

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

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Abstract- The paramount scenario behind Sri Lankan agriculture is that one-third of the country's population which engages in agriculture contributes to 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 the information age 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 continued use. The research explores reasons for the low 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 offer received for a digital classified AgriApp was observed for one year and collected data was analysed to identify farmers' and market behaviour patterns. Research findings will help increase ICT practices in agriculture, reduce wastage, control price fluctuation and eliminate oversupply. It will ensure a continuous supply of vegetables and food security to the nation.

Keywords: *ICT, agriculture, Sri Lanka, vegetable farmers*

I. INTRODUCTION

Sri Lanka is a country with 33% of the population engaged in agriculture or agriculture-related live hoods and only contributes 7% for the Gross Domestic Production (GDP) (Sandareka et al., 2020, Sivagnanasundaram et al., 2019). The Sri Lankan agriculture sector consists of several subsectors and vegetable subsector directly influencing the entire population since it is mainly for consumption (Samarasinghe et al., 2013). 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 higher for 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 correct way (Welisadeera et al., 2015). There are many ICT-based agricultural information systems available in Sri Lanka dedicated to farmers, with objectives such as eliminating vegetable wastage, controlling price fluctuations, the prosperity of farmers, and minimizing poverty (Weerasinghe and Priyadharsan, 2017). 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 stocks generation, non-controllable price fluctuations and vegetable wastage have become everyday situations in the sector (Pushpakumara, 2011). 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 farmers have rejected using provided systems.

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 investigated in this research is “What are the factors which lead to refuse by farmers continuous use of interactive agriculture information systems in Sri Lanka.”. Interactive information systems become more robust and reliable with increasing use and interactions. Agriculture information systems have been established after researches with considerable investment. The research aims to identify reasons behind rejecting the continuous use of interactive information systems by Sri Lankan farmers.

III. LITERATURE REVIEW

According to Welisadeera et al., (2013), farmers required various types of information during their farming activities. The nature of information required depends on the stage of the crop cycle (Lokanathan et al., 2012). Farmers in Sri Lanka obtain information via formal information sources such as AI (Agricultural Instructors), informal sources such as family members and neighbouring farmers, digital information sources such as online systems and traditional information sources such as TV, radio and newspapers (Rajapaksh et al., 2017). In addition, most Sri Lankan farmers have access to mobile phones and use mobile-based information systems mainly to obtain crop advices, market information, and weather details (Wijerathna et al., 2020).

According to Sivagnanasundaram et al., (2019), a large amount of food produced for human consumption gets wasted annually due to many basic errors of farmers. The volume gets wasted about 1,300,000,000 (1.3 billion) tons of foods per year. It is almost 33% of annual production, and the reasons behind it identified as pest, disease, crop losses with excess use of pesticides and incorrect handling. The situation in Sri Lanka also does not much different than the typical situation in the world and 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 wish with a very little amount of unreliable information, leading to cumulating less demanded products in the marketplaces during harvesting seasons. Farmers used to gather information via neighbouring farmers, expert farmers or agrochemical merchants. They used to contact agricultural offices for pest and disease 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 (Van Buggen et al., 2015). Farmers fail to make the right decisions at the right time due to a lack of information or not utilizing available information accordingly. This increases nondemandable commodities in the marketplace and increases vegetable wastage (Sivagnanasundaram et al., 2018). Finally, farmers face difficulties selling their products and suffer with financial losses (Silva et al., 2012). According to Ginige et al., (2016), 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, unreachable locations or transport issues and poor literacy levels (language and ICT) (Sivagnanasundaram et al., 2018).

Further to Sivagnanasundaram et al., (2019), there is a considerable knowledge gap between farmers and researchers. Therefore, the knowledge gained out of researches must be diverted into practice through farmers and other stakeholders. Unfortunately, this academicindustrial collaboration is not visible in Sri Lanka, but most developed countries have formed strong field-level collaborations and have proven results.

Not only developed countries but developing countries also use ICT in the agriculture sector with positive results. According to research done in Tamil Nadu state in India, farmers use a system that provides pest information and details about the disease (Phiri et al., 2018). Tologbonse et al., (2009) have mentioned that Nigerian farmers also have an ICT-based information system to obtain details regarding crop losses and pests. A

research done by Hashemi et al., (2009) in Iran have described that they have identified farmers have multiple kinds of ideas of pests/disease and effects of them. They have further identified that farmers required proper training to handle situations.

The Sri Lanka paddy marketing board developed www.pmb.lk and DOA developed www.goviya.lk are two systems available for farmers to obtain information regarding cultivation (Ekanayake et al., 2016). Silva et al., (2013) 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 price information for farmers, but farmers are reluctant to use these information systems since they need much efficient and timely information to make most suitable decisions. The information system developed and introduced by Sri Lanka paddy marketing board was not popular among farmers due to lack of basic ICT knowledge among farmers, unavailability of signal and other ground-level facilities and the non-user-friendly nature of the system (Ekanayake et al., 2016). Welandapola, Badumila and Govipola are classified AgriApp as available for farmers to directly access the vegetable market by overcoming intermediates (Sandareka et al., 2020). Further, as per Ekanayake et al., (2016), Dialog TradeNet and Mobitel price index provide only price information. The price becomes a non-important matter after harvesting since they have to sell at any price as soon as possible. Therefore, farmers use systems very rarely.

Jayathilake et al., (2015) mentioned that the high cost of information is a barrier to accessing ICT systems in the agriculture sector of Sri Lanka. Narmilan (2017) describes that due to constraints such as infrastructure facilities, training, research priorities, skills, community and political issues, farmers may be reluctant to use ICT information systems in Sri Lanka. Subashini and Fernando (2017) also mentioned that lack of knowledge is the biggest constrain for ICT use in the agriculture sector in Sri Lanka. In addition, language barriers and costs also give a negative impact on ICT use among farmers. As a result, farmers do not use farming information

systems due to lack of awareness, inaccessibility of systems and difficulties of handling systems (Sandareka and Wedasinghe, 2017). Jayathilaka et al., (2015) also say that 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 also some of the constraints for the use of ICT systems for agriculture in Sri Lanka. Pamarathna (2018) added some constraints for not using ICT systems by Sri Lankan farmers as knowledge lack, training issues, problems related to language and unawareness about benefits. Apart from that, complications in the sector, 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 (Jayathilaka et al., 2015).

According to Wijerathna et al., (2020), government operating information centres 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 nonavailability 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 Lanka agriculture 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 ICT agriculture information systems and Apps for Sri Lankan farmers. The research investigated the level of interactions with listed systems by observing the possibility

of direct access to the market using facilities. In addition, it considered the ability to sell vegetables via each of the listed information systems.

The research selected one App 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 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 2019 by accessing the online weekly price index of Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI).

Apart from that, field research was conducted in Wadagolla and Sonuththara villages in Matale district, Hiswalla and Butpitiya villagers in Gampaha district, Magamma in Kegalla Ambagaha Palassa in Mahanuwara district. The questionnaires were given to 105 farmers in Wadagolla, Magamma, Ambagaha Palassa, Hiswalla and Butpitiya villagers and collected 76 with 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 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).

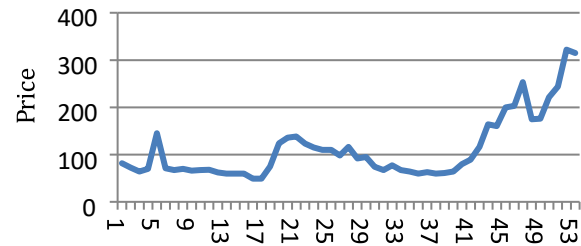


Figure 1: Carrot weekly average price details in 2019 at DDEC

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

There is a similar pattern can be observed in all these 03 commodities during the research period. Price hike can be observed during the 4th week, 16th to 19th weeks and 46 – 50 weeks, while slight drops in the middle.

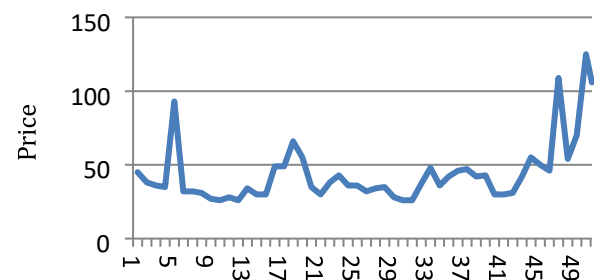


Figure 2: Cucumber weekly average price details in 2019 at DDEC

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

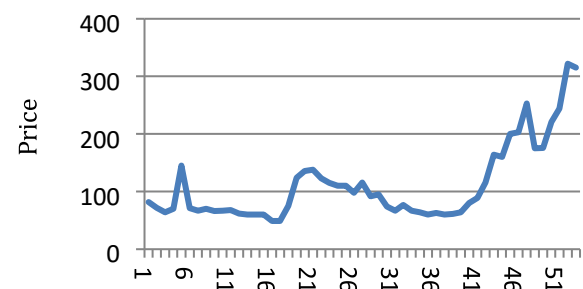


Figure 3: Cucumber weekly average price details in 2019 at DDEC

during 2019. 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 fluctuating during the year. Sudden price

drops, as well as extreme price hikes, are also visible within short intervals.

Recorded selling offers for the same commodities during the same period converted into graphs.

Figure 4 shows that it has only received very few selling offers for carrots during the year. There is no much change in other commodities as well. Figure 5 describes the situation of cucumbers.

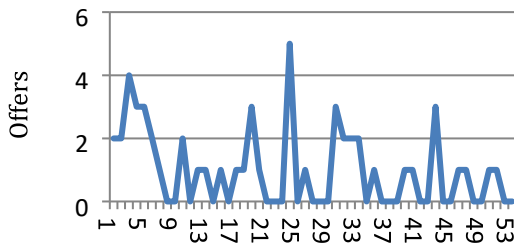


Figure 4: Carrots weekly selling offers in 2019

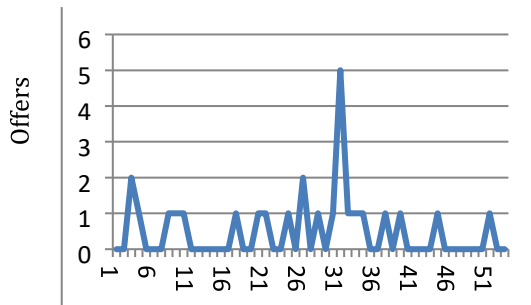


Figure 5: Cucumber weekly selling offers in 2019

Figure 6 presents weekly selling offers received for brinjal during 2019 from farmers for the selected app.

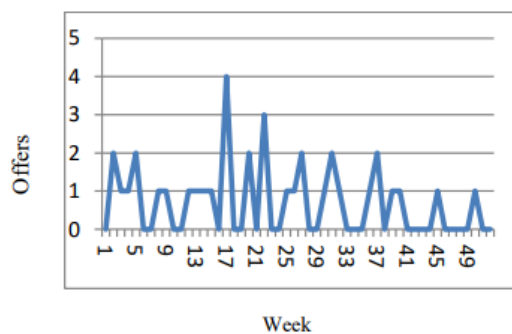


Figure 6: Brinjal weekly selling offers in 2019

Table 1 describes the summary of answers of questioners distributes among farmers.

According to the received response, most farmers are not using the internet but have mobile phones. They are not aware of agriculture

information systems not showing any interest in using them.

The most important factor identified during private discussions 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 abandoning the crop in the field. Farmers do this because of the difficulty of recovering the minimum harvesting costs and transportation costs in lower price situations.

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 Table 2 shows the summary of the level of interaction in the agriculture information system identified during the literature review.

VI. DISCUSSION

According to published literature, there is a requirement to introduce ICT-enabled information systems for farmers in Sri Lanka. It is possible to solve most critical issues such as 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 in awareness, literacy issues, ICT skills and many more factors come forward as constraints.

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

Price details of selected commodities are showing general market patterns in Sri Lanka. This nature of the market shows no impact of provided ICT solution for vegetable agriculture in Sri Lanka. Effective ICT-based agriculture information systems must support market stability. Elimination or control of price fluctuation is one of the main objectives of provided all the information systems. Price increments occur due to high demand, low supply and 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. Same as the oversupply leads to price drops in the market.

The level of interaction is very low with the selected App and farmers during the year. Farmers showed no much interest in selling their products via Apps. Therefore, the number of interactions becomes low and the level of reliability of the system also becomes low. This

may wipe the system from the user within a short period. It is not because of the non-availability of mobile devices. This is due to mainly non-awareness, not trustworthiness and lack of ICT skills.

Farmers consider the use of ICT-based interactive information systems as an overhead. They do not face any difficulties during high price periods but suffering low price periods. They do not have any reason to use ICTbased information systems during demanded situations. Farmers need assistance only when price drops situations. It is required to use systems continuously to increase reliability. Since there is no motivation or reason to use systems, farmers were neglecting them within a short time.

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

VII. RECOMMENDATIONS

Most of the farmers use mobile technologies just for communication purposes. Therefore, there should be strong awareness campaigns as well as ICT skill development programs launched along with the promotion of agriculture interactive 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

Farmers are suffering in poverty due to low income. Their income levels become lower with price drops, wastage, marketing issues and crop damagers. Incorrect crop selection, wrong agricultural practices, pest and disease, non-availability of timely information lead to these issues. The use of a proper agriculture information system can solve these issues, but

most farmers are reluctant to use them due to non-awareness, low-level ICT skills, language barriers, and lack of trust in ICT-based information systems. It is not possible to obtain benefits from ICT-based agricultural systems without using them. Awareness programs, ICT skill development programs and systems with native languages will increase ICTbased information systems among farmers in Sri Lanka

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