ICT Adoption in the Agriculture Sector: A Case Study in Sri Lanka

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***Abstract* — Information and Communication Technology (ICT) has become an indispensable tool in a number of sectors including the agricultural sector. It embodies all the digital technologies used to capture, store, process, and exchange information. Traditionally, agriculture has been the backbone of the Sri Lankan economy and in the transition towards food self-sufficiency in Sri Lanka, ICT integration in the agricultural sector would be imperative. Accordingly, the main objective of the present study was to develop a model for ICT integration in agriculture taking into account the Sri Lankan agricultural sector. The study was supplemented by a systematic review of literature which attempted to identify the different domains of research related to ICT in agriculture, existing frameworks for ICT adoption in agriculture around the world, and the global initiatives for ICT integration in the agricultural sector. As a case study, the study considered the Permanent Crop Clinic Program (PCCP) which is a plant pest and disease diagnostic and recommendation service implemented through farmer group structure called the Crop Clinics (CCs). CCs serve as an extension tool contributing to promote sustainable agriculture and also provides a unique educational experience for farmers through making recommendations based on the diagnosis of live samples. A questionnaire survey was conducted employing different stakeholder groups including officers from relevant government authorities, instructors, and farmers. The study further aimed to provide recommendations on where and how ICT can be better integrated into the above program in order to successfully realize the programme objectives.**

Keywords: ICT integration, Agriculture, Permanent Crop Clinic Programme

I. INTRODUCTION

Information and Communication Technologies (ICTs) are mostly used for the widespread transfer and sharing of information. Today ICT is developing rapidly all over the world. Sustainable agriculture focuses on producing long-term crops and livestock while having minimal effects on the environment [2]. In achieving sustainable development in the agricultural sector, ICT integration in agriculture is viewed as imperative [1].

Despite the immense potential of Sri Lanka to become agriculturally sustainable, there is a lack of established mechanisms for properly integrating ICT in the agriculture sector. The recent COVID-19 pandemic situation also has reiterated the importance of food self-sufficiency for world wide [3]. People tended to fulfill their own needs especially the food through their own cultivations. Through integrating ICT in agriculture it can be made easier for the people who are willing to acquire knowledge about new farming methods, trending agricultural tools etc. Recent advancements in technology which are ranging from micro devices to macro networks, have completely transformed modern global agriculture in a productive way. This transformation calls for investigations on the existing level of ICT adoption in agriculture and the future prospects.

Permanent Crop Clinic Program (PCCP) is also a new approach, which is introduced by the agriculture department to help farmers to provide beer advice on pest management to farmers when their crops are ill [4]. The farmers bring samples of their diseased plants for plant doctors called Agriculture Instructors to diagnose and prescribe safe, affordable and locally available pest management solutions. From this framework it will provide ICT knowledge related to enhance the agriculture productivity and information flow way for the farmers about the crop choosing, growing and selling of farming industry based on the PCCP objectives by surveying the agriculture officers and the farmers who connect with the PCCP.

II. OBJECTIVES

The major objective of this research is to introduce an operational framework for Sri Lanka for better integrating ICT in the Permanent Crop Clinic Program. That will to diagnose or to identify the causes for certain behavior of some farmers, agency staff, or other development actors. . The study aims to provide recommendations on where and how ICT can be better integrated in the above program thereby supporting the realization of the PCCP objectives. And some other specific objectives are as follows.

1) Specific Objectives

- To identify the different domains of research related to ICT in Agriculture.
- To review the existing models, frameworks, theories for ICT adoption in Agriculture.
- To review the global initiatives for ICT integration in the agricultural sector.
- To identify the major barriers, limitations, challenges in ICT integration in the Sri Lankan agricultural sector.
- To provide insights on the future of ICT in Agriculture.
- To develop an ICT adoption model for Sri Lanka for efficient and effective implementation of the Permanent Crop Clinic Program.

III. METHODOLOGY

Having discovered this research gap, the study has initiated a collaborative project to provide a solution for the prevailing farmer issues and also to increase the ICT literacy

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of the people of the agricultural departments of every region. As such inputs for the proposed solution will be coming from various research expertise from the past research studies from different countries. Since this research addresses a problem "The ICT Adoption in Agriculture Sector " which is rather under-investigated in Sri Lanka, this study takes an explorative approach.

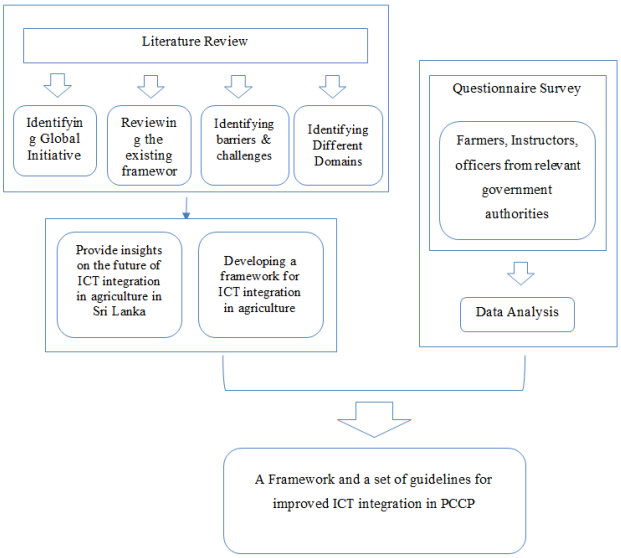

Fig. 1. Proposed Methodology

According to the proposed methodology, study includes reviewing the existing frameworks, identifying barriers and challenges and Identifying Different Domains. Considering those categories, the study aims to provide insights on the future of ICT integration in agriculture in Sri Lanka from that going to develop a framework for ICT integration in agriculture.

This study was proceeding with the aid of data collection techniques such as interviews, surveys and analysis of existing systems from farmers, instructors, officers from relevant government authorities. From reviewing the past studies and analyzing the data, the last aim is to introduce a framework and set of guidelines for improved ICT integration in PCCP.

The questionnaire was designed by considering two main areas which are Individual factors represent farmers and Organizational factors representing the agriculture departments and the agricultural officers. Considering that, two surveys have been carried out involving 30 individual farmers via interviews and questionnaires. Separate interviews have also been carried out with agriculture officers at the Department of Agriculture to identify what information is being gathered, analyzed and how these are currently being used. This was mainly conducted to identify issues faced by the farmers at different stages of the farming cycle and also identify the status of the ICT knowledge of the farmers and the agriculture officers. Questionnaires were distributed as a manual survey tool due to the fact that farmers don't have enough facilities related to the technology. During the surveys, analyzed the depth of Information and Communication Technology (ICT) usage among farmers to understand what type of recommendation can be made to overcome the current drawback situation using ICT.

According to this research study, by reviewing the past related studies, interviewing the people who are related to the agricultural field especially in PCCP, collecting data from related people, research study has recognized the major barriers and limitations that can be faced when integrating ICT in the agricultural sector. The following are some of the facts for integrating, implementation and effective use of ICT in the agricultural sector.

1. Inadequate computers and supporting technological infrastructure
2. Few trained human resources with computer use and research information management skills within the agricultural officers.
3. Limited laboratories to conduct agriculture research experiments related to ICT integrating in agriculture.
4. Poor ICT strategies and inefficiency of the current government structures, arrangement and management in the agricultural sector in Sri Lanka.
5. Not enough platforms to inform the new innovation that have been done from the researches, government and the private sectors related to the agricultural field to enhance the productivity of the agricultural field and from that develop the sustainability of the agricultural sector.
6. Lack of appropriate ICT policies and standards for monitoring, evaluating and assessing the ICT integrations in agriculture.

IV. Results and Discussion

When we consider the past research studies related to ICT in integrating agriculture, there are a number of technology development, application development and model development researches in all around the world. Among them, the following figures show the summary of the past research studies related to ICT integration in agriculture.

According to the pie chart most of the research has been done to introduce new innovative technologies integrating to the agricultural sector. Because of the recent COVID-19 pandemic most of the people have tended to produce their foods by their own and they have allured the use of products from their own countries. So the latest research related to ICT integrating in agriculture done about how smart technologies can be effectively used to link agriculture producers with markets to manage harvesting periods, reduce postharvest losses and wastage and ensure better market price for the farming community. For that they have considered the drone, sensor technologies, new innovative ICT tools and the latest applications. Most of the research studies are aimed to procure the effective solutions for the farmers and also the agriculture officers to improve the technical education and skills of the farming community, increase the availability and speed of internet connection in rural areas and lack of awareness of available also limit smart technology usage by farmers.

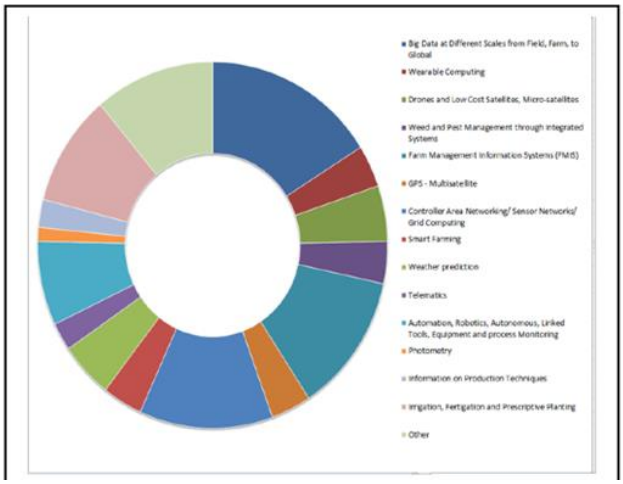

Fig. 2. Summary pie chart of past research studies

There are so many findings that are available at different stakeholders of the agriculture domain in different formats. When considering the frameworks that related to the knowledge management of ICT in the agricultural sector, most of them have been created to solve the current barriers of ICT literacy that have in the farming domain around the world as well as Sri Lanka.

V. CONCLUSION

Farmers and people who are related to the farming domain need accurate and reliable information at the right time to maintain their farming activities. Lack of information visibility for the crop choosing, growing and selling caused to decadence of the farming industry. Then it may affect the economic growth of the country and the whole human life-style. Thus, it is more important to provide the right information to make decisions precisely at the right time for the relevant communities. By review of related research, a huge number of researches based on developing new systems, ICT tools and the survey based researches to introduce new models, frameworks have been identified. But there is no any considerable development for distribute this knowledge among the agriculture sector and has not any particular platform including those innovations. For that purpose, we can integrate Information and Communication Technology for the agriculture sector. Thus, one of the main needs for the agriculture sector is to establish an information flow model connecting all stakeholders and related most suitable tools.
There are a number of same researches continually doing by the researchers, because of haven't any standard database including only all the research that have been done related to the ICT integrating in agriculture. To limit that weakness, as a future work this research study suggests publishing and maintaining a database for the agricultural journals, and online books about the agriculture related for help for the people who are interested in the agricultural sector as a knowledge sharing platform

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