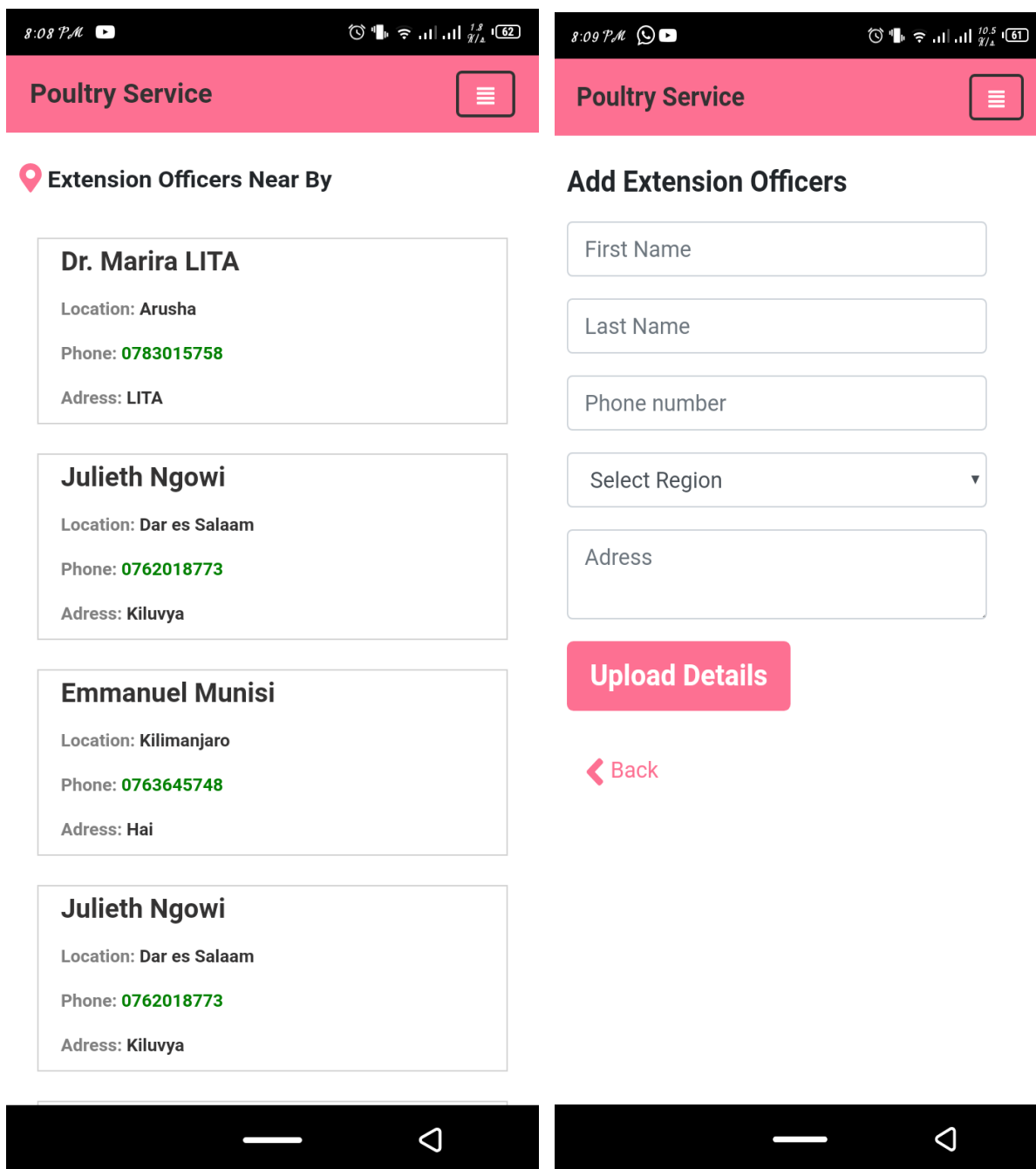
**Figure 18: Menu of the mobile application**

The home page displays the shops nearby and the new shops which are recently added in the system. Thus, once the user has logged in will be able to view the required shop. For further details on the intended shop, once he/she clicks it will show the details such as the products available, phone number of the agro-vet shop which will enable the user to call if he/she has an urgent need and can view the map of where exactly the shop is.



**Figure 19: Map showing the available agro-vet shop**

Not only is the agro-vet shop providing the poultry services to the poultry farmers but also the extension officers. Figure 19 shows the extension officer's directory based on the regions which they reside. The directory provides the name, region and the phone number of the Extension officer. Therefore, if there is a new extension officer can be added as indicated in Fig. 19(b).



**Figure 20: Extension Officer's details**

The PST App has a menu of more. The more option can also be used in adding new shops which rise up in the poultry industry sector. The details to be added are as shown in Fig. 20. It involves adding the shop name, contacts, what are sold including feeds, vaccines, or other products. The details also involve the photo of the added shop together with the GPS location.

The figure displays three sequential mobile application screens for adding a new agro-vet shop. Each screen has a pink header with 'Poultry Service' and a menu icon.

- Screen 1: Add New Shop Details**
  - Fields: Shop Name, Shop Owner, Gender (dropdown), Phone Number, district, Select Region (dropdown), Started year, Shop Location, GPS location.
  - Buttons: 'Back' (left arrow) and 'Next' (right arrow).
- Screen 2: Add More Details**
  - Fields: Feeds sold, Poultry Feeds sold, Vaccines Sold, Poultry Vaccines sold, Drugs sold, Poultry Drugs sold, others.
  - Buttons: 'Back' (left arrow) and 'Next' (right arrow).
- Screen 3: Add More Details**
  - Fields: Feeds sold, Poultry Feeds sold, Vaccines Sold, Poultry Vaccines sold, Drugs sold, Poultry Drugs sold, others.
  - Buttons: 'Back' (left arrow) and 'Next' (right arrow).

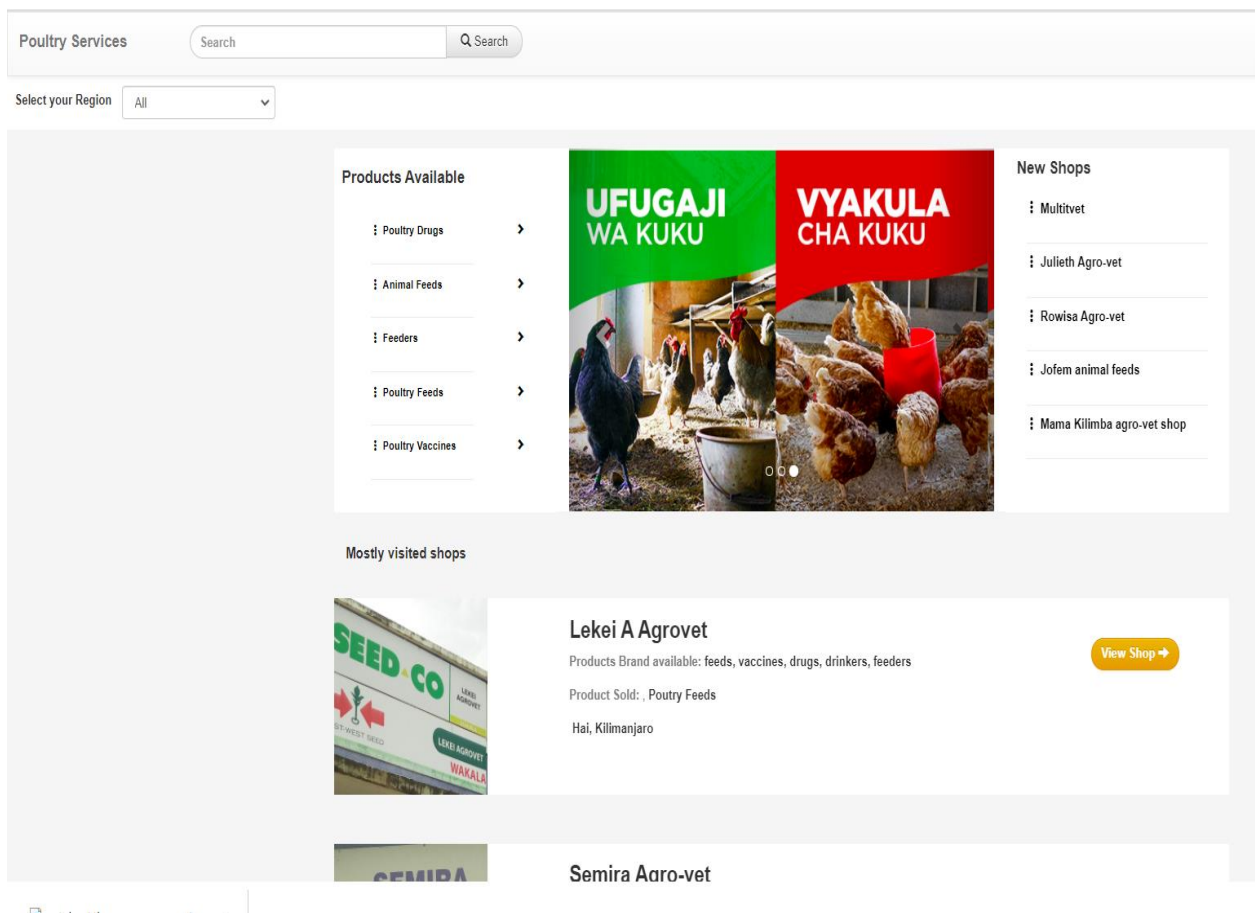
At the bottom of each screen is a black navigation bar with a white horizontal line and a left-pointing triangle.

**Figure 21: Adding new agro-vet shop**

## (ii) Web application System Development

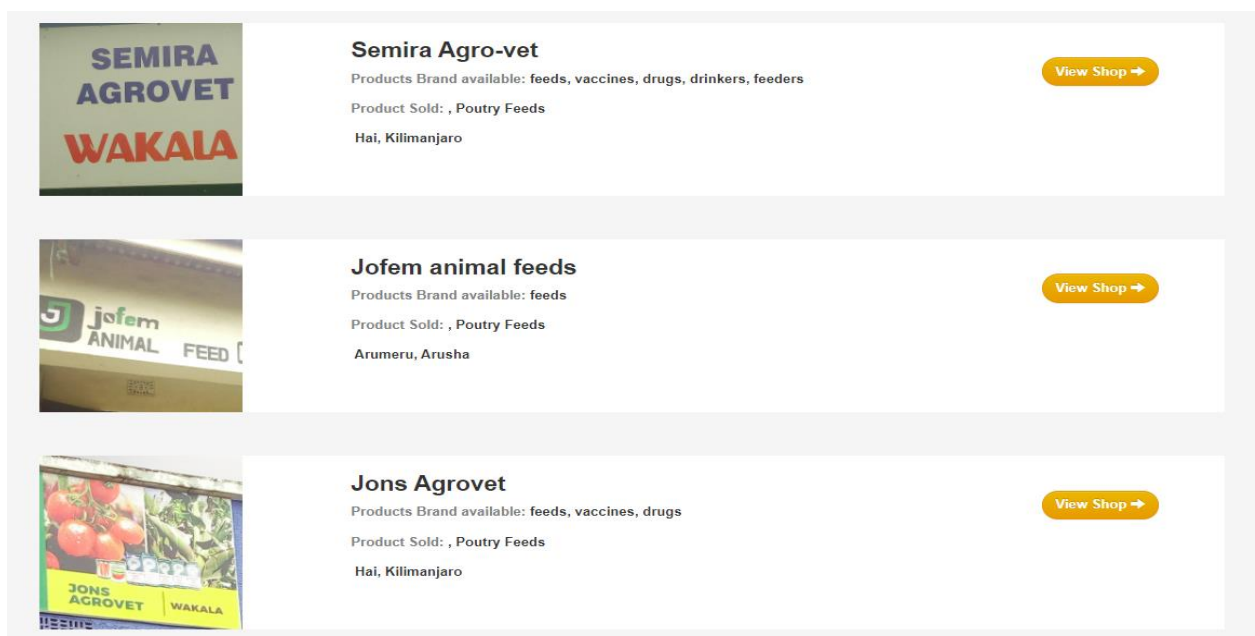
Besides the mobile application system also the web application system was developed. This is mainly helpful to the Administrators. The user interface is user-friendly and easy to interact with. The web interfaces help the administrators to add more new shops and extension officers who will be new.

Figure 21 shows the home screen of the web app where the user is able to see the most visited shops and also filter the agro-vet shops by selecting the required region. The user can also view the new shops added in the site.



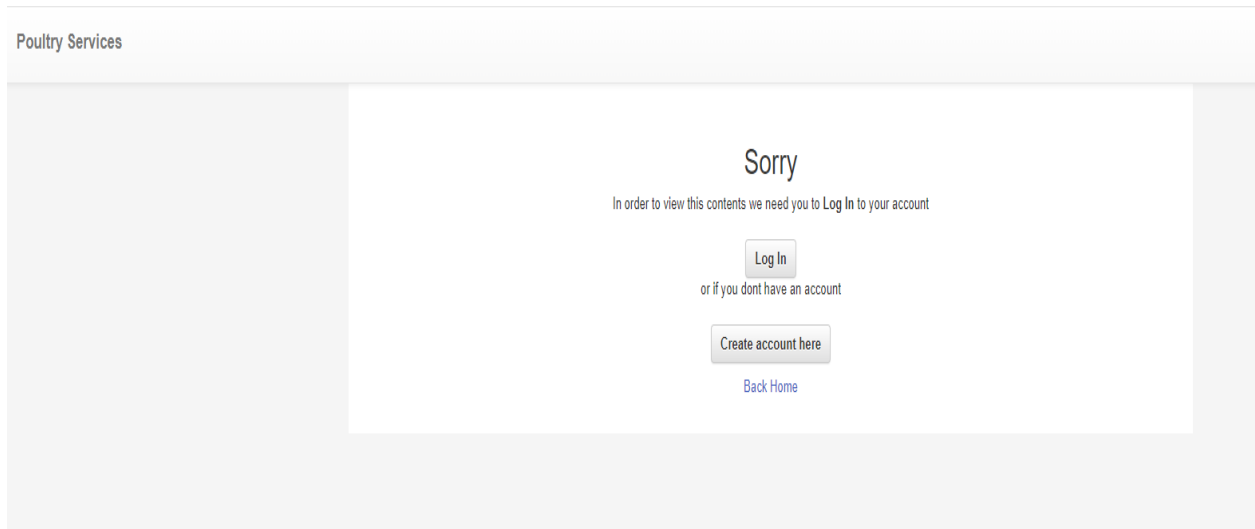
**Figure 22: Home screen of the web application**

Figure 22 shows the list of agro-vet by viewing their photos, knowing which region is found and the products sold. The user can click on the view shop button and it will direct him into another window which will display all the details of the corresponding shop.



### Figure 23: List of agro-vet shops

For the user to view the details of the corresponding agro-vet shop, he/she is required to create an account and if he/she has an account already is supposed to login. Figure 23 below shows the tab where the user is required to do among the two options otherwise go back to the home page.



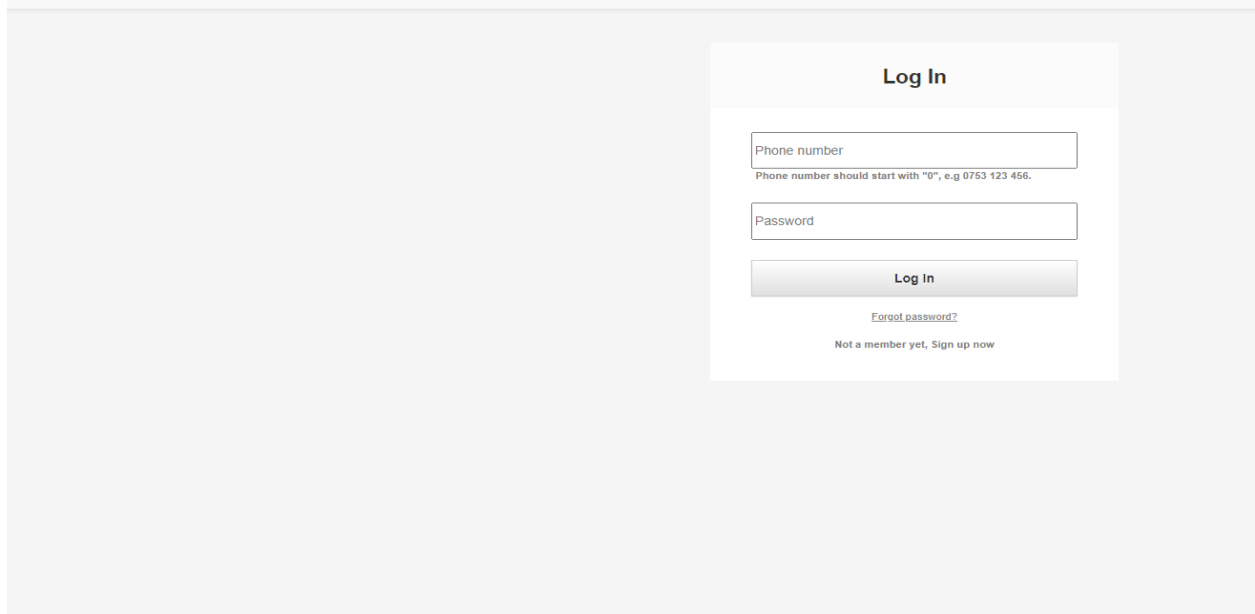
### Figure 24: Create an account or Login

As long as it is the first time user he/she is therefore required to sign-up to have an account from then on another tab will in-turn open up which requires the user to login using phone number and password which he/she created while signing up. Figure 24 shows the Sign up form and Fig. 25 shows the Login interface.

A screenshot of a web application interface showing a sign-up form. At the top, there is a header bar with the text "Poultry Services". Below this, the main content area is a light gray rectangle. On the right side of this rectangle is a white box titled "Sign Up". Inside this box are several input fields: "First name", "Last name", "Password", "Phone number", "Email", "Select Region" (a dropdown menu), and "Gender" (a dropdown menu). Below the "Phone number" field is a small text note: "Phone number should start with '0', e.g 0753 123 456.". At the bottom of the white box is a button labeled "Sign Up".

### Figure 25: Sign-up screen





**Log In**

Phone number

Phone number should start with "0", e.g 0753 123 456.

Password

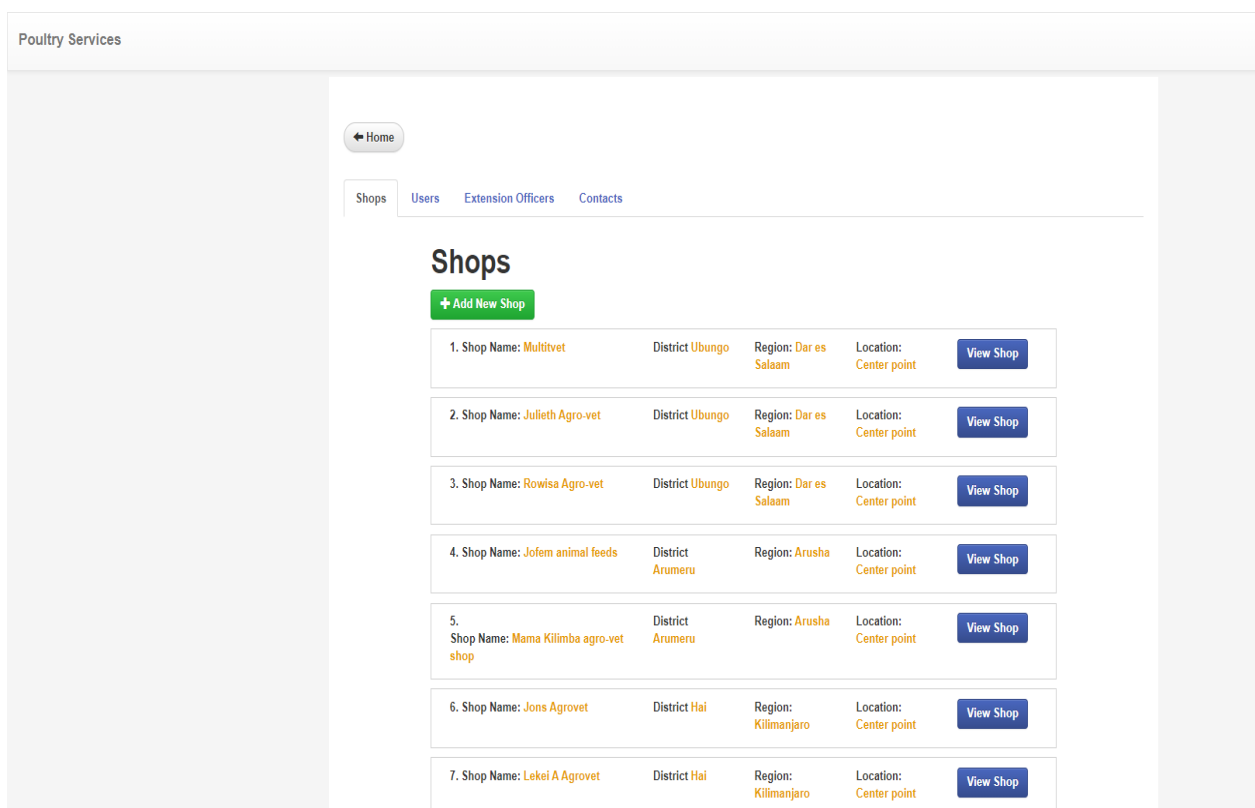
**Log In**

[Forgot password?](#)

Not a member yet, Sign up now

**Figure 26: Login screen page**

The administrator is able to add more new shops and view them as shown Fig. 27.



Poultry Services

← Home

Shops Users Extension Officers Contacts

## Shops

[+ Add New Shop](#)

1. Shop Name: <b>Multivet</b>	District <b>Ubungo</b>	Region: <b>Dar es Salaam</b>	Location: <b>Center point</b>	<a href="#">View Shop</a>
2. Shop Name: <b>Julieth Agro-vet</b>	District <b>Ubungo</b>	Region: <b>Dar es Salaam</b>	Location: <b>Center point</b>	<a href="#">View Shop</a>
3. Shop Name: <b>Rowisa Agro-vet</b>	District <b>Ubungo</b>	Region: <b>Dar es Salaam</b>	Location: <b>Center point</b>	<a href="#">View Shop</a>
4. Shop Name: <b>Jofem animal feeds</b>	District <b>Arumeru</b>	Region: <b>Arusha</b>	Location: <b>Center point</b>	<a href="#">View Shop</a>
5. Shop Name: <b>Mama Kilimba agro-vet shop</b>	District <b>Arumeru</b>	Region: <b>Arusha</b>	Location: <b>Center point</b>	<a href="#">View Shop</a>
6. Shop Name: <b>Jons Agrovet</b>	District <b>Hai</b>	Region: <b>Kilimanjaro</b>	Location: <b>Center point</b>	<a href="#">View Shop</a>
7. Shop Name: <b>Lekel A Agrovet</b>	District <b>Hai</b>	Region: <b>Kilimanjaro</b>	Location: <b>Center point</b>	<a href="#">View Shop</a>


**Figure 27: Agro-vet shops added**

When the administrator, clicks the view shop button, he/she will be able to see all the details including the photo of the agro-vet shop and the map that locates where it is in point. And if there is an information to be added, it is possible to do so. After making changes the update information

button must be clicked to save the data injected. In this page, the admin is also able to delete the shop or change the agro-vet shop's picture.

Poultry Services

[Admin Panel](#) [Change Shop Picture](#) [Delete Shop](#)



**MULTIVET**  
Dawa  
Chanjo  
Vyakula vya Mifugo  
Virukubisho  
Huduma na Ushauri  
Email: info@multivetfarmld.co.tz  
multivetfarmld@yahoo.com  
Tel: +255 784 617178/9, +255 714 959444

### Fill In Shop Details

Shop Name

Shop owner

Gender

Owner Phone


District

Region

Started Year

Figure 28: Preview of the MULTIVET shop

### Map Location



6°47'32.2"S 39°12'33.1"E  
6655+3M Dar es Salaam  
[View larger map](#)

Shop location

Shop GPS location

Brands of products sold

Feeds

Poultry Feeds

Vaccines

Poultry Vaccines

Animal Drugs

Poultry Drugs

Figure 29: Map showing the location of the MULTIVET shop

The admin is also able to add extension officers as per the regions and update information regarding the officers. Figure 29 shows the tab for editing extension officer's information and how to add new extension officers.

The screenshot shows a web application interface for 'Poultry Services'. A modal window titled 'Edit Extension Officer' is open, displaying a form for updating an officer's details. The form includes the following fields:

- First Name:** A text input field containing 'Dr'.
- Last Name:** A text input field containing 'Marira'.
- Phone number:** A text input field containing '0783015758'.
- Select region:** A dropdown menu with 'Arusha' selected.
- Address:** A text area containing 'LITA'.

At the bottom of the form is a green button labeled '+ Update'. A 'Close' button is located at the bottom right of the modal. In the background, a table of extension officers is visible, with columns for First Name, Last Name, Phone number, Select region, and Address. The table contains one entry: Emmanuel Munisi, 0763645748, Kilimanjaro, Hai. There are 'Edit' and 'Delete' buttons for each row in the table. The top navigation bar includes 'Home', 'Shops', 'Users', 'Settings', and 'Log Out'.

**Figure 30: Add and edit the Extension Officer's information**

#### **4.1.4 Testing Approach**

Testing is always and being performed from the early stages of developing the system which is termed as unit testing, therefore, integrating different parts that involve integration testing and lastly system testing. Then after it is taken to the users to perform user acceptance testing, where the users test whether the system meet the required and satisfy their needs. It involves both black box and white box testing.

### (i) Unit Testing

Unit testing is the testing approach that is always performed by developers while in the process of developing the system. It involves testing the functionality of each module to see the way it perform. Thus, this proposed system was tested in each of their module such as register module, login module, adding of new shops module, adding the extension officer's directory, add/deleting shops and other modules were all tested. This testing mainly dealt with finding bugs and error and fixing them.

### (ii) Integration and System Testing

Once, the unit testing has been performed, integration testing which involve the combination of unit testing together is performed and later the overall system is tested. All these is performed by the developers. So, the proposed system was tested and it proved to function well. The proposed system was therefore tested example, once the user registers, will he or she be able to login after the process of registration is done. Table 3 below shows the system tested modules results.

**Table 3: System modules testing results**

<b>System requirements</b>	<b>Test results</b>
The web app must be able compatible with all brewers, and the mobile app should work on IOS, android platform.	Pass
The admin should be able to add users on the web application.	Pass
The mobile application should enable new users to register and create new accounts.	Pass
The system must allow registered users to login and log out.	Pass
The system should allow the system administrator to add, delete and modify the agro-vet shops details present in the system.	Pass
The system should allow the system administrator to add, delete and modify details on the extension officers present in the system.	Pass
The system should show the required agro-vet shop as per the request as well as the directory of the extension officers.	Pass
The system should allow the logged in users to view the agro-vet shops present coring to the region selected.	Pass

### (iii) User Acceptance Testing

User acceptance testing is always done to check whether the system meet the intended needs that users required. Table 4 shows the user acceptance validation results.

**Table 4: User's acceptance validation 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 is 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

From the study, the mean score is above 3.5 which indicates that the respondents have accepted the developed system and they are willing to use it for the betterment of their lives by improving household income and increasing productivity in poultry industry.

## 4.2 Discussion

During the interview, 15 respondents mainly the poultry farmers reported that the tool was useful and it could simplify their means of getting the product/goods and services. They also commented that the app will 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 shop and ask first before taking further steps. They also found it to be productive to their poultry farming activities since the developed tool contains the products available at the agro-vet shop such as feeds, drugs, vaccines and other related products available at the intended shop even before they visit it physically. Some of the

respondents stated that the tool should also be in cooperated with a forum where feedback is taken from users and actions should to be taken accordingly. Six agro-vet owners were also interviewed on the usefulness of the tool and how it benefited them. They claimed that the tool is of significance to them since their products are placed online and anyone with the application installed in the smartphone will be able to get the services and products which they provide in a simpler technique to market their products. The main channel of information to farmers on the agro-vet shops were through the word of mouth or physically visiting the shops. The system is not only beneficial to poultry farmers to attend their poultry and enable them to earn income.

This study has analyzed the Poultry Service in Tanzania (PST) system compared to other systems and found that still poultry farmers rely on getting poultry information from friends, neighbors or they either use their husbandry experience in feeding their poultry together with getting the technical advices. In turn they still face the same challenges of low productivity.

According to the user acceptance testing results it shows that the system will be very useful first in improving the household income and increasing poultry productivity. Moreover, the system will help the poultry farmers to get reliable poultry information from the extension officers through call or physical meetings.

The developed system has contributed to one among the key strategies of Tanzania Livestock Modernization Initiative TLMI of improving poultry sector based on pillar 4. Whereby through the system, the poultry farmers are able to get improved high-quality feeds from the registered agro-vet shops which are within their locality and also the provision of services from the extension officers through accessing of the extension officer's online directory. As TLMI stated, the priority actions are to support concentrated delivery of vet and extension services and ensuring availability of high-quality improved feeds.

## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Conclusion**

Poultry farming remains to be a food and nutritional livestock sector which also provides household income. Tanzania having 3.7 million households who are dependent in this sector really needs to come up with technological innovations on how to increase production and improve income of different households. For this poultry sector to increase there must be better poultry service providers which are agro-vet shops and extension officers. However, there is uneven distribution of agro-vet shops and inadequate number of extension officers. Thus, there is no link between poultry farmers and the agro-vet services. This study focuses on using technology in solving this problem.

Tanzania Livestock Modernization Initiative (TLMI) of 2015, has key priorities towards poultry sector on increasing national's gross domestic product through improving production by provision of high supply of concentrated quality improved feeds and delivery of vet and extension services. This study has contributed to TLMI to accomplish its goal of improving poultry industry by linking poultry farmers with the poultry service providers through an online platform.

Technology as declared by TLMI is the major driver in the livestock sector , therefore both web and mobile application are the output of this research in linking together poultry farmers and the poultry service providers.

#### **5.2 Recommendations**

Poultry farming generally requires various poultry services which are not only reliable but also accurate to flourish. It is proposed on further research to widen the geographical coverage including more agro-vet shops in other regions of Tanzania also the presence of a forum where different discussions will be conducted. This will enable poultry farmers benefit more from the poultry services to improve their productivity.

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## **APPENDICES**

### **Appendix 1: Questionnaires for data collection**

I am Evelyn Mshana, currently a Master's student at The Nelson Mandela African Institution of Science and Technology pursuing a degree in Information Communication Science and Engineering. I am conducting research on Poultry farming which is titled "An online platform for linking poultry farmers and the agro-vet services: A case in Tanzania".

I am kindly requesting for your assistance in filling up this questionnaire. Your inputs will be of much worth and importance to successfully complete this research which will not only be for my benefit but you as poultry service providers and users.

### **SECTION A: Agro-Vet Shops questionnaire**

#### **PART A: General Information**

1. Name of the enumerator
2. Date of the survey
3. Age of the respondent
4. Education level of the respondent
5. Phone number of the respondent
6. Gender of the respondent
7. Are you the owner of the shop?
8. What is the name of the agro-vet shop?

#### **PART B: Poultry Products Information**

9. What products do you sell? Specify.....
10. Which company do you get your feeds from? Specify.....
11. What type of feeds do you offer to the poultry farmers?
12. What type of poultry breeds do you focus on based on the type of feeds and vaccines you sell? Why?
13. Which poultry vaccines and drugs do you sell in your shop? Specify.....
14. Which poultry feeds are sold out mostly compared to others and why?
15. Which drugs and vaccines are sold out most and why does it happen so?

#### **PART C: Access towards customers**

16. How do you get easy access to your customers? Specify the way you use to reach them.
17. When was the agro-vet shop established?

18. Why have you located your agro-vet shop here? Explain.....
19. What feedback do you get from your customers after purchasing your products?
20. How do you notify and advice your customers when new products evolve? What ways do you use?

**PART D: Usage of smartphone**

21. Do you possess a smartphone?
22. How do you use it? What mostly do you focus on?
23. How has your smartphone affect your income? Does it affect it positively or negatively?
24. How does your smartphone help you to bring closer your customers?

**PART E: Agro-vet shop information**

25. Picture of the agro-vet shop
26. GPS coordinate of the agro-vet shop.

**SECTION B: Poultry farmers.**

**PART A: General information**

1. Name of the enumerator
2. Date of the survey
3. Name of the respondent
4. Age of the respondent
5. Education level of the respondent
6. Phone number of the respondent
7. Gender of the respondent

**PART B: Poultry products information**

8. Which agro-vet shop do you get your poultry products from?  
Specify.....
9. How far is it from your locality?
10. Which company do you get your feeds from? Specify.....
11. What type of poultry breeds do you keep and how many are they?
12. Which poultry vaccines and drugs do you give your poultry breeds?  
Specify.....
13. How do you get access to the extension officer's services?

**PART C: Smartphone usage**

14. Do you possess a smartphone?
15. How do you use it? What mostly do you focus on?
16. How has your smartphone affect your poultry productivity? Does it affect it positively or negatively?
17. How does your smartphone help you to get the poultry services easily?

**PART D: GPS location**

18. Capture the GPD coordinate of the poultry farmers' farm.

## Appendix 2: Checklist questions for user acceptance validation testing

Validation aspects	Number of respondents					Mean score
	Strong disagree	Disagree	Not sure	Agree	Strong agree	
The system interface is user friendly						
The system is more interactive and attractive						
The system contents are easy to learn and understandable						
The system is useful on improving household income						
The system provides savings in terms of cost and time						
Forum should be deployed in the system for easy sharing of information						
I will use the system for easy accessibility of services and products						
I will recommend others to use the system for improving productivity						

### Appendix 3: Checklist question for system testing

System requirements	Test results
The web app must be able compatible with all brewers, and the mobile app should work on IOS, android platform	
The admin should be able to add users on the web application	
The mobile application should enable new users to register and create new accounts	
The system must allow registered users to login and log out	
The system should allow the system administrator to add, delete and modify the agro-vet shops details present in the system	
The system should allow the system administrator to add, delete and modify details on the extension officers present in the system	
The system should show the required agro-vet shop as per the request as well as the directory of the extension officers	
The system should allow the logged in users to view the agro-vet shops present coring to the region selected	

#### Appendix 4: Codes for the account activation of the developed system.

```
<?php
session_start();
include_once 'classUser.php';
$user_login = new USER();
if($user_login->is_logged_in()!="")
{
    $user_login->redirect('home.php');
}

//get user ID
$user_id = $_GET['ref'];
$user_id = $user_id - 225;
//include db
include_once 'db.php';
//getting user Data
$thisUser = $conn->prepare("SELECT * FROM users WHERE user_id = :this");
$thisUser->execute([
    "this" => $user_id
]);
$userData = $thisUser->fetch(PDO::FETCH_ASSOC);

if(isset($_POST['send_sms']))
{
    $phone = $_POST['phone'];
    if(strlen($phone) == 10){
        //adding +255
        $phone = substr($phone, 1);
        $phone = '255'.$phone;
        $phone_2 = $userData['Phone'];
        //check if phone number is the same
```



```

if($userData['Phone'] == $phone){
    //number is fine

    $activation_code = rand(1111111, 9999999);

    //registering activation code

    $activation = $conn->prepare("INSERT INTO activation_codes(codes, user_id)
VALUES(:codes, :user_id)");

    $is_insert = $activation->execute([
        "codes" => $activation_code,
        "user_id" => $user_id
    ]);

    //check if codes is insert

    if($is_insert){
        //proceed

        // send SMS

        $access_key =
'e59c49239d22c42823f5daa0c5c712cef8237e43c8db3e1b855fd48743f1818600f8a90332a77160
46aaad3e091d42dcd98f4f8c453be04d58530fb5c1a95695';

        $post = [
            'access_key' => $access_key,
            'codes' => $activation_code,
            'phone' => $phone,
        ];

        $ch = curl_init();

        curl_setopt($ch, CURLOPT_URL,
'https://stooyangu.com/API1000/SMS_API_TEST_SERVER.php');

        curl_setopt($ch, CURLOPT_RETURNTRANSFER, true);

        curl_setopt($ch, CURLOPT_POSTFIELDS, http_build_query($post));

        $response = curl_exec($ch);

        if($response){
            // $msg = "<div class='alert alert-success' style='width:60%; margin:0 auto;'>

            // <button class='close' data-dismiss='alert'>&times;</button>

            // <strong>Sent.</strong>

```

```

        // </div>";

        //redirect here

        header("location: verify.php?ref=".$_GET['ref']);
        exit();

    }

    //close
    curl_close($ch);

}

    }else{
        $msg = "<div class='alert alert-danger' >
        <button class='close' data-dismiss='alert'>&times;</button>
        <strong>Sorry!,</strong> Error on Registering Codes.
        </div>";
    }

}

    }else{
        $msg = "<div class='alert alert-danger' >
        <button class='close' data-dismiss='alert'>&times;</button>
        <strong>Sorry!,</strong> We can't find that number.
        </div>";
    }

}

    }else{
        $msg = "<div class='alert alert-danger' >
        <button class='close' data-dismiss='alert'>&times;</button>
        <strong>Sorry!,</strong> Invalid Phone Number
        </div>";
    }

}

}

```

```

?>
<!DOCTYPE html>
<html>
<head>
    <title>Account Activation</title>
    <!-- Bootstrap -->
    <link href="assets/css/bootstrap.css" rel="stylesheet" media="screen">
    <link href="assets/css/bootstrap-theme.css" rel="stylesheet" media="screen">
    <!-- custom css for this page -->
    <link href="assets/css/custom.css" rel="stylesheet" media="screen">
    <!-- JQuery -->
    <script src="assets/js/jquery-3.1.1.min.js"></script>
    <!-- bootstrap here -->
    <script src="assets/js/bootstrap.min.js"></script>

</head>
<body>
<?php
include_once 'nav_signUp.php';
?>
<div class="container">
    <div id="account_activation_div_holder">
        <div id="div_head">
            <h3 id="account_activation_header">
                <span class="glyphicon glyphicon-earphone"></span>
                Account Activation</h3>
        </div>
        <div>
            <?php
                // Div for error here

```

```

        if(isset($msg)){
            //infos error here

            echo $msg;
        }
    ?>
</div>

<div id="account_activation_form_div">
    <form method="post" autocomplete="off">
        <div class="form-group" >
            <p id="welcome_p">
                Hi <strong><?php
                    echo ucfirst($userData['FirstName']);
                ?></strong>, We will send you 7 digits activation codes, to your phone number ending
with:
                <b><?php echo substr($userData['Phone'], 9); ?></b>
            </p>
            <input type="tel" name="phone" id="send_msg_btn" maxlength="50"
required="required" placeholder="Phone Number">
            <p class="input_label">
                Phone number should start with "0", e.g 0753 123 456.
            </p>
        </div>
        <div class="form-group">
            <button type="submit" name="send_sms" class="btn btn-default"
id="send_sms_btn">Send SMS</button>
        </div>
    </form>
</div>
</div>

```

</body>

</html>

## **RESEARCH OUTPUTS**

- (i) Evidence of Publication (Acceptance letter from Journal)
- (ii) Poster Presentation

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Research and Engineering**



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**Acceptance of Research Paper**

Date: 17 - 10 - 2021

**Paper ID: IJASRE\_34094**

Dear Evelyn M. Mshana,

We would like to inform you that your article entitled **"Mobile Application for enhancing Agro-vet services accessibility to poultry farmers"** has been accepted for publication in International Journal of Advances in Scientific Research and Engineering (IJASRE) as per reviewer comments. Your paper will be published in current issue, as per the recommendation of the Editorial Board, without any major corrections in the content submitted by the researcher. Complete the registration procedures for further publication processing.

**Reviewers Comments:**

- Briefly, they have gone through your article, it was good.
- The research methodology for the study is appropriate and applied properly.

**Suggested Title : Title is suggested**

**Development of Mobile Application for enhancing Agro-vet services accessibility to poultry farmers, of Tanzania**

**Comments:**



- The objective of this research is to Development of Mobile Application for enhancing Agro-vet services accessibility to poultry farmers.
- Data were collected from 115 poultry farmers in Arusha and Dar es Salaam regions.
- Based on study, the researchers recommends that, extension of research in widening the geographical coverage, including more agro-vet shops and extension officers in other regions of Tanzania

**Corrections/Suggestion**

- Nil

With regards  
Publishing Manager  
[www.ijasre.net](http://www.ijasre.net)

## Poster Presentation

	<p><b>ONLINE PLATFORM FOR LINKING FARMERS AND AGRO-VET SERVICES IN TANZANIA. CASE STUDY: POULTRY</b></p> <p>Evelyn Mshana <sup>1*</sup>, Dina Machuve <sup>2</sup></p> <p><sup>1*,2</sup> The Nelson Mandela African <u>Institution</u> of Science and Technology, <u>Arusha</u></p>	
<p><b>BACKGROUND</b></p> <ul style="list-style-type: none"> <li>. High demand of poultry (TLMP, 2017)</li> <li>. Only 20% of the livestock producers are able to access the extension services (URT, 2015)</li> <li>. 3.7 million Households depends on poultry keeping for their living (FAO, 2017).</li> </ul>	<p><b>PROPOSED SOLUTION</b></p> 	<p><b>FUTURE WORK</b></p> <ul style="list-style-type: none"> <li>. Widen geographical coverage all over Tanzania.</li> <li>. Embedded forum for different discussion</li> </ul>
<p><b>PROBLEM STATEMENT</b></p> <ul style="list-style-type: none"> <li>. Uneven distribution of Agro-vet services leading to poor high quality feeds</li> <li>. Inadequate number of Vet and Extension services</li> </ul>	<p><b>RESULTS</b></p> <p>Mobile and web application for linking both poultry farmers and Agro-vet services</p>	<p><b>REFERENCES</b></p> <ul style="list-style-type: none"> <li>. URT, 2015 Tanzania Livestock Modernization Initiative: Ministry of Livestock and Fisheries</li> <li>. (TLMP, 2017), Tanzania Livestock Master Plan</li> </ul>