FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE
JOURNAL OF ENGINEERING AND ENGINEERING TECHNOLOGY

DEVELOPMENT OF A WEB BASED AGRICULTURAL EXTENSION SERVICES USING KNOWLEDGE MANAGEMENT (KM)

Fadamiro, A. O., Lawal, E. O. and Ogunti, H. O.

Department of Computer Engineering,School of Engineering and Engineering Technology, Federal University of Technology, Akure, Nigeria
aofadamiro@futa.edu.ng, habeeblawal88@gmail.com and eoogunti@futa.edu.ng.

Fadamiro A. O., Lawal E. O. and Ogunti H. O. (2022): Development of A Web Based Agricultural Extension Services using Knowledge Management (km). *Journal of Engineering and Engineering Technology /16(1), 27-32*

Received 02-07-21 **Accepted: 11-02-22**

Abstract
Technological advancement has brought about evolution in every sector. The agricultural sector is known to be a crucial sector in every country's economy. Knowledge Management (KM) is the interaction of people, process and available technology. The use of Information and Communication Technology as KM conceptual tool to bolster the agricultural sector is known as E-agriculture. This paper focuses on Knowledge management concept on Agricultural Information and experiences of farmers. This research studies the harmonization of scientific knowledge with Indigenous knowledge to enhance a well-structured Agricultural Knowledge Management System in holistic view.

Keywords**:** *Knowledge management system, information systems, agriculture, information and communication technology, indigenous knowledge, community of practices.*

Introduction

Technology advancement has positively impacted the agricultural sector bringing about an increase in productivity and growth of most developed countries. In developing countries, the agricultural sector seems to still be struggling and is mostly practiced in the rural areas (Kwadwo, 2008). Information and Communication Technology (ICT) is a key factor in the agricultural sector providing economic growth as the use of ICT to boost the agricultural sector is termed as E-Agriculture (Sachithra and Darshana, 2020). Agricultural extension is the application of scientific research and new knowledge to agricultural practices through farmer education. It is known as the provision of agricultural advisory services to farmer especially in rural areas to improve their livelihood. There are different types of agricultural extension service classified based on different group extension methods. They are; expert lectures, group discussion and field days (Dragic et al., 2009). All these are the physical classification of agricultural extension. A knowledge system is needed to create a web based agricultural extension service for users to share knowledge. The applied technological advancements and developed tools are potentially capable of supporting the agricultural sector and smallholder farmers. However, their use and relevance are still alien to the rural communities (Masinde, 2013). Agricultural KMS is therefore unsuccessful in attaining its full potential in developing countries (Puri, 2007).

Knowledge is known to be the basic enabler for sustainable development and innovation (Sarkhel, 2016). Hence, the need to create, capture and share knowledge as become crucial and been raised by different organization in their efforts to transform the agricultural sector. However, most of the available KMS have been focused on the creating, capturing and sharing of scientific knowledge grossly neglecting the Indigenous Knowledge (IK) contained in the local communities. The historically marginalization of indigenous knowledge from the modern scientific community exacerbates the weak links between scientific and indigenous knowledge (Natek and Lesjak, 2021; Johan and Oivind, 2017). As a result, such techniques fail to meet the requirements and expectations of farmers (Johan and Oivind, 2017). Hence, it is claimed that following such knowledge trend approaches can lead to solutions that do not fit the realities in the content. This condition has increased interest in the importance of IK and its incorporation with scientific knowledge in KMS creation and use in order to tailor IT systems to the demands of users. It can be generally accepted that IK plays an important role in every KMS in developing countries. However, IK is not reliable on its own and requires the integration of the scientific knowledge and techniques for the enhancement of the agricultural sector (Kipkorir, 2011). Knowledge is defined as "an evolving mix of

 https://doi.org/10.51459/futajeet 2022.16.1.360

framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information" (Davenport and Prusakm, 1998). Knowledge is recognized as a valuable asset to any firm, yet it can be difficult to share, imitate, acquire, sell, store, or analyze. This is due to the fact that knowledge is embedded in people's thinking, job habits, and processes. Jennex, (2014) stated that, to make knowledge repository useful, it must capture and store the context. Knowledge in its on context can be divided into two main categories: Scientific Knowledge and Indigenous Knowledge (IK). Scientific knowledge is driven by theoretical models and governed by testing of hypothesis and experimentation (Tripathi and Bhattarya, 2004). While IK is the knowledge and experience from the local people passed onto generation through trial-and-error method with long histories of close interactions with the natural environment across different cultures (Natek and Lesjak, 2021; Lanzano, 2013). It has long served as the foundation for local-level decision making in agriculture, art and craft, communication and entertainment, traditional medicines and healing, education, and other essential socioeconomic activities in many parts of the world (Lanzano, 2013). The majority of the IK, on the other hand, is yet to be examined and explored, posing a huge threat to IK extinction. As a result, immediate action is essential to document and manage IK in a systematic manner, as failure to do so could affect rural development. IK exhibits sustainability since it is well adapted to its surroundings, relies on local resources, is small-scale and decentralized, and tends to conserve the natural resource base (Palak and Rajendra, 2020). It is believed that the indigenous knowledge together with scientific knowledge has the ability to solve some major agricultural challenges.

Knowledge management (KM) can be defined as a systematic discipline of policies, processes, and activities which empower organizations to apply knowledge to improve effectiveness, innovation, and quality (Sehai, 2006). Knowledge Management refers to the collaborative efforts and methods used by businesses to produce, store, accumulate, utilize, re-use, apply, and distribute knowledge (King, 2009)

There are two generations of knowledge management which are: top-down generation and technological perspective generation. The primary idea here is that agricultural research develops technology that extension experts deliver to users, ignoring the importance of farmers articulating their wants and fostering their self-confidence and empowerment (Getahun et al., 2013). The argument of the second generation of KM is that meaningful knowledge is created socially, in groups, through networking and communication systems (Arisha and Ragab, 2013)

The aim of KM is to understand, focus on and manage knowledge building and application, manage knowledge processes and renew the knowledge constantly. The organization's knowledge management function runs KM processes (knowledge creation, storage, sharing, and application), develops methodology and tools to support them, and motivates people to engage in them (Jennex, 2012).

Jennex and Olfman have suggested that KM activities need to be supported through KMS to boost an organization's effectiveness. A KMS, a class of Information Systems (IS), is a managerial, technical, social, and organizational system structured to support the implementation of KM within an organization thereby enables organization to manage knowledge effectively and efficiently (Jennex, 2014). What differentiates the KMS from other type of IS is the involvement of human activities in their operation.

Web 2.0 tools are used to develop online KMS helping users interact and share knowledge protecting the indigenous knowledge. The aim of the web 2.0 tools is to understand users' interaction for knowledge sharing and integration (Gaál et al., 2015; Jennex, 2007; Sivarajah et al., 2015; Wang et al., 207).

Web 2.0 tool are web technologies that allow for user interaction in form of a messaging system in which the different users can read and reply each other's messages. Web 2.0 refers to a set of Web-based technologies such as wiki, blogs, content aggregators, social networking sites, podcasting, and other emerging forms of participatory applications and social media. Examples are Facebook where users can interact with each other from anywhere in the world. Another is blog where users can comment and share ideas with each other. This research study focuses on the creation of an agricultural KMS merging scientific knowledge with IK to create a successful system in increasing agricultural productivity.

Materials and Methods

This system aims to enable farmers to relate and share problems and their solutions via the website. The system also allows access to stored archives. This was achieved with the development of a web application designed to satisfy the required features of a good agricultural knowledge management system. Users would have access to the website without registration or logging in but would lack full features access. To have full access users would have to be registered and logged in. A data base would be created to store all registered users with password reset and recovery links also been provided for users who have forgotten their passwords and cannot log in. Once logged in users would have full access to all website features enabling

 https://doi.org/10.51459/futajeet 2022.16.1.360

them to share problems and receive answers to their problem, users would also have access to post articles for administrative approval. All actions ranging from asking of questions to answering of questions and even uploading of articles would be stored in the database enabling access to them when needed. Users of the website can view already asked questions and their answers without been logged in to the website but can't provide answers or take any other actions on the question without been logged in. If tried, they would be redirected to the log in page. Also, an important feature of the website that cannot be overlooked is the ability to provide users with update on agricultural news and happenings within the country, availability of loans and grants to users and the feature of weather update to help farmers determine the current season to know the best crop for that time. The use of the platform would grant all users access to some features of the sites while restricting other features to only registered and logged in users as illustrated in Figure 1.

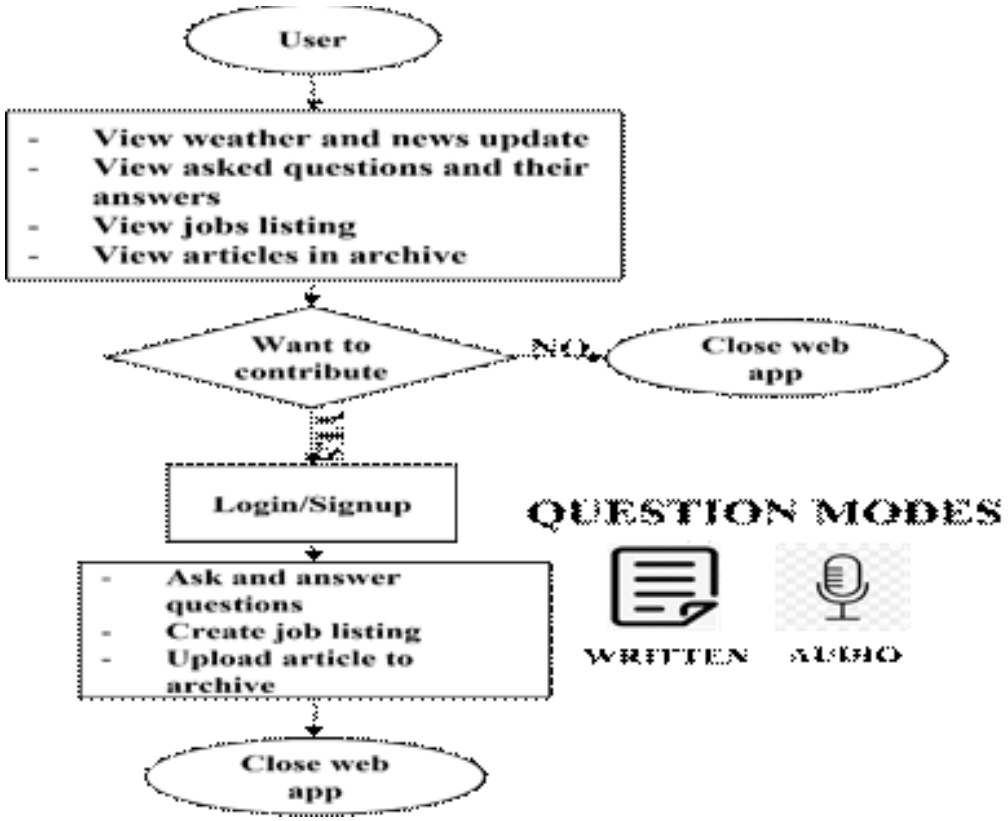


Figure 1: Flowchart of web application

Results and Discussion

The web application is designed to satisfy farmer's need in the agricultural community in terms of knowledge management and implementation for growth in the sector. The features are characterized based on the pages of the web application.

The homepage is the welcome page that the user first encounter upon launching the web application's URL to the browser of the system. It gives few details of what the site entails and provides link to other pages in what we call the menu bar and still contain some other links in the body.

The major features contained in the homepage are:
Weather Update feature gives update on the climate conditions to help farmers predict the way a season (either rainy or dry) is going to be and enable them to decide what crop is best for growing at that time.

News updates gives farmers updates on the latest happenings in the agricultural field ranging from news on different new farming methods, subsidy on products in different states, available loans, and grants and other related agricultural news. Figures 2(a) and (b) showed the view of the features of the homepage;

 https://doi.org/10.51459/futajeet 2022.16.1.360

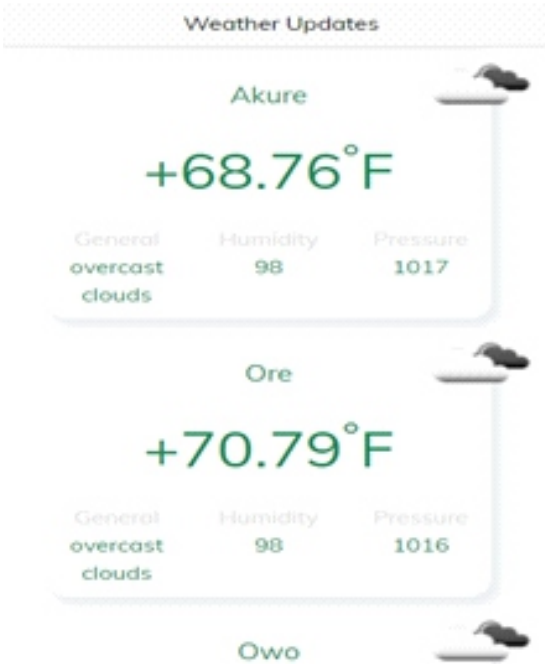


Figure 2(a): View of the weather update feature

Figure 2(b): View of the news update feature

There is a Job page which gives details on available agricultural job opportunities to users; to apply to for any job of their choice. Registered users can create job application vacancies for related experts to apply. All jobs would be reviewed by the admin to avoid scammers from using the platform as a means of robbing people. All verified jobs can be viewed on the jobs view pages with the necessary details for application.

The Question feature allows the farmers to communicate and relate their issues together providing solutions to the issues and thereby creating a storage and reference point for the knowledge shared. The question feature is divided into two parts as regards the format of questioning: Audio and Written feature.

The Audio feature helps bridge the illiteracy barrier to enable farmers who are not well-learned on the lingua-franca also contribute and have the problems heard and solved.

The question page doesn't require user login for view purposes but actions like asking and answering of both audio and written questions cannot be done until farmer is registered and logged in. Figures 3(a) and (b) showed the view of the audio and written questions list respectively.

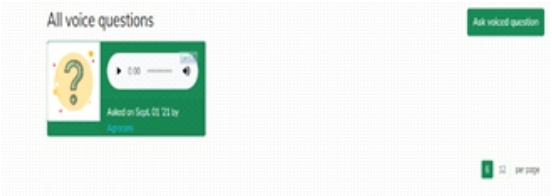
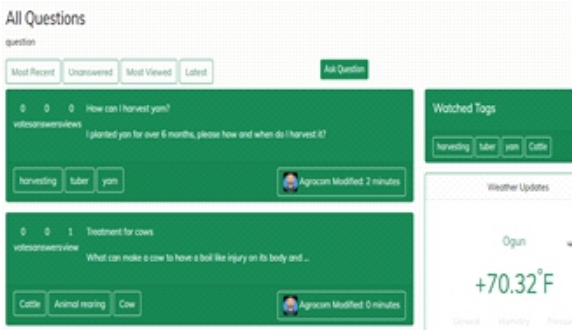


Figure 3(a): Audio Question list view



Figures 3(b): Written Question list view

The admin is not to be held responsible for any issue related to jobs or any dispute arising from the application of a job listed on the website. All jobs related disputes are to be resolved the local way as deemed fit by the involved parties.
Figure 4. displays the view for the jobs page illustrating the required information of the job and how users can apply.

 https://doi.org/10.51459/futajeet 2022.16.1.360

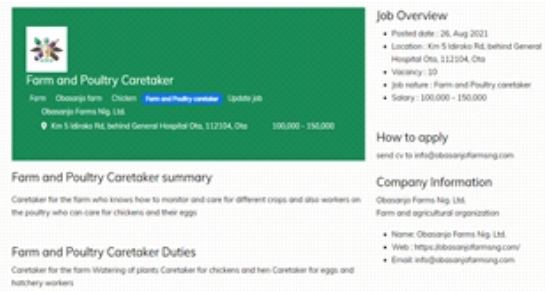


Figure 4: Jobs page view

The User Profile page gives users control over their profile which entails their basic info and some of their activities on the web application. Users can edit their profile but can't edit the activities they have performed on this page. In this page, there also exist a link where users can upload articles and await the approval of it by the admin.

User profile settings is the page where users can successfully edit their basic info. They can edit the following info: Full name, Display name, User Location, About user and Social media contacts (Facebook, Instagram etc.)

Upload Article settings is the page that allows the uploading of articles by users to the web application. The uploaded articles are not going straight to the archive until it has been reviewed and approved by an admin.
The Archive is the page in which articles posted by users can be viewed and downloaded by any and every user of the web application. No uploaded articles can be uploaded by any user on the application.

Conclusion

Knowledge Management concept enhance reversible knowledge sharing; and unified disjointed knowledge among the capacity leaders. The study deployed information and communication technology (ICT) as KM tools to unify the farmers' knowledge towards productivity and extension programme. The web application is designed to solve the farmers problems by giving them a platform to interact with themselves as it was found that farmers tend to trust themselves than other bodies hence would listen to advices and instructions from their co-farmers and build a better farming community. This also helps agricultural extension workers keep a better store and distribution of the farmers' knowledge for their work purposes. The web application is available on www.agrocomnigeria.herokuapp.com.

References

Arisha, A., and Ragab, M. A. F. (2013). Knowledge management and measurement: a critical review, J. Knowl. Manag., 17(6), 873–901.

Davenport, T. H., and Prusak, L. (1998). Working knowledge. Boston, MA: Harvard Business School Press.

Dragic, Z., Jelic, S., and Rajic, Z. (2009). The role of Knowledge, Innovation and Human Capital in Multifunctional Agriculture and Territorial Rural Development, Economics of Agriulture, 57:2–11.

Gaál, Z., Szabó, L., Obermayer-Kovács, N., and Csepregi, A. (2015). Exploring the role of social media in knowledge sharing, Electron. J. Knowl. Manag., 13(3), 185–197.

Getahun. S., Monica, G., Million, M., and Danny, D. (2013). Agricultural knowledge management systems in practice: The ability to support wereda knowledge centers in Ethiopia. 19th Americas Conference on Information Systems, AMCIS 2013 - Hyperconnected World: Anything, Anywhere, Anytime. 1:295–302.

Jennex, M. E. (2014). A proposed method for assessing knowledge loss risk with departing personnel," VINE J. Inf. Knowl. Manag. Syst., 44(2), 185–209.

Jennex, M. E. (2007). Knowledge management in support of education, J. Adm. Dev., 1(2), 15–28.

Jennex, M. E., Smolnik, S., and Croasdell, D. (2012). The search for knowledge management success," in Hawaii International Conference on Systems Sciences.

Johan, O. and Oivind, R. (2017). Working smarter and greener: Collaborative knowledge sharing in virtual global project teams. International Journal of Information Management, 37(1), 1441–1448.

Kwadwo, A., Kristin, D., and Dejene, A, (2008). Advancing Agriculture in Developing Countries through Knowledge and Innovation, [Online].https://ebrary.ifpri.org/utils/getfile/collection/p15738coll5/id/855/filename/856.pdf

King, W. R. (2009). Knowledge management and organizational learning, Ann. Inf. Syst., 4:3–13.

Kipkorir, E. C., Songok, C. K., and Mugalavai, E. M. (2011). Integration of indigenous knowledge systems in climate change adaptation and enhancing food security in Nandi and Keiyo districts, Kenya., in Experiences of Climate Change Adaptation in Africa, Climate Change Management, 1: 69–95.

Lanzano, C. (2013). What kind of knowledge is 'indigenous knowledge? critical insights from a case study in Burkina Faso, Transcience, 4(2), 3–18.

Masinde, M. (2013). Survivability to sustainability of biodiversity:what do ICTs and indigenous knowledge have to do with it?, ICTD, 2:80–83.

Natek, S., and Lesjak, D. (2021). Knowledge management systems and tacit knowledge, International Journal of Innovation and Learning, Inderscience Enterprises Ltd, 29(2), 166–180.

 https://doi.org/10.51459/futajeet 2022.16.1.360

Palak, M., and Rajendra, R. (2020). Documentation of Indigenous Knowledge of Agriculture Practices in Rajasthan, International Journal of Current Microbiology and Applied Sciences, 9:434–441.

Puri, S. K. (2007). Integrating scientific with indigenous knowledge: constructing knowledge alliances for land management in India," MIS *Q.*, 31(2), 355–379.

Sachithra, L., and Darshana, S. (2020). Rural Entrepreneurship and Innovation in the Digital Era, IGI Global, 1:12–15.

Sarkhel, J. K. (2016). Strategies of indigenous knowledge management in libraries, Qual. Quant. Methods Libr., 5:427–439.

Sehai, E. (2006). Knowledge Management in Ethiopian Agriculture, 14th Annual Conference, Ethiopian Society of Animal Production. [Online]. Available: https://www.semanticscholar.org/paper/Knowledge-Management-in-Ethiopian-Agriculture-of-14-Sehai/0055c93c62e6ec7680b4d4e1dc79feef41058528

Sivarajah, U., Irani, Z., and Weerakkody, V. (2015). Evaluating the use and impact of Web 2.0 technologies in local government, Gov. Inf. Q., 32:473–487.

Tripathi, N., and Bhattarya, S. (2004). Integrating indigenous knowledge and GIS for participatory natural resource management: state-of-the-practice, Electron. J. Inf. Syst. Dev. Ctries., 17(3), 1–13.

Wang, W., Xiong, R., and Sun, J. (2007). Design of a Web 2.0-based knowledge management platform, in Integration and innovation orient to E-society, W. Wang, Ed. Boston: Springer, 1:237–245.