

THE FEASIBILITY OF USING E-CROP SELLING BY SRI
LANKAN FARMERS

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of
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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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ABSTRACT

Sri Lanka is an agriculturally highly potential country. Country's agricultural industry has an opportunity to gain a sustainable development parallel to rapid penetration of ICT in the Sri Lankan society. Particularly digital literacy with over 100% mobile subscriptions and over 20% Internet access Sri Lankan society is able to improve quality of living using e-solutions. This study focus explores the feasibility of introducing e-Crop Selling to the Sri Lankan farmer community. A questionnaire was instrumented capture three types of information about farmers. Firstly, demographic data such as age groups, gender, education level and income levels of farmers were collected. Secondly current selling practice such as farmer selling price, market prices and methods of selling were collected. Finally the familiarity of mobile phone usage and Internet access by farmers were collected. The descriptive and correlation analyses showed that the age groups has a moderate influence on e-Crop Selling readiness of farmers and gender has no influence. Further the results showed that 97% of youngest farmer group between 20-30yrs of age are already equipped with e-Crop Selling adoptability. Selling practice verifies that majority of farmers still sell crops to middle parties and that method is the least beneficial method for farmers. Finally the study concludes with possible e-Crop Selling ideas to facilitate farmers for direct selling customers via e-Crop Selling applications.

The research approach is taken by gathering the data about the farmers, the farmers' behavior toward the ICT technology and their selling pattern.

Key words: ICT, Agriculture, Farmers, Crop, Selling, Marketing

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List of Abbreviations

AL	GCE Advanced Level
AVC	Audio Visual Center
DEC	Dedicated Economic Center
DSC	Direct Sell to Consumer
DSW	Direct Sell to Whole Seller
FSCS	Farmers Selling Price to Consumer Buying Price Ratio Percentage
GGS	Govi Gnana Servive
ICT	Information Communication Technology
IoT	Internet of Things
IVR	Interactive Voice Responds
LKR	Sri Lankan Rupees
ND	No Data
OL	GCE Ordinary Level
SDEC	Sell at the Dedicated Economic Center
SMP	Sell to the Middle Person
SMS	Short Message Service
SNF	Sell to the Nearest Factory/ company
SNR	Sell to the Nearest Retail shop/retail vendor
SPSS	Statistical Package for the Social Science
SPV	Sell to Pre-agreed Vendors
USSD	Unstructured Supplementary Service Data

1. INTRODUCTION

Overview of Chapter

This chapter presents the background and motivation for the research. Then research problem and research question are discussed. Finally the research objectives are presented at the end of the chapter.

1.1. Background

Sri Lanka is a tropical country with the high potential of cultivating a variety of crops such as rice, wheat and other cereals, fruits, vegetables, coconut, tea and spices. Also Sri Lanka is rich with all the extensive resources such as climate, whether, fertilized soil, water sources needed for different varieties of cultivation. Around 21% of the population involves in agriculture in Sri Lanka and almost every district has potential of growing its own types of crop but no significant agricultural prosperity has been achieved yet. Figure 1-1 illustrates the distribution of cultivation in Sri Lanka in 2014 (Department of Census and Statistics Sri Lanka, 2014). Accordingly, agriculture is distributed all throughout the country but none of the areas have marked a significant development based on agriculture. The reasons for this situation should be analyzed at different stages of agricultural production process, such as provision of inputs for cultivation, cultivation, harvesting, post-harvest processing, packaging and selling. In this study the focus is on the crop selling aspect using ICT in agriculture ground.

The supply chain of the crop market consists of the middleman, the wholesaler and the retailer to connect the farmer and the market. Each step along the supply chain, a value will be added to the products. ICT enabled crop marketing has been a trusted area in several countries even the developing countries such as Malaysia (Razaque, 2013) and Iran (Lashgarara, 2011).

Sri Lanka also has a potential to enable crop marketing using ICT by taking the benefit of Internet and mobile communication penetration in the Sri Lankan society. Parallel

to the technology expansion, application of technology using mobile devices in Sri Lanka increases gradually. According to (Daily News, 2017) out of 20.86 million Sri Lankan population 30% are internet users while 23% is active social media users. Further, mobile subscriptions are 126% of the population and active mobile social users are 20% of the population.

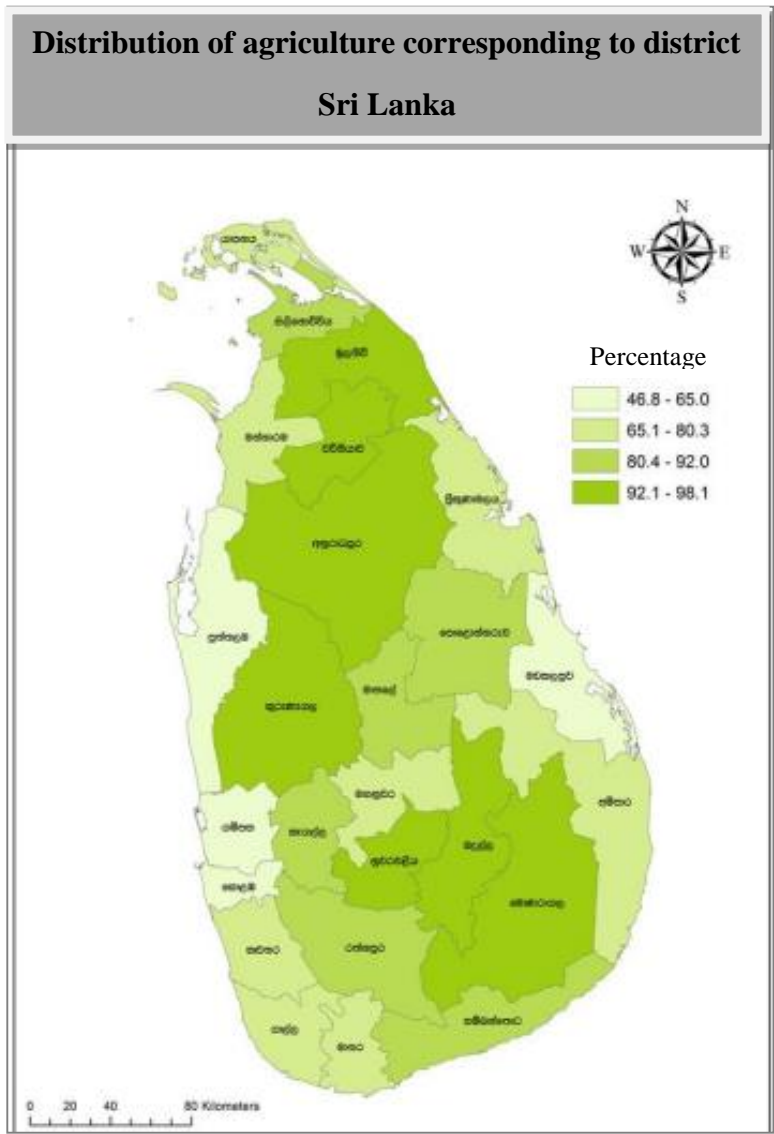


Figure 1-1: Distribution of cultivation in Sri Lanka 2014

Source: e-Sri Lanka: What Is in it for Agriculture. Joint National Conference on Information Technology in Agriculture

However much the ICT and mobile communication has penetrated in Sri Lankan population, it is doubtful how far the farmer community in Sri Lanka is ready to accept crop selling by accessing the technology to sell their crops. The less efficiency of crop market in Sri Lanka may be resulting from the fact that still the farmer community is far behind to accept the technological crop market and face the challenges of accessing the digital market.

Dialog Trade Net and 6666 Agri Price Index are two applications to share real-time essential information in farmer community in Sri Lanka initiated by Dialog and Mobitel service providers respectively. However their usage is very low according to (De Silva, 2012).

1.2. Motivation of the research

The main purpose of this study is to comprehend the feasibility of the farmers to use ICT in mobile platform in order to perform crop selling.

A digital portal can facilitate the farmers to sell the crop to the open market, observe the quantity of the crop, check the prices of different types of crop and their availability in places, check the current market prices, identify market crop suppliers, estimate the market crop demand, obtain updates and news relevant to crop market behavior. This study will analyze the feasibility to establish such an ICT enabled crop market which we refer to in this study as “e-Crop Selling”. This requires a detailed study of the ICT usage level of farmers and crop selling practices.

1.3. Research problem

With the rapid penetration of mobile phones and Internet access in Sri Lanka, the farmer community in the country may have an opportunity to reduce the hardships of

selling their crops at a fair price by taking fact-based decisions and with more access to markets via e-Crop Selling. However, the question is whether the farmer community is ready for e-Crop Selling. The core research question in this study is:

“Are Sri Lankan farmers ready for e-Crop Selling?”

1.4. Research Objectives

In order to evaluate whether the Sri Lankan farmers are ready for e-Crop selling we aim our study at following objectives:

1. To identify the factors that affect use of e-Crop Selling by farmers in Sri Lanka
2. To analyze how these factors affect e-Crop Selling by farmers
3. To identify most effective farmer groups for adopting e-Crop Selling.

1.5. Structure of the Thesis

This thesis contains five chapters. Chapter 1 provides the background, motivation, and research problem and research objectives. In Chapter 2, I present the literature review focusing on theoretical concepts in Marketing and Selling, literacy related to ICT and previous research in the area of ICT enabled agro marketing and identify factors for the research problem. Chapter 3 explains the research methodology adopted for this study including the theoretical framework, research variable definitions, variable relationships, questionnaire instrument development, survey approach, development of hypotheses and method of data collection and analysis. Chapter 4 provides data analysis including descriptive and correlation analyses. Chapter 5 draws conclusions on the total research outcome, including the recommendations based on data analysis and result interpretation. Also, the limitations of the present study along with the directions for future research would be discussed.

2. LITERATURE REVIEW

Overview of Chapter

This chapter provides the review of the literature relevant to the research questions. We present related theories in marketing, illustrate different frameworks adopted in literature for ICT enabled crop marketing.

2.1. Theories and Concepts Related to Crop Selling

Agriculture is producing crops that ultimately become directly food or processed food items. According to Maslow's Need Hierarchy (Maslow, 1987), food is one of the main physiological needs and therefore there is no doubt that generally food has a consistent demand in the society. However the consumer has a variety of choices and buying patterns of food. Therefore marketing may be needed.

According to Goi (Goi, 2009) Borden in 1965 introduced the term “Marketing Mix” and it is the set of activities that a business uses to promote its brand or product in the target market. Marketing mix has initiated with single “P” denoting Price and then several “P”s were introduced. 4Ps of Marketing Mix are Product, Price, Promotion and Place. Later 8P concept was introduced by adding Participant, Physical evidence, Process and Personalization. Borden’s original marketing mix had 12 elements namely, Product Planning, Pricing, Branding, Channels of Distribution, Personal Selling, Advertising, Promotion, Packaging, Display, Servicing, Physical handling and Fact finding and analysis (Goi, 2009).

“Sales is concerned with a mere transaction and the exchange of goods/services for money. It does not consider the need to develop a long term relationship with the customer. Thus Sales is more short-termist. Sales is more focused on generating enough exchange transactions. Marketing on the other hand is about building a sustainable value proposition that can then be marketed to its target market. Marketing on the other hand is more concerned with ‘delighting’ the customer and building brand loyalty towards the company’s products.” (Fonseka, 2015)

2.2 Marketing Mix

This study considers sales of crops by farmers and we consider selling of raw crops. Marketing concepts that are relevant to selling side will be applied. Product in 4Ps of marketing mix are classified into Consumer Products and Industrial Products (Kotler & Armstrong, 2012). Raw agricultural crops fall into industrial products. This study considers using ICT for product selling which is a growth opportunity. Product/Market Expansion grid (Kotler & Armstrong, 2012) in **Error! Reference source not found.** is a device to explain such opportunities. In this study we consider the opportunity of Market Penetration by Existing Products such as vegetables and fruits in Existing Markets. The marketing mix improvement are proposed in by adjustments to its product design, advertising, pricing, and distribution efforts (Kotler & Armstrong, 2012). As crops are industrial raw material type product we can mainly consider pricing and distribution efforts. Place in marketing mix refers to channels of distribution and Direct Marketing is advantageous to both buyers and sellers and main forms of direct marketing include personal selling, direct-mail marketing, catalog marketing, telephone marketing and online marketing (Kotler & Armstrong, 2012). We also consider ICT enabled platform targeting farmers so it is desirable to facilitate direct marketing. Priyankara (Priyankara, 2016) in his study to analyze present status of vegetable market claims that the majority of direct marketing farmers are in “Pola” and farmer can earn a significant income in direct marketing. He further reveals that the consumers are more interested in purchasing directly from farmers because they concern about freshness and quality (Priyankara, 2016). Government of Sri Lanka also recommends to reduce demand-supply gap and enhance outreach and profitability of Sri Lankan products and services through vibrant e-agriculture market place (Department of Agriculture, 2016).

The process of delivering crops from farmer to the consumer can be explained by Supply Chain concepts. The food supply chain is the flow of food from the farmer to the consumer. The main element of the food supply chain can be recognized as Farmer, Processor, Distributor, Retailer and Consumer. According to the traditional supply chain in Sri Lanka, delivery of vegetables from farmers to consumer happens via

wholesale market, wholesaler and retailer (Perera, 2011). The middleman plays the role of linking between consumer and any of these entities (Sandika, 2012).

2.3 Challenges in Crop Selling

The farmer in Sri Lanka has several typical challenges in selling their crop (De Silva, 2012), (Perera, 2011), (Sandika, 2012). They are similar to the following challenges given in (National Institute of Agricultural Extension Management, 2018) in Indian context: (i) The accurate prices are not available to farmers at selling, (ii) The quantity of crop is small of small holders, (iii) Lack of transportation facilities, (iv) The quality of their crop is poor at the point of sale and (v) The farmers are desperate to sell their crop due to their family commitments.

According to above mentioned challenges in crop selling and related theories in sales and marketing, Finding Prices, Setting Prices, Channel of Distribution are important factors.

2.4. Use of ICT among farmers

Digital Literacy

“A person (aged 5-69) is considered as a digital literate person if he/she could use computer, laptop, tablet or smartphone on his/her own” (Department of Census and Statistics, 2018).

Computer literacy

“A person (aged 5-69) is considered as a computer literate person if he/she could use computer on his/her own. For example, even if a 5 years old child can play a computer game then he/she is considered as a computer literate person” (Department of Census and Statistics, 2018).

According to Table 2.1, computer literacy of Sri Lanka is 27.5% while digital literacy is 40.3%. This implies that ICT capabilities of Sri Lankans drift from Personal

Computer to Smartphones. Therefore in this study we consider mobile phone including smartphones rather than other computing devices. Also we focus more on digital literacy hereafter.

Table 2.1: Computer literacy and Digital literacy with gender and age (Department of Census and Statistics, 2018)

Gender, Sector, Age Group	Computer Literacy	Digital Literacy
Sri Lanka	27.5	40.3
By Sex		
Male	29.7	44.5
Female	25.4	36.4
Sector		
Urban	38.4	53.9
Rural	25.9	38.4
Estate	11.1	18.7
By Age Group		
5-9	11.2	21.4
10-14	37.4	47.7
15-19	56.6	70.4
20-24	56.2	75.3
25-29	46.9	67.3
30-34	33.9	54.7
35-39	26.5	45.1
40-49	20.1	34.1
50-59	11.3	19.2
60-69	5.7	8.9

Further, according to Table 2.1, 44.5% of the male population has digital literacy while only 36.4% of the female population has digital literacy. The statistics related to age in the same figure show that 75.3% of the population in age group 20-24 yrs has digital literacy. Next, 70.4% of population has digital literacy in the age group 15-19 yrs. It is also noted that 67.3% of the population in age group 25-29 yrs has digital literacy. Even a notable portion that is 54.7% and 45.1% of those who are in age groups 30-34 yrs and 35-39 yrs respectively has digital literacy. Not only that but also 34.1% of the population in age group 40-49 yrs possess digital literacy. Also 19.2% of the population in age group 50-59 yrs are digitally literate and 8.9% of those who are in age 60-69 yrs has digital literacy. These figures show that Sri Lankan population, particularly youth and middle aged are capable in accessing electronic solutions such

as e-Crop marketing. Further analysis is needed to see whether there is a significant difference in digital literacy among farmer population.

Table 2.2: Percentage distribution of device use to connect to internet/ email household population

Gender, Sector, Age Group	Desktop /Laptop	Smart Phone	Tablet Computer	Mobile Computer
Sri Lanka	27.1	67.5	3.0	2.4
By Sex				
Male	27.3	67.5	2.9	2.3
Female	26.9	67.5	3.2	2.4
Sector				
Urban	31.5	62.8	3.8	1.8
Rural	25.6	69.1	2.7	2.6
Estate	6.9	87.8	3.2	2.1
By Age Group				
5-9	27.0	67.7	5.3	0.0
10-14	28.6	65.3	4.5	1.7
15-19	26.9	68.0	3.1	2.1
20-24	24.3	71.2	1.8	2.6
25-29	25.5	68.6	2.7	3.1
30-34	24.9	69.9	2.9	2.3
35-39	24.9	69.7	2.5	2.9
40-49	29.3	64.9	3.7	2.0
50-59	34.8	59.6	3.9	1.7
60-69	39.2	54.4	4.2	2.2

* (aged 5 – 69 years) by Sex, Sector and Age group – 2018 (during 1st 6 months)

According to Table 2.2, 67.5% of Sri Lankans use a smartphone. Smartphone usage is alike among males and females. Smartphone usage by different age groups show that 71.2% of age group 20 – 24 yrs, 68.6% of the age group 25 – 29 yrs, 69.9% of the age group 30 – 34 yrs and 69.7 % of the age group 35 - 39 yrs use a smartphone. This implies that around 70% of the Sri Lankan population who are in the employable age use a smartphone. Around 55 to 65% of even those who are in older ages like of has age group 40 – 60 yrs use a smartphone. These figures are positive in terms of introducing e-solutions in Sri Lanka.

2.5. ICT enabled crop selling

ICT solutions in agriculture range from voice calls, SMS, and Internet based information delivery systems and devices may include basic phones, smart phones, tablets, and customized ICT software or systems (O'Donnell, 2013). Mobile phones are given more prominence in majority of ICT based agricultural solutions for example for finding new buyers and obtaining market information to achieve higher prices for example, mFarm in Ghana, FarmBook in Zambia, Zimbabwe, Madagascar, and Malawi (O'Donnell, 2013).

We identify device owned by farmer, device functions used by farmer are importance factors to use ICT in crop selling. Calls, SMS and Internet are the main channels of using ICT based agricultural solutions.

In Sri Lankan context there are several ICT based agricultural applications. Dialog Telekom launched a service to deliver agri-produce price information to farmers from three Dedicated Economic Centres at Dambulla, Meegoda and Narahenpita (Dialog, 2009). This service is based on Dialog's TradeNet platform and the Govi Gnana (Farmer Knowledge) Service (GGS) under eSri Lanka initiative of Government of Sri Lanka. Information on the TradeNet platform is disseminated via SMS, Unstructured Supplementary Service Data (USSD) via mobile phones, web and Interactive Voice Response (IVR) over phone calls (Dialog, 2009).

Govi Sahana Sarana is a toll free agriculture advisory service launched as an extension to Department of Agriculture, Sri Lanka. This service uses the database maintained at Audio Visual center (AVC), Gannoruwa. Farmers contact this service for their queries over any fixed phone or mobile phone during office hours by dialing 1920 (Dissanayake, 2009).

Mobitel "6666" Agri Price Information Index provides daily whole sale price information collected from Pettah, Kandy, Dambulla, Meegoda, Norochcholai, Thabuthegama, Nuwaraeliya and Kappetipola markets. Customer needs to dial 6666

to connect to the IVR that provides information both in Sinhala and Tamil (HARTI, 2014).

According to above mentioned services, feasibility of introducing ICT based crop selling applications or systems to farmers depend on type of ICT devices used by farmers and functions the farmer can use with the device.

2.6. Factors affecting e-crop selling

Studies of ICT enabled agricultural services in variety of countries identify Age, Gender and Educational level as factors (Benedek, 2014), (Razaque, 2013), (Mwakaje, 2010). We categorize these factors as Farmer Characteristics. Study in (Benedek, 2014) further identifies Experience and Farm size also as factors. Studies in (Razaque, 2013) and (Mwakaje, 2010) also identifies Income level as a factor. We add Experience, Farm size and Income level also into farmer characteristics. Under the Marketing Mix in Section 2.1, Price and Channel of Distribution (Place) are important factors. It is important to find current channels of distribution that the farmers use as it is revealed that Direct Marketing is more advantageous to both farmer and the consumer. In direct marketing farmer's selling price and the consumer's buying price are key factors.

3. METHODOLOGY

Overview of Chapter

This chapter highlights the details of the research method adopted for the study. In this chapter we detail the conceptual research framework, define the variables, develop hypotheses and explain data collection data collection procedure.

3.1. Conceptual research framework

A concept map was developed as shown Figure 3-1 where the main concepts are: Farmer characteristics, Selling practice and e-Crop Selling Readiness. We explore the relationship among these three main variables.

e-Crop Selling Readiness: We define e-Crop Selling as the process of selling raw agricultural produce such as vegetables, cereal and fruits through mobile phone using Internet based applications. For example we imagine applications similar to Uber that connect crop seller to the buyer. We consider only the farmer readiness for e-crop selling. If some organization or an institute is planning to launch such a service the only condition for the farmer is to have digital literacy as defined in Section 2.2.

When applying the definition of Digital Literacy into this study, a farmer should be able to use a smartphone on own (or without assistance). We consider only mobile phones as the device and the Internet as the use in this study due to the mobile phone penetration and Internet usage trend shown in Chapter 1.1. Therefore, the e-Crop Selling Readiness is that a farmer is able to use Internet applications on a smartphone without assistance. This goes beyond digital literacy because we add that the farmers must be able to use Internet application.

This study is aimed at identifying which factors affect e-Crop Selling Readiness and how these factors affect e-Crop Selling as previously mentioned in Section 1.4. Here

the dependent variable is e-Crop Selling Readiness. The independent variables are the farmer characteristics.

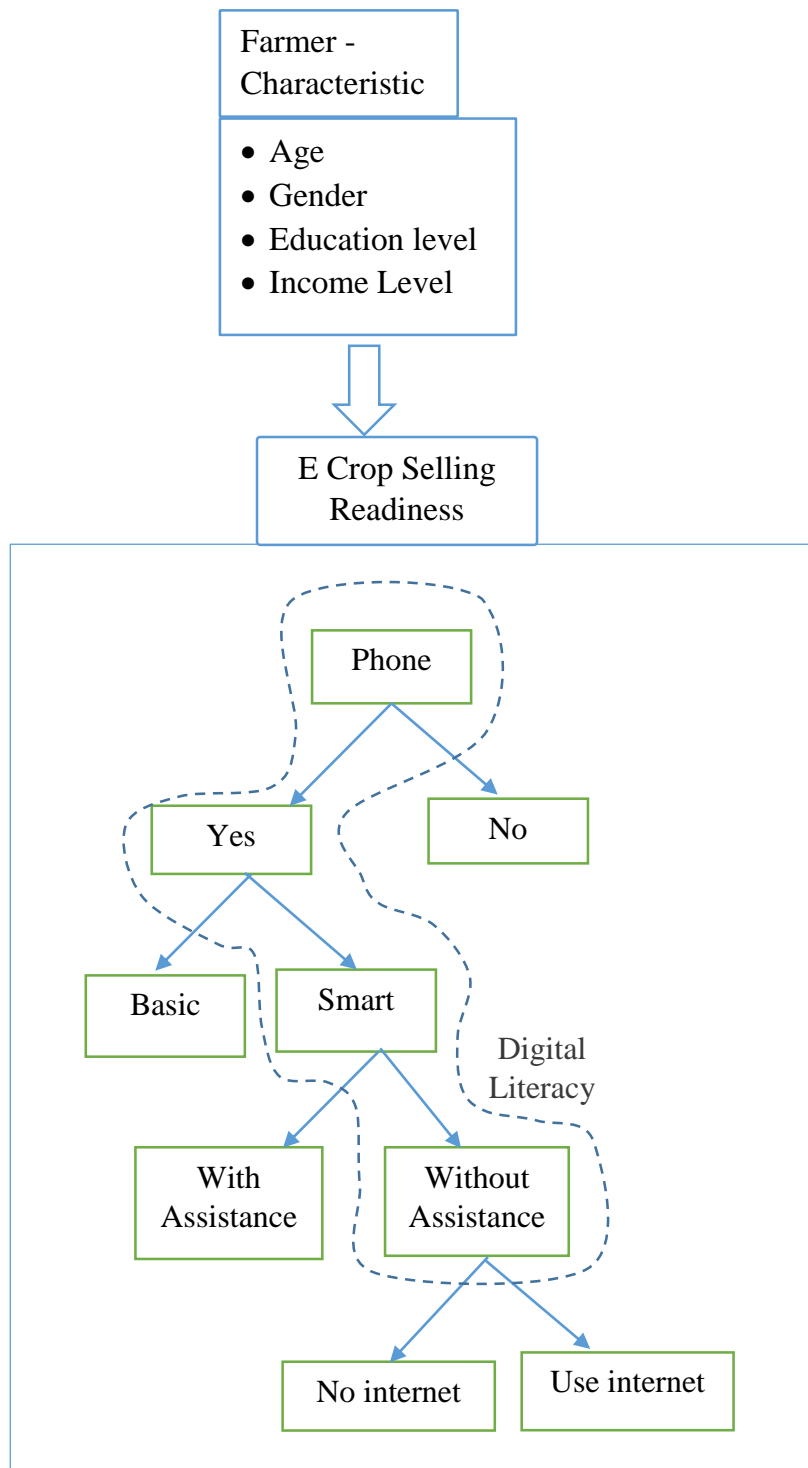


Figure 3-1: Concept map of the problem

Farmer characteristics are Age group, Gender, Education level and Income level as previously explained in Section 2.6.

Selling practice: We focus on Crop Prices and Channel of Distribution as the key factors out of all the factors related to selling practice identified in Section 2.1. The type of e-Crop Selling applications that can be offered to farmers over a mobile phone vary according to the selling practices of farmers. For example there can be an application that gives a location map of distribution channels with indicators to show current market prices of different crops.

3.2. Define the variables

Table 3.1 lists the variables extracted from literature and the table also categorizes the variables.

Table 3.1 Identified Variables from Literature Survey

Concept derived from literature	Variables	Literature aspect
Farmer characteristics	Age	(Benedek, 2014) (Razaque, 2013)
	Gender	(Mwakaje, 2010)
	Income level	(Mwakaje, 2010) (Razaque, 2013)
	Educational level	(Benedek, 2014)
Selling practice	Channel of distribution	(Goi, 2009), (Kotler & Armstrong, 2012)
	Price	(Mwakaje, 2010), (Goi, 2009), (Kotler & Armstrong, 2012)
e-Crop Selling Readiness	Use of mobile phone	(Masuki, 2010)
	Type of mobile phone	(O'Donnell, 2013)
	Use of phone functions	(O'Donnell, 2013)
	With or without assistance	(Department of Census and Statistics, 2018)

We identify both Farmer Characteristics and Selling Practice variables as demographic data of a farmer.

The e-Crop Selling Readiness is a single variable derived using four variables, namely whether a phone is used, whether the phone is a smartphone or a basic phone, whether the farmer access Internet with the smartphone and whether the phone is used on own (with or without assistance) as shown in Table 3.1. As given in Figure 3-1, e-Crop Selling Readiness variable can be explained using a tree diagram. A farmer has digital literacy if his data fall into the tree path marked with a dash boundary. However, we added “use of Internet” for e-Crop Selling Readiness. Therefore for a famer to be e-Crop Selling Ready he/she must have digital literacy and access Internet applications as well.

A questionnaire (in Appendix A) was developed to capture all the variables in Table 3.1.

3.3. Hypothesis Development

Initially, four hypotheses were developed based on the variable classification in Table 3.2. eCrop Selling Readiness is the only dependent variable. Independent variables ae the Age group, Gender, Income level and Education level under Farmer Characteristics.

Table 3.2: Variable classification

Independent variable	Dependent variables
Age	e-Crop Selling Readiness
Gender	
Income level	
Educational level	

Four hypotheses are as follows:

1. H1₀: Age group has NO influence on e-Crop Selling Readiness
H1_A: e-Crop Selling Readiness is influenced by Age group
2. H2₀: Gender has NO influence on e-Crop Selling Readiness
H2_A: e-Crop Selling Readiness is influenced by Gender

3. H3₀: Income level has NO influence on e-Crop Selling Readiness
H3_A: e-Crop Selling Readiness is influenced by Income level
4. H4₀: Education level has NO influence on e-Crop Selling Readiness
H4_A: e-Crop Selling Readiness is influenced by Education level

The aim of the study is to check acceptance and rejection of above four hypotheses. Recommendations for desirable functions and features of an e-Crop Selling solution can be derived by analyzing relationship between farmer characteristics and their crop selling practices.

3.4. Research methods

A questionnaire based survey method was used in this study for data collection. A descriptive analysis is employed to represent the total Sri Lankan farmer population and to summarize collected data. Correlation analysis is employed to establish, confirm and validate above hypotheses. We use primary data collection to gather only the view point of the farmers. The survey was standardized to ensure reliability, generalizability, and the validity. Every respondent were presented with the same questions and in the same order as other respondents.

3.5. The population

We consider Sri Lanka as a single population without giving consideration to geographical divisions or ethnicities. Farmer population was reported as 26% of the total population of 21 million in 2017. Therefore the farmer population is around 5.5 million (Central Bank, 2017).

3.6. Sample size

Since we consider whole Sri Lankan population without regard to any grouping and we use Simple Random Sampling to select the sample of data points. Equation 1 is the formula that we used to calculate the sample size (SurveyMonkey, 2019).

$$\text{Sample size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N} \right)} \quad \text{--- Equation 1}$$

Here z is the z-score which is 1.96 for 95% confidence interval according to the lookup table in (SurveyMonkey, 2019). We leave 5% margin of error as e . N is the population size which is 5.5 million. Term p is the response rate and the default value in SurveyMonkey sample size calculator was used. The calculated sample size was 385.

3.7. Data collection

The farmer is the focused data point for this study. Both primary and secondary data were collected for the study. Primary data was collected using a survey questionnaire and secondary data was collected from literature. The questionnaire was initially organized as both open-ended and closed-ended questions.

A pilot survey was carried out in Anuradhapura with around 35 respondents. The respondents did not readily accept to fill the form on their own. Rather they were curious what the purpose of filling such form and some even questioned what will be the impact on them after giving these information. When the form was presented the farmers were reluctant to reveal their true information assuming that the survey might reveal their identity and create an inappropriate atmosphere for their farming. Some asked whether they will be given loans or some other benefits based on the filled answers. In conclusion, it was observed that getting farmers themselves to fill the questionnaire was not practical.

Therefore we verbally collected answers to the questions from the farmer as in a conversation and filled ourselves the form which was more comfortable for the farmer. Based on the experience at the pilot survey in order to get a wide reach to the farmer community throughout the country, we set up an online version of the questionnaire and used agents such as family members and friends of farmers to get answers from the farmers. Farmers gave vague and confusing answers when the questions were open ended. Therefore, we revised the questionnaire to employ only closed-ended questions after the pilot survey. Pilot survey also helped us understand nature of important variables such as Channel of Distribution under Selling practice (given in Section 3.2). This particular variable is explained in detail during data analysis in Section 4.3.4.1.4

Secondary data was collected from census such as (Department of Census and Statistics, 2018), (Department of Census and Statistics Sri Lanka, 2014) and (Central Bank, 2017).

I myself and my agents spent around four months gathering responses for the questionnaire (both paper based and online) and we managed to gather 401 responses from eight provinces. After cleaning to remove mismatching data we retained 389 responses.

3.8. Questionnaire Structure

The survey questionnaire was prepared with questions covering three main areas, namely Farmer Characteristics, Selling Practices and e-Crop Selling Readiness.

3.9. Methods of data analysis

Both Microsoft Excel and IBM SPSS Statistics 23.0 software were used to analyze data. Descriptive statistics were used to make frequency tables, pie charts, histograms, bar graphs and to calculate averages, ranges, percentages and means of variables in analyzing Farmer Characteristics and Selling Practices. Correlation analysis tests were conducted to analyze the relationship between e-Crop Readiness and Farmer Characteristics.

4. DATA ANALYSIS

Overview of Chapter

This chapter discusses the analysis of gathered data from the farmers during the data collection phase by focusing on following main objectives.

- Identify farmer characteristics
- Identify current selling practices of farmers
- Identify farmer characteristics that affect feasibility of introducing Internet based crop selling applications

The scope of this study is limited to descriptive statistics and correlation analysis. Descriptive analysis describes the main aspects of;

1. Demographical data of farmers
2. Data of ICT capabilities of farmers
3. Data of crop selling behaviors of farmers

The correlation analysis were used to evaluate following hypotheses derived in Section 3.3:

1. H1₀: Age group has NO influence on e-Crop Selling Readiness
H1_A: e-Crop Selling Readiness is influenced by Age group
2. H2₀: Gender has NO influence on e-Crop Selling Readiness
H2_A: e-Crop Selling Readiness is influenced by Gender
3. H3₀: Income level has NO influence on e-Crop Selling Readiness
H3_A: e-Crop Selling Readiness is influenced by Income level
4. H4₀: Education level has NO influence on e-Crop Selling Readiness
H4_A: e-Crop Selling Readiness is influenced by Education level

As previously explained in Section 3.4 SPSS was used as statistical analysis software. Since the questionnaire was circulated online via contacts it is not practical to calculate all farmers that the questionnaire has reached. Therefore a Response Rate was not calculated. A total quantity of 401 completed questionnaires were collected

successfully. However, 12 responses were removed in data cleaning phase. Questionnaire is in Appendix A.

4.1. Demographic Analysis

In this section farmer characteristics are analyzed to understand the population in terms of sample population. We use Descriptive statistics for this purpose.

Descriptive Statistics

Descriptive statistics is a tool to analyze data in the form of described, or summarized in to meaningful way. Descriptive statistics are important when the raw data is presented in simple but hard to visualize in an organized manner. Descriptive statistics present the data in a more meaningful way with simple interpretation through statistics and graphs. Following subsections describe the farmer population distribution with respect to demographic information, namely, Gender, Age group, Education level and Monthly income.

4.1.1 Farmers' Gender

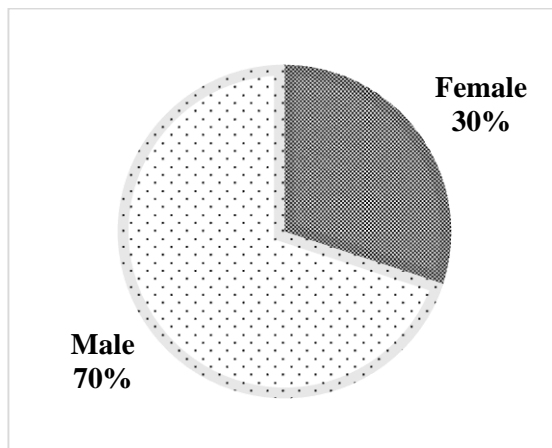


Figure 4-1: Farmer distribution by gender

The gender distribution of the farmers in the study is shown in Figure 4-1. Accordingly, 70% of the total farmer population are male and 30% are female.

4.1.1 Farmers' Age Groups

Age group of farmers are tabularized against the number of the farmers in table 4.2. Accordingly, the age group that are highly involved in farming are 41-50 yrs, 51-60 yrs and 31-40 yrs accounting for 20%, 26% and 21% of the sample population respectively. A 67% of the farmers which is more than half of the population are in age group 30-60 yrs. The youngest group who are farmers is 20-30 yrs representing only 9% of the population. The age group above 70 yrs of age accounts for only 6% of the total population. Figure 4-2 graphically shows the farmer distribution by age group.

Table 4.2: Farmers' age groups

Age Group (yrs)	Count	Percentage of total population
20- 30	36	9%
31- 40	76	20%
41- 50	103	26%
51 -60	83	21%
61-70	66	17%
71-80	21	5%
above 80	4	1%

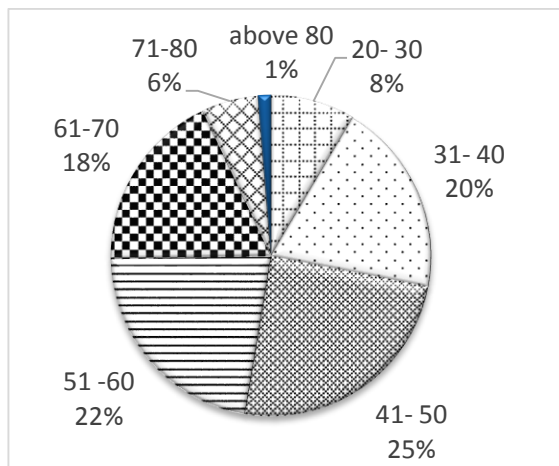


Figure 4-2: Farmer distribution by age group

4.1.2 Farmers' Education Level

Table 4.1 illustrates the education level of the farmers. A 42.2% of farmers have completed G.C.E. Ordinary Level. Also 19.3% of the farmers has the qualification of G.C.E. Advanced Level. Farmers educated below grade 8 is only 9% of the population and those who have just passed grade 8 are only 3% of the population. Only 4.4% of the farmers have achieved the highest education level of graduate and post graduate degrees.

Table 4.1 Farmers' education level

Education	Farmers' total	Percentage
Below grade 8	35	9.0%
Grade 8	98	25.2%
OL	164	42.2%
AL	75	19.3%
Graduate	16	4.1%
Post Graduate	1	0.3%

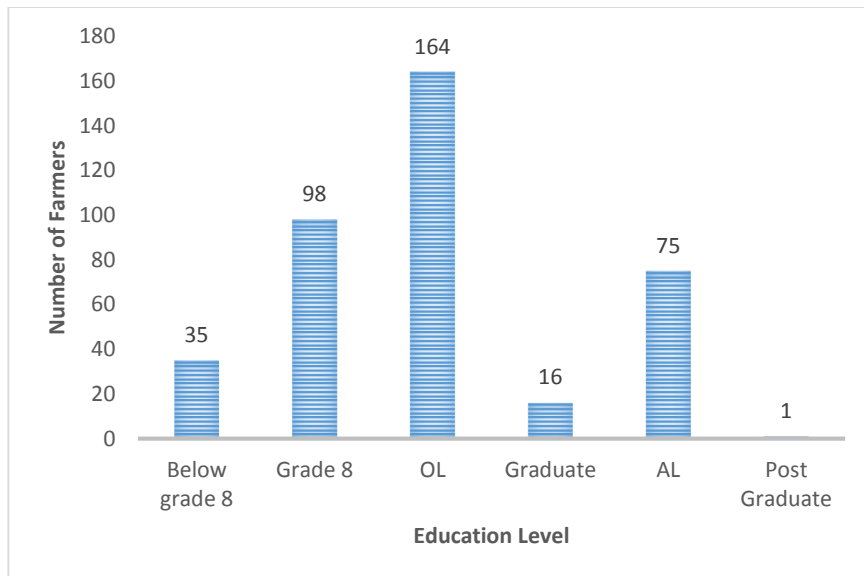


Figure 4-3: Distribution of farmers according to education level

4.1.3 Farmers' Income Level

Table 4.2 shows the income level of farmers. Accordingly 34% of the population earns an average monthly income of LKR 50,000-75,000. Another 21% of the farmers earn an average monthly income of LKR 75,000-100,000. The proportion of farmers who earn an average monthly income of LKR 25,000-50,000 is 16% of the population. Moreover, 10% of farmers earn an average income less than LKR 10,000. At the other end is 1% farmers who earn more than LKR 200,000 per month.

Table 4.2: Farmer-Income level

Monthly range (LKR)	income	Total Number of Farmers	Percentage out of total
>200,000		3	1%
10,000-25,000		43	11%
100,000-150,000		29	8%
25,000-50,000		60	16%
50,000-75,000		130	34%
75,000-100,000		80	21%
less than 10,000		38	10%

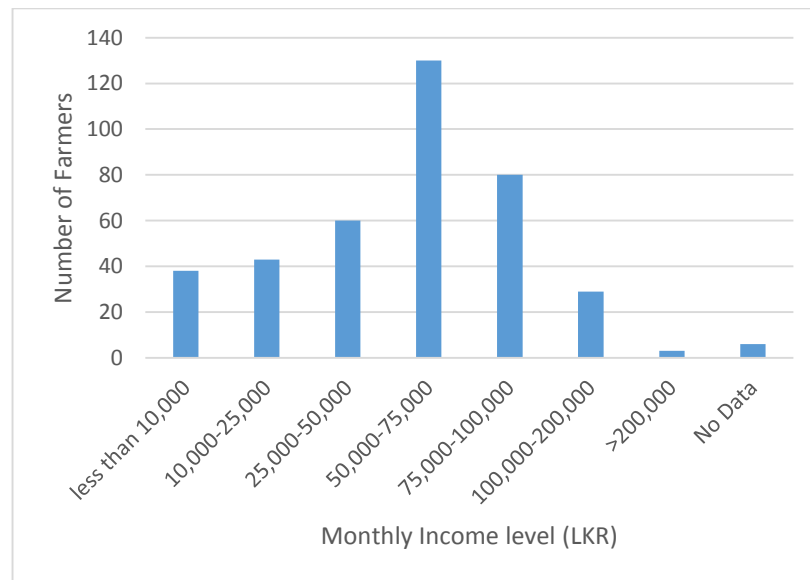
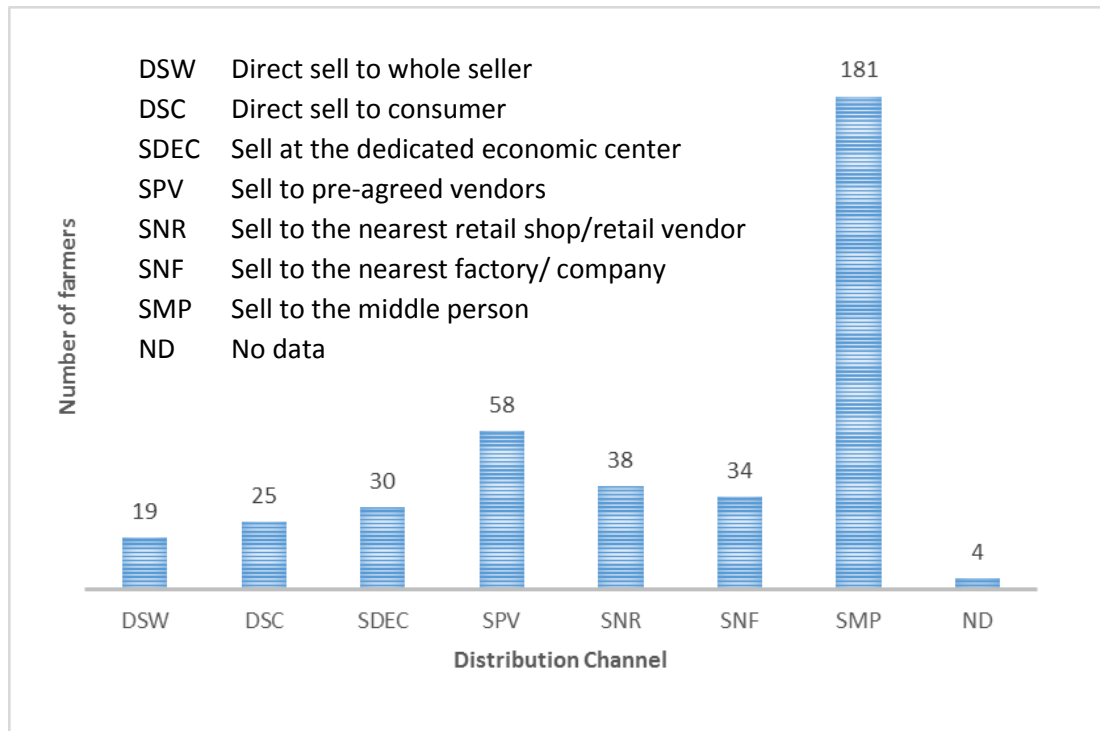


Figure 4-4: Farmer income level

4.1.4 Descriptive analysis of selling practice of farmers



We consider the gap between the farmer's selling price (FS) and consumer's buying price (CB) as percentage of consumer's buying price in as in **Error! Reference source not found.** We denote this value as a percentage and name it as FSCB. A smaller FSCB implies that the farmer gets a larger portion of the money paid by the consumer. A larger FSCB means a bigger gap between the price that the farmer got for his crop and the price that the consumer paid for it. This implies middle parties has grabbed a considerable amount of money.

$$FSCB = \frac{CB-FS}{CB}\% \quad \text{--- Equation 2}$$

According to Table 4.3 shows different selling methods that can be identified as distribution channels explained in Section 3.2. According to the responses following distribution channels were identified according to the farmers view:

1. Direct sell to wholeseller (DSW): In this method, the farmer sells the crop as bulk to the whole sale trader at the market avoiding the middle mans'

participation. The farmers have direct link to the wholesale traders. The whole sale trader decides the buying price.

2. Direct sell to consumer (DSC): In this method, the farmer has a place like by-road or retail market place ('Pola') or few retail market places (Pola in different places). Family members of the farmer support selling the farmer's crop directly to consumer. Unlike other selling options, the farmer has the power of setting the selling price but still.
3. Sell at the dedicated economic center (SDEC): At the setting up of Dedicated Economic Centers in 1998, one of the main objectives was to ensure obtaining reasonable prices for farmers for their crops by providing targeted market. But according to farmers' responses today the reality at the economic centers is that the brokers will line up to collect the crop from the farmers. The brokers has established their buying power at economic centers and farmers sell the crop to these brokers. The brokers collect crop from multiple farmers and make their own bulk of collection. The wholesale trader will buy these bulk of collection from the brokers in the economic centers.
4. Sell to pre-agreed vendors (SPV): Supermarket chain is one type of pre-agreed vendors in Sri Lanka such as Keels, Cargill's initiating a healthy trend in Sri Lanka towards agricultural industry contributing the farmers to sell crop directly to them. Further the vegetable export institutes also got strengthen past years emerging few of them as pre-agreed vendors. This can be similar to retail vendor or whole sale trader.
5. Sell to the nearest retail shop/retail vendor (SNR): In this method, the price decision is taken by the shop or retail vendor. Mostly, the price is lesser price than the current market price but farmer agree the price offer from these retail shop as it helps farmers to save their transport expenses. Retail sell the crop to the consumer directly to the market price.
6. Sell to the nearest factory/ company (SNF): Based on production area, government and private sectors have establish collection points. The farmers are able to sell their crop at the collection points for the price offering by the factory or the company. The buying price is still decided by the

factory/company but yet the farmer has the power to decide whether to sell it or go for another selling option. CIC, Nipuna Rice products are some of well-known companies that are located at the collection points to buy the crop from the farmers. This method can also be considered as whole sale trading as these factories and companies collect the crop from farmers and resell it as wholesale traders. Some cases these factories or companies perform intermediate cleaning and packaging to add values to the crop before re-selling to next trader.

7. Sell to the middle person (SMP): Middleman or broker stay in the middle of the supply chain and buy crop from the farmer and re-sell it to the wholesale traders as collection of bulk of crop. The middleman has the power of setting the buying price. The offered price would be accepted by the farmers as no other choice for farmers is there to sell their crop. The price offered by the middleman is believed to be quite low than the actual market price and middleman re-sell it to wholesale rising up the price he bought.

Table 4.3: Selling practice among sample population

Distribution Channel	Abbreviation	No of Farmers	Percentage of farmers
Direct sell to whole seller	DSW	19	5%
Direct sell to consumer	DSC	25	6%
Sell at the dedicated economic center	SDEC	30	8%
Sell to pre-agreed vendors	SPV	58	15%
Sell to the nearest retail shop/retail vendor	SNR	38	10%
Sell to the nearest factory/company	SNF	34	9%
Sell to the middle person	SMP	181	47%
No data	ND	4	

According to Table 4.3 majority of farmers which is 47% sell their crop via middle persons. Only 6% of the farmer population sell directly to the consumer.

Figure 4-5 shows the distribution of FSCB value throughout the population categorized according to Channel of Distribution. According to Figure 4-5 the data points are scatters in ranges as in Table 2.1.

Table 4.4: Farmer Selling and Consumer Buying price gap FSCB variation with Channel of Distribution

Channel of distribution	Range of FSCB (%)	Difference of the Range
DSW	15-55	40
SDEC	40-55	15
DSC	30-60	30
SPV	30-65	35
SNF	40-65	25
SNR	40-70	30
SMP	40-75	35

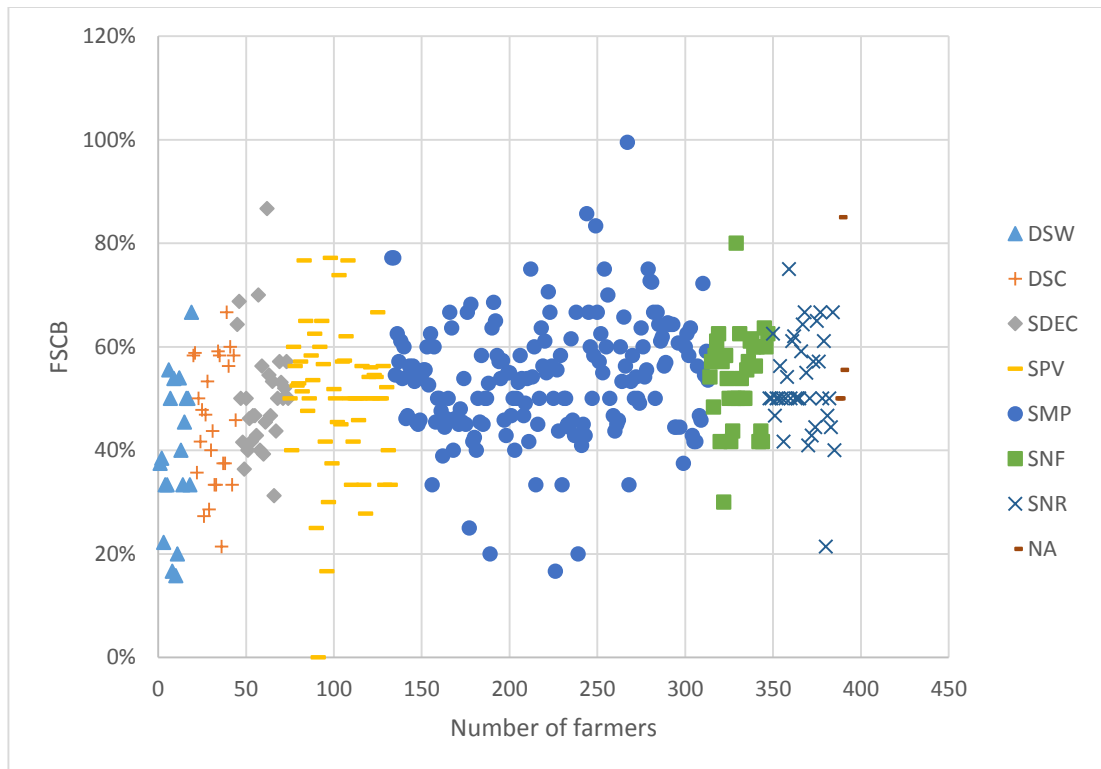


Figure 4-5 Distribution of farmer selling and consumer buying price (FSCB) throughout the population

According to Table 4.4 Selling to Middle Person (SMP) is at the high side such 40-75% of SFCB while Direct Selling to Whole seller (DSW) is at the lowest end such as 15-55%. Therefore farmer get a significant benefit by selling to the Whole seller

compared to Middle Person. Direct Selling to Customer (DSC) is also slightly more beneficial to the farmer compared to Selling to Middle person.

4.2 Correlation Analysis

4.2.1 Pearson Chi-square test

A chi-square test is used to see if there is a relationship between two categorical variables. In SPSS, crosstabs is used to obtain the test statistic and its associated p-value or Cramer's V value.

The chi-square independence test is a procedure for testing if two categorical variables are related in some population. This section discuss the Pearson Chi-Square Test of Independence to compare categorical variables to find the relationships among the Farmer Characteristic variables and e-Crop Selling Readiness introduced in Section 3.1.

4.2.2 Cramer's V value

Cramer's V is defined as a measure of association based on Chi Square. Cramer's V value is a statistic used to measure the strength of association between two nominal variables, and it take values from 0 to 1.

Values close to 0 indicate a weak association between the variables and values close to 1 indicate a strong association between the variables. The Cramer's V statistic is a symmetric measure, in the sense that it does not matter what variable is placed in the rows and what variable is placed in the columns.

4.3 Chi-Square Test and Null Hypothesis

The chi-square test allows us to test whether the observed proportions for a categorical variable differ from hypothesized proportions.

The null hypothesis for a chi-square independence test is that two categorical variables are independent in some population. Table 4.5 shows an SPSS result table given for Chi Square Independence test between Age group and e-Crop Selling Readiness. According to the test result, following procedure is used to accept or reject null

hypothesis and to find the level of correlation if null hypothesis is rejected: If the number of cells in correlation grid has less than 20% cells with expected count less than 5, then the Pearson chi square test is valid. Then the Asymptotic Significance also known as P value can be checked to evaluate null hypothesis. If the p -value is less than 0.05 then the conclusion is ‘the null hypothesis is rejected’. In the other word if p value <0.05 , then there is a relationship between two variables. This value 0.05 is known as α value. The nature of this relationship is interpreted by Cramer’s V value. It is common belief that a Cramer’s V closer to 1 means a strong association and that closer to 0 means weak association. Let’s assume 0 to 0.4 as weak, 0.4 to 0.7 as moderate and 0.7 to 1 as strong association.

4.3.1 Age Group * e-Crop Selling Readiness

Table 4.5: Pearson Chi Square Test Results for Correlation between Age Group and e-Crop Selling Readiness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	78.364 ^a	6	.000
Likelihood Ratio	87.012	6	.000
N of Valid Cases	389		

a. 2 cells (14.3%) have expected count less than 5. The minimum expected count is 1.44.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.449	.000
	Cramer's V	.449	.000
N of Valid Cases		389	

This is a valid test as there are only 14.3% of cells with value less than 5, which is less than 20%. The p -value is 0.000 which is less than 0.05. Therefore the null hypothesis is rejected for the relationship between e-Crop Selling Readiness and Age group.

Cramer's V value is 0.449, which implies that the association between e-Crop Selling Readiness and Age group is moderate.

4.3.2 Gender * e-Crop Selling Readiness

Table 4.6: Pearson Chi Square Test Results for Correlation between Gender and e-Crop Selling Readiness

Chi-Square Tests						
		Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square		.008 ^a	1	.928		
Continuity Correction ^b		.000	1	1.000		
Likelihood Ratio		.008	1	.928		
Fisher's Exact Test					1.000	.512
N of Valid Cases		389				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 41.39.

b. Computed only for a 2x2 table

This is a valid test as the cell count of less than 5 has 0.0% which is less than 20%. But the p-value is 0.928 which is greater than 0.05 therefore Null Hypothesis is accepted.

Therefore, the Gender has no influence on e-Crop Selling Readiness.

4.3.3 Education Level * e-Crop Selling Readiness

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	36.186 ^a	6	.000
Likelihood Ratio	37.829	6	.000
N of Valid Cases	389		

a. 4 cells (28.6%) have expected count less than 5. The minimum expected count is .36.

This is also not a valid test as the cell count of less than 5 is 28.6% which is greater than 20%. We cannot draw a conclusion about the relationship.

4.3.4 Income Level * e-Crop Selling Readiness

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.553 ^a	7	.477
Likelihood Ratio	7.498	7	.379
N of Valid Cases	389		

a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is 1.08.

This is again not a valid test because the count of cells holding values less than 5 is 25.0% which is greater than 20%. Therefore this test does not allow us to draw any conclusion about the relationship between e-Crop Selling Readiness and Income Level.

Pearson Chi Square Test results are summarized in Table 4.7. We will further analyze the relationship between Age Group and e-Crop Selling Readiness.

Table 4.7: Summary of Correlation Analysis

Correlated variables with e-Crop Selling Readiness	Conclusion
Age group	Moderate association
Gender	No association
Education level	Unknown
Income level	Unknown

4.4 Influence of Age Group on e-Crop Selling Readiness

Table 4.8: Cross tabulation of Age Group and e-Crop Selling Readiness

Age group * e-Crop Selling Readiness Crosstabulation

			e-Crop Selling Ready		Total
			No	Yes	
Age group	20- 30	Count	3	33	36
		% within Age group	8.3%	91.7%	100.0%
	31- 40	Count	46	30	76
		% within Age group	60.5%	39.5%	100.0%
	41- 50	Count	64	39	103
		% within Age group	62.1%	37.9%	100.0%
	51 -60	Count	53	30	83
		% within Age group	63.9%	36.1%	100.0%
	61-70	Count	60	6	66
		% within Age group	90.9%	9.1%	100.0%
	71-80	Count	19	2	21
		% within Age group	90.5%	9.5%	100.0%
	above 80	Count	4	0	4
		% within Age group	100.0%	0.0%	100.0%
Total		Count	249	140	389
		% within Age group	64.0%	36.0%	100.0%

According to Table 4.8 around 92% of the population in age group 20-30yrs are e-Crop Selling Ready. However, age group 31-60 yrs have only around 40% e-Crop Ready.

Let's consider the demographic analysis of age group 20-30 yrs. This group is already capable of adopting e-Crop selling.

4.5 e-Crop Selling Readiness of Age group 20-30 yrs

As discussed in Section 3.1, e-Crops Selling Readiness variable is composed as shown in Figure 4-6. According to the figure, all in the age group 20-30yrs 100% full fill requirements of digital literacy (defined in Section 2.2). In other words, they all use a smartphone without any assistance. However 8% is not ready for e-Crop Selling only due to “not accessing Internet”.

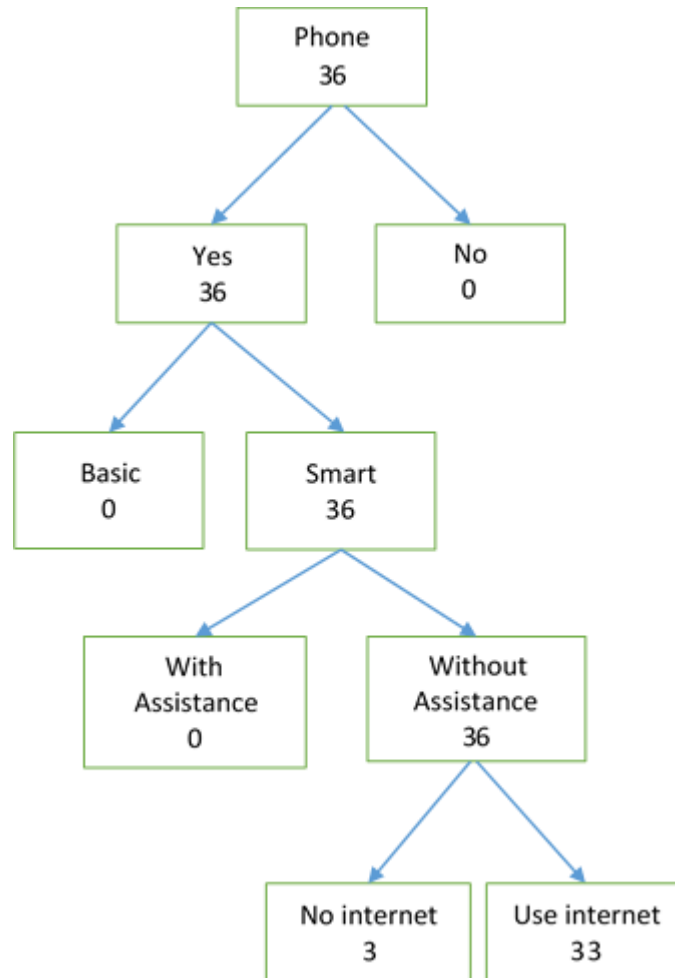


Figure 4-6: e-Crop Selling Readiness variable analysis for Age group 20-30yrs

There are 36 farmers in the age group 20-30 yrs. According to Figure 4-7 the male population is 67% and the female population is 33%. This is nearly close to the total population ratio between male and female in Figure 4-1.

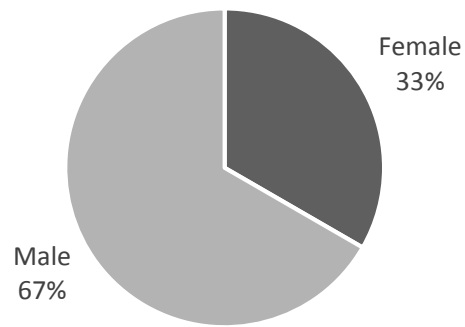


Figure 4-7: Gender distribution in 20-30 yr Age group

According to Figure 4-8, a significant portion which is 83% of the population in 20-30 yrs are educated with at least G.C.E. Ordinary Level.

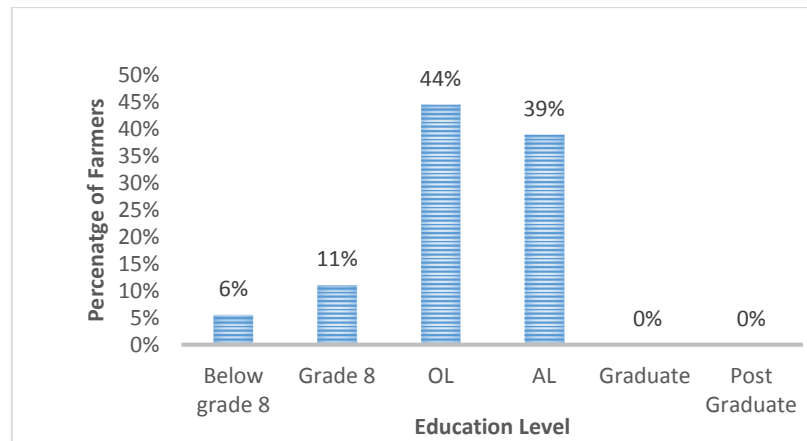


Figure 4-8: Distribution of Age group 20-30yrs according to Education level

In age group 20-30 yrs the most widely used channel of distribution is to sell to the middle person. There are 14 out of 36 farmers selling to the middle person, which means 40%.

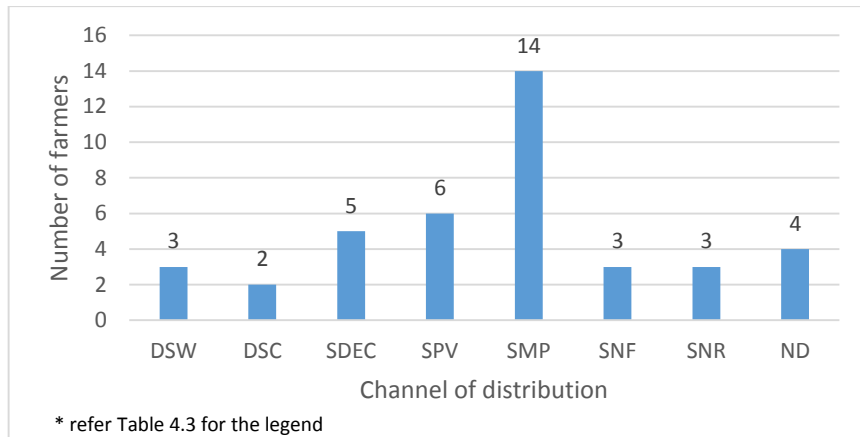


Figure 4-9: Distribution of Age group 20-30 yrs according to Channel of Distribution

4.6 e-Crop Selling Readiness of Age group 30-60 yrs

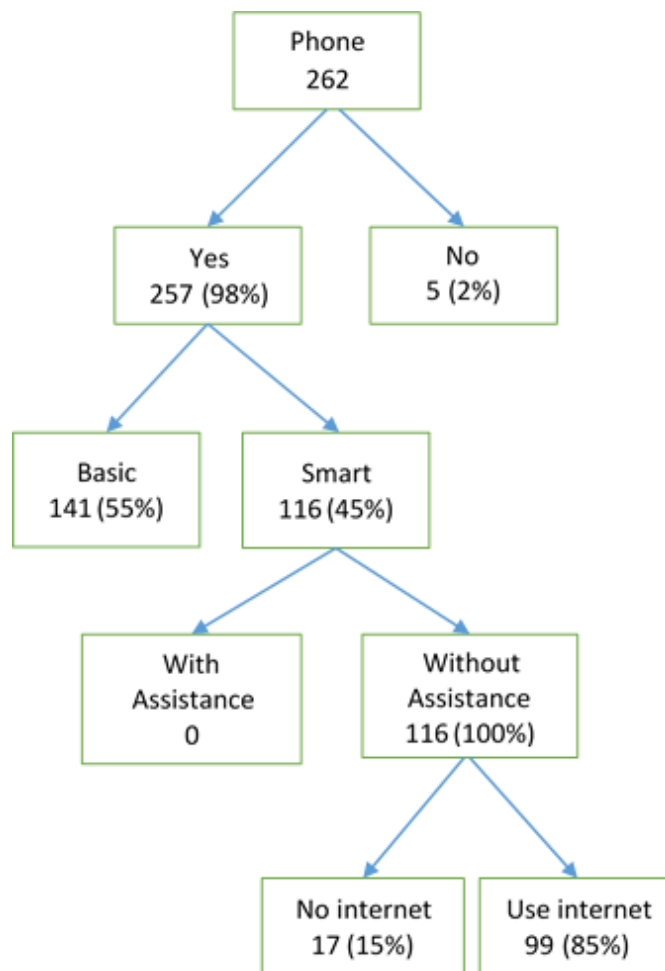


Figure 4-10: e-Crop Selling Readiness variable analysis for Age group 30-60yrs

In considering the composition of e-Crop Selling Readiness variable, in Figure 4-10 the age group 30-60yrs becomes less ready for e-Crop Selling mainly due to “not having/using a smartphone”.

5. DISCUSSION AND CONCLUSION

5.1 Discussion

Sri Lanka is a country quite suitable for agriculture. Agriculture is spread throughout the island with around 20% of its population being farmers. However, agriculture oriented development is minimal. An Internet based crop selling application that we call e-Crop Selling can give farmers more reach and ability to make data driven decisions in crop selling process.

This research seeks answers to the question whether Sri Lankan farmers are ready for e-Crop Selling and we consider smartphones for accessing Internet due to rapid penetration of mobile phone usage. For example mobile subscription is around 125% in Sri Lankan society as explained in Chapter 1.

Previous studies showed that Sri Lanka already have ICT based solutions for farmers including services such as Dialog TradeNet and Mobitel 6666 Agri Price Index mediated by Government of Sri Lanka and leading mobile phone service providers. These applications for example give farmers the important information such as current market prices and weather conditions in the country. However usage of these solutions remain negligible as per literature review in Chapter 2. Therefore this study was aimed at identifying factors that affect farmers to adopt e-Crop Selling.

As explained in Section 2.1 under the “Place” in 4Ps of Marketing Mix, distribution channel is an important aspect and during the pilot survey we identified channels given in Section 4.34.1.4 including Direct Selling to Consumer and Selling to Middle Man. The other important aspect was Price in the 4Ps of Marketing Mix. We took the gap between farmer’s selling price and the consumer’s buying price as a percentage of consumer’s buying price. We called this value the FSCB in Section 4.34.1.4.

According to the data analysis nearly 70% of the farmer population was males and remaining 30% were female. This imbalance had no influence on e-Crop Selling

Readiness because correlation analysis proved that Gender has no influence. Age wise farmers are distributed almost equally in age groups 30-40, 41-50, 51-60 and 61-70yrs with around 20% of the population in each group. Age group has a moderate influence on the e-Crop Selling Readiness of farmers. Almost all farmers which is 97% of the age group 20-30yrs are ready for e-Crop Selling. Over 80% of this group is educated at least up to GCE O/L. Only 40% of the farmers in the combined age group 31-60 yrs are ready for e-Crop Selling.

However around 40% of farmers in age group 20-30 yrs sell their crop to the middle man slightly less than the total population in which around 50% of the selling is through middle man. Further analysis into prices show that Selling to Middle Person is the least beneficial channel of crop selling because the value we defined as FSCB is high in this method. As described in Section 0)4.34.1.4, a smaller FSCB implies that the farmer gets a larger portion of the money paid by the consumer. A larger FSCB means a bigger gap between the price that the farmer received for his crop and the price that the consumer paid for it. This implies middle parties have grabbed a considerable amount of money. Since crops are raw vegetables, fruits and cereal there is minimum value addition rather than transportation and classification costs if any.

Even though the Direct Selling to Whole seller is the highest gain to the farmer, there are practical issues of connecting the wholesaler to farmer due to reason that the wholesaler collecting crop as huge bulk and the farmer cannot fulfil the wholesaler's required amount at request. Therefore not every farmer can reach to wholesaler directly and farmers might tend to follow other methods for selling. The other concern is power of setting the selling price is out of farmers' hand all the other methods except Direct Selling to Customer. Thereby farmer is being controlled by power of setting the selling price owned by the other parties such as wholesaler, middleman or pre-agreed vendors so on in all the other methods except Direct Selling to Customer.

Considering the above analysis there is an opportunity that can be created by facilitating the Direct Selling option for the farmers for better price gains for the farmer. Direct Farmer-Consumer relationship brings the benefit to both the farmer and the buyer. This is because the farmer can sell the crop at higher rate compared to other

methods and buyer can purchase fresh crops with minimum intermediate handling. This method will aid the farmer to hold the setting up the selling price without direct influence and bargaining powers of other parties other than the consumer.

Consumers may also be more interested in purchasing vegetable directly from farmers because they may be concerned about the freshness and especially the quality, health and the nutritional value.

e-Crop Selling is a viable platform for facilitating Direct Selling such that farmers and consumers can be directly linked in a business model like how Uber operates. Even the other parties such as Agricultural authorities, Transport services, Researchers...etc can also get involved via e-Crop Selling. An e-Crop Selling solution can also facilitate farmer to take informed decisions so that he is able to decide best time and place to sell their crops and even to decide a profitable crops for the next cultivation. Also up to date market information such as market prices and demand for crops can be disseminated to the community via such apps. The existing such isolated systems can also be integrated to a common platform with government mediation.

We identified that age group 20-30yrs are already equipped with e-Crop Selling capabilities in terms of device and its usage to access Internet. Also they have an opportunity to reduce middle man intervention and gain a better price because at the moment majority of them sell to middle man. Therefore we recommend popularize existing Internet based agricultural tools to the young farmer group such as 20-30yrs. A pilot e-Crop selling project can be started among this group particularly by convincing the benefits of direct selling to consumer than traditional selling to middle persons or parties.

5.2 Future work

During the period of data collection the farmers generally showed an enthusiasm and some expressed their hope that we would introduce a technological system for them to make their life easier at the point of marketing and selling their crops direct to consumer. With the initial studies in this research give a clue that middle parties are

likely to reduce farmers' benefits in crop selling. A further study is required to identify the influence of middle parties on pricing.

It is vital to understand their needs of technology to be applied and unnecessary parties involve in the agricultural supply and value chain at least from the farmers to consumer. This study focused only on the famers' view and to the raw crop selling only. These are a large scope to study the agriculture industry to make e-Crop Selling a practical reality. Such a system of research and development should be directed towards solving practical problems such as informed decision making by all stakeholders for example in selecting the next crop to cultivate and when and where to optimally transport and sell crops. We envision a practical applications in this domain such as introducing a map which has the updated information about the type of crop available, current prices, crop demands and geographical location of crop distribution, the estimated periods of harvesting and so on. Various types of users such as farmers and consumers should easily interact with it at a fingertip move.

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Appendix A: Farmer Questionnaire

SURVEY - THE FEASIBILITY OF USING E-CROP SELLING BY SRI LANKAN FARMERS

This data collection is done by a MBA student of CSE Department University of Moratuwa for the purpose of MBA research.

If you have a family member or a friend who involves in cultivation or agriculture please fill the answers for following set of questions on behalf of him/her.

***Required**

YOUR NAME

CONTACT NO

Read carefully before answering

Following questions are about the farmer

The following questions can be answered by you, on behalf of the person who involves in the cultivation of your family or friend.

Who involves in your family in cultivation?(Pick the main person who runs it) *

- My self
- Father
- Mother
- Brothers/Sisters
- Grand parents
- Friend

Age group of the farmer *

- 20- 30
- 31 -40
- 41- 50
- 51 -60
- 61- 70
- 71-80
- above 80

Gender of the farmer *

- Male
- Female

Level of the education of the farmer

- Below grade 8
- Grade 8
- OL
- AL
- Graduate
- Post Graduate

What is the province the farmer represents *

- Northern
- North Western
- Western
- North Central
- Central
- Sabaragamuwa
- Eastern
- Uva
- Southern

What is the district the farmer represent?

The following questions are about the farmer's mobile phone

Does the farmer use a mobile phone? *

- Yes
- No

If the farmer does not use a mobile phone, what is the reason for not using one because

- He /She doesn't like to use electronic devices.
- He /She cannot afford the cost of a phone and the bills.
- He /She doesn't have the skills to use a phone.
- It disturbs the farmer's life style.
- No signal in the area.
- Phone is something that is not necessary.
- Other reason

Does the farmer use a smart phone? *

- Yes
- No

Can the farmer use a mobile phone without any assistance? *

- Yes
- No

What is the model of farmer's mobile phone *

- Nokia
- Samsung
- LG
- Sony
- Apple
- Huawei
- HTC
- Chinese brand
- Oppo
- Microsoft
- Other brand
- Unknown brand
- NA

What is the network the farmer use *

- Dialogue
- Mobitel
- Airtel
- Hutch
- Etisalat
- NA

How does the farmer get the mobile fixed when there is a fault *

- Someone in the family or friend
- Phone shop nearby
- Phone shop in the town
- Other
- None

What are the functions does the farmer do with the mobile phone *

- Call
- SMS
- MMS
- Facebook
- Viber
- Whatsapp

- Email
- Google search
- Google map
- Skyp
- Other
- None

The family member or the friend involves in the cultivation as a *

- Farmer
- Labour
- Hire the labours to cultivate his own land
- Rent/lease the own land someone to cultivate
- Someone cultivate for harvest share basis
- Provide the harvest transportation
- Manufacture another product to sell from crop
- Sell fertilizers and other farming equipment
- Rent out the lands for farmers to cultivate
- Other

The farmer cultivates because *

- It is the main income
- An extra income
- For family consumption
- A hobby or habit
- Other

The following set of questions are about the farmer's harvest

* You may answer the following questions using few words or as numbers in short.

* Please do not avoid the question if you can find the correct figures.

*It is really appreciated, taking a little effort if you can find the accurate figures whilst answering.

How long the farmer has been cultivating?

- Less than one year
- 1 to 5 years
- 5 to 10 years
- 10 to 15 years
- 15 to 20 years
- more than 20 years
- more than 30 years
- more than 40 years

What is the category of crop the farmer cultivate? *

- Cereal and Nuts
- Vegetable
- Fruits
- Coconut
- Paddy

What is the name of vegetable fruits most recently the farmer harvest?

Your answer

What is the land size the farmer harvest?

- Less than half acre
- One Arce
- One to two Arce
- Two to three Arce
- Three to four Arce
- Four to five Arce
- More than 5 Arce
- Other:
-

What is the monthly income of the farmer?

- Less than 10,000
- 10,000-25,000
- 25,000-50,000
- 50,000-75,000
- 75,000-100,000
- 100,000-200,000
- >200,000

What is the amount of the most recent harvest the farmer collected (in kg or amount)?

Your answer

How much was the unit price of the most recent crop, the farmer sold in Rupees?

Your answer

How much was the market price at the time the farmer sold above crop in rupees?

Your answer

The following questions are about the methods the farmers use to sell their crop.

What are the methods, the farmer use to sell the crop? *

- Direct sell to consumer
- Direct sell at the market
- Sell to the middle person
- Sell to the nearest retail shop/retail vendor
- Sell to the nearest factory/company
- Sell at the economic centres (such as Dambulla, Meegoda)
- Sell to pre-agreed vendors

Who set the 'selling price ' of the crop while farmer selling at other party? *

- The farmer
- The consumers
- The middle person
- Retail vendor
- The factory/company
- As per early agreed price with a vendor
- NA

The farmer sells his/her crop because ... *

- The main income
- To find additional income
- to pay debts or loan took by the farmer to do the cultivation
- extras after consumption
- other reason

How does the farmer find the current selling price of the crop he/she expects to sell? *

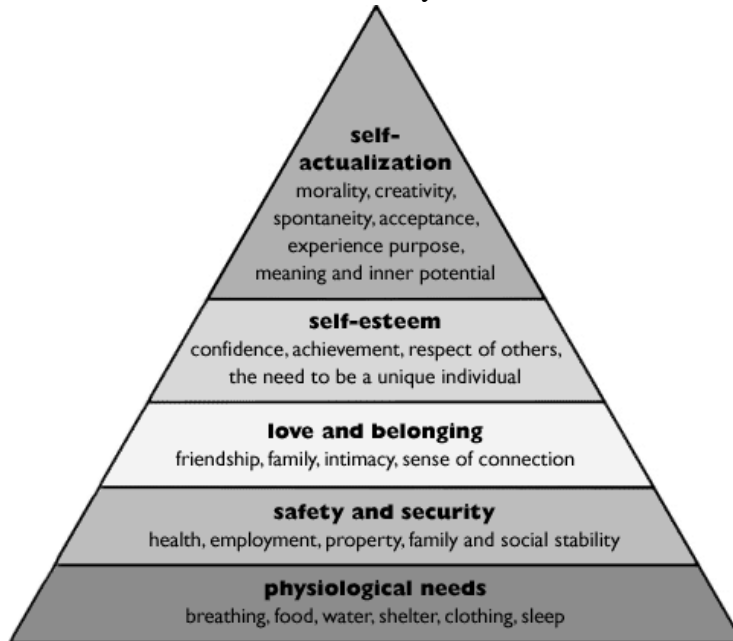
- From media
- From vendor
- From the market
- From company
- From field officer
- From economic center
- From friend
- From government authority
- Internet
- No idea about the current price.
- Other

How does the farmer decide the crop that would be harvest for next season? *

- Randomly pick up the crop
- Pick up by experience
- Guess the demand and harvest
- Analyse and select the crop
- Gain advice from experts
- Carry on the same crop
- Ask from a friend
- Ask from field officer
- Other

Appendix B

I. Maslow's Need Hierarchy



II. Product market expansion grid

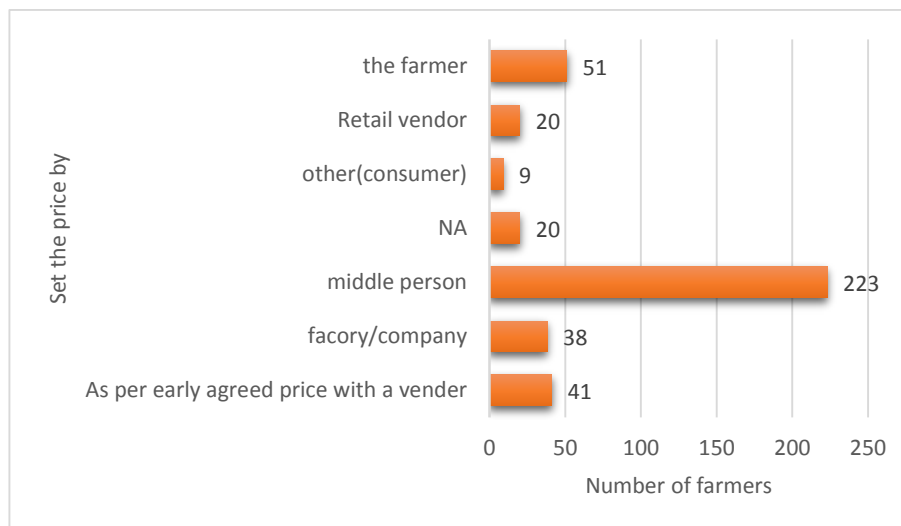
	Existing products	New products
Existing markets	Market penetration	Product development
New markets	Market development	Diversification

Appendix C

I. Demographic Analysis

This discussion is to additionally understand the farmer's demography and their behavior which gathered as data during the research is analyzed below for future reference.

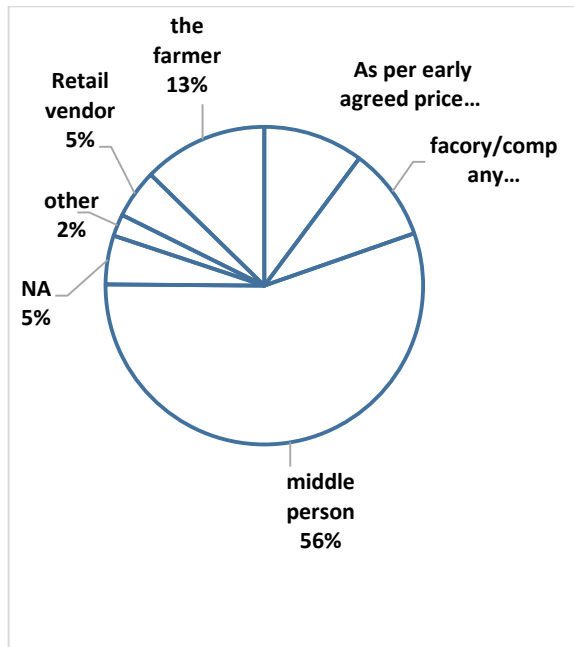
i. Farmer - Set the 'selling price 'of the crop by



At the phase of selling crop, the bar chart reveals, the power of setting price has only for 13% of farmer population even though he is the main crop producer. Rest of 87% of the farmer population doesn't have the power of setting price of their crop at selling instead, few other groups take the authority of setting the price for crop at buying from the farmer.

Such other groups are the highest figures 56%, belongs to middle man as the controlling person of setting of price at selling price decision. The rest of majority of the farmers agree the prices is offered by the middle man.

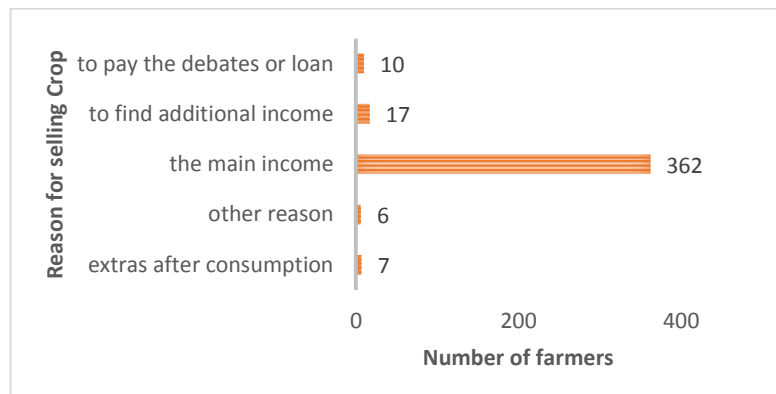
Set the sellign price by



Set the selling price by-As percentage

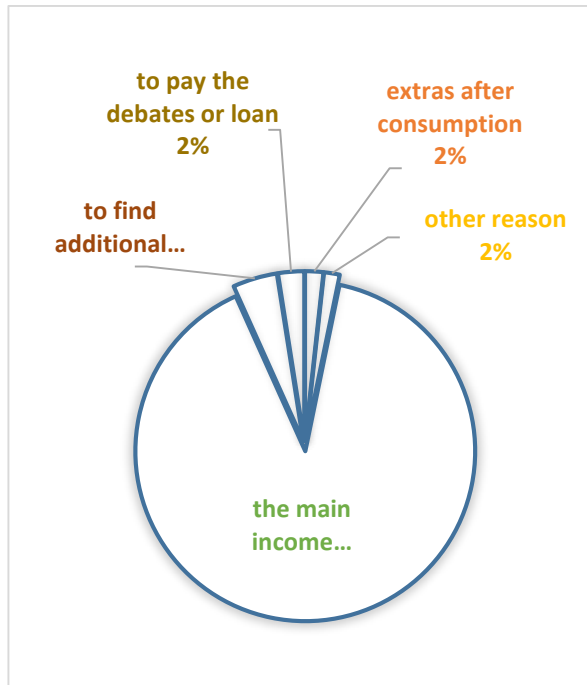
10% of farmer agree with price of as per-agreed vender offer as it was mutual agreement set up before harvesting.9% of farmer population agrees the price offered by the factory or the company as it is convenient or less transportation cost for selling them at nearest agro collecting factory or company. The 5% of the farmer population agrees with the price offer by the retail vendor selling it the closet retail shop.

ii. Farmer -Reason for selling Crop



The reasons for selling crop is recognized as

- The main income
- Find additional income
- Sell extras after consumption
- Pay the debates or loan
- Other reasons



Crop Selling reason of farmers as percentage

The pie chart reveal 90% of the farmers' main income is crop selling. 4% of population involve in farming for their additional income. In this case some farmers have other main income such as salary from a job or a pension, or a business earnings other than farming. 2% the population sell extras after consumption. This 2% doesn't have a purpose of crop selling as they use the crop for family consumption but selling the extras after consumption to the neighbors or neighbors' shops.

iii. Farmer -Decision making for next season

The decision is taken by the farmer about ‘the Crop which harvest in next season’ is important decision for future harvesting. Identify how the farmer make the next season decision implies how the farmers use the past data to apply in the future investment. 38% farmers carry on the same crop that harvested last time without any consideration while 37% select the next crop decision harvest by experience. The both majority type of decision making doesn’t have selling or marketing ground of the supply and demand of the crop before select the type of crop for harvesting.

18% guess the demand and harvest.2% analyse the past market and select crop and other 2% gain advice from experts.

Decision Making for next harvest	Farmers	Percentage
Select by own experience	146	38%
Carry on the same crop	141	37%
Guess the demand and harvest	67	17%
other	10	3%
Analyse and select the crop	9	2%
Gain advice from expert	9	2%
Ask from a frind	3	1%