

# Information Management for Sri Lankan Vegetable Farmers: Effectiveness of ICT Applications

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**ABSTRACT** The scenario behind Sri Lankan agriculture sector is that one-third of the country's population who engage in agriculture contributes only 7% of the GDP. The distribution of smaller amounts of income among large communities increases poverty among farmers in Sri Lanka. This limited income shrinks further due to sudden price drops, wastage, damages and oversupply. Various types of ICT-based solutions have been provided to eliminate poverty among farmers in Sri Lanka. However, research findings and literature show that most farmers are still suffering in poverty in an age of information even with the availability of many forms of information sources required for farmers. Due to some issues or reasons, farmers do not continuously use information systems and available information systems become obsolete within a short period due to lack of continual use. The research explores reasons for the limited use of information and communication technology-based agricultural information systems among Sri Lankan farming community. The research collected data using literature review, questionnaires and interviews from 76 farmers in four districts of Sri Lanka. Weekly average prices of three selected vegetables and selling offers received for a digital classified AgriApp were observed for one year and collected data was analyzed to identify farmers' and market behavior patterns. Research findings will help to increase ICT practices in agriculture, reduce wastage, control price fluctuation, and eliminate oversupply. It will ensure a continuous supply of vegetables and food security of the nation.

**KEYWORDS:** ICT adoption in Agriculture, Agriculture in Sri Lanka, Vegetable farmers.

## I INTRODUCTION

Sri Lanka is a country where 33% of the population is engaged in agriculture or agriculture related livelihoods but they only contribute 7% for the Gross Domestic Production (GDP) of the country [1], [2]. The Sri Lankan agriculture sector consists of several subsectors and vegetable subsector directly influences the entire population since it is mainly for the consumption of the citizens [3]. The main stakeholders of vegetable cultivation are farmers and they require various types of information throughout the crop cycle. The accuracy level of information must be high to engage in a successful crop selection, preparation, cultivation, maintenance, harvesting and post-marketing activities in agriculture. Cultivation will be profitable with proper use of information at the right time in the correct way [4]. There are many ICT-based agricultural information systems available in Sri Lanka which are dedicated to farmers, with objectives such as eliminating vegetable wastage, controlling price fluctuations, ensuring the prosperity of farmers, and minimizing poverty rate [5]. Findings of published literature and preliminary research show that critical issues in the Sri Lankan vegetable sector continue even though there

are various types of information systems. Excess stock generation, uncontrollable price fluctuations and vegetable wastage have become everyday situations in the sector [6]. This indicates that functioning information sources are not adequate; their contribution is not substantial enough for the sustainability of the vegetable agriculture sector in Sri Lanka or the farmers might have rejected using the provided systems for some other reason.

## II RESEARCH PROBLEM

A large number of information systems are available in Sri Lanka to assist farmers in obtaining information required during the crop cycle. These systems have been developed by government organizations as well as private sector companies. However, the lifetime of interactive informational systems has become very short due to underutilization. The main problem that is investigated in this research is "What are the factors which lead to farmers' refusal to the continuous use of interactive agricultural information systems in Sri Lanka". Interactive information systems become more robust and reliable with increasing use and interactions. Agriculture information systems have been estab-

lished after conducting researches with considerable investment. The research aims to identify reasons behind the continuous rejection of the use of interactive information systems by Sri Lankan farmers.

### III LITERATURE REVIEW

According to Walisadeera, Ginige, and Wikramanayake [4], farmers require various types of information during their farming activities. The nature of information required depends on the stage of the crop cycle [7]. Farmers in Sri Lanka obtain information via formal information sources such as AI (Agricultural Instructors), informal sources such as family members and neighboring farmers, digital information sources such as online systems and traditional information sources such as TV, radio and newspapers [8]. In addition, most of the Sri Lankan farmers have access to mobile phones and use mobile-based information systems mainly to obtain crop advices, market information, and weather details [9].

According to Sivagnanasundaram, Ginige, and Goonetillake [2], a large amount of food produced for human consumption gets wasted annually due to many basic errors of farmers. About 1,300,000,000 (1.3 billion) tons of food get wasted per year; it is almost 33% of the annual production. This wastage is a result of crop damages caused by pests, diseases, excess use of pesticides and incorrect handling of crops. The situation in Sri Lanka is not much different from the typical situation in the world and even in Sri Lanka a large amount of food wastage is reported every year. Sri Lankan farmers used to cultivate vegetables without using proper information sources. They used to cultivate as they wished with a very little amount of unreliable information in hand, which led to cultivation of less demanded crops. Farmers used to gather information via neighboring farmers, expert farmers or agrochemical merchants. They used to contact agricultural offices for pest and disease control information via very basic ways. Farmers use pesticides and fertilizers according to their experiences, without having any expert advice. It causes a high cost of production as well as crop losses. It was found that incorrect agricultural practices lower the quality of products and production [10]. Farmers fail to make the right decisions at the right time due to the lack of information or their inability to utilize the available information accordingly. This increases non-demandable commodities in the marketplace and increases vegetable wastage [11]. Finally, farmers face difficulties selling their products and they suffer with financial losses [12]. According to [13], farmers suffer losses due to incorrect crop selections, lack of professional advice, technologies, seeds, best practices and proper agricultural knowledge. This situation may occur due to financial issues, marketing difficulties, cultural or social problems, transport issues

and poor literacy levels (language and ICT) [11].

According to Sivagnanasundaram, Ginige and Goonetillake [2] there is a considerable knowledge gap between farmers and researchers. Therefore, the knowledge of researches must be directed into practice through farmers and other stakeholders. Unfortunately, this academic-industrial collaboration is not visible in Sri Lanka, but most of the developed countries have formed strong field-level collaborations and have gained favorable results.

Not only developed countries but developing countries also use ICT in the agriculture sector with positive results. According to a research done in Tamil Nadu state in India, farmers use a system that provides pest information and details about the disease [14]. Tologbonse, Fashola, and Obadiah [15] have mentioned that Nigerian farmers also have an ICT-based information system to obtain details regarding crop losses and pests. Research done by Hashemi, Hosseini, and Damalas [16] in Iran have described that they have identified that farmers have knowledge on pests/diseases and their effects on crops. They have further identified that farmers required proper training to handle situations.

The Sri Lanka paddy marketing board developed [www.pmb.lk](http://www.pmb.lk) and department of agriculture developed [www.goviya.lk](http://www.goviya.lk) which are the two available systems for farmers to obtain information regarding cultivation [17]. Silva, Goonetillake, Wikramanayake, and Ginige [18] mentioned that Govinana, a system introduced by the department of agriculture, Dialog Trade Net of Dialog mobile and 6666-Agri price index of Mobitel are active agriculture information systems available in Sri Lanka. These information systems provide timely information for farmers about crop prices, but farmers are reluctant to use these information systems since they need more efficient and timely information to make the most suitable decisions. The information system developed and introduced by Sri Lanka paddy marketing board was not popular among farmers due to the lack of basic ICT knowledge among farmers, unavailability of signal and other ground-level facilities and the non-user-friendly nature of the system [17]. Welandapola, Badumila and Govipola are classified AgriApps that are available for farmers to directly access the vegetable market by avoiding intermediaries [1]. Further, as per Ekanayake, and Sirisuriya [17], Dialog TradeNet and Mobitel price index provide only price information. The price becomes an unimportant matter after harvesting since they have to sell at any price as soon as possible. Therefore, farmers use these systems very rarely.

Jayathilake, Mudalige, Gow, Waidyanatha, and Perera [19] mentioned that the high cost of information is a barrier

to access the ICT systems of the agriculture sector of Sri Lanka. Narmilan [20] describes that due to constraints such as lack of infrastructure facilities, and training, different research priorities, lack of skills, community and political issues, farmers may be reluctant to use ICT information systems in Sri Lanka. Subashini and Fernando [21] also mentioned that lack of knowledge is the biggest constrain for the use of ICT in the agriculture sector in Sri Lanka. In addition, language barriers and high costs also have a negative impact on the use of ICT among farmers. As a result, farmers do not use farming information systems. Moreover, reasons such as the lack of awareness, inaccessibility of systems and difficulties of handling systems further affirms their decision to not to use these farming information systems [22]. Jayathilake, Mudalige, Gow, Waidyanatha, and Perera [17] also say that cost of technology, lower trust regarding systems, no training, infrastructure issues, non-availability of support services resistance and limitations in adopting new technologies are also some of the constraints for the use of ICT systems for agriculture purposes in Sri Lanka. Pamarathna [23] mentioned few more reasons for not using ICT systems by Sri Lankan farmers and they are; lack of knowledge, training issues, problems related to language and unawareness about benefits. Apart from that, complications in the sector, issues regarding the level of outside support, farming experiences, infrastructure, information availability, farmer's personality, ability to learn new things, ICT knowledge, cost of ICT equipment, user-friendliness, trust about ICT systems, training issues, system integration issues and availability of software also have become reasons to not to use ICT enabled agriculture systems in Sri Lanka [17].

According to Wijerathna, Dissanayake, Navaratne, and Gunawardena [9] government operating information centers are not formally receiving information. Offices in some particular subject areas are not willing to provide information properly. This may be due to the bureaucratic nature and politics of government offices in Sri Lanka. Technical issues such as the non-availability of systems are also an issue in the access of information. The poor coordination between farmers, economic centers and buyers, is the biggest issue in the Sri Lankan agricultural sector.

#### IV METHODOLOGY

Published literature was used to identify the nature of vegetable cultivation, associated issues and ICT solutions available in the agriculture sector in Sri Lanka. There were several ICT-based agriculture information systems identified during the literature review. According to literature, www.pmb.lk, www.goviya.lk, Govinana, Dialog Trade Net, 6666-Agri price index, Welandapola, Badumila and Govipola are some of the available agriculture information systems and applications for Sri Lankan farmers. The

research investigated how frequently these listed systems were used by farmers by studying the facilities these systems offer to gain a direct access to the market. In addition, the ability to sell vegetables via each of the listed information systems is also considered.

The research selected one application for further investigation. The selected App was the only system that facilitates selling vegetables online. The observed App was one of the most promoted agriculture apps in 2019. This App is available for farmers to forward their selling offers and buyers can purchase vegetables through the system without any influence of intermediates. The research observed the behaviour of few vegetables. Selected vegetables were Carrots, Cucumber and Brinjal. The number of selling offers received for selected commodities was recorded during 53 weeks of the year 2019. In addition, the research obtained weekly market prices of the same selected three vegetable commodities during 53 weeks of the year 2019 by accessing the online weekly price index of Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI).

Apart from that, a field research was conducted in Wadagolla and Sonuththara villages in Matale district, Hiswalla and Butpitiya villagers in Gampaha district, Magamma in Kegalla, and Ambagaha Palassa in Mahanuwara district. The questionnaires were given to 105 farmers in Wadagolla, Magamma, Ambagaha Palassa, Hiswalla and Butpitiya villagers and collected 76 responses. In addition, direct unstructured interviews were conducted with 16 farmers in Sonuththara village to obtain information regarding ICT-enabled technologies. MS Excel was used as the analytical tool since there were no many complicated data to be analyzed. The same package was used to create charts and graphs required for the demonstration of collected data.

#### V DATA ANALYSIS

Average weekly wholesale prices of carrots, cucumber and brinjal during 52 weeks of the year 2019 were observed and drastic price fluctuations were identified. Figure 1 describes the average weekly price of carrots in 2019 at Dambulla Dedicated Economic Centre (DDEC).

Figure 2 describes the average weekly prices of cucumber in 2019 at DDEC. Figure 3 shows the weekly average prices of brinjal during 2019 at DDEC.

A similar pattern can be observed in all these 03 commodities during the research period. Price hikes can be observed during the 4th week, 16th to 19th weeks and 46th –50th weeks, with some slight drops in the middle.

The survey identified that only 120 selling offers were received from farmers for carrots, cucumber and brinjal.

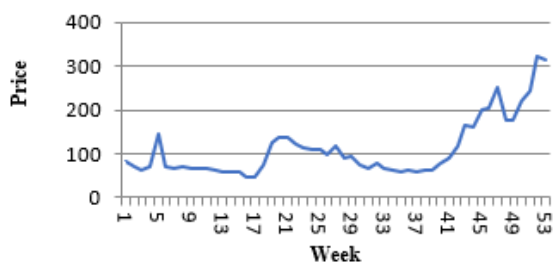


Figure 1: Carrot weekly average price details in 2019 at DDEC

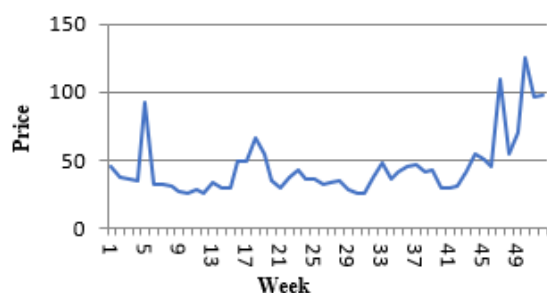


Figure 2: Cucumber weekly average price details in 2019 at DDEC

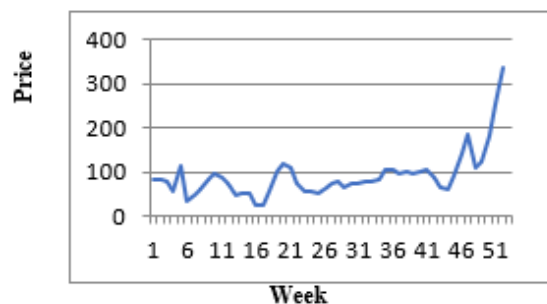


Figure 3: Brinjal weekly average price details in 2019 at DDEC.

There were 53 selling offers for carrots, 26 selling offers for cucumber and 41 offers for brinjal during the period. These price patterns show that vegetable prices are fluctuat-

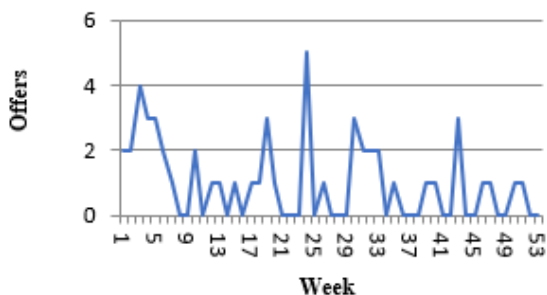


Figure 4: Carrots weekly selling offers in 2019.

ing during the year. Sudden price drops, as well as extreme

price hikes, are also visible within short intervals.

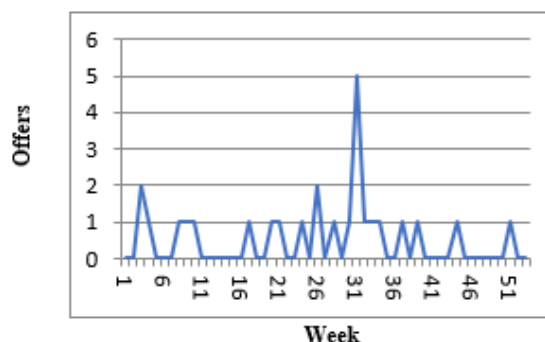


Figure 5: Cucumber weekly selling offers in 2019.

The recorded selling offers for the same commodities during the same period are illustrated through graphs. Figure 4 shows that farmers have only received a very few selling offers for carrots during the year. There is hardly any change in other commodities as well. Figure 5 depicts the situation of cucumbers.

Figure 6 presents weekly selling offers received by farmers for brinjal during 2019 via the selected application.

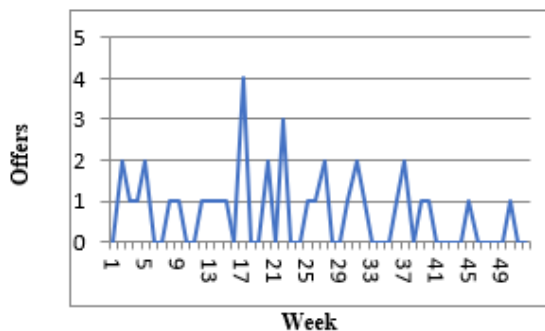


Figure 6: Brinjal weekly selling offers in 2019..

Table 1 summary the answers given by farmers for the questions that were directed at them.

According to their responses, most farmers are not using the internet but have mobile phones. They are not aware of agricultural information systems and they are hardly showing any interest in using them.

Table 1: ICT awareness among farmers

Question	Yes	No
Are you using Internet	11	53
Do you know about Agriculture IS	16	48
Have you used agriculture IS	5	61
Do you trust agriculture IS	4	44
Do you have a mobile phone	69	7

The most important factor that was identified during the private discussions that were carried out with farmers was that they used to contact their regular merchants at DDEC to get price details. If the price is satisfactory, the crop will be harvested and taken to DDEC. Otherwise, they were in the habit of leaving the crops in the field without harvesting them. Farmers do this because the farmers find it difficult to recover the harvesting costs and transportation costs from the profit they gain due to the low prices of the vegetables.

The Table 2 shows how frequently farmers use the agricultural information system which was identified during the literature review.

Table 2: Web-based agriculture information systems and Apps

App/Web site	Can sale vegetables?	Observation
www.pmb.gov.lk	No	Informational web site with price details
www.goviya.lk	No	Cannot access
Govinane App	No	Underdevelopment and cannot access
DialogTradeNet	No	Only provide price details
666 AgriPrice Index	No	Only provide price details
Weladapola App	No	Cannot access and very complicated
Badumila App	No	Only provide price details
Govipola App	Yes	Possible to add selling offers

## VI DISCUSSION

According to the published literature, there is a requirement to introduce ICT-enabled information systems for farmers in Sri Lanka. It is possible to solve most of the critical issues regarding proper crop selection, obtaining the required information, selecting an accurate market, minimizing stock wastage, optimizing prices, and eliminating poverty among farmers theoretically. However, when it comes to practice, the situation is much different. Issues due to lack of awareness, literacy issues, lack of ICT skills and many other factors can be considered as barriers for the use of a technology based information system by farmers in Sri Lanka.

Price details of selected commodities are showing the general market patterns in Sri Lanka. This nature of the market does not show an impact of provided ICT solutions on vegetable cultivation in Sri Lanka. Effective ICT-based agricultural information systems must support market stability. Elimination or control of price fluctuation is

one of the main objectives of all the provided information systems. Price increments occur due to high demand, low supply and the price drops due to low demand and high supply. The demand for vegetables in Sri Lanka increases only during festival seasons. There are no many variations in demand during other periods of the year. According to this scenario, low supply can be considered the most influencing factor for vegetable price increment. Similarly, oversupply leads to price drops in the market.

During the time period, the farmers rarely used selected application. Farmers showed no interest in selling their products via apps. Since the farmers seldom use the application, the level of the reliability of the system will also be reduced. As a result of the minimal use of the application, it may wipe out from the system within a short time period. This may cause not because of the non-availability of mobile devices but due to unawareness, lack of trustworthiness and lack of ICT skills of farmers. Farmers consider the use of ICT-based interactive information systems as something which is beyond their understanding. They do not face any difficulties during time periods when the market price of vegetables is high but they suffer during time periods when the price is low. They do not have any reason to use ICT-based information systems when the demand for vegetables is high. Farmers need assistance only in situations where the price drops. It is required to use these systems continuously to increase their reliability. Since farmers do not have any motivation or a reason to use the systems, they simply start neglecting them within a short time.

Table 2 describes the nature of available web-based agricultural information systems and AgriApps. A stranger can interact only with Govipoala App as Govinane is still under construction. Furthermore, Weladapola App and www.goviya.lk are also not accessible. All the other systems are only providing information.

## VII RECOMMENDATION

Most of the farmers use mobile devices merely for communication purposes. Therefore, there should be effective awareness campaigns along with the promotion of interactive agricultural information systems. Farmers must be empowered with benefits that can be obtained from such systems. Simple, straightforward systems with native language will increase interactive mobile systems in farmers' communities. It is recommended to use innovative marketing strategies during the introduction and research further the nature of factors that can be influenced to increase the use of ICT systems among farmers in Sri Lanka.



## VIII CONCLUSION

At the time being, farmers are suffering due to their low income levels. Their income levels lowers with price drops, increased wastage, marketing issues and crop damagers. Incorrect crop selection, wrong agricultural practices, crop[7] destructions due to pests and diseases, non-availability of timely information lead to these issues. The use of a proper agricultural information system can solve these issues, but most farmers are reluctant to use them due to unawareness, low-level ICT skills, language barriers, and lack of trust in[8] ICT-based information systems. It is not possible to obtain benefits from ICT-based agricultural systems without using them. Awareness programmes, ICT skill development programmes and systems with native languages will increase the use of ICT-based information systems among farmers in Sri Lanka.

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## ABBREVIATIONS AND SPECIFIC SYMBOLS

- GDP: Gross Domestic Production
- DDEC: Dambulla Dedicated Economic Centre
- ICT: Information Communication Technology
- HARTI: Hector Kobbekaduwa Agrarian Research and Training Institute

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