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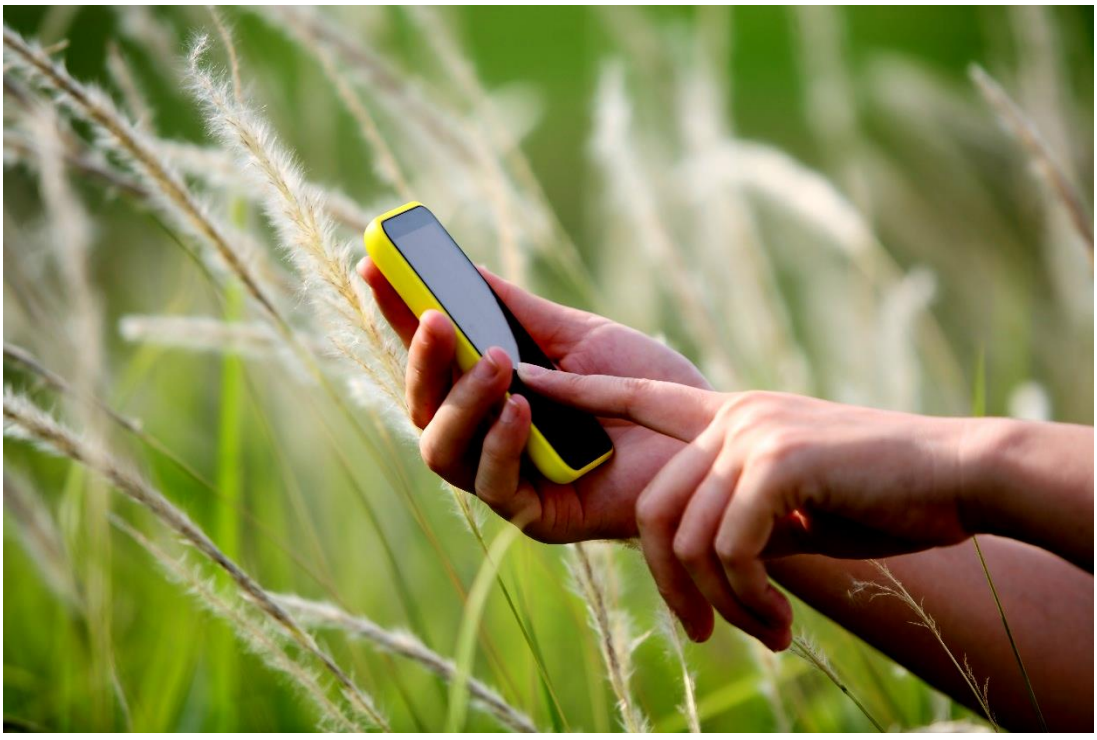
"An empirical study of the relationship between the availability of agriculture-related information and the usage of Information and Communication Technologies (ICT) among the farmers in Shida Kartli Region"



Submitted by: **Mariam Zaldastanishvili**

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Abstract

The uses of Information and Communication Technologies (ICT or ICTs) in agriculture, usually referred to as 'e-Agriculture', has been studied extensively. Information and Communication Technologies can enable the transfer of information through digital means. Thus, ICTs can facilitate the informed decisions of the players involved in agriculture sector – the most vulnerable of which are the farmers. The literature available on the farmers' usage of Information and Communication Technologies suggests that ICTs have a potential to make agriculture-related information available to a greater number of farmers. ICTs also save time needed for the latter to obtain the information and are useful for providing them with more quality information. When considering the factors affecting the farmers' usage of ICTs, a particular emphasis is given to farmer's age, education level, his/her perception of farming as a business, the size of the land owned by the farmer and the income outside farming. The above-listed factors are likely to predict whether or not the farmer will utilize ICTs in order to get agriculture-related information.

A face-to-face quantitative field research was conducted among the farmers in Shida Kartli region of Georgia. The study found that the farmers' usage of Information and Communication Technologies did contribute to a greater availability of agriculture-related information, while its effects on the time saved on getting the information and the quality of the information available were less significant. The study also suggests that the factors such as the age of the farmer, the size of the land owned by the latter and the farmers' perception of farming as a business are likely to predict the farmers usage of ICTs.

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Introduction

Agriculture is thought to be one of the major drivers of a country's economy, as well as an important contributor to the employment of billions of people around the world (Maumbe, 2013)[1]. In addition to that, it is popularly known as a livelihood activity of the vast majority of the poor (The World Bank, 2011)[2], which makes it a promising sector for pro-poor growth. The latter usually results from poverty reduction and improved access to opportunities by the poor (Batchelor, et al., 2005)[3]. Making the information and communication tools available to the farmers, is one of the ways in which opportunities can be created to the poor in agriculture, because the knowledge-intensive nature of agriculture creates the need for the farmers to make informed decisions on the issues which have an impact on the livelihoods of their families and societies (Sylvester, 2015)[4].

Farmers have different types of information needs, ranging from the weather forecasts to the improved cultivation practices (Aker, 2010)[5]. Given the farmers' increased need for the information, the emergence of the 'Digital Age' and Information and Communication Technologies (ICTs or ICT) is well-timed. ICTs are usually referred to as 'any device, tool, or application that permits the exchange or collection of data through interaction or transmission' (The World Bank, 2011). Nowadays, when we think of Information and Communication Technologies we mostly think of the internet or mobile phone, while ICTs can also refer to traditional technologies, such as radio or television (Batchelor, et al., 2005). As a result, 'ICT is an umbrella term that includes anything ranging from radio to satellite, imagery to mobile phones or electronic money transfers' (The World Bank, 2011). The technological innovations and changes are argued to be the most beneficial to the disadvantaged communities, such as the farmers, because ICTs are thought to unlock developmental opportunities for the latter (Yueh, et al., 2013)[6].

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1 Maumbe, B.M. (2013) 'Global e-Agriculture and Rural Development: E-value Creation, Implementation Challenges, and Future Directions'. *IGI Global*;

2 The World Bank (2011) 'ICT in Agriculture'. Available at: http://www.ictinagriculture.org/;

3 Batchelor, S., Scott, N. & Woolnough, D. (2005) 'Good Practice Paper on ICTs for Economic Growth and Poverty Reduction'. DAC Journal, 6(3);

4 Sylvester, G. (2015) 'Success Stories on Information and Communication Technologies for Agriculture and Rural Development' (FAO, 2015, February). Available at: http://www.fao.org/3/a-i4622e.pdf [Accessed on: March 8, 2016];

5 Aker, J.C. (2010) 'Dial "A" for Agriculture: Using Information and Communication Technologies for Agricultural Extension in Developing Countries'. Tuft University, Economics Department and Fletcher School, Medford MA02155, 37;

6 Yueh, H-P., Chen T-L., Ciu, L-A. & Lin W-C. (2013) 'Exploring Factors Affecting Learners' Perception of Learning Information and

Although Information and Communication Technologies are argued to advance people's lives, ICTs are not likely to bring about any change if the potential users are not able to make the use of them. Consequently, IT-related changes are usually followed by several risks. Firstly, there is a risk that IT systems will not be able to meet the user needs, and secondly, there is a risk that the system will not be used because of the users' resistance or lack of commitment (Chircu & Lee, 2003)[7]. Consequently, this study is based on the measurement of the above-mentioned risks with regards to the farmers' usage of ICTs for the purpose of getting agriculture-related information.

The paper first considers the ability of Information and Communication Technologies to meet the farmers' information needs. By doing so, the research attempts to study whether the ICTs are able to contribute to the greater availability of agriculture-related information to the farmers. Next, the study considers whether or not the usage of ICTs saves time needed for the farmers to get the information they are interested in. In addition to that, the research attempts to find out whether or not the farmers are able to find more quality information with the use of ICTs. Regarding the second risk factor, the study provides information about the farmers' usage of Information and Communication Technologies – namely, what makes farmers committed to using ICTs when they need to get agriculture-related information. In order to do so, the research considers some of the social and economic factors affecting the farmers' usage of ICTs in Georgia, in Shida Kartli region.

Georgia is rich in agricultural resources, has diverse climate zones, 49 types of soils, and 43.4% (more than 3 million hectares) of the land designated for agricultural purposes (MOA, 2015)[8]. Consequently, the issue of keeping the farmers informed about the agriculture-related topics is among the challenges that the Ministry of Agriculture of Georgia is targeting in the scope of the 2015-2020 "Strategy for Agricultural Development in Georgia" (MOA, 2015). Shida Kartli region is one of the most productive regions in the agriculture sector of Georgia. However, the 2008 August war affected the livelihoods of many in Shida Kartli,

Communication Technology: A HLM Analysis of a National Farmers' Training Program in Taiwan'. Educational Technology & Society, 16(1): 231-242;

7 Chircu, A.M & Lee, D. (2003) 'Understanding IT investments in the Public Sector: The Case of E-Government'. Ninth Americas Conference on Information Systems, 2003 Proceedings, Paper 99;

8 MOA (2015) 'Strategy for Agricultural Development in Georgia 2015-2020'. Available at: http://moa.gov.ge/Ge/Strategy [Accessed on February 12, 2016];

including those of the farmers. Since the region is located near the borders of the occupied territories of Georgia, there is more likelihood that the farmers living in this region are faced with the problems with regards to the availability of agriculture-related information. For this reason, Shida Kartli region was selected for the study.

This paper is started out by the review of the existing literature about the uses of Information and Communication Technologies in agriculture, as well as the uses of ICTs in Georgian agriculture sector. The research proceeds with explaining the methodology adopted for studying the usage of ICTs by the farmers in Shida Kartli region. Later, the paper presents the field research findings, followed by discussions, research limitations and managerial implications. The paper is finalized with conclusion.

What is ICT?

ICT (or ICTs) is an acronym which is used to refer to Information and Communication Technologies. There are a number of ways in which ICTs can be defined. However, almost all of these definitions are likely to share a common characteristic – they will 'revolve around the devices and infrastructures that facilitate the transfer of information through digital means' (Zuppo, 2012)[9]. As a result, *'ICT is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning'* (TechTarget, 2016)[10]. The reason why the definitions of ICTs vary is that the latter is used differently in education, economic, IT and other domains (Zuppo, 2012). In addition to being used differently as a term, ICTs are also thought to deliver different benefits to each of these sectors and according to the European Commission, the importance of ICTs are less about the technology itself and are more about their abilities to broaden access to information and communication to the disadvantaged communities (TechTarget, 2016). Consequently, it is

9 Zuppo, C.M. (2012) 'Defining ICT in a Boundaryless World: The Development of a Working Hierarchy'. International Journal of Managing Information Technology (IJMIT), 4(3): 13-22.

10 TechTarget (2016) 'ICT (Information and Communication Technology – or Technologies)'. Available at: http://searchcio.techtarget.com/definition/ICT-information-and-communications-technology-or-technologies

important to proceed with outlining some of the most common potential benefits that ICTs are able to deliver to agriculture sector.

The potential benefits of ICT in agriculture

Information and Communication Technologies facilitate communication and flow of information through digital means. As a result, ICTs are able to meet the information and communication needs of the players involved in the agriculture sector – which, as already mentioned, is a very knowledge-intensive domain. The usage of ICT in agriculture is usually referred to as 'e-Agriculture'. The term 'e-Agriculture' has been defined as '*the application of modern ICT to agriculture input or ingredient procurement, production, storage, distribution, processing, and marketing with the goal of transforming people's lives*' (Maumbe, 2013). Based on this definition, it can be argued that ICTs are able to enhance each stage of agricultural production, ranging from the procurement of agriculture inputs, to the marketing of the finished goods. The reason why Information and Communication Technologies are able to do the latter is that with the help of modern ICTs, such as the internet, mobile phone, radio, or television, the players in the agriculture sector are able to receive relevant and timely information and make informed decisions more productively and profitably (Ali, 2012)[11]. As a result, there are several ways in which ICTs create a potential to facilitate the effective information delivery and communication among the players in the agriculture sector.

Information and Communication Technologies in agriculture can potentially make information *available* to a greater number of people involved in the agriculture sector. In their study about the ICT uses in agriculture, Wasihun & Maumbe (2013)[12] emphasize the ability of ICTs to promote market transparency, making information accessible, understandable, reliable and comparable across regions and countries. Maumbe (2013) points at the ability of ICTs to facilitate the share of the information about the best practices and new product and

11 Ali, J. (2012) 'Factors Affecting the Adoption of Information and Communication Technologies (ICTs) for Farming Decisions'. Journal of Agriculture and Food Information, 13: 78-96;

12 Wasihun, T.A. & Maumbe B.M. (2013) 'Information and Communication Technology Uses in Agriculture: Agribusiness Industry Opportunities and Future Challenges'. IGI Global;

service innovations worldwide. For example, farmers are thought to be traditional innovators in agriculture, who actively share their best practices and ICTs provide new channels for this communication (The World Bank, 2012)[13].

Information and Communication Technologies also have a potential to *save time* needed for communicating and obtaining information. The latter is especially important to the rural communities – living in remote areas. For example, with the use of mobile phones, agricultural producers do not need to go directly to the market and communicate about the prices (Chhachhar, et al., 2014). In addition to saving time, ICTs save costs related to obtaining and communicating agriculture-related information. Aker (2010) also refers to this idea by suggesting that mobile phones are less expensive than the equivalent per-search opportunity and transport costs or the costs of obtaining the same information from a newspaper every time.

A number of studies suggest that the use of Information and Communication Technologies in agriculture can potentially facilitate the delivery of more *quality* information to the players in agriculture sector. For example, Maumbe (2013) highlights the importance of ICTs in reducing the information asymmetries.

It has been mentioned earlier that the main potential benefit of 'e-Agriculture' lies in the improvement of livelihood activities of the poor, who usually dominate the agriculture sector. When considering the poor in agriculture, a particular emphasis is given to the farmers, who are usually incapable of competing with larger agricultural producers. In order for the farming communities to stay competitive, they have to make informed decisions, hence, they constantly need to be updated on agriculture-related topics, which is not always easy for them (Ali, 2012). Due to the farmers' increased need for the agriculture-related information, the factors affecting the usage of Information and Communication Technologies by the latter have been studied extensively. As a result, following section summarizes some of the common factors affecting the farmers' usage of ICTs for the-agriculture related purposes.

13 The World Bank (2012) 'Using ICT to Enable Agricultural Innovation Systems for Smallholders'. Available at: http://www.fao.org/docrep/018/ar130e/ar130e.pdf

Factor affecting the farmers' usage of ICT

It has been mentioned earlier that the IT-related changes are unlikely to be successful if the IT systems are not being used by the users because of the resistance or lack of commitment of the latter (Chircu & Lee, 2003). In the same way, Information and Communication Technologies are unlikely benefit the agriculture sector if the users are not willing to adopt them. As a result, the research emphasizes on the factors affecting the farmers' usage of ICTs. One of the most common factors affecting the farmers' usage of Information and Communication Technologies are the social factors. According to Derso, et al. (2012)[14] and Ali (2012), *Age* and *education level* are likely to affect the farmers' decisions to utilize ICTs for the agriculture-related purposes. In their study, Derso, et al. (2012), found that the mean age of the users and non-users of ICTs were 38.16 and 50.73, respectively, meaning that, on average, the users of ICTs were younger than the non-users. Ali (2012) also found the older farmers to appear more conservative towards ICTs and be less committed to using the latter for their farming enterprises, compared to the younger farmers. With regards to the education level, Ali (2012) suggests that ICT users have more years of schooling, mostly, secondary/senior schools and/or above, while according to Derso, et al. (2012), 85.5% of the literate farmers were the users of ICTs and 77.3% of the illiterate farmers were the non-users of ICTs. The above mentioned suggests that the more educated a farmer is, the more likely he/she is to utilize ICTs for the agricultural purposes.

Other common factors affecting the farmers' usage of Information and Communication Technologies are the economic factors, such as *land size*, perception of *farming as a business*, and *off-farm income*. Derso, et al. (2012) found that the mean sizes of the lands owned by the users and non-users of ICTs were 3.11 and 2.94 hectares, respectively, meaning that the bigger their lands the more likely are the farmers to use ICTs. Contrary to that argument, Ali (2012) found that the farmers with large landholdings are less likely to utilize ICTs, compared to smallholders.

An important factor affecting the usage of Information and Communication Technologies by the farmers is their perception of farming as a business. Ali (2012) found that farmers who

14 Derso, D., Mammo, Y. & Jema, H. (2012) 'Analysis of the Use of Information and Communication Technologies among Farmers in Tole District, South West Shewa Zone, Oromia Regional State, Ethiopia'. International Journal of ICT Research and Development in Africa, 3(2): 1-12;

perceive farming as a business are 52% more likely to utilize ICTs for making agriculture-related decisions. No less important is the factor of off-farm income. Ali (2012) suggests that farmers who have off-farm income (secondary sources of income), are 12% more likely to use ICTs for agriculture-related purposes.

ICT in Georgian agriculture sector

Georgian agriculture sector has seen some positive changes with regards to utilizing Information and Communication Technologies. A number of governmental, private, or international organizations have used their online platforms in order to provide information about different agriculture-related topics. For example, the website of the LEPL Scientific-Research Center of Agriculture of the Ministry of Agriculture of Georgia regularly publishes scientific researches for the players involved in agriculture sector.

Some websites enable the consumers to shop online for agricultural products. For example, www.soplidan.ge is a website aimed at providing the Georgian population with products supplied from different villages of Georgia. Such online platforms can potentially help the farmers to observe the market trends (e.g. the demand for the products, or the market prices). The website operates a blog and actively collaborates with the Georgian farmers' association – helping the farmers to enter new markets.

A number of internationally funded projects address the issue of improved farmer knowledge and delivery of quality services by supporting the Farm Service Centers (FSC). These centers are mainly aimed at providing farmers with agricultural input products, such as pesticides and fertilizers, small tools, veterinary drugs, seeds, chemicals, as well as machinery and veterinary services necessary for agricultural production (REAP, 2016)[15]. Established in 2005, Ltd 'Agrokartli' is a Farm Service Center operating in Shida Kartli region. The company is one of the FSC grantees of the USAID funded REAP project. Ltd 'Agrokartli' has several branches in the region with around 1000 farmers visiting the service centers daily. This FSC utilizes Information and Communication Technologies for the purpose of delivering information related to whether forecasts and potential risks to the farmers. The company collects data

15 REAP (2016) 'REAP Approved Projects'. Available at: http://www.arcgis.com/home/webmap/viewer.html?webmap=be7a5f8405824cddb14befbf87542fd6

from 9 meteorological stations and informs farmers about plant protection needs via short message services. The target farmers are selected using the contact database of Ltd 'Agrokartli'. In addition to that, Ltd 'Agrokartli' owns show rooms which are equipped with monitors and which track the information obtained from meteorological stations from Gori and Kareli municipalities, helping the farmers to timely identify all risks and take sufficient measures using the company's products and services (REAP, 2016). By doing so, Ltd 'Agrokartli' avoids information asymmetries and enables the farmers' access to the official sources, in this case, the meteorological stations. In addition to that, by utilizing ICTs, the company delivers the information in a timely manner, which is essential with regards to the issues such as whether forecasts and potential risks. As a result, the company provides more context-specific information to the farmers.

Research questions and hypothesis

Based on the issues discussed above, this paper aims to answer two research questions. The study will attempt to answer the question of whether or not the usage of Information and Communication Technologies by the farmers can lead to the potential benefits of ICTs mentioned above. There were three potential benefits of the uses of ICTs in agriculture: (1) the greater availability of agriculture-related information, (2) the time saved on getting agriculture-related information and (3) the improved quality of the agriculture-related information.

The research assumes that the more frequently the farmers use Information and Communication Technologies, the more available the agriculture-related information is to them. As a result, the study will test the following hypothesis:

H1: The frequency of the farmers' usage of ICTs will be positively related to the farmers' perceptions about the availability of agriculture-related information.

Another assumption is that the more frequently the farmers use Information and Communication Technologies, the more they are able to find agriculture-related information in a timely manner. Consequently, the following hypothesis will be tested:

H2: The frequency of the farmers' usage of ICTs will be positively related to the farmers' ability to find agriculture-related information in a timely manner.

Final assumption is that the more frequently the farmers use Information and Communication Technologies, the more quality agriculture-related information they are able to find. As a result, the study will test the following hypothesis:

H3: The frequency of the farmers' usage of ICTs will be positively related to the farmers' perceptions about the quality of agriculture-related information.

Another research question to be answered by this study is: what are the factors influencing the farmers' usage of Information and Communication Technologies in Shida Kartli region? The factors considered by the study are social factors of age and education level and economic factors of the size of the land owned, the perceptions of farming as a business and the off-farm income.

Research Approach

The research questions and hypothesis were derived from the existing literature. Such an approach is usually referred to as a deductive theory, where what is known about a particular domain becomes a subject to empirical study (Bryman & Bell, 2011)[16]. Such a deductive approach was selected in order to look at the extent to which the literature available on the uses of Information and Communication Technologies in agriculture could be fitted to the Georgian reality. The principle of deductivism is usually a subject to positivist research philosophy, which is related to the development of knowledge (Saunders, et al., 2012[17]). Positivism is described as an 'epistemological position that advocates the application of the methods of the natural sciences to the study of social reality and beyond' (Bryman & Bell, 2011). Positivist philosophy is usually related to collecting information about observable reality and making law-like generalizations. Considering the positivist philosophy and the deductive approach, this study answers to the research question by testing the hypothesis.

16 Bryman, A. & Bell, E. (2011) Business Research Methods. Oxford: Oxford University Press;

17 Saunders, M., Lewis, P. & Thornhill, A. (2012) Research Methods for Business Students. Harlow: Pearson Education Limited;

The research questions can be answered with the use of different methods. These methods differ according to the type of the information which is needed to answer the questions. The information is delivered by the raw data, which is why the main distinguishing feature between the research methodologies are the data collection techniques (Crowther & Lancaster, 2009)[18]. There are two types of data – quantitative and qualitative. The first is numerical, while the second is more about the letters than numbers (Bryman & Bell, 2011). Quantitative data is generalizable, while qualitative data is non-generalizable (Crowther & Lancaster, 2009). Due to the fact that quantitative data is more generalizable, it fits the positivist research philosophy – which makes law-like generalizations. As a result, quantitative data collection method was selected for this study.

There are several methods of quantitative data collection. The surveys used for this method can either be face-to-face, online, telephone, or e-mail. This research was based on a face-to-face survey with farmers in Shida-Kartli region. One of the advantages of a face-to-face survey is the presence of the interviewer. The latter is thought to be important, because with the help of the face-to-face interaction, the interviewer has more chances of building good relationships with the participants, while the latter are able to receive answers to their queries (Saris & Gallhofer, 2014)[19].

Sample

The research targets the population of farmers in Shida Kartli region. In order for the sample to represent the population, a mix of snowball sampling and convenience sampling was selected. A snowball sampling is a technique for finding the research subjects in a way where one subject gives the researcher the name of another subject, who in turn provides the name of the third, and so on (Atkinson & Flint, 2001)[20]. In this case, several villages in Shida Kartli region were visited and the farmers who were recruited for the study, suggested to survey other farmers who lived in the same village. The other participants were recruited using

18 Crowther, D. & Lancaster, G. (2009) Research Methods. Oxford: Butterworth – Heinemann;

19 Saris, W.E. & Gallhofer, I.N. (2014) Design, Evaluation and Analysis of Questionnaires for Survey. Hoboken: Wiley;

20Atkinson, R. & Flint, J (2001) 'A Social Research Update: Accessing Hidden and Hard-to-Reach Populations: Snowball Research Strategies'. Department of Sociology, University of Surrey. Available at: http://sru.soc.surrey.ac.uk/SRU33.pdf

convenience sapling method. This method applies a non-random sampling technique, where the participants are recruited according to how they fit the criteria of the study (Emerson, 2015)[21]. In this case, some of the farmers were approached in the surrounding of several Farm Service Centers in Shida Kartli region. People who visit the Farm Service Centers are farmers. Thus, the participants surveyed in the surrounding of Farm Service Centers fitted the criteria of the study.

Questionnaire Design

The survey consisted of 21 questions (see Appendix 1). The first part of the questionnaire had 17 questions, while the other part had four questions. The first part of the questionnaire collected demographic information about the participants, as well as the information about the usage of Information and Communication Technologies by the latter. In the first part of the questionnaire, five out of 17 questions were open-ended. These questions asked the participants to indicate where they lived, what was their age, what was the size of the land owned by them (in hectares), what were their main farm-related activities (what were they producing), what type of agriculture-related information they usually needed the most and what type of agriculture-related information they usually lacked the most. The rest of the questions were close-ended and asked the participants to indicate a response out of the set of several responses. However, three out of 17 questions (regarding education level, the type of ICTs used and the sources of agriculture-related information) included an additional option under the name 'other', where the participants could indicate the response which they did not find in the list of the options provided to them. In three out of 17 questions (regarding the type of ICTs owned, the type of ICTs used and the sources of agriculture-related information) the participants had an opportunity to select more than one option. The farmers were also asked to indicate whether or not had they heard about Ltd 'Agrokartli's' SMS service, and whether or on were they subscribed to that service.

The four questions in the second part of the questionnaire were measured using scales, which require ordering of the response categories and are commonly used to measure subjective

21 Emerson, R.W. (2015) 'Convenience Sampling, Random Sampling, and Snowball Sampling: How does Sampling affect the Validity of Research?'. Journal of Visual Impairment & Blindness, 109(2): 164-168;

judgments (Saris & Gallhofer, 2014). The first question in part two of the questionnaire asked the participants to evaluate how frequently did they use Information and Communication Technologies on a five point Likert scale. The response scales were bipolar, representing two opposite sides of the scale from negative to positive. As a result, 1 point stood for 'Hardly Ever', while 5 points denoted – 'Almost Always". The remaining 3 questions asked the participants to evaluate, on a five point Likert scale, (1) their perceptions about the availability of agriculture-related information, (2) their ability to get agriculture-related information in a timely manner and (3) their perceptions about the quality of agriculture-related information available to them. These response scales were also bipolar – 1 point stood for 'Very Bad', while 5 points denoted – 'Very Good". The second part of the survey was used to test the hypothesis, while the first part of the survey was used to identify the factors affecting the farmers' usage of ICTs.

The presentation of descriptive statistics

A total of 127 farmers were approached for the survey. The majority of those who refused to take part, named 'no time' as their reason for not participating. Only one, out of 115 participants, started taking part in the survey, but did not proceed with completing it. As a result, 114 valid questionnaires were used for the analysis. The Statistics Software programs, IBM SPSS Version 24 and Stata were used. The data collected from the questionnaires were transferred to the software programs.

The questionnaire started with collecting demographic information about the participants. A total of 93 (81.6%) males and 21 (18.4%) females took part in the survey (see Table 1). The majority, 60.55% of the farmers surveyed, lived in Gori municipality, followed by Kareli and Kaspi municipalities, with 33.33% and 6.14%, respectively (see Appendix 2).

Table 1: Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	93	81.6	81.6	81.6
	Female	21	18.4	18.4	100.0
	Total	114	100.0	100.0	

The participants were grouped according to their ages. People aged between 26 and 35 and 46 and 55 were the most frequently represented age groups, with 25.4%, while people aged 56 and higher were the least represented age group, with 13.2% (see Table 2).

Table 2: Age groups					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under 25	17	14.9	14.9	14.9
	26-35	29	25.4	25.4	40.4
	36-45	24	21.1	21.1	61.4
	46-55	29	25.4	25.4	86.8
	56 and Older	15	13.2	13.2	100.0
	Total	114	100.0	100.0	

The mean ages of the male and female participants were 41 and 44, respectively; the youngest participant was aged 18 and the eldest was aged 65 (see Table 3).

Table 3: Gender and age				
Gender	Age			
		Minimum	Mean	Maximum
	Male	18	41	65
	Female	32	44	62

Regarding the education level of the participants, the majority, 48.2%, indicated to have completed or currently pursued high school education (see Table 4).

Table 4: Education level					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High School	55	48.2	48.2	48.2
	Undergraduate Studies	47	41.2	41.2	89.5
	Postgraduate Studies	12	10.5	10.5	100.0
	Total	114	100.0	100.0	

An absolute majority of the participants (100%) said that they owned land for agriculture-related purposes. The majority of the farmers surveyed were small landholders; the smallest size of the land owned by the farmers was 0.10 hectares, while the biggest size of the land owned by the farmers was 40.00 hectares (see Appendix 3). The majority of the farmers surveyed were vegetable and fruits producers (see Appendix 4).

92.1%, of the participants perceived farming as their businesses (see Table 5). 73.7% of the farmers said that farming was their main source of income (see Table 6), while 38.6% said that they had income outside farming (see Table 7).

Table 5: Perception of farming as a business					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	9	7.9	7.9	7.9
	Yes	105	92.1	92.1	10.0
	Total	114	100.0	100.0	

Table 6: Farming as a primary source of income					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	30	26.3	26.3	26.3
	Yes	84	73.7	73.7	100.0
	Total	114	100.0	100.0	

Table 7: Income outside farming					
Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	No	70	61.4	61.4	61.4
	Yes	44	38.6	38.6	100.0
	Total	114	100.0	100.0	

The participants were asked about which Information and Communication Technologies they owned. The majority, 97.4% of the participants, had television; the latter was followed by mobile phone and the internet, with 96.5% and 63.2%, respectively (see Table 8).

Table 8: Information and Communication Technologies owned by the participants										
	Radio		Television		Mobile Phone		The Internet		Fixed Phone	
	N	%	N	%	N	%	N	%	N	%
No	76	66.7	3	2.6	4	3.5	42	36.8	58	50.9
Yes	38	33.3	111	97.4	110	96.5	72	63.2	56	49.1
Total	114	100.0	114	100.0	114	100.0	114	100.0	114	100.0

In addition to the ownership of the Information and Communication Technologies, the participants were asked about which ICTs they usually used for the purpose of getting agriculture-related information. The most frequently used ICTs were mobile phone and the internet, with 59.6% and 57.9%, respectively (see Table 9). The least used ICTs were radio and fixed phone with 1.8% and 0.9%, respectively, while 4.4% of the participants said that they did not use any of the ICTs for the purpose of getting agriculture-related information (see Table 9).

Table 9: Information and Communication Technologies used by the participants for the purpose of getting agriculture-related information												
	Radio		Television		Mobile Phone		The Internet		Fixed Phone		None	
	N	%	N	%	N	%	N	%	N	%	N	%
No	112	98.2	69	60.5	46	40.4	48	42.1	113	99.1	109	95.6
Yes	2	1.8	45	39.5	68	59.6	66	57.9	1	0.9	5	4.4
Total	114	100.0	114	100.0	114	100.0	114	100.0	114	100.0	114	100.0

The participants were asked to name their sources of agriculture-related information. Farm service centers (61.4%) and fellow farmers (60.5%) were the most common sources of agriculture-related information (see Table 10).

Table 10: Sources of agriculture-related information		
Source	Number of Participants	Percent
Fellow Farmers	69	60.5
Farm Service Centers (FSCs)	70	61.4
Municipalities	15	13.2
Ministry of Agriculture of Georgia (MOA)	13	11.4
International and Donor Organizations	18	15.8
Scientific Researches	4	3.5
Banks and other Financial Institutions	1	0.9
Agricultural Experts	1	0.9
None	11	9.6

When the participants were asked to name the type of information which they usually needed, the majority named information about agricultural technologies (43.86%), agricultural input products (31.58%) and markets (21.05%) (see Appendix 5). In addition to that, the farmers were asked about which type of information did they usually lack, the majority named: Information on agricultural input products (14.04%), agricultural technologies (10.53%) and markets (8.77%) (see Appendix 6).

Regarding familiarity with Ltd 'Agrokartli's' SMS service, which delivers information on whether and spread of diseases in the region, the majority of the farmers surveyed (62 people) were neither familiar, nor subscribed to the service, 32 people were familiar with the service and were subscribed to it, while 20 participants were familiar with the service, but were not subscribed to it (see Table 11).

Table 11: Familiarity with and usage of Ltd "Agrokartli's" SMS service				
	Subscription to Ltd "Agrokartli's" SMS service			
Familiarity with Ltd "Agrokartli's" SMS service		Not subscribed	Subscribed	Total
	Not familiar	62	0	62
	Familiar	20	32	52
	Total	82	32	

In order to illustrate the findings from the questions which were measured by 5-point Likert scales, descriptive statistics tables were generated. The tables measured the minimum and the maximum scale points, as well as the means and the standard deviations per each scale item. According to descriptive data (see Table 12), mean score attributed to the farmers' perceptions about the availability of agriculture-related information was 3.76, while the majority of those surveyed (36 people) said that the availability of agriculture-related information was 'Very Good' (see Table 13). Mean score attributed to the farmers' ability of finding agriculture-related information in a timely manner was 4.07 out of 5 and the mean score attributed to the Farmers' perceptions about the quality of agriculture-related information available to them was 3.85 out of 5 (see Table 12).

Table 12: Descriptive statistics per each scale item				
	Minimum	Maximum	Mean	St. Deviation
Farmers' perceptions about the availability of agriculture-related information	1	5	3.76	1.06
Farmers' ability to find agriculture-related information in a timely manner	1	5	4.07	0.99
Farmers' perceptions about the quality of agriculture-related information	1	5	3.85	1.05

Table 13: Frequency of responses per each scale item					
	Response scales (from "1" - "Very Bad" to "5" - "Very Good")*				
	1	2	3	4	5
Items measured	Number of responses per each scale item				

Farmers' perceptions about the availability of agriculture-related information	2	11	35	30	36
Farmers' perceptions about their ability to find agriculture-related information in a timely manner	1	8	22	34	49
Farmers' perceptions about the quality of agriculture-related information	2	9	33	30	40

*Response scales: 1 - "Very Bad", 2 - "Bad", 3 - "Average", 4 - "Good", 5 - "Very Good"

In order to measure the frequency of the participants' usage of Information and Communication technologies, a separate descriptive statistics table was generated. The mean score attributed to the frequency of using ICTs was 3.82 out of 5 (see Table 14). However, it should be mentioned that standard deviation was significantly high for this variable (see Table 14).

Table 14: Descriptive statistics table measuring the frequency of using ICTs

	Minimum	Maximum	Mean	St Deviation
Frequency of using ICTs for the purpose of finding agriculture-related information	1	5	3.82	1.22

The majority of the participants (45 people) said that they were using Information and Communication Technologies 'Almost Always' when they wanted to find agriculture-related information (see Table 15).

Table 15: Frequency of responses with regards to the item measuring the frequency of using ICTs for the purpose of finding agriculture-related information

	Response scales (from "1" - "Hardly Ever" to "5" - "Almost Always")*				
	1	2	3	4	5
Items measured	Number of responses per each scale item				
Frequency of using ICTs for the purpose of finding agriculture-related information	8	7	28	26	45

*Response scales: 1 - "Hardly Ever", 2 - "Seldom", 3 - "Sometimes", 4 - "Frequently", 5 - "Almost Always"

The relationships between the variables

In order to study the relationship of the frequency of the farmers' usage of Information and Communication Technologies with the other variables, Pearson correlation coefficients were generated using IBM SPSS software. The Pearson correlation coefficient is used to measure the strength of the relationship between the two sets of variables (Lind, et al., 2005)[22]. A correlation coefficient of 0 indicates that there is no relationship between the variables, while the values between 0 and +1.00, or 0 and -1.00 indicate positive and negative relationships, respectively. The values between 0 and +1.00, and 0 and -1.00 can either be weak, moderate, significant, or strong (Lind, et, al., 2005).

Hypothesis 1 assumed that *the frequency of the farmers' usage of Information and Communication Technologies* would have been positively related to *the farmers' perceptions about the availability of agriculture-related information*. According to Table 16, there was a positive relationship between the frequency of the farmers' usage of ICTs and the farmers' perceptions about the availability of agriculture-related information. This suggests that the more frequently the farmers use ICTs, the more available agriculture-related information is to them. As a result, Hypothesis 1 was confirmed.

Table 16: Relationship between the frequency of using ICT and the perceptions about the availability of agriculture-related information

	Perceptions about the availability of agriculture-related information	
Frequency of using ICTs for the purpose of finding agriculture-related information	Pearson Correlation	0.438**
	N	114

**. Correlation is significant at the 0.01 level (2-tailed)

Hypothesis 2 assumed that *the frequency of the farmers' usage of ICTs* would have been positively related to *the farmers' ability to find agriculture-related information in a timely manner.* Hypothesis 2 was also confirmed (see Table 17). This implies that the more frequently the farmers use ICTs, the more they are able to find agriculture-related information in a timely manner.

22 Lind, D.A., Marchal, W.G. & Wathen, S.A. (2005) Statistical Techniques in Business Economics. Boston: McGraw-Hill Irwin;

Table 17: Relationship between the frequency of using ICTs and the ability to find agriculture-related information in a timely manner		
	Perceptions about the ease of finding agriculture-related information in a timely manner	
Frequency of using ICTs for the purpose of finding agriculture-related information	Pearson Correlation	0.346**
	N	114

Finally, *Hypothesis 3* had an assumption that *the frequency of the farmers' usage of ICTs* would have been positively related to *the farmers' perceptions about the quality of agriculture-related information.* This hypothesis was also confirmed (see Table 18) – meaning that the more frequently the farmers use ICTs, the more quality agriculture-related information they are able to find.

Table 18: Relationship between the frequency of using ICTs and the perceptions about the quality of agriculture-related information		
	Perceptions about the quality of agriculture-related information	
Frequency of using ICTs for the purpose of finding agriculture-related information	Pearson Correlation	**0.378****
	N	114

**. Correlation is significant at the 0.01 level (2-tailed)

Apart from the relationship between the frequency of the farmers' usage of Information and Communication Technologies with the other variables, the determinants of the farmers' usage of ICTs were also studied. The research assumed that the participants' age, education level, the size of the land owned, the perception of farming as a business and the income outside farming would have predicted the participants' usage of different ICTs. In order to study the relationship of these factors with the farmers' usage of different ICTs, a Probit Regression Model was generated using Stata. Regression analysis is used to describe statistical relationship between one or more independent variables and the dependent variable. In this case, the independent variables are: the participants' age, education level, the size of the land owned, the perception of farming as a business and the income outside

farming. The dependent variable is the farmers' usage of ICTs. The Probit Regression Model assumes that the dependent variable has only two outcomes and measures the probabilities of these outcomes. In this case, the outcome is that the participants either use ICTs or do not use ICTs.

According to this study, the most frequently used Information and Communication Technologies were mobile phones, the internet and television, while only 2 participants used radio and 1 participant used fixed phone for the purpose of getting agriculture-related information (see Table 9). Due to the fact that radio and fixed phone were the least used ICTs, the study measured only the factors affecting the usage of mobile phones, the internet and television.

First, the regression table was generated in order to study the factors affecting the farmers' usage of mobile phones (see Table 19). The independent variables in the table were denoted as follows: age - 'age', education level - 'education', size of the land owned - 'area', perception of farming as a business – 'business', income outside farming – 'sec_income'. A P-value (showed in the 5th columns of the Tables 19,21 and 23) which is below 0.1, gives an acceptable 90% confidence level to say that that any given predictor is statistically. The coefficients (denoted by 'coef' and showed in the second columns of the Tables 19, 21 and 23) represent the mean change in the dependent variable for one unit change in the independent variable, while holding other predictors in the model constant (Frost, 2013)[23].

In table 19, according to the P-values, only the sizes of the lands owned and the perceptions of farming as a business predicted the farmers' usage of mobile phones. The coefficient for the size of the land owned - "area" (0.0518353) – is positive, which means that an increase in the size of the land increases the probability that the farmer will use mobile phone in order to get agriculture-related information. On the other hand, the coefficient for the perception of farming as a business - "business" (0.57171) – is also positive, meaning if the farmers perceive farming as their businesses, they are more likely to use mobile phones in order to get agriculture-related information.

23 Frost, J. (2013) 'How to Interpret Regression Analysis Results: P-values and Coefficients'. The Minitab Blog. Available at: http://blog.minitab.com/blog/adventures-in-statistics/how-to-interpret-regression-analysis-results-p-values-and-coefficients

Table 19: The factors affecting the farmers' usage of mobile phones

Probit regression — Number of obs = 114; LR chi2(5) = 12.74; Prob > chi2 = 0.0259; Log likelihood = -70.511005; Pseudo R2 = 0.0829

MobilePhone	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.0138904	.0106685	-1.30	0.193	-.0348003	.0070195
education	.1340268	.1946472	0.69	0.491	-.2474748	.5155284
area	.0518353	.0298649	1.74	0.083	-.0066987	.1103694
business	.57171	.2970222	1.92	0.054	-.0104428	1.153863
secon_income	.2185154	.2692393	0.81	0.417	-.3091838	.7462147
_cons	-.0524417	.5948087	-0.09	0.930	-1.218245	1.113362

Another table was generated to study the factors affecting the farmers' usage of mobile phones. Table 20 measures Marginal effects of the factors affecting the farmers' usage of mobile phones. Marginal effects show the change in probability of the dependent variable when the independent variable increases by 1 unit. In this case, a one hectare increase in the size of the land owned by the farmers, increases the probability that the farmers will use mobile phone by 1.9% (see table 20). On the other hand, people who perceive farming as their business, are 21.9% more likely to use mobile phone in order to find agriculture-related information (see table 20).

Table 20: Marginal effects of the factors affecting the farmers' usage of mobile phones

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.0053409	.0041078	-1.30	0.194	-.0133921	.0027103
education	.0515337	.0748631	0.69	0.491	-.0951952	.1982626
area	.0199308	.0113754	1.75	0.080	-.0023646	.0422262
business	.219824	.1145588	1.92	0.055	-.0047072	.4443551
secon_income	.0840197	.1036019	0.81	0.417	-.1190362	.2870757

The age and the size of the land owned were the predictors of the farmers' usage of the internet (see Table 21). The coefficient for age - 'age' (-0.0394854) – is negative, which means that as the age of the farmer increases, the probability that the farmer will use the internet in order to find agriculture-related information decreases (see Table 21). The coefficient for the size of the land owned by the farmers - 'area' (0.1233605) – is positive, meaning that an increase in the size of the land increases the probability that the farmer will use the internet in order to find agriculture-related information (see table 21).

Table 21: The factors affecting the farmers' usage of the internet

Probit regression — Number of obs = 114
LR chi2(5) = 30.93
Prob > chi2 = 0.0000
Log likelihood = -62.12895 — Pseudo R2 = 0.1993

TheInternet	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.0394854	.0115472	-3.42	0.001	-.0621175	-.0168534
education	-.0396514	.2168041	-0.18	0.855	-.4645796	.3852767
area	.1233605	.0431815	2.86	0.004	.0387263	.2079947
business	-.4560578	.3338154	-1.37	0.172	-1.110324	.1982084
secon_income	.2290448	.2854795	0.80	0.422	-.3304847	.7885742
_cons	1.745943	.639784	2.73	0.006	.4919891	2.999896

Regarding the marginal effects, a one year increase in the age of the farmer leads to 1.4% decrease in the probability that the farmer will use the internet in order to find agriculture-related information (see Table 22). On the other hand, one hectare increase in the size of the land owned by the farmers, increases the probability that the farmers will use the internet by 4.6% (see Table 22).

Table 22: Marginal effects of the factors affecting the farmers' usage of the internet

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-.0149545	.0043895	-3.41	0.001	-.0235577	-.0063513
education	-.0150173	.0821045	-0.18	0.855	-.1759393	.1459046
area	.0467208	.0156835	2.98	0.003	.0159816	.0774599
business	-.1727245	.1256625	-1.37	0.169	-.4190185	.0735696
secon_income	.086747	.1083368	0.80	0.423	-.1255893	.2990833

Finally, the factors affecting the farmers' usage of television were studied. In this case, given the P-values in Table 23, age and perceptions of farming as a business were the most significant predictors of the participants' usage of television for the purpose of finding agriculture-related information. The coefficient for age - "age" (0.0187609) – is positive, which means that as the age of the farmer increases, the probability that the farmer will use television in order to find agriculture-related information increases as well (see Table 23). The coefficient for the perception of farming as a business - "business" (0.5537801) – is also positive, meaning that perceiving farming as a business increases the farmers' likelihood to use television for the purpose of getting agriculture-related information (see Table 23).

Table 23: The factors affecting the farmers' usage of television

Probit regression — Number of obs = 114
LR chi2(5) = 7.81
Prob > chi2 = 0.1669
Log likelihood = -72.567761 — Pseudo R2 = 0.0511

Television	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.0187609	.0105471	1.78	0.075	-.001911	.0394328
education	-.1677957	.1929685	-0.87	0.385	-.546007	.2104156
area	-.0182736	.0226895	-0.81	0.421	-.0627443	.026197
business	.5537801	.3027351	1.83	0.067	-.0395698	1.14713
secon_income	-.061157	.2652658	-0.23	0.818	-.5810685	.4587545
_cons	-1.147652	.601015	-1.91	0.056	-2.32562	.0303154

The marginal effects table suggests that a one year increase in the age of the farmers leads to 0.4% increase in the probability that the farmer will use television in order to find agriculture-related information, while those farmers who perceive farming as their business, are 21.1% more likely to use television in order to get agriculture-related information (see Table 24).

Table 24: Marginal effects of the factors affecting the farmers' usage of television

	Delta-method					
	dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.0071818	.0040299	1.78	0.075	-.0007165	.0150802
education	-.0642335	.0738425	-0.87	0.384	-.2089621	.0804952
area	-.0069953	.0086752	-0.81	0.420	-.0239983	.0100077
business	.2119912	.1155815	1.83	0.067	-.0145444	.4385269
secon_income	-.0234114	.1015541	-0.23	0.818	-.2224538	.175631

Discussions

The frequency of the farmers' usage of Information and Communication Technologies was positively related to the farmers' perceptions about the availability of agriculture-related information. The correlation coefficient of 0.438 between the two variables (see Table 16) was a significant indicator of the idea that the more frequently the farmers use ICTs, the more the agriculture-related information is available to them. This suggests that the farmers who utilize ICTs, generally have more sources of information and are more likely to make informed decisions.

The correlation coefficient measuring the relationship between the farmers' usage of Information and Communication Technologies and the farmers' ability to get agriculture-related information in a timely manner, was 0.346 (see Table 17). The positive relationship between the latter was less significant than the relationship between the farmers' usage of ICTs and the farmers' perceptions about the availability of agriculture-related information. This means that the farmers' usage of ICTs has a moderate impact on the farmers' ability to

get agriculture-related information in a timely manner. The latter could possibly be explained by the farmers' information sources. As already mentioned, the main sources of agriculture-related information were the Farm Service Centers and the fellow farmers (see Table 10). When these two happen to be the sources, there is usually no need for the farmers to use ICTs in order to receive information, because there are several Farm Service Centers operating in the region, and the farmers usually contact these centers by visiting them, while the fellow farmers usually live in the same villages (or the neighboring villages), thus, the latter are also usually contacted without using ICTs. An ICT that can contribute to saving the time needed to get agriculture-related information from the above-mentioned sources is a mobile phone, which was the most frequently used ICT among the farmers surveyed (see Table 9).

The correlation coefficient measuring the relationship between the farmers' usage of Information and Communication Technologies and the farmers' perceptions about the quality of agriculture-related information, was 0.378 (see Table 18). This coefficient was also less significant compared to the correlation coefficient measuring the relationship between the farmers' usage of ICTs and the farmers' perceptions about the availability of agriculture-related information. Although the farmers have more sources of information when they utilize ICTs, the quality of the information may not always satisfy the farmers. One possible explanation to this idea is that the sources may not be able to provide content which is specific to the activities of the farmers. Information about agricultural input products was one of the most common information needs of the farmers (see Appendix 5). In addition to that, the participants claimed to lack information about the latter the most (See Appendix 6). Since the Farm Service Centers are the major sources of the information about agricultural input products, the quality of information does not increase significantly when the farmers start using ICTs, because they still receive this information from the same source. It should be mentioned that when the participants were asked if they were aware of Ltd 'Agrokartli's' SMS service and were subscribed to it, 62 people were not familiar with it, while 20 out of 114 participants said that they had heard of the service, but were not subscribed to it (see Table 11). Considering the fact that the company uses the SMS service in order to help the farmers to timely identify all risks and take sufficient measures using the company's products and services, there might be an issue with regards to the farmers' trust towards the quality of information provided to them. One potential measure to increase the trust of the farmers is

to increase the support services to the latter. In order to do so, the FSCs can utilize their websites and run blogs or Q/A pages which will facilitate two-way communication between them and their customers, especially the younger ones, who, as already mentioned, are more likely to be using the internet in order to receive agriculture-related information.

Regarding the factors affecting the usage of Information and Communication Technologies, the study showed that the education level of the participants and secondary income of the participants did not determine the usage of any of the ICTs considered (mobile phone, the internet and television). However, age, the size of the land owned and the perception of farming as a business did determine the usage of some of the ICTs.

The study found that the farmers were more 21.9% likely to use mobile phones for getting agriculture-related information, in case they perceived farming as their businesses (see Table 19). In addition to that, one hectare increase in the size of the land owned by the farmers, increased the probability that they would use mobile phones for agriculture-related purposes by 1.9% (see Table 20). Both, the size of the land owned and the perception of farming as a business, are related to the farm income of the participants. For example, the bigger the lands of the farmers, the more products they are likely to produce and sell. According to Chhachhar (2014)[24], mobile phones reduce the gaps between that traders and farmers, helping the latter to directly contact the buyers and find good prices. As a result, it can be argued that the more business-oriented the farmer is the more he/she is likely to use ICTs, in this case, the mobile phone. Being business-oriented requires building networks in agribusiness, and mobile phones have an ability foster those networks (The World Bank, 2012).

Another finding of the study was that one year increase in the age of the participants leads to 1.4% decrease in the likelihood that the latter will use internet to get agriculture-related information, while one hectare increase in the size of the land owned by the farmers increases the likelihood that the farmers will use the internet by 4.6% (see Table 22). This finding suggests that the younger farmers are more likely to use internet, which is able to deliver almost any type of agriculture-related information, ranging from the new agricultural

24 Chhachhar, A.R., Qureshi, B., Khushk, G.M. & Ahmed, S. (2014) 'Impact of Information and Communication Technologies in Agriculture Development'. Journal of Basic and Applied Scientific Research, 4(1): 281-288;

techniques to the market demands and prices (Chhachhar, 2014). In addition to that, as already mentioned, the bigger the size of the land, the more products the farmers are able to produce and according to Ali (2012), the adoption of ICT-based information is higher among the farmers who cultivate diversified multiple crops.

Finally, the factors affecting the usage of television were age and the perception of farming as a business (see Table 23). More specifically, the age of the farmers lead to 0.4% increase in the probability that the latter would use television in order to get agriculture-related information, while the perception farming as a business, increased the likelihood of getting agriculture-related information from television by 21.1% (see Table 24). This indicates that the television appears to be a source of information to the older farmers. The farmers who perceive farming as a business are also more likely to watch television programs which are related to agriculture. According to Chhachhar (2014), television is useful for disseminating scientific information and agricultural knowledge which is vital for the businesses of the farmers. This is especially true to the findings of this study, because 97.4% of the participants said that they had television (see Table 8), which leads to the idea that information provided by television can reach a greater number of farmers.

Research Limitations

One possible limitation of the research could be the low number of female participants (see Table 1). However, rather than a research limitation, the low presence of female farmers might also be the depiction of the current situation in Georgian agriculture sector, because when the representatives of the Farm Service Centers were asked about how many females visited the FSCs daily, they responded that, on average 5 out of 100 daily visitors were females. According to Table 3, the mean age of the female participants was 44, while the youngest female was aged 32. This potentially indicates at the low engagement of the female youth in agriculture. As already mentioned, with the increase of the age of the farmers, the likelihood that the farmers watch television to receive agriculture-related information increases by 0.4%. As a result, television might be a useful tool for disseminating agriculture-related information to the female farmers, who, according to the study, rarely happen to be the youth.

Managerial Implications

One of the most interesting findings of the study was that the increased frequency of the farmers' usage of Information and Communication Technologies increases the availability of agriculture-related information more significantly than the quality of agriculture-related information. This finding highlights the importance of the content of the ICT-based initiatives. One of the most common problems with ICT-based initiatives is that they sometimes may push the content to people, forgetting the demand-side of agriculture-related information (Glendenning &Ficarelli, 2012)[25]. Bachelor & O'Farell (2003)[26] also argue that the content delivered by ICTs need to be based on a careful consideration of the interests of the external groups. As a result, when utilizing ICTs for the purpose of delivering agriculture-related information to the farmers, the information needs of the latter should be considered. This statement holds true for Farm Service Centers, Governmental entities and other relevant organizations who deliver information to the farmers with the use of ICTs. Without careful consideration of the demand-side of the information, the initiatives of these organizations are faced with the risk of not being able to meet the user needs.

Another finding which could also be considered very important is that the age of the farmers serves as a factor influencing the farmers' usage of Information and Communication Technologies. Specifically, the younger farmers are more committed to getting agriculture-related information from the internet. As a result, the study suggests that the online platforms of different organizations, who deliver agriculture-related information through their websites, should also be fitted to the interests of the younger farmers, who may not have big lands, but may be more willing to turn their farms into profitable businesses. Ali (2012) suggests that the smaller landholders are becoming more willing to adopt modern agricultural techniques for improving their productivity. The above-mentioned could possibly explained by the tough

25 Glendenning, C.J. & Ficarelli, P.P. (2012) 'The Relevance of Content in ICT initiatives in Indian Agriculture'. *International Food Policy Research Institute;*

26 Bachelor, S. & O'Farrell, C. (2003) 'Revisiting the "Magic Box": Case Studies in Local Appropriation of Information and Communication Technologies (ICT)' Available at: http://www.fao.org/3/a-y5106e.pdf

competition that the small landholders face in the agriculture sector.

Conclusion

The study used the existing literature on the uses of Information and Communication Technologies in agriculture in order to formulate the research questions and hypothesis and apply the latter to Georgian reality. The research has several findings.

Firstly, the research aimed to study the relationship of the frequency of the farmers' usage of Information and Communication Technologies with (1) the farmers' perceptions about the availability of agriculture-related information, (2) the farmers' ability of to get agriculture-related information in a timely manner and (3) the farmers' perceptions of the quality of agriculture-related information available to them. In all three cases the relationships were positive and the hypotheses were confirmed. However, the farmers' frequency of using ICTs affected the availability of agriculture-related information more than the other two variables.

Secondly, the research aimed to study the factors affecting the farmers' usage of Information and Communication technologies. Not surprisingly, the results showed that the younger farmers utilize modern ICTs (the internet), while older farmers stick to traditional ICTs (television). Business-oriented farmers use mobile phones and television for getting agriculture-related information and the farmers with bigger lands use mobile phones and the internet in order to receive information which is interesting to them.

Overall, the study concludes that the agriculture-related information which is delivered with the use of Information and Communication Technologies should be based on the careful consideration of the farmers' information demands, in order to avoid the risk of being unable to meet the user needs. The study also suggests that the organizations utilizing ICTs for the purpose of delivering agriculture-related information, should consider the factors affecting the farmers' usage of ICTs. The research showed that different factors influence the usage of different types of ICTs.

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Appendix 1: The Questionnaire (English Version)

For the participant's information

You are invited to participate in the empirical study about the 'relationship between the availability of agriculture-related information and the usage of Information and Communication Technologies (ICT) among the farmers in Shida Kartli Region'. The study is carried out in the scope of the 'Mariam Kutelia Research Grant', fincnaced by CNFA and the USAID/REAP Project.

Please, provide anwers to 21 questions. This will take you a maximum of 15 minutes. Please, be aware that your participation is voluntary and that you are free to withdraw at any time, without providing any reason. You can omit any question which you feel you do not want to answer.

Part 1

1) Please, indicate your age: _____

2) Please, indicate where you live: _____

3) Please indicate your gender:

□ Male
□ Female

4) Please, indicate your education level:

□ I have not received any education
□ Secondary school
□ Undergraduate university
□ Postgraduate university
□ Other _____

5) Do you iwn a land for agriculture-related purposes?

□ Yes
□ No

6) If you own a land, please, indicate the number of hectares of land you own: _____

7) What do you produce?

_____

_____

8) Do you perceive farming as your business?

□ Yes
□ No

9) Do you have income outside farming?

□ Yes
□ No

10) Which of the following Information and Commuication Technologies do you own? (You can select more than one answer)

□ Radio
□ Television
□ Mobile phone
□ The Internet
□ Fixed Phone

11) What type of information do you usually need for your agriculture-related purposes?

_____

_____

12) What type of information do you usually lack for your agriculture-related purposes?

_____

_____

13) Which of the following Information and Communication Technologies do you use for the purpose of finding agriculture-related information? (You can select more than one answer)

□ Radio
□ Television
□ Mobile phone
□ The internet
□ Fixed phone
□ Other _____
□ None of the above

14) Which of the following appears to be your source of agriculture-related information? (You can select more than one answer)

□ Fellow farmers
□ Farm Srvice Centers
□ Municipality
□ Ministry of Agriculture of Georgia
□ International/Donor organizations
□ Scientific researches
□ Other _____
□ None of the above

15) Have you heard about Ltd 'Agrokartli'?

□ Yes
□ No

16) Have you heard about Ltd 'Agrokartli's' SMS service?

□ Yes
□ No

17) Are you subscribed to Ltd 'Agrokartli's' SMS service?

□ Yes
□ No

Part 2

18) On a five point scale, please, evaluate how frequently do you use Information and Communication technologies for the purpose of finding agriculture-related information?

□ 1 – 'Hardly Ever'
□ 2 – 'Seldom'
□ 3 – 'Sometimes'
□ 4 – 'Frequently'
□ 5 – 'Amost Always'

19) On a five point scale, please, evaluate your perception about the availability of agriculture-related information.

□ 1 – 'Very Bad'
□ 2 – 'Bad'
□ 3 – 'Average'
□ 4 – 'Good'
□ 5 – 'Very Good'

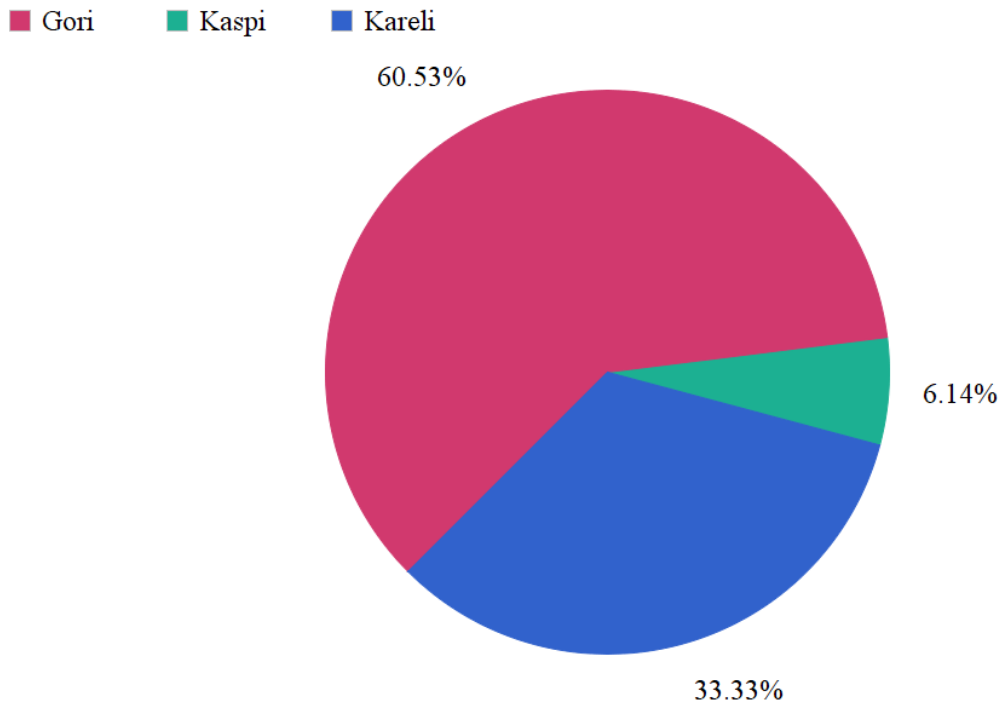
20) On a five point scale, please, evaluate your ability to find agriculture-related information in a timely manner.

□ 1 – 'Very Bad'
□ 2 – 'Bad'
□ 3 – 'Average'
□ 4 – 'Good'
□ 5 – 'Very Good'

21) On a five point scale, please, evaluate your perception about the quality of agriculture-related information available to you.

□ 1 – 'Very Bad'
□ 2 – 'Bad'
□ 3 – 'Average'
□ 4 – 'Good'
□ 5 – 'Very Good'

Appendix 2: The geographic locations of the participants



Appendix 3: Hectares of land owned by the participants

Hectares of land owned by the participants	Number of participants
0.10	2
0.27	1
0.50	1
0.70	5
0.80	2
1.00	11
1.12	1
1.20	3
1.25	12
1.40	1
1.50	7
2.00	12
2.15	1
2.30	1
2.40	1
2.50	7
2.60	1
2.65	1
2.77	1
3.00	14
3.50	1
3.60	1
4.00	3
5.00	2
6.00	4
7.00	3
8.00	4
10.00	2
13.00	1
15.00	3
20.00	1
23.00	1
25.00	1
30.00	1
40.00	1

Appendix 4: Farmers' activities

Farm Activity	Number of Participants	Percent
Vegetable production	91	79.82%
Fruits production	84	73.68%
Poultry raising	47	41.23%
Crops production	39	34.21%
Cattle breeding	34	29.82%
Seeds production	7	6.14%
Beekeeping	4	3.51%

Appendix 5: Information needs of the farmers

Types of information	Number of participants	Percent
Technology-related information	50	43.86%
Agricultural input products	36	31.58%
Market information	24	21.05%
Weather	9	7.89%
Credits	9	7.89%
Insurance	8	7.02%
Agricultural Machinery	7	6.14%
Agriculture-related grants and/or financial aid	4	3.51%
Spread of diseases	4	3.51%
Irrigation systems	2	1.75%
Agricultural projects	2	1.75%
Scientific research	1	0.87%
Greenhouses	1	0.87%
Cold rooms	1	0.87%

Appendix 6: The information the farmers lack the most

Type of information	Number of participants	Percent
Agricultural input products	16	14.04%
Technology-related information	12	10.53%
Market	10	8.77%
Credit	8	7.02%
Agricultural machinery	8	7.02%
Agricultural projects	6	5.26%
Agricultural grants and/or financial aid	6	5.26%
Scientific research	3	2.63%
Insurance	2	1.75%
Spread of diseases	1	0.87%
Irrigation systems	1	0.87%
International best practices	1	0.87%