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A Model Mobile Phone Based Livestock Health Advisory System

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Abstract:
Livestock farmers in Kenya face a number of challenges which includes; climate change, use of outdated technology, pest and diseases, lack of information on the right kind of nutrition and correct vaccines to use and the appropriate time of application of the same. Some of these challenges can be managed through carrying out effective extension advisory services. The use of agricultural extension officers to contact farmers, though very effective is expensive and unsustainable as the sole means of reaching farmers. The aim of this paper was therefore to develop a model mobile phone based livestock health advisory system for disseminating information to farmers. The Objectives of this paper were to; analyze the challenges that arise in dissemination of livestock health information to farmers, to establish the need for a mobile phone based livestock health advisory system and to design and develop a mobile phone based livestock health advisory system for farmers. The population size for the farmers was 1000 and the sample size was 50, the population size for the agricultural officers was 4 and all of them were interviewed. The population size for the veterinary officers was 10 and 5 of them were interviewed. It was concluded that the model system could effectively give advice to farmers on livestock health, which includes animal nutrition, services available, diseases and pests. It is recommended that the system is adopted for improved livestock health.

Key words: Livestock, health, Mobile Phone, Information, system, Technology.

1. INTRODUCTION

The growth of mHealth in Kenya provides likelihood for farmers to access information through their mobile phones. According to Dairy board(2002) mHealth is a service or application that involves voice or data communication for health purposes between a central point and remote locations, It includes the use of mobile phones and other devices as platforms for health related purposes as long as there is some use of a network. Although its approval is escalating quickly, there are concerns that must be considered. This paper establishes the benefits associated with adoption of mHealth and presents a model of the system. The aim of the paper is to develop a mobile phone based livestock health advisory prototype for disseminating information to farmers. According to Kihara T and D. G. (2015), the approval of adoption of mHealth will have the opportunity to offer many benefits which includes; remote diagnosis, monitoring and care of livestock animals, emergency response, tracking of the spread of infectious disease, training of livestock professionals and dissemination of health information to farmers. Such applications have important potential to contribute to major sustainable development goals, including the provision of real time information on livestock health. Adoption of this technology is necessary for veterinary doctors, farmers, livestock officers, and the industry and research institutions. According to a report published by livestock farming (2002), livestock contributes about 10% of Kenya's GDP. The major types of commercial livestock farming include dairy farming and beef farming. 90% of beef cattle in Kenya are owned by subsistence farmers and pastoralists. In the report on state of good dairy farming practices in the world, it was stated that, for dairy animals to produce quality milk and milk products which satisfy the expectations of the food industry and consumers, good dairy farming practices need to be observed. According to Goswami, D. (2013). The good practices consists of areas like animal health, use of medicine, animal housing condition, animal feeding and water intake and milking hygiene .According to Kihara T and D. G. (2015), with the improved accessibility of mobile phones in the country due to availability of low cost brands, increased network coverage and reduced connectivity fees, many people especially in the rural areas are currently able to communicate and access any type of information using mobile telephones. According to Communications Commission of Kenya (2012) quarterly report of 1st April -30th June 2012 indicates that there was an increase of 1.6 per cent mobile subscriptions to 29.7 million from 29.21 million reported in the quarter ending June 2012. The prevalence of the mobile phone technology platform can be harnessed for hosting the livestock health advisory system. According to Deepak, (2012) Livestock farming is one of the largest and most profitable sub-sectors of agriculture in Kenya. It has a lot of significance in helping the country achieve the Millennium Development Goals which includes eradicating poverty and hunger and also ensuring that there is environmental sustainability. According to Kihara T and D. G. (2015), livestock farmers in Kenya face a number of challenges which include; climate change, use of outdated technology, pest and diseases, lack of information on the correct vaccines to use and the appropriate time of application of the same. These challenges can be managed through carrying out effective extension and advisory services. The use of extension agricultural officers to contact farmers on a one-to-one basis, though very effective, is expensive and unsustainable as the sole means of reaching farmers. Through the use of agricultural technology and increased use of information communication and technology in agricultural extension, can assist in the collection, processing and transmission of data, resulting in faster extension of quality information to farmers. It is therefore necessary for the farmers to have an application that will allow them to access information related to livestock health in a more efficient

manner. However, only efficient and innovative application of mobile phones will make the difference.

1.2.0 Challenges faced by farmers

A study conducted by Kihara T and D. G. (2015), indicated that farmers in Karura village face several challenges in regard to their livestock which includes; lack of information about diseases, pests, the correct type of nutrients for their livestock and also how to access the few veterinary doctors and agricultural extension officers.

1.2.1 Diseases

According to a report published by International Livestock Research Institute, diseases transmitted from livestock and livestock products kill more people each year. One new human disease emerges every 2 months and 20 percent of these are transmitted from livestock (ILRI, 2012). The Government through various state corporations and departments carry out activities aimed at reducing livestock health problems in order to increase food security in Kenya. Small scale farmers in Karura village depend largely for their livelihood on dairy and beef cattle. However, the livestock is threatened by diseases such as mastitis, anaplasmosis, east coast fever, dystocia, bloat and foot rot. This highly affects the production levels of milk and meat from the animals. Most of the infections are caused by poor hygiene especially when milking, especially use of dirty towels and buckets resulting to reduced livestock productivity.

1.2.2 Pests

According to Gitau et al, (2008), livestock farming is one of the largest and most profitable sub-sectors of agriculture in Kenya. It has a lot of significance in helping the country achieve the Millennium Development Goals which includes eradicating poverty and hunger and also ensuring that there is environmental sustainability. However challenges like pests that affect livestock is a major concern. Pests are common in Karura village which affect the productivity of the beef and dairy cattle. They include; mites, ticks, lice and flies. Dirty cow sheds attracts the pests and therefore the farmers are advised to observe high levels of cleanliness. Worms are also common in this area, most farmers are not aware of the recommended times of deworming the animals especially when to deworm the young calves.

1.2.3 Nutrition

The farmers interviewed agreed that they do not fully understand the proper kind of nutrition to give to their animals for optimum production of both meat and milk. They mostly depend on the local feeds which include maize stalks, nappier grass and sweet potato leaves. These local feeds are locally available but do not necessarily produce the right kind of nutrients needed by the animals. Therefore it is important that the farmers supplement the local feeds with commercial feeds like silage and bran.

1.2.4 Livestock Health Services

According to Swanson (2008) agricultural extension officers are very few as compared to large number of farmers who need their services. The available extension officers fail to adequately eliminate uncertainties among farmers since it is difficult to provide a precise picture of future expectations. They also fail to cope with ever changing farming challenges which require latest cutting edge techniques of solving them. Therefore, many farmers lack knowledge, skills, capacity and means of tackling animal health related problems (Swanson, 2008). They do not have effective access to the information they desperately need. The alternative sources of information such as magazines or television are not accessible to majority of the farmers who are in rural areas. Most of these sources lack consistency are based on old methods, not clear or understandable and cannot tackle real-time problems affecting farmers (Flood, 2010). According to Rege (2006), Agricultural sector is challenged by lack of financial, human and technical capacity to generate, manage and disseminate accurate agricultural information. The extension service has been so weakened by decades of declining support that it often fails to deliver what farmers need (Flood, 2010). The farmers require access to the veterinary officers. The officers are able to offer services such as advice on the best fodder to feed the animals with, best practices to ensure that the animals produce enough meat and milk. The veterinary officers and also the agricultural extension officers are not readily available. It is therefore important for the farmers to have contacts of the veterinary officers and the agricultural extension officers. The effort of the livestock farmer to ensure that there is good quality of milk and beef production, therefore, requires support through implementation of a mobile phone based advisory system that will advice the farmers. Enhancement and progress will be achieved through proper understanding of the challenges experienced by the farmers and also focus on the opportunities that the farmers will gain once the system is in place.

1.2.5 The Problem statement

According to Rege (2006), agricultural sector is challenged by lack of financial, human and technical capacity to generate, manage and disseminate accurate agricultural information. Livestock farmers in Karura village depend on their dairy and beef cattle for their livelihood. They obtain milk and also meat from their livestock which they use for their own consumption and also sell to their neighbors and earn a source of income. However, these farmers are faced by a number of challenges. These challenges include; lack of access to information on livestock health like the common diseases and pests affecting the livestock and how to treat them, the right kind of nutrition to feed their livestock with for optimum meat and milk production and also the contacts of the available few service providers who are the veterinary officers and agricultural extension officers. According to Flood (2010) the extension service has been so weakened by decades of declining support that it often fails to deliver what farmers need. Use of a mobile phone based advisory system will enable the farmers to effectively communicate with the service providers who are the veterinary officers and agricultural extension officers and will not be constrained by physical location. They will also obtain information on the diseases, pests and also the right kind of nutrition for their livestock. Based on the above concern, there was need to investigate how farmers in Kenyan villages received information on livestock health so as to develop an appropriate advisory system to enable them access information related to livestock health with specific reference to Karura village.

1.2.6 The Aim of the paper

The aim of the paper was to develop a mobile phone based livestock health advisory prototype for disseminating information to farmers.

1.2.7 The Objectives of this paper are to:

a) To analyze the challenges that arises in dissemination of livestock health information to farmers.

b) To establish the need for a mobile phone based livestock health advisory system.
c) To design and develop a mobile phone based livestock health advisory system for farmers.

II. LITERATURE REVIEW

2.2.1 Theoretical Perspectives

According to Wang (2013) the adoption and use of technology has been studied extensively in several distinct fields such as management information systems, communication, and marketing. There are three theories that help expand on the use of technology which are Technology Acceptance and Adoption theory, User and gratification theory and Innovation theory. This study focuses on the theory of Technology Acceptance and Adoption.

2.2.2 Theory of Technology Acceptance and Adoption

According to Wang (2013), this theory identifies the factors influencing individual acceptance of technology from various dimensions. According to Venkatesh et al (2003), the first dimension is performance expectancy, defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance". The second dimension is effort expectancy, which is "the degree of ease associated with the use of the system". The third dimension is social influence, "the degree to which an individual perceived that he or she should use the new system". The fourth dimension is facilitating conditions which are defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system". The fifth dimension is the cognitive beliefs towards technology. The sixth dimension is attitude toward using technology, defined as "an individual's overall affective reaction to using a system". All these factors are identified to influence the individual behavioral intention to use or reject technology. This study has used the theory of technology acceptance and adoption. This guaranteed that the mobile phone livestock health advisory system created was easy to use, and also that the farmers felt that it would make them generate optimal production of meat and milk.

2.3.1 Livestock Farming

Kenya's agriculture is predominantly small-scale farming mainly in the high-potential areas. Production is carried out on farms averaging 0.2–3 ha, mostly on a commercial basis. This small-scale production accounts for 75 per cent of the total agricultural output and 70 per cent of marketed agricultural produce (GOK, 2010). Despite their significant contribution, smallholder farmers in Kenya are facing a number of challenges (KDLC, 2010). According to Kibet, (2011) the major challenges facing farmers include; Climate change - The changing and unpredictable raining seasons has greatly affected their ability to plan their farming activities. Extension services- There is limited access to extension services in most parts of the country with the National extension staff: farmer ratio standing at 1:1,500. This situation has hindered most farmers from keeping pace with changing technological advances. Uses of outdated technology - Farmers have continued to use outdated and ineffective technologies like radios and posters. This brings the need of extension services that can link research and the farmers. Pest and Diseases- Pests and diseases have continued to cause a lot of losses to farmers. This is caused by lack of information by the farmers on how to control these diseases. Use of inputs- Most farmers lack information on the right type of farm inputs to use and the appropriate time of application of the same. Soil nutrient deterioration- These farmers need information on the right farming practices aimed at restoring the soil nutrient. This can be provided by extension and advisory services.
These challenges can be solved if effective extension and advisory services are availed to farmers especially small scale farmers. It is therefore necessary to develop an animal health advisory system for a farmer that is easily accessible in order to manage these challenges. The provision of information and farmers' use of it are influenced by a number of key factors, which include the following Glendenning et al, (2010): Lack of agricultural extension officers. The capacity of extension personnel to engage and obtain feedback from farmers, and also to seek global and local information for sharing with farmers, influences how farmers use the information provided.
Livestock Information: The reliability, relevance, usability, and timeliness of the information is critical. Information Dissemination Process: The process through which the information is shared can determine the effectiveness of the information and its use. Mobile phone technology: Increasing use of technology can improve the nature and speed of information sharing. Effective and sustainable use of technology depends on the appropriateness of the technology for the user and the content shared via this technology.

2.3.2 Agricultural Extension Services

According to Evenson (1998), agricultural extension refers to the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies to improve their livelihoods. Agricultural advisory (extension) services have long been recognized as an important factor in promoting agricultural development Anderson, (2007). Agriculture's poor performance in Kenya in recent years and the country's declining budgetary resources have increasingly called into question the effectiveness of extension services. In Kenya extension staffs are often unable to cover the required number of households because of lack of transport and also impassable roads in the rainy season. However, the nature of linkage of the extension system with research stations may have affected the availability of relevant farming technology that could be passed to farmers. The identified weaknesses here, concern cost ineffectiveness of national extension systems and non-availability of agricultural technology of the magnitude that merits a uniform machinery of transmission to farmers Evenson, (1998). According to Madukwe, (2006), the failure of the various extension delivery approaches in developing countries to effectively engineer significant and sustainable agricultural growth has become a major concern to all stakeholders. The age-old practice of extension-farmer contact on a one-to-one basis, though very effective, is expensive and unsustainable as the sole means of reaching farmers with agricultural technology. Increased use of ICT in agricultural extension can energize the collection, processing and transmission of data, resulting in faster extension of quality information to more farmers in a bottom-up and interactive channel of communication.

2.3.3 ICT Agricultural Extension Services.

Mobile -based agricultural extension brings incredible opportunities and has the potential of enabling the empowerment of farming communities. There are several mobile based extension initiatives which cater for market information and extension services including financial, utilization of best agriculture practices, research, weather, climate, and distribution and supply chain management. Some

of the initiatives include: iCow, KenCall, Farmers Helpline, Kilimo Salama, and Mali Shambani all in Kenya, Esoko, Cocoalink and Radio Ada in Ghana, and Makwacha in Malawi. KenCall Farmers Helpline, a call center in Kenya, is a real-time call center service staffed by agricultural experts that provide agricultural information, advice and support to smallholder farmers over the phone, using voice and voice call-back to farmers Payne et. al, (2010a). According to Payne et al, (2010), Mali Shambani, in Kenya, is a weekly hour-long radio program featuring agricultural news and responding to a wide range of topics, including market prices and trends, farming techniques, weather and seasonal issues, financing opportunities, inputs, land use, and quality standards. Each program also offers an interactive call-in component where farmers are given the opportunity to pose agricultural questions to a panel of experts either via phone or SMS.

2.4 Theoretical Framework

According to Liehr & Smith (2001), a theoretical framework is the structure of concepts which exists in the literature which is a map for the study. According to Ingelse (1997), a theoretical framework provides the structure for examining a problem and serves as a guide to examine relationships between variables. Love (2001) also affirms that theoretical frameworks or perspectives are what consciously or unconsciously guide each researcher in the development of their research and thesis.

2.4.1 Electronic Extension System Model.

Agricultural advisory extension services have long been recognized as an important factor in promoting agricultural development Anderson, (2007). According to Mukhebi et al (2007) the spread of the internet and mobile phones in rural areas in Kenya can generally improve the business situation of small-scale farmers and lead to a transformation of the sector, in particular with regard to significant higher food security and lower poverty. Livestock farming plays a very important role in poverty alleviation and economic growth in Kenya .Use of technology as an enabler will therefore facilitate dissemination of timely information to farmers. It will enable better linkages between agricultural extension officers and livestock farmers. The figure 1 below describes an electronic extension system model that describes the traditional method of disseminating information.

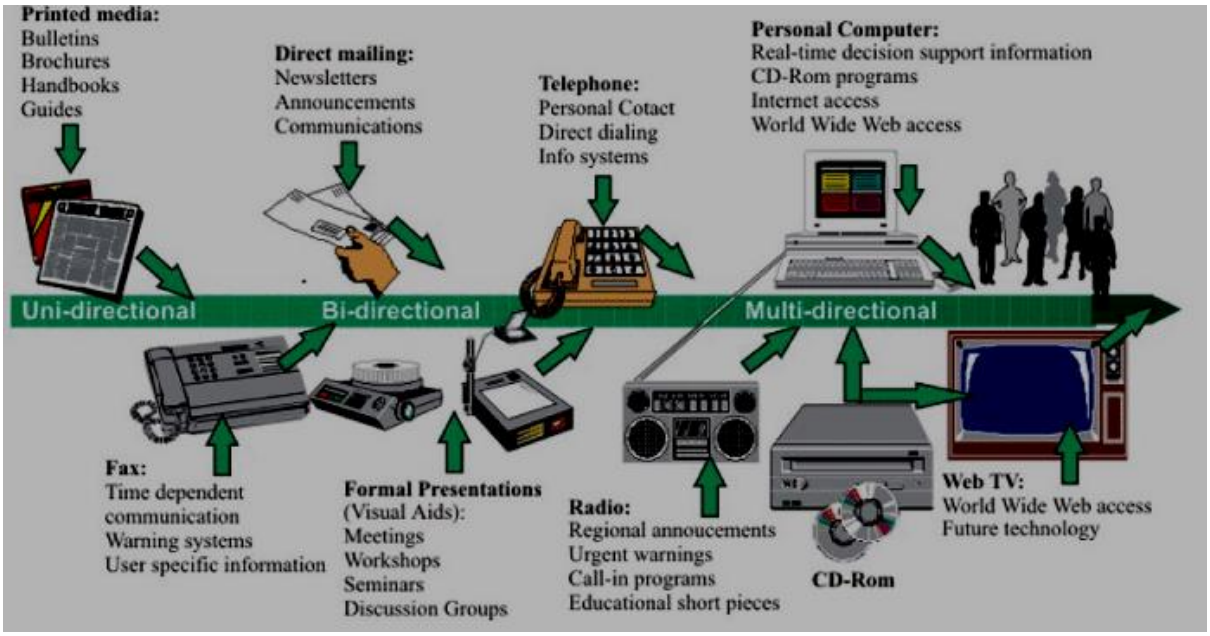

Figure.1. Continuum of communication and information exchange technologies and nodes commonly used in extension and education programs (Bajwa et al, 2003).

According to Bajwa & Kogan (2003) electronic communication provides an effective multidirectional exchange of information. A continuum of communication and information exchange technologies and modes commonly used in extension and education programs is given in Fig. 1 above. Electronic extension systems provide 24 hour access to an inquirer of specific information to be used in planning and decision support. It is rapidly changing the way individuals exchange information and make decisions. It is possible for extension services and applied researchers to deliver and receive information to and from much larger audiences via fax (both Internet- and telephone-based document delivery systems), multimedia programs, email, and the web. The emphasis is, however, beginning to shift from traditional one-way flow of information from research, then to extension, and finally to end-users of information. However, the electronic extension system was traditional and not portable. The modern electronic extension systems are portable and are accessible on twenty four hour basis from any location. According to Trede (1993), there are a few barriers such as lack of time on the part of extension personnel, funds, training, and experience to efficiently using this technology for information delivery and analysis. Nevertheless, email and other Internet tools are widely used and preferred by extension agents for exchanging time-sensitive information and networking with researchers and subject specialists. However, use of telephone landlines and fax machines is limited; this is because they are not portable to every destination the farmer goes to. Also radios and televisions do not provide all the relevant information that a farmer needs. It is therefore important to have a system that has ease of use and is portable. The farmers were able to access livestock health related information at their convenience. The knowledge management system therefore offered a better opportunity for farmers to access timely information on livestock health.

2.5.0 Knowledge Management Systems.

According to Qwaider (2011), knowledge management systems are a special type of information systems that supports activities related to the acquisition, generation, codification,

storage, transfer, retrieval, and use of knowledge. The goal of a knowledge management system is to disseminate the right information to the right people at the right time. This increases efficiency leading to competitive advantage and to support knowledge processes (Abdullah, 2008). Effective knowledge management is achieved when the right knowledge and information is delivered to the right person at the right time in a user friendly and accessible manner that helps the recipients to perform their jobs efficiently (Islam, 2010). The outcome of effective knowledge management includes improved productivity and performance of the agricultural sector.

2.5.1 Knowledge management processes

Knowledge management can be described as the state of knowing something with a significant degree of awareness obtained through experience, association or contact. Knowledge consists of the attitudes, cumulative experiences, and developed skills that enable a person to consistently, systematically and effectively perform a function (William & Michael, 2005). It is an integration of explicit and tacit knowledge. Explicit knowledge refers to all aspects of formal, systematic, recorded, communicated and shared knowledge that is made accessible through a variety of information delivery systems. Tacit knowledge on the other hand is highly personal, created by doing, trial, error, reflection and revision. Knowledge management encompasses processes and practices concerned with the creation, acquisition, sharing and use of knowledge, skills and expertise and follow a circular flow and a nonstop process that continuously updates it. (Bwalya, 2011). Knowledge management deals with the process of capturing, sharing and using knowledge and techniques .As indicated in figure 2 below, for the circular flow of knowledge management to take place both knowledge, that is sufficiently better than the existing knowledge, and means for transmitting it must be both available. In addition, the consumers of knowledge must be willing and able to use the better knowledge that is now available. Knowledge is considered as the fourth production factor after labor, land and capital (AFAAS, 2011) and is particularly critical in the agricultural sector. Making relevant knowledge accessible to the livestock farmers helped improve production and productivity which leads to more returns.

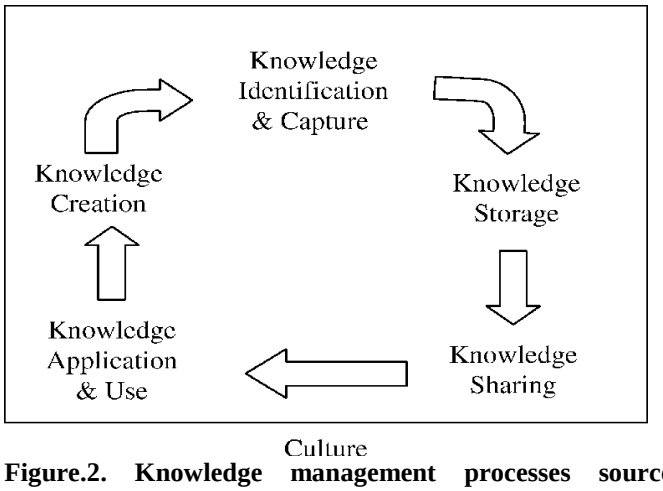

Figure.2. Knowledge management processes source: Adopted from Cong et al. (2007)

2.6 Conceptual Design of the Developed System

2.6.1 Conceptual Framework

According to McGaghie et al (2001), a conceptual framework is an argument that the concepts chosen for investigation or interpretation, and any anticipated relationships among them, will be appropriate and useful, given the research problem under investigation. It contributes to a research report in at least two ways; first, it identifies research variables; secondly, it clarifies relationships among the variables. According to Kihara T and D. G. (2015), **livestock** farmers will benefit by having a system that will disseminate information to them effectively. The farmers will access information on animal nutrition, services that are provided by the veterinary officers, diseases and pests affecting the livestock.

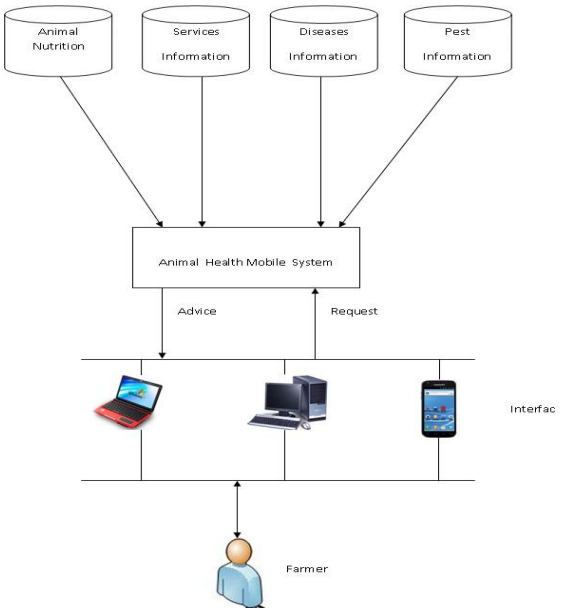

Figure.3. Conceptual Framework showing the developed system

The health advisory system was developed using android programming language with support for android 2.2 version. The system consisted of three major components, a user interface, a logic unit which was the knowledge base and a database as shown in figure 3 above.. The user interface acted as the front-end client. The livestock health information was stored in an SQLite database. The mobile prototype application was tested on the Ericsson Xperia Arc LT15i. The code was compiled and tested on the android phone emulator.

III. SYSTEM DEVELOPMENT METHODOLOGY

3.0 Sample

A sample of respondents was drawn from Karura village. The target population were farmers from Karura village, agricultural extension officers and veterinary officers. Cluster random sampling method was used. The technique used ensured that it was possible to select the farmers randomly where no single list of the population members existed; the selected groups were used in the study.

3. 1 Requirement Gathering

In a study conducted by Kihara T and D. G. (2015), the researcher used the objectives of the study to lay a foundation for the presentation of the qualitative data analysis under the three cadres namely; farmers, veterinary officers and agricultural extension officers.

The objectives of the study were to;

a) To analyze the challenges that arise in dissemination of livestock health information to farmers.

b) To establish the need for a mobile phone based livestock health advisory system.

c) To design and develop a mobile phone based livestock health advisory system for farmers.

The researcher conducted interviews and also used the existing literature to complement the data collected. The aim of using interview method was to get a lot of information from the people being interviewed. The researcher had an interview schedule that helped in guiding and having objectivity during the interview forums. Prior to the start of the session the researcher reassured the respondent's confidentiality of all the information given. The researcher tape recorded all the interviews and also took notes to make sure that no details were omitted. The interviews were then transcribed and recorded.

3. 2 Requirement Analysis

According to Ikhu (2007), requirements phase provides appropriate mechanisms for understanding and analyzing users' needs, specifying the solution unambiguously, ensuring a correct, complete, and concise specification and managing the requirements as they are transformed into desired products. According to Kibet (2011), farmers in Kenya face major challenges which includes; limited access to extension services in most parts of the country , attack of livestock by pests and diseases have caused a lot of losses to farmers and farmers lacked information on the right type of farm inputs to use and the appropriate time of application of the same. A study carried out by Tabitha Kihara, D. G. (2015), noted that the farmers faced several challenges which include lack of appropriate information for their livestock.

Table 1: Group Sampling

The cadre that was interviewed is as follows in table 1 below; farmers, agricultural extension officers and veterinary officers.

Table.1. Group Sampling

Groups	Population Size	Sample Size	Percentage %
Farmers	1000	50	5
Agricultural Extension Officers	4	4	100
Veterinary Officers	10	5	50
Total	1014	59	

IV. 1 Research Analysis and Design

According to Green & Tull (2009), a research design is the specification of methods and procedures for acquiring the information needed, it is the overall operational pattern or framework of the project that stipulates what information is to be collected, from which sources and by what procedures. A qualitative research design was used. The researcher interviewed the farmers, agricultural extension officers and veterinary officers. It enabled the researcher to obtain their opinions and suggestions about dissemination of livestock health. According to Creswell (2009), a qualitative research design allows for the in-depth exploration of a human or social problem and the meanings that have been constructed by those involved. Experimentation approach was used during system development.

4.2 System Development Methodology

According to Hameed (2014) a system development methodology is a comprehensive guideline to follow for completing activities in the systems development life cycle, including specific models, tools, and techniques. The study adopted the Extreme Programming methodology.

4.2.1 Extreme Programming Methodology

According to Abrahamsson et al (2003), Extreme Programming is a collection of well known software engineering practices that addresses risk and value of software at all levels of the development process.

V. SYSTEM IMPLEMENTATION

5.1 Database Design

An SQLite database was created to provide data needed by the system. According to Kiran (2014) SQLite is a software that implements an SQL engine and it requires minimum memory and occupies a small amount of disk storage and memory making it good to use in mobile phones. The database was used to store all the information of the four modules of the system which were diseases, pests, nutrition and services. Data was normalized to make sure that the tables were structured correctly .The database was made up of four tables as follows;

Table 2: Diseases

Table 2 below shows the type of diseases affecting the animals, the symptoms that the animals portray and the treatment given.

Table.2. Diseases

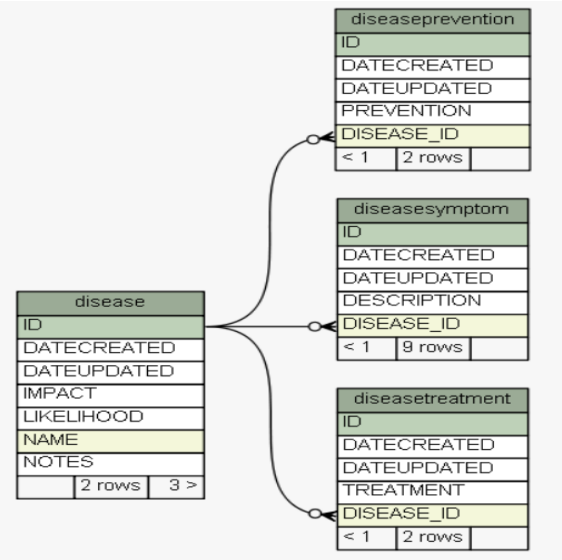

Table.3. Pests

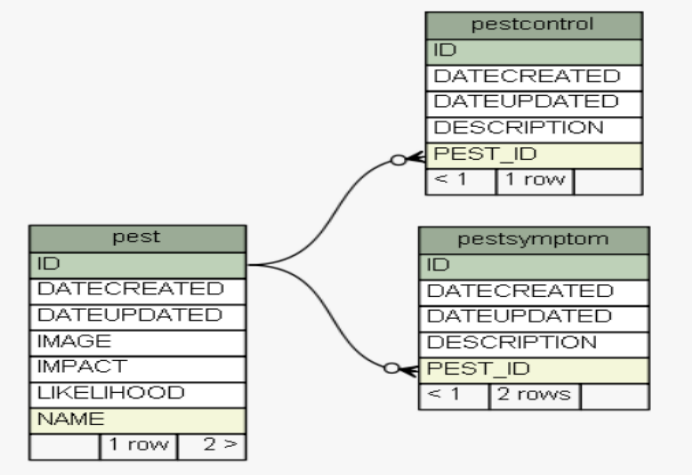

Table 3 above shows the pests that are affecting livestock in Karura village, it also shows the symptoms that the livestock portray and how to control them.

Table.4. Services

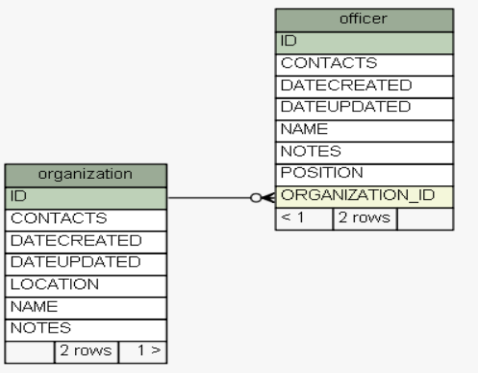

Table 4 above shows the contacts of the veterinary officers. Farmers in Karura village are able to contact them at ease.

Table .5. Nutrition

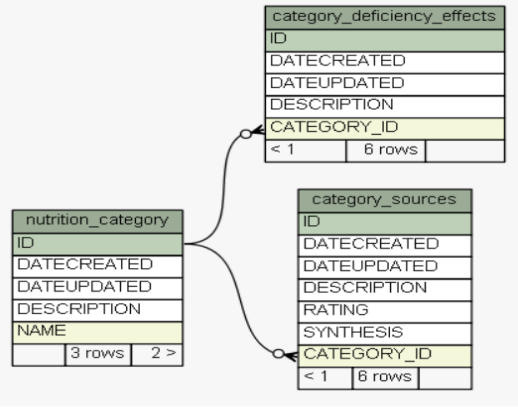

Table 5 above shows nutrition available for the livestock. It also shows the sources of the nutrition.

5.4 Knowledge Base

The farmer queries the knowledge base for updated knowledge on livestock health. The knowledge base has all the information of the four modules of the system which are diseases, pests, nutrition and services.

5.5 Mobile Phone Interface

The farmer interacts with the mobile device through the mobile phone's screen. Figure 12 below shows the lead farmer Mr Njuguna milking his cattle.

Figure.4. Mr Njuguna the lead farmer milking his cattle

5.3 mHealth advisory system implementation

The mobile health advisory system has been implemented using Java programming language. The scripts are deployed on an android phone which is Ericsson Xperia Arc LT15i. The system consists of three major components, a user interface, a logic unit and a database. The user interface acts as the front-end client. The health information is stored in a SQLite database. The database has been used to store all the information about the system on nutrition which was obtained from the farmers, diseases and pest information was obtained from the veterinary officers and services information was obtained from the veterinary officers.

5.4 mHealth advisory system screenshots

Farmers in Karura village expressed a lot of interest in having a mobile phone based application that they could use to access information on animal health. The screen shots below which are figure 13 shows one of the key farmers, Mr. Njuguna milking his cattle. The snapshot appears immediately the application is run. Out of the 50 farmers interviewed, 200 of them have mobile phones and are able to access the health information through their mobile phones.

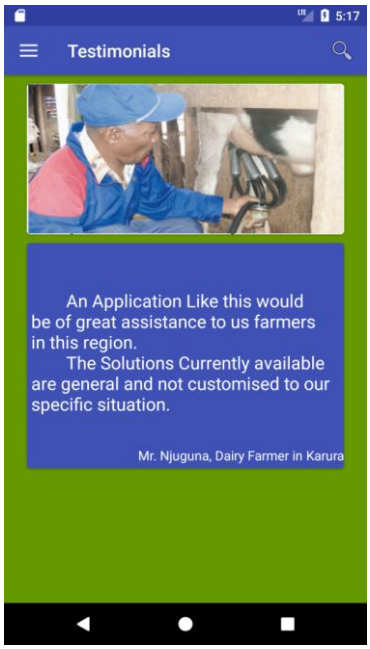

Figure.5. Mr Njuguna milking his cow

5.4.1 System screen description.

The system description is given in Figure 14 below.

Figure .6. Home Screen

When the application is first started, the user is directed to the main screen shown above. It contains the four main items contained within the databases resident in the phone, namely:

1. Nutrition
2. Disease
3. Pest
4. Services

Nutrition

Figure.7. Nutrition

The figure 15 above indicates various minerals that livestock need in their diet. These minerals include; Vitamin A, phosphorous, calcium, sodium and magnesium. The farmer will access information on which minerals are important for optimal production of meat and milk for his livestock.

Disease information

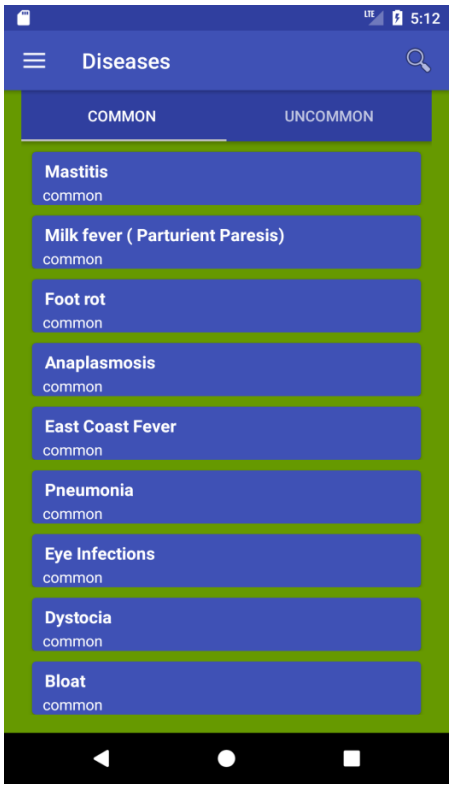

Figure.8. Diseases

The disease module demonstrates the common diseases that affect livestock in Karura village as shown in figure 16 above. They are Rift valley fever, Edema, Pneumonia, Eye infections, Foot rot and Pneumonia. When the farmer clicks on the disease, a drop down menu that shows the symptoms of that disease appears, also details of how to prevent the disease and also how to treat it are indicated and also how to prevent and treat the diseases.

Pest information

The pest module as shown in figure 17 below indicates the most common pests in Karura village that affect livestock health. These pests are; houseflies, ticks, mites, horn flies, face flies and stable flies. When the farmer clicks on the pest, a drop down appears that shows the symptoms that livestock will demonstrate when attacked by a particular pest and also how to control the pest.

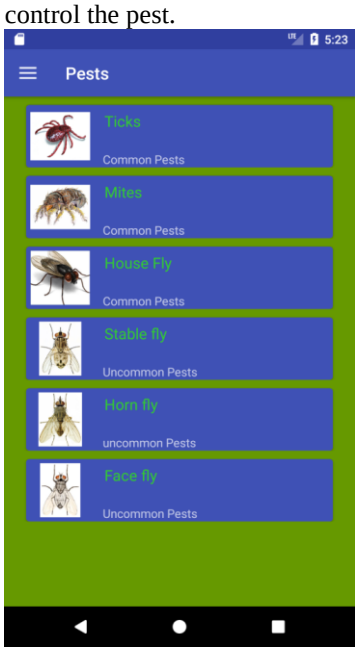

Figure.9. Pests

Services

In the Services module as shown by figure 18 below indicates that the farmers are provided with a list of veterinary officers who can be contacted at any time. Phone numbers are also included in the database and are displayed together with the names of the officers and also their location as shown below in figure 18.

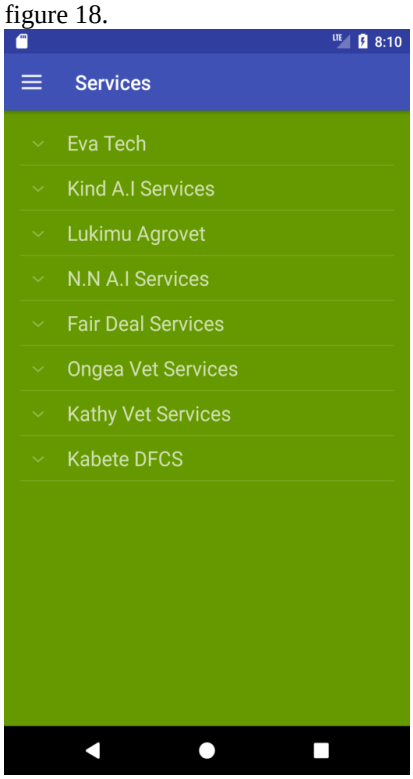

Figure.10. Services

The databases have been made small and simple, first so that it is easily understandable by the users during access time and to optimize on phone memory. A mobile phone based livestock health advisory system was developed. The system developed allows the farmer to request information regarding the diseases affecting livestock animals in Karura village, animal nutrition, pests and also the services available to livestock farmers in Karura village. The application is simple since the only input the users who are the farmers put is regarding animal health.

5.7 System Evaluation details

The system was evaluated for usability with 4 veterinary officers to determine if it fulfilled its desired requirements. According to (Clare Martin, 2013), heuristic evaluation is a way of measuring the usability of an interface, whereby a small group of usability experts examine different aspects of the interface in relation to standard design principles, or heuristics. The number of experts involved in such an evaluation can be as small as three since it has been proved that three to five experts are sufficient to uncover most usability problems.

5.8 Testing

A heuristic evaluation was conducted with four veterinary officers based on the following usability factors;

The system is instructive: The system should bring up to date information about what the user wants to know and therefore making it very informative.

The system is proficient: The system can interact easily with both literate and illiterate users. This is because it should be very efficient.

VI. CONCLUSION AND RECOMMENDATION

6.1 Health Advisory system

To achieve the aim of this project, a mobile phone based advisory system was developed. The aim of the project was to determine and analyze challenges that arise in dissemination of animal health information to farmers with a view to develop a mobile phone based system that would disseminate information to farmers in Karura village through the use of their mobile phone. The farmers agreed that the information that they were able to receive through their phone was very informative and timely.

6.2 Conclusion

6.3 Health Advisory system

To achieve the aim of this project, a mobile phone based advisory system was developed. The aim of the project was to determine and analyze challenges that arise in dissemination of animal health information to farmers with a view to develop a mobile phone based system that would disseminate information to farmers in Karura village through the use of their mobile phone. The farmers agreed that the information that they were able to receive through their phone was very informative and timely.

6.4 Future work

In future it is highly recommended that a system that uses Unstructured Supplementary Service Data (USSD) provided by the mobile service providers be developed. This would assist in making the system more interactive with the farmers and it would be used with any kind of phone irrespective of the operating system that it was using. Also a system that is multi lingual and uses local dialects is highly recommended, this will enable even illiterate farmers to access information through their local language. Also a system that uses video formats where live data can be shared between the veterinary officers and the farmers through video demonstrations or presentations is recommended.

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