



Factors Affecting the Utilization of Information & Communication Technology (ICT): A Case of Badulla & Nuwara Eliya Potato Farming Community, Sri Lanka

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Abstract: ICT upgrades farmer knowledge thus, enhances overall production and marketing aspects in agricultural systems. However, transferring traditional farmer into new technologies in developing countries is a significant challenge. At present, there have been many ICT tools which introduced to farmers in Sri Lanka. Thus, the central question is whether agro-community is utilizing these different ICT tools in a productive way. Therefore, the objective of this study is to explore the factors which affect the overall usage of ICT tools of potato farmers in Sri Lanka and their perception on future use of ICT. Primary data was collected from 241 farmers randomly in Badulla and Nuwara Eliya Districts using a pre-tested questionnaire. Correlation analysis was deployed to elicit the relationship between selected socio-economic factors of the farmer and the number of ICTs those farmers have utilized. Results revealed education level ($p < 0.05$, $r = 0.659$), average monthly farm income ($p < 0.1$, $r = 0.352$) and number of crops cultivated ($p < 0.05$, $r = 0.851$) by farmer were positive and significant with the number of ICT appliances used by the potato farmer. Age ($p < 0.05$, $r = -0.7432$) and years of experience engaged in agricultural activities ($p < 0.05$, $r = -0.254$) were negative and significant with the number of ICT appliances used by the potato farmer. Further, 60% farmers have used internet once a week to gather agriculture related information. Another, 13% have used GPS and only 1% have used e-mail. Even though there have been numerous ICT tools, still ICT literacy of local farmers were not up to the satisfactory level. This implied Sri Lankan agriculture sector is not fully utilizing ICT in agriculture. Perhaps changing the way or mode of delivering of ICT tools may cause positive influence in agriculture. Rather than focusing advanced ICT appliances and tools, it is recommended to exploit the full potential of current ICT appliances and tools to disseminate vital information. Consideration of farmer accessibility of different ICT appliances and tools are much important to decide the next step of agriculture modernization in Sri Lanka.

Keywords: Agricultural Information, ICT, Potato Farming

1. Introduction

Facilitate disseminating and sharing of information is one of the key success factors in modern agricultural systems around the globe. Continuous flow of accurate information through different modes may enhance farmer knowledge thus, it directly increases both production and marketing aspects of agricultural commodities. In other words, it lessens inefficiencies in all farming activities. ICT is one such approach which used to disseminate information promptly

regardless to distance. ICT could be described in various ways and most prominently it's a computer-based technology. ICT is a process of gathering, distributing, and communicating information through computers and computer base networks [11]. ICT is becoming a profound game changer in every sector. ICT has vast and enormous strength to revolutionized agriculture sector in any country. Adaptation to technology is a complex and a dynamic process which governed by many factors. Hence, transferring traditional farmer into new technologies in developing

countries is a significant challenge. Nevertheless, successful transformation always creates a commercial and market-oriented producer. The economic rationale for the farmers can access to the manage risk and uncertainties regarding production and marketing. The better farmers manage these risks and uncertainties, the more profitable their businesses will be. Information and Communication Technology facilitates awareness among farmers and access to market information. The hypothetical evidence from research finds that mobile phones, radios, and televisions are the most important means of ICT for farmers to access info awareness, access and knowledge related to agriculture [14, 3]. Telephone facilities (especially mobile phones) are reported to increase access to people living in rural areas. Despite poorly developed rural electronics, mobile phone use is at an all-time high.

Rural families have gained various advantages from mobile technology. Its relevance in terms of usability is evident in the senses of urgency and emergency [4]. Farmers, for example, reported utilizing ICTs to learn about market days, where items might be sold, and how to discover appropriate market areas for efficient produce marketing [15].

Farmers have been reported to use conventional ICTs, including radio and television, to access agriculture-related information [5, 12]. Farmers, on the other hand, have been found to utilize ICT applications such as calls and short messaging services often [16]. This indicates that the use of mobile phones is developing and becoming more important in people's lives, assisting in further development and improved communication. Computers and the internet have also been used to communicate agricultural information and data.

Farmers have also been reported to use traditional ICTs such as radio and television to access agriculture-related information. Farmers, on the other hand, have been discovered to use ICT applications such as calls and short messaging services regularly [8]. This indicates that the use of mobile phones is increasing and is becoming more essential in people's lives, contributing to further growth and better communication. Computers and the internet have also been used to transmit agricultural data and information.

In this current situation Sri Lankan agriculture sector has faced for a substantial issue in Agriculture Information Communication Technology system. Sri Lanka has also been taken some initiatives to use ICT for rural agricultural development [2]. But its effectiveness in overcoming rural backwardness is rather sluggish in spite of relatively better literacy rates among rural communities compared to other South Asian countries. In spite of rapid economic growth in the recent past, regional disparities are widening in the country indicating negative effects of urban biased development. This situation is visible in the western province and coastal areas of the country [6].

Access to the right information at the right time through the right medium is crucial for people involved in the agricultural sector. This includes farmers, fishers, foresters, policymakers, industries and other actors in the agricultural

value chain. Increasingly, the challenges faced by small holder farmers as a result of climate change, irregular rainfall patterns, attack of pest and the onset of diseases, drought, desertification are detrimental to the agriculture sector's goals. However, opportunities exist through innovative ICT solutions to address a number of these challenges. In recent past, the role that ICTs play in promoting innovation in the agricultural sector has been phenomenal and potentially transformative. Smallholder farmers, particularly women and youth involved in the sector, have a huge advantage when the right ICTs are induced into the agricultural value chain. The access to the right information at the right time gives them the capacity to make informed decisions that would improve their livelihoods, make agri-business more attractive and play a major role in ensuring food security. The Role of ICTs in agriculture; Improving market access, Agricultural extension and advisory services, Climate change adaptation and early warning, Food safety, traceability and certification, financial inclusion, Insurance and risk management and Precision Agriculture.

Farmer is the principal node of agricultural production thus, decides how, when and what to produce. Timely and accurate information is pivotal for farmer to decide optimal combination of resource allocation in the production process. This ultimately derives the efficiency in the marketing process. Since, information acts as a key player, farmer awareness, availability, accessibility and usability of different ICT appliances may decide the overall productivity in the agriculture sector. At present, there have been many ICT tools which introduced to farmers, traders and other actors within the agricultural value chain by both private and public entities in Sri Lanka [10]. Those tools provide information related to production and marketing. However, yet information asymmetry presents in the agricultural markets in the developing nations. This implies that the farmers and other actors in the value chain are not utilizing ICT properly to harness its benefits [1]. Thus, it is important to understand the present ICT usage behavior of farmers in Sri Lanka before advance further. In light of this, sole objective of this study is to explore the factors which affect the overall use of ICT appliances of potato farmers in Sri Lanka and their perception on future use of ICT.

2. Methodology

2.1. Study Area

Potato cultivation in Sri Lanka is mainly concentrated within the Uva and Central Provinces of Sri Lanka and it contributes 99% to the total national production. The highest number of potato cultivation extents are located in Badulla (77%) and Nuwara Eliya (22%) districts. Therefore, Badulla and Nuwara Eliya districts were selected for the study. Three DS divisions (*Welimada*, *Uva Paranagam* and *Bandarawela*) were selected from Badulla district, while one DS division (Nuwara Eliya) was selected from Nuwara Eliya district based on the respective potato land extent.

2.2. Sample and Sampling Technique

The population of the study was the total number of potato farmers in both provinces. Multi-stage random sampling was deployed to select farmers. Several GN divisions were selected from each DS divisions based on the total number of potato farmers. Accordingly, 89 farmers from *Welimada*, 63 farmers from *Uva Paranagama*, 51 farmers from *Nuwara Eliya* and 38 farmers from *Bandarawela* were proportionately selected for the study. Total sample of the study was 241 farmers.

2.3. Data Collection & Analysis

Both primary and secondary data was used for the study. Primary data was collected from both farmers and key informants. Secondary data was collected from various publications and reports. Data collection was carried out in the latter part of year 2019. A pre-tested structured questionnaire was administered to collect data from the farmers. Key informant interviews were carried out for the selected stakeholders using a key informant interview guideline.

Both descriptive (frequencies and percentages) and inferential statistics were used to analyze and interpret data. Correlation analysis was deployed to elicit the relationship between selected socio-economic factors of the farmer and the number of ICTs those farmers have utilized (Osondu & Ibezim, 2015). It is assumed that the micro level socio-economic factors have an impact on ICT usage of farmers. Hence, for the model for correlation analysis is as follows:

$$Y=f(X_1, X_2, X_3, X_4, X_5, X_6, ei)$$

Where;

Y=number of ICTs farmer has utilized

X1=Age of the farmer in years

X2=Gender of the farmer

X3=Education level of the farmer

X4=Farming experience of the farmer in years

X5=Average monthly farming income of the farmer in LKR

X6=Total number of crops cultivated by the farmer

ei=Error term

Accordingly, number of ICTs farmer has utilized depends on the selected socio-economic factors such as age (years), gender, education level (Grade one to five, grade 6-11, sat for O/L, Passed O/L, Sat for A/L, Passed A/L, Graduated and Diploma/NVQ), farming experience (years) and average monthly farming income (LKR).

3. Result and Discussion

Result revealed that, majority (29%) of farmers were in the age of 46 years to 55 years. In addition, 16% were above the age of 56 years. Interestingly, only 14% of farmers were below 25 years of age. This implies only trivial number of youngsters were attracted and retained with the cultivation process. The average age of a farmer was 52 years. Majority (29%) of farmers had 16 to 20 years of experience in agricultural activities and average was 17 years. Majority of

farmers were used to extract information through traditional channels such as from traders, commercial farmers etc. [9] specified that farming experience caused more excellent harvests and experienced agriculturalists could raise their productivity by implementing advanced technologies in their agronomic practices. Hence, adaptation to novel ICT appliances may inflict a challenging scenario. Majority (84%) of farmers were males. The farmer respondents were more of males than females. However, justify the generally held view and common practice in developing countries that extension should be directed to the males. Comparing with other countries women contribute to the agriculture sector more than 60%. [7]. Educated individuals are predicted to have positive aspects near farming skills, awareness, and information compared to unschooled people [13]. When referring to education level of the farmers, majority (46%) had educated up to grade six to eleven. Only 2% had completed their advanced level. Sample did not have any graduates. Interestingly, 1% have obtained Diploma or NVQ qualifications. However, in general sample had reasonable education background. Further, more than 90% literacy rate was observed within the sample. Majority (33%) farmers had four family members in their household (Table 1).

Table 1. Demographic Characteristics of the Sample.

Demographic Character	Category	Frequency (n=241)	Percentage
Gender	Male	202	84
	Female	39	16
Age Category	<25	34	14
	26-35	53	22
	36-45	46	19
	46-55	69	29
	>56	39	16
	Grade 1-5	46	19
Education Category	Grade 6-11	112	46
	Sat for O/L	41	17
	Passed O/L	19	8
	Sat for A/L	14	6
	Passed A/L	6	2
	Graduated	0	0
Marital Status	Diploma / NVQ	3	1
	Married	210	87
	Single	31	13
	<5000	8	3
	5001-10000	10	4
	10001-15000	16	7
Monthly Income (LKR)	15001-20000	28	12
	20001-25000	35	15
	25001-30000	58	24
	30001-35000	45	19
	>35001	41	17
	<5	43	18
Farming Experience	6yr-10yr	55	23
	11yr-15yr	20	8
	16yr-20yr	69	29
	>21	54	22

Source: Survey Results.

Majority (24%) of farmers earned LKR 25,001.00 to 30,000.00 monthly farm income and average monthly farm income was LKR. 29,467.00. Monthly farming income was

derived only from agricultural sources of the respondent. The lowest average gross monthly income was noted in *Bandarawela* DS division. Hence, farmers were not willing to take risks when engage in the cultivation process. This is the major reason why farmers tend to restrict in traditional approaches.

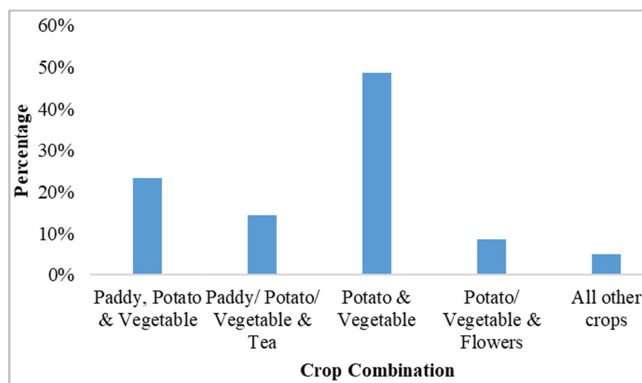
Nearly half of the farmers have engaged in potato and vegetable cultivation. Another 23% have engaged in potato, vegetable and paddy. Paddy cultivation was prominent in

Welimada DS Division. Interestingly, in *Bandarawela* there was an increasing demand for cut flower cultivation. This is mainly due to exercise of irregular cultivation system, relative easiness of the cultivation and moderate-income generation by the cut flower cultivation. Nevertheless, vegetables, potato and paddy are the main crop types which cultivated in these areas and always there was a rotation between these crops. Apart from those farmers also engaged in tea and cut flower cultivation.

Table 2. Utilization of ICT Appliances.

Utilization of ICT Appliances						
Type of ICT	Availability		Accessibility		Usage	
	Frequency	%	Frequency	%	Frequency	%
Radio	234	97	219	91	219	91
Television	221	92	221	92	221	92
CD/DVD Player	176	73	116	48	95	39
Land Phone	114	47	96	40	96	40
Feature Phone	241	100	202	84	198	82
Smart Phone	165	68	85	35	25	10
Computer	48	20	9	4	3	1
Tab	5	2	1	0	1	0
Laptop	29	12	2	1	1	0
Printer	9	4	1	0	1	0
Scanner	2	1	1	0	1	0
Fax machine	3	1	0	0	0	0
Removable Storage Device	67	28	0	0	0	0
Projector	0	0	0	0	0	0
Digital/Manual Camera	56	23	19	8	14	6

Source: Survey Results.



Source: Survey Results.

Figure 1. Types of Crop Combination.

Highest number of farmers utilized television (92%) and radio (97%) as common ICT appliances (Table 2). Interestingly, feature phones were available in all most every household. However, only 84% had accessibility and 82% had usability over feature phones. More than half of the farmers had smart phones within their household. However, only 10% had usability over smart phones. From the total sample, 20%, 12% and 2% of farmers had computer, laptops and tabs respectively within their households. However, only 1% of farmers had usability of any of those appliances. The radio, television and feature phones were accessed by farmers without a prior ICT knowledge. They did not require higher education knowledge and technology for used these facilities. In comparing with table 2, Sri Lankan farmers have limited knowledge related to ICT. It directly affected the development and production of the agriculture sector.

Table 3. Utilization of ICT Facilities.

Utilization of ICT Facilities						
Type of ICT	Availability		Accessibility		Usage	
	Frequency	%	Frequency	%	Frequency	%
Internet	198	82	170	71	145	60
GPS	120	50	51	21	32	13
E-mail	15	6	10	4	2	1

Source: Survey Results.

Further, only 60% of farmers have used internet facility. Another 13% have used GPS and only 1% have used e-mail facility. This clearly show cases the reality of ICT usage

among Sri Lankan potato farmers. Even though there have been numerous ICT tools, still ICT literacy of local farmers are not up to the satisfactory level. Nevertheless, this doesn't

mean Sri Lankan agriculture sector is not ready for ICT revolution. Perhaps changing the way or mode of delivering

of ICT tools may cause positive influence in agriculture.

Table 4. Correlation Analysis of Selected Socio-Economic Factors and ICT Usage of Farmer.

Variable/s	Y	X1	X2	X3	X4	X5	X6
Y	1						
X1	-0.7432**	1					
X2	0.537	0.564**	1				
X3	0.659**	0.541	0.654	1			
X4	-0.254**	0.265	0.326*	0.235	1		
X5	0.352*	-0.231	-0.321	0.654	0.326	1	
X6	0.851**	0.351	-0.654	0.245	-0.214	0.694	1

Source: HARTI survey, 2018

***p<0.01, **p<0.05 and *p<0.1 are represented significance at the 0.01, 0.05 and 0.1 respectively.

The interpreted on the correlation analysis of selected socio-economic variables of farmer and number of ICT appliances used by the farmer. According to the results education level ($p<0.05$, $r=0.659$), average monthly farm income ($p<0.1$, $r=0.352$) and number of crops cultivated ($p<0.05$, $r=0.851$) by farmer are positive and significant with the number of ICT appliances used by the potato farmer. Age ($p<0.05$, $r=-0.7432$) and years of experience engage in agricultural activities ($p<0.05$, $r=-0.254$) are negative and significant with the number of ICT appliances used by the potato farmer. Interestingly, farmers who cultivated several crops tend to seek more information. Hence, they used multiple sources including different ICT appliances. In general, these farmers seek production information such as: price, types, availability of inputs including seeds, fertilizers and chemicals and weather forecast specifically rainfall. Farmers also seek information related to marketing aspects such as market price to determine farm gate prices, buyers' and traders' details, market places etc. However, it is envisaged that these most of the time farmers were able to obtain partial information. Hence, information asymmetry is a crystal-clear issue. Rather than focusing advanced ICT appliances and tools, it is recommended to exploit the full potential of current ICT appliances and tools to disseminate vital information. Consideration of farmer usability of different ICT appliances and tools are much important to decide the next step of agriculture modernization in Sri Lanka.

4. Conclusions

The agriculture and the development of agribusinesses were the ideal foundation in the development of Sri Lankan economy. Novel technology, innovation, tools and knowledge were mostly important and affected on the developing of agriculture. The farmers had a good preference and favourable response from the ICT usage in their agriculture practices. The farmers' experience and monthly income were positively significant to the usage of ICT technology. According to the study farmers did not use ICT technologies properly in their cultivation process. Most of the farmers still preferred in radio and television. Only few

preferred to use feature phone to acquire knowledge to improve their cultivation. Consideration of farmers' awareness, access and usage over different ICT applications is important before implementing novel ICT applications. Continuous awareness and demonstration is key to promote ICT usage among farmers. Public-private collaboration with a sound policy is recommended to extract, gather, store and disseminate vital information in agriculture. Creating and updating accurate farmer databases with cultivation dimensions is a must to implement timely decisions. Continuous monitoring and training is the key to transfer the ICT knowledge to rural farming communities.

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