

Identify the usage level of ICT-based Knowledge Management Systems (IKMS) among vegetable farmers in Sri Lanka

SI Baddegamage^{1#}, J Goonetillake² and L De Silva²

¹National Institute of Library and Information Science, The University of Colombo, Colombo, Sri Lanka

²School of Computing, The University of Colombo, Colombo, Sri Lanka

#indika_bg@hotmail.com

Abstract: Information and communication technologies significantly bridge the information gap within communities towards creating a knowledge economy. Agriculture in Sri Lanka is one such sector that can derive benefits by providing the correct information at the right time to make actionable decisions. The use of information during the crop life cycle helps farmers eliminate most of the daily issues. Information on cultivation methods, price fluctuations, supply, and demand is essential for farmers to make the right choices and get a better income. Having identified the essence of information and communication systems in bridging the information gap in farming communities, many mobile-based information systems have been introduced to the agriculture sector of Sri Lanka. We conducted a survey to understand how widespread these information systems among the farmer communities were and consequently found out that the use of such systems is very low among farmers. This survey was conducted among 54 farmers covering the major agriculture zones in Sri Lanka and revealed that only 63% were aware of the available systems. In contrast, only 35% of the farmers use these applications to obtain information. Around 37% were unaware of the existence of applications though smartphone usage is recorded to be about 85%. This paper highlights the reasons for the lack of digital information systems usage among the farming community in Sri Lanka. Furthermore, the paper will pave the path by highlighting the initiatives that can be carried out to increase the use and thus contribute toward a knowledge economy.

Keywords: ICT-Based Knowledge Management Systems, Knowledge Economy, Technology Acceptance Model

1. Introduction

The use of ICT in agriculture sector is very low among the farmer communities as well as agricultural organizations (Jayathilake et al., 2015). ICT related technologies can be used as a strategic tool to improve the agriculture sector in Sri Lanka. Maximum utilization of ICT can be obtained via increase the adoption of ICT, promoting ICT tool and

creating the awareness among communities. Use of proper ICT application will support stakeholders of agriculture sector in Sri Lanka to access correct and accurate information which can be positively influence the growth of agriculture sector in many aspects. Mahindaratne (2022) described that use of ICT related technologies in agriculture sector as at today in a range of make a simple mobile phone call to obtain some details regarding the market information to high-tech practises such as “mobile-mediated agricultural information systems, e-agriculture, m-agriculture, cyber extension, precision agriculture through informatics of cultivation, and mechatronics technologies and agriculture resource planning via global positioning systems (GPS) and global information systems (GIS)”. Information and communication technology has become the facilitator and platform of the agricultural sector, enabling field connectivity as well as precision. Mahindaratne (2022) mentioned further that, given the pace and desire to revolutionize the ICT sector; the opportunities for agriculture to benefit from ICT are enormous and exciting.

Sri Lanka's telecommunications sector has undergone dramatic transformation since 1977, passing several substantial milestones. As a result, Sri Lanka has made significant progress in ICT infrastructure as well as ICT literacy level during past few years. Some of the applications introduced by department of agriculture in Sri Lanka for agriculture sector are; “use of IMM CD-ROMs as crop-based information materials (2004), cyber extension (2004), a farmers' database for e-marketing, the Toll-Free Agriculture Advisory Service (2004), and the Cyber Agriculture ‘WikiGoviya’ website (2013)”. Apart from that, Ministry of agriculture- Mobitel (pvt) Ltd introduced “Mobitel Agri-price Index 6666” to access latest market prices details for farmers. The “Dialog TradeNet agri-price service” is another establishment done by “Dialog Axiata” and it also provides market price details (Mahindaratne, 2022), (Ekanayake and Sirisuriya, 2016). There are several web sites such as www.pmb.lk introduced by “Sri Lanka paddy marketing board” and www.goviya.lk of DOA to obtain crop

related information required by farmers in Sri Lanka (Ekanayake and Sirisuriya, 2016). Baddegamage et al. (2022) mentioned that Govinana is a system introduced for Sri Lankan farmers to access market place without much issue.

Information systems provide accurate and timely information to farmers, but most of Sri Lankan farmers are reluctant to use ICT based Information Systems (IS) for many reasons. Farmers are expecting comprehensive and updated information via available ICT based information systems. The internet based information system developed and established by "Sri Lanka Paddy Marketing Board" is not using by farmers due to lack of awareness and low ICT literacy, issues with infrastructure and signal, non-user friendliness and complexity of the system (Ekanayake and Sirisuriya, 2016). There are various types of Apps have been developed by many government and non-government organization for use of the agriculture sector in Sri Lanka. Apps such as Govipola, Badumila and Welandapola provide direct access of the market places and buyers for farmers. These Apps facilitate to skip intermediates and link farmers directly with buyers. But said applications have reported very little use by farmers (Sandareka et al., 2020).

2. Research Question

Proper use of Information Management (IM) with the support of ICT can help farmers to overcome issues in the sector. ICT based IM systems must be equip with valid up to date data and it is required to continuously use the IS to have adequate data to provide proper information. Knowledge in an essential factor in agriculture and information required to build up the knowledge. Knowledge can be used as a tool to solve issues in the agriculture and there are many information management systems available create required knowledge. Since farmers do not interested to use available ISs and lack of awareness, information systems have become obsolete during shorter period, IS can't support farmers, farmers can't obtain assistance from ISs and issues in the field used to continue as usually.

The research question investigate in this research is What is the usage level of ICT-based Knowledge Management Systems (IKMS) among vegetable farmers in Sri Lanka?.

3. Literature Review

Vegetable farmers in Sri Lanka are reluctant to make the right decisions at the right time as they do not have the correct information obtained by accessing the right information channels. They do not use available information systems for agriculture sector. Underutilization of available information channels and in-proper decisions taken by farmers cause to escalation of demand-less vegetables and

get wasted at market places or farm lands (Sivagnanasundaram et al., 2018). As a result, farmers are facing financial losses as well as a number of socio-economic problems (Baddegamage et al., 2022). Ginige et al. (2016) also have mentioned that "incorrect crop selections, lack of professional advice, technologies, seeds, best practices and proper agricultural knowledge" are the some of the reason for losses and frustrations in the agriculture sector of Sri Lanka. Root causes for above reasons have been identified as monetary concerns, difficulties of proper marketing campaigns, transport and delivery related issues, cultural and social norms, Difficulty in reaching due to distant and remote areas as well as ICT literacy and poor language abilities (Sivagnanasundaram et al., 2018).

Sivagnanasundaram et al., (2019) have identified that the knowledge gap among vegetable growers and researchers is significant. It is in the national interest to establish a mechanism to impart to farmers the knowledge gained through research and development conducted by universities and other research institutes. Although the essential link between research institutes-universities and the agro-industries are not present in Sri Lanka, it remains strong in developed countries. Developed countries see research and development as an investment for the future and they benefit the most.

Developed countries are heavily using advance technologies to increase agricultural production. Use of "fast-growing genetically modified crops", use of Artificial Intelligent (AI) to minimise cost and improve productivity, use of "Microbiomes and biopesticides" to protect crops from pest and diseases, use of RNAi (Ribonucleic acid interference) which plants can be programmed for growth and survival, practice of "block-chain technology" to manage information regarding all the stages of production of the agro- products, "Hydroponic farms", use of packing which can be consumed (Edible Packing), use of satellite have direct access to weather related information, use of meat cultivation technologies (Tube Meat) and robotics are most commonly used technologies in Europe and UAS. All the above technologies use high tech knowledge-oriented systems. These countries expect food security and sustainable development in the agriculture sector by establishing such technologies in their countries (Kuvaeva et al., 2019). It shows that economies need to be transformed into "knowledge-based" economies, and that the use of technology is essential in this direction.

There is no problem of lack of information required for the agricultural sector in Sri Lanka. The issue is with the utilization of available information. In 2019, 11 information

systems were developed and implemented, but farmers did not know much about this initiative. The hotline number of DOA knew only 33% of vegetable farmers and 12 % farmers knew about Hector Kobbakaduwa Agrarian Research and Training Institute (HARTI) hotline of market information centre. Only 3-4% of farmers were aware about “Govi Mithuru App”, “Krushu FM Web Radio” and “Govipola app”. Awareness regarding other available Apps was reported much lesser than 3%. Around 65% of farmers had issues in accessing information systems since they have only land phone or non-smart mobile phones. Farmers with ability to access information system were reported as 30%. There is an in-balance in the agriculture sector about the availability of tools to access information systems, ability of accessing and willingness of use information systems in the agriculture sector in Sri Lanka (Wijesinghe et al., 2021).

The cost of accessing information via ICT application is very high in Sri Lanka. Difficulties in obtaining information due to cost have obstructed the use of information and communication technology in the agricultural sector of the country (Jayathilake et al., 2015). Lack of infrastructure facilities, non-availability of training, poor research and development, lack of skills, issues due to social and political norms are also have become barriers for farmers to access ICT related technologies in Sri Lanka (Narmilan et al., 2020). Correspondently, Subashini and Fernando (2017) have stated that the poor ICT literacy is one of the main issues for ICT adoption in the agriculture sector in Sri Lanka. Furthermore, difficulties of using English language as well as the cost of ICT equipment also prevent farmer from using ICT enabled technologies (Sandareka and Wedasinghe, 2017). According to Baddegamage et al. (2021), “cost of technology, lower trust regarding systems, no training, infrastructure issues, non-availability of support services resistance and limitations of adoption to new technologies” are encountered as obligations for use and adoption of ICT based information systems among Sri Lankan farmers. Premarathna (2018) also mentioned that “knowledge lack, training issues, problems related to language and unawareness about benefits” are some of the reasons to not to use ICT based applications by farmers in Sri Lanka. Not only that, complexities of the agriculture sector, low level of external supports, lack of real farming experiences, issues of infrastructure facilities, availability of information, farmer strength to accept and adopt into new technologies, farmer’s wiliness of absorb new stuffs, training related issues, issues in system integration as well as software non-availability also encountered as factors which are prevent farmers access from ICT based information systems in Sri Lanka (Ekanayake, and Sirisuriya, 2016).

As per Wijerathna et al. (2020), there are some problems of receiving up-to-date information for government owned information centres in Sri Lanka. Some of the government officers are not capable of providing their information services for farmers up to the expectations. The bureaucratic nature of public officials and their political as well as social background are the reasons behind these unacceptable behaviours. Poor coordination among farmers, buyers and markets, as well as technical concerns such as unavailability of systems, also block farmers' access to ICT based agriculture information systems in Sri Lanka. Finally, due to factors such as poor knowledge and non-awareness, difficulties in accessing, complexity of systems, language barriers farmers do not have access to ICT based information systems available in the agricultural sector in Sri Lanka (Sandareka and Wedasinghe, 2017).

4. Methodology

The objective of the research is to identify the usage level of ICT-based Knowledge Management Systems (IKMS) among farmers in Sri Lanka. According to the literature review, it has been shown that the use of IKMS among farmers' communities in Sri Lanka is very low and some farmers are not aware of the existence of such support systems. This research has been conducted to identify the current status of utilization level of vegetable farmers in Sri Lanka. As ICT systems have become a common practice in the daily lives of the common people and the pandemic and lockdown conditions have increased the use of online systems among communities, it is worth investigating the current level of use of IKMS in the vegetable agriculture sector in Sri Lanka.

The research started in September 2022 and was unable to reach farmers communities in the country due to the lockdown and travel restrictions imposed during the COVID-19 pandemic. Due to these constraints, a 27-question Google Form-based questionnaire was created and distributed through social media.

The questions created in the Google Form focused mainly on awareness of the existence of IKMS, use of IKMS, user expectations, reasons for non-use, and infrastructure availability(accessibility).

The Google form was distributed among Facebook farmers' groups and WhatsApp groups. The language used in the Google model was Sinhala as the target community is very comfortable with this language. It sent via e-mail using personel contacts . By the 2nd week of December, it had received 66 responses and 42 responses from non-farmer categories.

As per the request, agricultural advisers in Kehelbaddara, Udugampola, Makevita and Malwatu - Hiripitiga provided contact details of farmers registered with the Department of Agriculture. All these farmers are from Gampaha district and 30 responses were obtained through telephone interviews. Forty-two (42) responses had to be omitted due to inapplicability during the data screening and validation process. 54 responses remained for analysis. As the data set was not so complex, it used Microsoft excel for analysis.

5. Data Analysis

Since the main objective of the research identified as “Identify the usage level of ICT-based Knowledge Management Systems (IKMS) among farmers in Sri Lanka”, responds received from farmers for the question (Q8) “Do you know that there are computer/mobile phone information systems that provide agricultural information for farming activities?”

Yes : 34 No : 20

Awareness percentage was 62.9% and 37.03% of farmers were not know that there are such systems in Sri Lanka.

The next major issue was related to the amount of system usage. It is only from farmers who say "Yes" to Q8 in the questionnaire. The question (Q10) “Do you use computer/mobile information systems that provide agricultural information for farming activities?” received responds as follows:

Yes : 19 No : 15

Since the data set was 54, it indicated that 35 farmers out of 54 are not using any information system for their farming activities. It is 64.8% as a percentage and according to the current level of ICT use in the society; it is not a satisfactory figure.

There were several reasons mentioned by farmers as not to use information systems. Details of farmers’ responds appeared in table 1.

Table 1. Reasons for not to use Information Systems

Reason for not to use Information Systems	Count
No computer or smart phone	1
Does not know how to use a computer or smart phone	1
Lack of confidence in computerized information systems that provide information	2
I don't understand what is written in English	1
Those information systems are very complex	1
Dislikes the use of technical tools	1
The use of technical tools cannot be taught	1
There is no time to use technical tools	1
The benefits of computer/mobile information systems that provide agricultural information are not known.	1

Data costs a lot	1
The internet connection in our province is not sufficient for the use of information systems	1

According to the responses received for Q10, there are 19 users of information systems. The next important question given to those 19 users was (Q14), which asked "Are you satisfied with the services provided by the information systems you use?". Responds received as follows:

Yes: 12 No: 7

There were 12 satisfied users and 7 non satisfied users. The percentage of non-satisfied users was 36.8%. Reasons for non-satisfaction have mention as per the table 2.

Table 2. Reasons for Non-Satisfaction

Reason for Non-Satisfaction	Count
The information displayed is incorrect	3
No new information (no updates)	9
No required information	7
The available information is incomprehensible	1
Handling is very complex	1
Difficult to learn how to use	3
It is difficult to use because the mother tongue is not used	1
No accessories/facilities required	0
It consumes a lot of data	1
The internet connection in our province is not sufficient for the use of information systems	1

6. Discussion

The data analysis limited to responds received for 02 selected main questions out of 27 questions in the questionnaire. As per the results, 37.03 % of farmers are not aware about the existence of agricultural information systems in Sri Lanka. 33.2% of farmers in the sample actually use existing information systems, which is also very low use. Given this situation, moving to a knowledge-based economy will be an extremely challenging task as the use of IKMS is a key requirement of such an economy. Reasons given for not to use information systems are almost equally effective. “No new information” and “No required information” are very important for dissatisfaction with system usage.

7. Conclusion, Recommendation and Further Research

Sri Lankan farmers have different types of information systems to obtain necessary information within the crop cycle, but the use of the existing information systems are very low among farmer communities. Low use of the information systems make IS incomplete, non-comprehensive, low informative and low lifetime. It is required to use the information systems continuously to become a knowledge base. Use of knowledge gained with proper information will help to manage mentioned issues in the agriculture sector of Sri Lanka. The 'knowledge driven agriculture' can be used as the driving force for solving most of the issues in Sri Lankan agriculture sector and that has been proved in many other similar economies as well as developed countries. The main obstacles of implementing such "knowledge driven agriculture" in Sri Lanka are low use and resistance to accept ICT based information systems among farmers. There should be an acceptable attraction for farmers to use information systems continuously. It is recommended to identify factors can influence to increase the usage of ICT systems among farmers in Sri Lanka. As the next step of the research, it recommended to research with a large population to identify how to motivate farmers to use IKISs in Sri Lanka.

References

- Baddegamage, S.I., De Silva, L.N.C. and Goonethilake, M.D.J.S., 2022. Information Management for Sri Lankan Vegetable Farmers: Effectiveness of ICT Applications. Available from : <http://ir.kdu.ac.lk/handle/345/5299>
- Ekanayake, C. and Sirisuriya, S.C.M., 2016. Mobile Based Solution for Harvest Selling System in Sri Lanka. <http://ir.kdu.ac.lk/handle/345/1294>
- Jayathilake, H.A.C.K., Mudalige, J.U., Gow, G.A., Waidyanatha, N., and Perera, L.D.R.D., 2015. Use of low cost information communication technologies for knowledge mobilization in agricultural communities in Sri Lanka.
- Mahindaratne, M.G.P.P. and Min, Q., 2018. Information needs and seeking patterns of farmers within changing information environment: A case of Sri Lankan vegetable farmers. In *Information and Knowledge Management* (Vol. 8, No. 4, pp. 37-49).
- Sandareka, K.P.P., Pradeep, R.M.M., Wedasinghe, N. and Perera, M.P.L., 2020, E-Farmer Management System for Empowering Sri Lankan Small-Scale Agriculture-Based Producers.
- Sivagnanasundaram, J., Ginige, A., and Goonetillake, J., 2018. "Event Detection over Continuous Data Stream for the Sustainable Growth in Agriculture Context," *Computational Science and Its Applications – ICCSA 2018 Lecture Notes in Computer Science*, pp. 575–588 (doi: 10.1007/978-3-319-95162-1_39).
- Sivagnanasundaram, J., Ginige, A., and Goonetillake, J., 2019. Achieving Agriculture Biotic Sustainability through Mobile-based Information System: Adapting the characteristics of Geographical Information Systems (GIS). <<https://aisel.aisnet.org/acis2019/92/>>.
- Kuvaeva, Y.V., Reshetnikova, T.V. and Boronenkova, N.L., 2019, October. Knowledge economy changes in the perception of investment nature in agriculture. In *IOP Conference Series: Earth and Environmental Science* (Vol. 341, No. 1, p. 012220). IOP Publishing
- Wijesinghe, P., Wickramasingh, R. and Kuruppu, V., 2021, Factors Influencing Vegetable Farmers' Decisions. http://www.harti.gov.lk/images/download/reasearch_report/new/report_for_web_247.pdf
- Narmilan, A., Niroash, G. and Sumangala, K., 2020. Assessment on consequences and benefits of the smart farming techniques in Batticaloa district, Sri Lanka. Available from : <http://192.248.66.13/handle/123456789/5052>
- Subashini, K.P., and Fernando, S., 2017, September. Empowerment of farmers through ICT literacy. In *2017 National Information Technology Conference (NITC)* (pp. 119-124). IEEE.
- Wijerathna, R.M.S., Dissanayake, U., Navaratne, S., and Gunawardena, D., 2020. Evaluation of a Mobile SMS based Twitter Information Service for Rural communities: A Case study of Ipologama Vidatha Resource Center, Sri Lanka. *Journal of the Community Development in Asia*, 3(3), pp.19-28
- Sandareka, K.P.P., and Wedasinghe, N., 2017, Introducing E-Farmer Management System for Dedicated Economic Centres in Sri Lanka to Reengineer the Current Marketing Process. <ir.kdu.ac.lk>

Abbreviations and Specific Symbols

- ICT: Information Communication Technology
 IKMS: Information Knowledge Management Systems
 GPS: Global Positioning Systems
 IS: Information Systems
 IM: Information Management
 AI: Artificial Intelligent
 RNAi: Ribonucleic acid interference
 HARTI: Hector Kobbakaduwa Agrarian Research and Training Institute

Acknowledgment

Researchers would like to acknowledge all the staff of NILIS- University of Colombo, supervisors and HARTI for the guidance and the support they have given throughout the research work.

Author Biography



S.I. Baddegamage is a member of the British computer society and the Computer society of Sri Lanka. He is an entrepreneur and completed his Masters in CSU Australia. Currently, he is reading his Ph.D in the National Insitute of Library and Information Science – University of Colombo. He is a visiting lecturer at the University of Vocational Technology (*UNIVOTEC*). His research interests are information systems in agriculture, Games development and Sustainable development.



M.D.J.S. Goonetillake graduated from the University of Colombo. She obtained her Masters from Keele University, UK and her Ph.D. from Cardiff University, UK. She is a Senior Lecturer Gr. I and Head ISE - School of Computing, University of Colombo. Her research interests are Sensor Network Data management, Data Security, Social Networks and Applications, Data Management in Mobile Applications, NOSQL Data Sores.



L.N.C. De Silva graduated from the University of Peradeniya. She obtained her Ph.D. from the University of Colombo. She is a Senior Lecturer at - School of Computing, University of Colombo. Her Research Interests are ICT for Development (ICT4D), HCI for Development (HCI4D), Digital Knowledge Ecosystems, and Software