Development of a Communicative Knowledge Management Decision Support System for Rabbitry Farming

Adedayo Olayinka Theodorio¹, Francisca Jumoke Theodorio², Ganiyat Ranti Bello³ and Isaac Kehinde Amao⁴

¹,³,⁴Department of Computer Science, Oyo State College of Agriculture and Technology, Igboora, Oyo State, Nigeria.
²Physics Unit, Oyo State School of Science, Idere, Ibarapa Central Local Government, Oyo State, Nigeria.

Email: ¹theodoriodayor@gmail.com, aothedorio@oyscatech.edu.ng; ²theodoriafrancisca@gmail.com, ³beloganiyatranti@gmail.com, ⁴titamaokenny@gmail.com

ABSTRACT
This study examined the current challenges being faced by rabbit breeders using the rabbitry section of Oyo State College of Agriculture and Technology and a Local Breeder as case studies. The necessity for the study was borne out of the current need for an electronic platform where experts and users can identify problems, solutions and recommendations. The instrument used for fact findings include observing day to day practice of the said section and an interview session with a staff in the section. These were needed in order to acquire information on the current challenges being experienced. A ‘D’ algorithm, which was later translated into model, was developed by the author to show the process of problem identification process, as well as the solution pathway for the system. The system was designed with tools such as HTML, JavaScript and MySQL Database. It was able to facilitate knowledge through communication between users and experts. The communication network adopted was client-server mode of communication. The result of the system developed showed that knowledge was shared, validated and stored for reusable purposes.

Keywords: Network, Model, Knowledge Management, Decision Support System, Rabbitry Farming.

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I. INTRODUCTION

For over the years, rabbit rearing has moved from backyard farming to a commercial-driven business tailored towards white meat production. Rabbits have been of great advantage to farmers as well as scientists [14]. These animals can serve as a socio-economic tool of development that could lead to high income and quality of livings [11] in [2]. Rabbit rearing has the capabilities to increase in every two months. A female rabbit (Doe) can give birth to four to nine babies, as the case may be. Its commercial values include: laboratory use, white meat full of protein and low in cholesterol. Rabbitry is a livestock farming that requires experience and technical-know how. Unfortunately, most farmers do not have an indept and modernized experience on this. For instance, a farmer must know how to handle a rabbit at every stage of their development, how to adopt a rabbit, relative diseases and gestation periods.

A successful rabbit business requires advocacies from experts and experienced scientists. This farming business, on its own, has some shortcomings that need urgent attentions. Some of these shortcomings include: lack of technical-know by farmers, lack of modern technology, diseases outbreaks and lack of quality and affordable feeds [12] and housing styles [19]. Having a basic and diverse knowledge of how a rabbit is bred still remain a major problem in Nigeria. Most times, farmers are condemned to resolve to faith if he makes no headway in the process of solving a health problem of his or her rabbits. This problem however remains a necessity for this study. This study used approaches of knowledge management system to develop a decision-support system for information on how to technically raise a rabbit and how to raise the bar for commercial rabbitry.

1.1 Knowledge Management System and Decision-Support System for Rabbitry Farming

[16] defined knowledge management as a distinct but interdependent process of knowledge creation, knowledge storage, retrieval and knowledge application. Knowledge Management (KM) is an approach with series of procedures, strategies and practices that allow an organization to identify, create, represent, distribute, and facilitate the adoption of problem-solving solutions that will culminate cognitive experience. Knowledge Management is a tool that unlocks knowledge. It may also be referred to as a procedural method of integrating the technical, organizational and behavioral issues associated with enterprise knowledge. KM can be described as a strategic process that captures the ways in which an organization integrates its information assets with the processes governing the manipulation of its intellectual assets. [20] opined that knowledge is developed from a context, people, culture and technology. The position of [20] was that in order to develop knowledge, it must come from a practice which involves a day to day interaction with people who are solving a problem in a context (which may be in engineering, medical, technology, education, science, agriculture fields and the likes). This assertion corroborates [18] believe that knowledge are of three forms: before knowledge is created, it must be acquired. Secondly, it must come from a context and lastly, it must be stored up for reusable purposes through a medium.

Today, the easiest way of solving a problem is through knowledge sharing and through consultations [5]. The world is moving away from the natural resources dependences to an era of knowledge-based researches and development. Besides, knowledge has the capability to link and transform the global world technologically. Every knowledge acquired is acquired through a process, which is basically out to solve a problem. All problems on earth emanated from a source, so does every solution. Most researchers often move closer to problems in order to identify the problem, analyze the problem, look at previous or applied solution and then, proffer a new workable solution. [13] opined that in order to create knowledge, there must be a problem, a solution must be sorted for and hence, the process of sorting for solution creates knowledge.

From the opinions of [8, 9], it could be deduced that a knowledge could only be attained if and only if an experiential approach is used. The beauty of technologically-built knowledge is that, it can be applied from one domain to another. The intention behind this study is to proffer solution-driven process through the use of stages of knowledge management system to solve problems observed in the rabbitry section of the aforementioned college. A decision-support system helps organizations, businesses and personnel make a structured decision about a problem they are currently facing [22]. Most Decision-Support System (DSS) are structured, interactive and software-based system that combines raw data and personal experience to form an applicable solution to problem identified. In DSS, every solution is stored up in a dataware house. Models, figures as well as charts are also used to show the solution path to a
problem. A DSS has four stages of application: Design, Intelligence, Choice and Implementation [22]. In rabbit production, knowledge or information on house design, intelligent reports on disease management and choice of rabbit could be gathered and stored up in a dataware house for reusable purposes.

II. REVIEW OF SIMILAR INNOVATIVE LITERATURES

[21] created a model for animal diseases diagnosis expert system based on Support Vector Machine from the perspective of animal disease diagnosis. SVM was established on the principles of structural risk minimization; this has a strong ability of generalization. They attempt to make use of its strong generalization ability to resolve the difficulty of the rapid diagnosis process due to the complexity and diversity of animal diseases. [3] developed a Collaborative Animal Diagnostic Systems (CADDS) using the concept of Content Based Reasoning approaches. The CADDS links similar problems to similar solutions. Hence, problems are populated for a collaborative discussions and solutions from expert.

The CADDS developed was able to retrieve similar experience, solutions and problems from users and expert. Also, it also uses the concept of indexing to fetch out solutions to similar problems. [15] used agricultural information system theory to analyze the current information system used by organic and in-organic hazelnut producers and found that the information systems for the two groups of farmers were largely separated and supply of integrated pest management information. Moreso, [7] developed and implemented a herbal therapy knowledge management system using the concept of collaboration and case-based reasoning technique to solve problems herbal doctors inability to identify ailment. The result obtained was a self-solving to self-knowing method of identification and solution conceptions. [1] researched on analysis of factors influencing farmers’ adoption of improved rabbit production technologies: a case of Nyamira County, Kenya. They stated level of awareness of improved rabbit production technologies and adoption of improved rabbit technologies as research questions. Questionnaires were developed as research instrument and used for a sampled population.

The result of their research showed that the four regions involved have two years and above experience of rabbit farming. They also have a high percentage of rabbit rearing awareness (76.6%). Their adoption of technology adoption in rabbit rearing is very low (Frequency low, 40%) and Frequency high (19%). From the result, there was a low rate of adoption. [2] studied challenges of rabbit farming in Ogba/Egbema/Ndoni Local Government Area of River State. Their methodology involved the use of a sampled forty respondents from twenty contact farmers and twenty non-contact farmers. A personal interview and direct discussion with farmers was used to elicit responses from the farmers.

The result of their study showed that rabbit farming was introduced as a pet animal and not as a business animal to make profit. Also, they discovered that adoption of rabbit for production was very low with maximum breeding of ten rabbits. The study also revealed that production of rabbit feeds and drugs has not been adopted by the farmers. Lastly, the findings revealed that lack of proper awareness, techniques involved in business, inadequate knowledge and information about the advantages of eating rabbit meat are some of the problems identified in the study. Conclusively, [10] wrote on the disease management practices among rabbit farmers in Enugu State, Nigeria. A structured interview was used for data collection and validated by four academic staff of the Department of Agricultural Extension, University of Nigeria, Nsukka.

The results of the study revealed that majority of the farmers are small-scale farmers with stock of size 1-10. They mostly have in stock, New Zealand and Californian White Breeds. The study further revealed that mange, ear canker, sniffle, diarrhea were some of the diseases recorded in the findings. To source for drugs for these diseases, the study showed that most farmers source for appropriate drugs from fellow farmers: a confirmation that information sharing played a major role for this study.

III. METHODOLOGY AND RESULTS

The method employed for information gathering on the problem involved the use of observation and interview session. A ‘D’ algorithm was used to elicit the solution pathway for the system developed. Also, a Use-Case diagram was designed from the algorithm to show the graphical interactions among elements in the system. Further, a Process State Diagram was used to show the processes and states of execution of the system developed. A Client-Server Communication network is
used to show the distribution of resources on the system. Finally, few samples of the system outputs were presented as evidence of system developed.

3.1 Instrumentation
The instrument used to gather current problems faced by farmers was the use of open, face-face interview with an animal scientist in the Department of Animal Science and Production, Oyo State College of Agriculture and Technology, Igboora and a local rabbit breeder in Idere, a suburb of Igboora. The interview questions used were:

1. What are the breeds of your rabbit?
2. How many rabbits do you have now?
3. What is the general health condition of the animals?
4. How often do you observe them?
5. Do you employ the services of a veterinarian or animal scientists for treatment?
6. What are the ailments these animals experience?
7. What housing style do you use for these animals?
8. What is your feeding programme for these animals?
9. Is there any electronic platform where animal scientists discuss solutions to rabbit problems?

3.2 CASE STUDIES

CASE 1:
It was observed that a problem of space competition exists in the Rabbitry section of Animal Health and Technology Department, Oyo State College of Agriculture and Technology, Igboora. The rabbits have multiplied more than the available spaces, and thus, diseases such as mange are being transferred from one animal unto another. Also, a staff of Animal Health and Production Department of the College affirmed that the college currently has more than forty animals comprising New Zealand and Chinchilla. The strength of the Department was that there are more than a good number of animal scientists in the department as well as veterinary doctors, only few specializes in rabbitry.

The problem at hand is that most of the veterinary doctors and scientists do not live in the community; they are sometimes called to attend to emergency. She also confirmed that some drugs could not be seen easily in the community except if bought from advanced neighboring town. Moreso, the housing style of the rabbitry section needs to be updated as there is problem of space in the section. This problem led to disease transfer among the animals. Some of the diseases identified were Diarrhea, Pneumonia, Mange and coccidiosis. Among these ailments, the mange is now very difficult to treat because the animals are kept together. She further suggested that with the current style of breeding, the college may continue to experience the current challenges except if the latest technological method of breeding rabbit is adopted. Also, that rabbit breeding approaches are of different methods and practices. She opined that the use of technology in breeding will assist in showcasing the different approaches of identifying problems as well as proffering solutions.

CASE 2: A local breeder in Idere, Ibarapa Central Local Government, Oyo State complained about non-access to doctor in the days of emergency. He also complained about his inability to determine the exact disease affecting his rabbits, and if he is lucky to get information online, he does not know the required drugs or preventions to be applied.

3.3 The ‘D’ ALGORITHM

Match target problem to a pack of solutions (knowledge)

Where

\[ T = \text{Target problem} \]
\[ M = \text{Matching} \]
\[ S = \text{Solution} \]
\[ B = \text{Case Base} \]
\[ C = \text{Collaboration} \]
\[ N = \text{New Solution} \]

\[ S \leq B \forall T \] (S is less than B for every T)

Where \( S \rightarrow B \) (where Solution (S) is fetched from Case Base(B))

\[ N := T = S < B \] (New Solution (N) is equal to new Target Problem (T); where Solution is found in Case Base (B))

\[ N := T \geq S \geq B \leq C \] (New Solution is equal to solution fetched from Collaboration, greater than solution not seen from Case Base)

The D algorithm stands for Discussions to Yield Solution Algorithm. We conceptualized the algorithm to produce solutions from experts to be stored in a data warehouse (Case Base) where a solution to a target problem is not seen [6]. The Algorithm follows the principles of
matching a problem in a solution base. Else, it is discussed by experts.

Technically, \textbf{For Matched Solution}
\[ N := T = S < B \] \text{Solution Pathway 1}

\textbf{For Collaborated Solution}
\[ N := T \geq S \geq B \leq C \] \text{Solution Pathway 2. For this study, emphasis was laid on the collaborated solution for the system developed.}

3.4 The CKMDSRF Use-Case Graphical Interactions

A Use-case diagram was used to show interactions among the two types of user; a user and expert. As shown in Figure 1 below, the system has two ends:

The Users end (knowledge finders) and the Experts end: the system revealed that a user will first be prompted to register his/her details before gaining access to the system. From Figure 1 above, there are two types of users that interact with the system. First, a user who needs information and an expert who shares information through the collaboration forum. The user interacts with the system by quarrying a problem and fetches the solution while an expert interact with the system by proffering solutions to unseen solutions; view solutions provided by others as well as fetch solutions as a user. If the information needed is not found, the system automatically prompts a query for communication among experts.

3.5 CKMDSRF Flowchart Diagram

The flowchart diagram shown in figure 2 below shows the steps by steps process of arriving at solutions of the system developed.

From figure 2 above, a user is required to login with his registration details (same with experts) before being allowed to search for solution(s) from the dataware house. If the solution is not seen, the system automatically pushes the query for experts to discuss and bring out solutions. The solution(s) given by the experts is also automatically populated into the database as possible new solutions to the problem queried.

3.6 CKMDSRF Communication Network

The communication network adopted for the system is Client-Server network. \cite{4} described this type of network as computers on a network that are connected, monitored and centralized by a server.

From figure 3, it can be seen that the two users are fetching for solutions or proffering solutions through the internet. The internet gives room for wider and easy communication. The system developed adopted the method of client-server communication. They both source for information, the only difference is that they all controlled by a system. For instance, experts’ information are captured and stored up while access is given through a central computer/administrator. The function of the administrator is to coordinate activities of the experts as well arranged their comments as they come in. Clients are free to retrieve any information through the internet after completing registration procedure.

IV. SYSTEM OUTPUTS

The System was developed with Hypertext Text Markup Language, Windows 8.1 O.S, JavaScript and MySQL Database. Below are samples of system outputs.

4.1 Welcome Page
The system welcome page has features to capture information of a new user, grant entry for registered user, get information from data ware house and get feedback from experts.

4.2 Users PAGE
The CKMDSRF has a page for already registered users to ask experts questions that solutions could not be fetched.

4.3 Communication Page
The experts’ communicate through a chat page on the system. Access is given only to registered experts. This page allows users to moderate, constructively criticize a solution, identify ailments and solutions together and to unanimously reach a consensus on any solution. Their solutions are automatically stored up in a data warehouse.

V. CONCLUSION

The study of knowledge management system is a procedural process that solves problems for a wider consumption. The knowledge developed is however subject to applicability in any context, locally or globally. In this study, a decision support system for rabbitry farming was developed to aid the decision making of users and experts. A Jennex and Olfman KMS Success Model (2004)\cite{17} was used to validate the system.
developed. Jennex and Olfman [17] opined that a good Knowledge Management System must have a good system quality, knowledge and Information quality and Service Quality together with the intent to use/perceived benefits and Users satisfaction. Prior to the development of the system, interview sessions were conducted in order to provide a justification for the study.

REFERENCES


Figure 1: Use-case Diagram for CKMDSRF
Figure 2: Flowchart for CKMDSRF
Figure 3: Communication Network Diagram for CKMDSRF

Figure 4: CKMDSRF Welcome Page
Figure 5: CKMDSRF Users’ Question Page

Figure 6: CKMDSRF Communication Page
4.3 Snapshots of CKMDSRF Data Warehouse

Figure 7: Diseases Data Warehouse (Populated)
Figure 8: CKMDSRF Database Structure
Figure 9: Experts’ Solution Warehouse (Discussion).