

ICT and Mobile Phone Use for Agricultural Knowledge Sharing by Cypriot Farmers

G. Adamides, A. Stylianou

Agricultural Research Institute

Abstract

The aim of this paper is to reveal the current situation regarding the use of mobile phones as a mean of information sharing by Cypriot farmers. In particular, a project at the Agricultural Research Institute is underway, to survey methods currently used for agricultural information and knowledge sharing, to determine the level of satisfaction of the farmers of the available sources of information, and to suggest how ICT tools can be applied to help in transferring agricultural knowledge to farmers who live and work in rural and remote areas. The results showed that nearly 98% of the farmers in Cyprus use the mobile phone as a source of agriculture information. Furthermore it was found that there are no differences between educational groups and between crop farmers and their livestock counterparts concerning mobile phone usage. Future research is needed to examine the factors that affect mobile phone usage, its usefulness and the possible benefits for the Cypriot farmers.

Key words

Rural areas, mobile telephone, ICT, agriculture, information sharing.

Introduction

In the past decade, there has been a rapid growth of mobile phones usage all over the world. As of 2012, while the world population is 7.1 billion, the International Telecommunication Union estimated that there were 6.8 billion mobile phone subscribers worldwide (ITU 2013). In fact, according to Rashid and Alder (2009), most developing countries have skipped fixed-line infrastructure and have moved directly into mobile technology.

Within the discourse of “Information Society”, “Knowledge Society”, “Information Economy” and the like, it is maintained that information and knowledge play a key role in ensuring sustainable development (Amponsah, 1995; Koutsouris, 2010). However, it is generally acknowledged that the rural population still faces problems accessing vital information that could help in making timely and accurate decisions (Anandaraja, Rathakrishnan & Philip, 2006).

Today, in many countries, mobile phones are being used by farmers, not only as a person to person voice communication medium, but also, to provide access to information though sending messages service (SMS), multimedia messages service (MMS), and

access to the Internet. Hence, we are now talking about mobile technology that includes mobile phones, smartphones, tablets and the technologies that surround them.

The main aim of this paper is to present the findings of a survey carried out in Cyprus, about the use ICT and mobile phones by Cypriot farmers, specifically as a mean for access to agricultural information. The introductory part is organized as follows: the literature review is presented followed by an outline of the profile of the Cypriot agricultural economy through which the main goal of this study is documented. In Section 4, the research materials and methodology is described. What follows is the presentation of the research results (Section 5). Finally, the conclusions and prospects for further research are presented in Section 6.

There is a growing literature related to the adoption and usage of ICT and mobile phones in rural areas in general and in agriculture specifically (Vanek et al. 2008; Rashid and Elder 2009; Ballantyne 2009; Aker 2010; Michailidis et al 2010; Vanek et al, 2010; Aker, 2011).

The adoption and usage of mobile phones by Cypriot farmers has not been examined so far.

In contrast, several studies on this subject have been conducted in other countries and regions (Canada, Greece, sub-Saharan countries, India, China, Latin America and the Caribbean, etc.).

The mobile phones are regarded as more accessible and less expensive mean to close the digital divide compared to other ICT technologies (Wade 2004). In fact, Rashid and Elder (2009) state that, "...mobile telephony is the predominant mode of communication in the developing world". Furthermore, these studies found that mobile phones usage appears to be an effective and low-cost mean of providing information, and as a consequence are considered to be an effective tool for poverty reduction for poor rural households (Rashid and Elder, 2009; Aker, 2010). According to Aker (2010, 2011), mobile phone infrastructure can have a positive spillover effect on markets with higher transport costs, with a reduction of 10 to 16 percent in price dispersion across markets.

Mobile phones significantly reduce communication and information costs. Poor communication facilities lead to limited access to information and this can lead to loss of income. For example, farmers who do not have access to prices before travelling to the market often rely to middlemen who take advantage of this ignorance and offer to buy crops at prices far lower than they would get if they travelled to market themselves (Rashid and Edler, 2009). According to de Silva (2008), the "cost of information" constitutes eleven percent of the total cost of farmers, from Sri-Lanka, from the time of deciding what to grow to the time of selling. To support the above finding, another study (BBC, 2002) carried out in Senegal showed that farmers who were able to check market prices before setting off and find out the best price of their produce, using a mobile phone, were able on average to have fifteen percent higher profits.

Aker (2011) explains that the use of mobile phones provides new opportunities for farmers to obtain access to agricultural information, such as market prices, weather reports, transport information and agricultural techniques, in various formats like audio (voice), video (internet), and text (SMS).

Michailidis et al (2010), explain why the mobile technology has been accepted and adapted much faster compared to other ICTs in rural areas. In their paper, they categorize the benefits from using mobile technology into two groups: (a) socio-economic, for example reducing the distance between individuals and institutions,

thus making the sharing of information easier and more effective, and (b) rural, for example making local content available and making rural services more efficient in terms of logistics and coordination, and cost-effective.

The Cypriot economy in general and as a consequence its rural economy, is in a transitional period, due to the new economic environment that was created, as a result of Cyprus' accession to the European Union (EU), in May 1st, 2004 (DOA, 2010).

According to the Organization for Economic Cooperation and Development (OECD), rural areas are defined as the local units (e.g. municipalities) with a population density below 150 habitants per square kilometer. However, this definition is not used in the case of Cyprus, as it is a small island, with small agricultural land ownership and small to medium size cities. Therefore, in Cyprus, an area is characterized as rural, if it is not defined as urban by the national cadastre. Consequently, the rural population of Cyprus is the population that lives permanently in rural areas, regardless the kind of employment. The farming population is not identical to the rural population but rather it is a subset of the rural population (DOA 2010).

Based on data provided by the Statistical Service of Cyprus (2012) the rural population of Cyprus is 32.6% of the total population. Since the beginning of the 20th century, the rural population of Cyprus accounted for the largest percentage of the total population. Particularly, in 1901, 81.2% of the total population was living in rural areas, while in 1960 that percentage dropped to 64%. Following the Turkish invasion in the island in 1974, the rural population was forcefully reduced and in 1982 was only 36.5% of the total population. From 2000 onwards, a small annual increase is observed and the percentage is now stabilized around 30%. This stabilization is attributed to the development of the infrastructure and of the road network, to the improvement of services in the rural areas, the creation of job opportunities in these areas, as well as to both the increased cost of living and the degradation of quality of life in the cities (DOA, 2010; Vakakis & Associates, 2010).

However, the rural areas are also facing major problems and these are more significant and obvious in less favored, remote and mountainous areas. To start with, these areas have a low population density and unfavorable demographics.

The population is relatively isolated, mainly due to the absence of direct connection with cities, limited public transportation and low quality of the rural road network. Furthermore, the rural population of Cyprus, as compared with the urban population, is lacking behind in education, present skewed age distribution and has lower incomes. Specifically, the level of education is lower than the national average, the majority of the residents are old people and the job opportunities are limited. In addition, the infrastructures for education and for healthcare provision are deficient. A serious weakness of rural areas is that a large proportion of the rural population is dependent heavily on agriculture, an activity that is shrinking. The dependence of the rural population on agriculture, due to the lack of alternative employment opportunities, is a barrier for the development of rural areas. Hence, there is a need for socioeconomic diversification and combination with complementary activities, such as rural tourism (agritourism). On the other hand, rural areas have significant advantages, like the natural resources and cultural heritage (DOA, 2010; Planning Bureau, 2006).

Despite the fact that the agricultural sector is shrinking, it is still considered as important in the Cyprus' economy and to rural population livelihood. Agriculture contributes merely 2.4% to the Gross Domestic Product (GDP), compared to 20.9% in 1965, 4.8% to employment and 17.6% to total exports for 2011 (Statistical Service of Cyprus, 2012). The most important Cypriot agricultural products are early potatoes, citrus fruit, olives, as well as vegetables and wine products. The most important animal products are meat (beef, pork, poultry and goat/sheep) and milk (cow and goat/sheep). As for processed Cypriot agricultural products (including traditional products), stable demand, both in the internal and third markets, is for: "haloumi", "lountza", "trahanas", "flaouna", "soutzoucos", "zivania" and local wines (DOA 2010).

The agricultural sector of Cyprus is facing several structural problems including the small size of holding and farm fragmentation, the aging and low educational level of the farming population, land degradation, water shortage, high production costs, limited agricultural research and marketing problems (Papadavid, 2008; DOA, 2010).

In relation to the adoption of ICT, there is a gap between rural and urban areas (Ramirez, 2001; Madden & Coble-Neal, 2003; Michailidis

et al., 2011). The rural areas of Cyprus are not an exception. According to the Broadband Performance Index (BPI) of the European Commission, Cyprus is ranked second to last, before Bulgaria (European Commission, 2008). Based on data by the Department of Agriculture (2010) there are 151 small and remote communities in Cyprus with no broadband access and are characterized as "white areas". Furthermore, ICT in agriculture is still very limited with the exception of certain intensive livestock units and food processing industries.

According to the Statistical Service of Cyprus (2012) in 2011 there were 1.266 mobile subscriptions per 1000 inhabitants. Furthermore, 54.1% of farming households in Cyprus have access to a PC and 47.6% have access to the Internet. For urban households these percentages are 67.8% and 61.3%, respectively, showing the digital divide between urban and rural areas. In Cyprus, almost 30% of the persons that use the Internet in the first quarter of 2012, use mobile phone or smart phone to access the Internet away from home or work while 25,9% use a laptop, notebook or netbook

It is worth mentioning here that there are no research works dealing particularly with the usage of mobile phones in the Cypriot agriculture sector. Hence, it was considered that this should be studied by field research and by using a structured questionnaire on a representative sample.

Materials and methods

To examine the usage of mobile phone by Cypriot farmers, a stratified random sample of 250 producers was developed, covering all areas under the authority of the Republic of Cyprus. The sampling frame was based on applicant-beneficiaries of the Rural Development Plan 2007-2013, and specifically on Measures 1.5.1 "Modernization of agricultural holdings" and 1.2 "Setting up of young farmers". Given that currently an official National Farmers' Registry is not available, based on our experience, we consider that the sample size selected is satisfactory. We followed the rules of the stratified random sampling method based both on crop and livestock production (two strata), and on location districts (five strata), as our main criteria for the categorization. Hence we consider that the results are reliable to the entire population where the sample was based.

The majority of the beneficiaries possess farms

with fruits and vegetables, potatoes and cereals, whilst from the animal production farms most are breeders of sheep and goats, cattle and pigs. Between May and July 2011 we have visited 219 rural communities and with face to face interviews we collected 142 filled questionnaires, giving a response rate of 56.8%. The non-respondents fall into three categories: those who rejected the interview (10.6%), those who did not show up to the interview (either due to illness or other personal reason) (26.7%), and those who did not answer the phone in order to make arrangements for an interview appointment (62.7%).

The main aim of this paper is to identify the farm and farmer preferences of sources of agricultural information in general, with focus on mobile phones and ICTs. Specifically, we investigate the frequency of use of these sources, and mobile phone applications most frequently used for obtaining agricultural information. Finally, we examine if there are any differences between educational groups and between agriculture activity groups, in relation to mobile phone usage. For this purpose, descriptive and inferential statistics have been used.

Results and methods

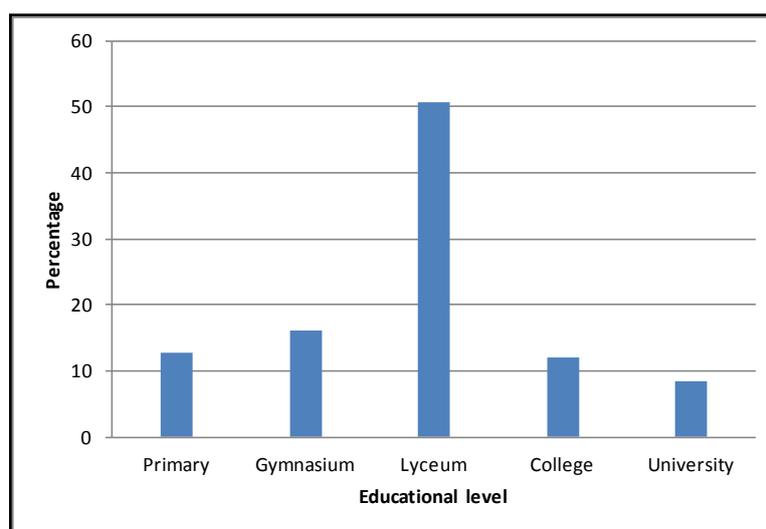
Regarding demographics 88.5% of the participants were male and 11.5% female, with mean age 39. Moreover, farmers' location was found to be as follows: 28% live and work in Limassol

district, 20% in Larnaka district, 18% in Paphos district and 6% in Famagusta. Their educational level is illustrated on Figure 1. As shown, 12.7% of the farmers had completed primary education, 66.8% secondary education, and 20.5% tertiary education. Moreover, 64.8% of the participants were crop farmers and the remaining 35.2% were livestock farmers.

The participants were asked to answer several questions related to the usage of mobile phone and ICTs for business purposes. The statistical analysis for the survey was carried out by using the statistical package IBM SPSS Statistics version 20.

In Table 1, the responses related to the tools that farmers use as sources of agricultural information are presented. As shown, 98% of the participants are using the mobile phone as an information source. The second most favor source of information that farmers use is other farmers (89%), followed by Extension Service officers visits to the fields (85%), private sector Extension consultants (81%), and input suppliers (74%).

In Table 2, the responses of the participants, based on how often they use each tool is presented (1 = daily, 2 = weekly, 3 = bi-weekly, 4 = monthly, 5=never). The results depict that farmers use mobile phone on a daily basis to obtain agricultural information. Specifically, mobile phone ranked first among eight information sources. The remaining sources are used less frequently, once every two weeks, on average.



Source: own processing

Figure 1: Educational level of respondents.

Information source	%*
Mobile phone	98
Through other farmers	89
Extension Service	85
Extension consultants	81
Input suppliers	74
Newspapers/Magazines	69
TV (agricultural related programmes)	67
Cooperatives	51
Radio (agricultural related programmes)	42
Internet	40
Experts	15

*Note: Multiple answers were allowed

Source: own processing

Table 1: Sources of agriculture information (N=142).

Information source	Mean	Rank
Use Mobile phone	1,50	1
Watch TV show 'Ypaithros'	3,46	2
Use Computer	3,77	3
Use World Wide Web	3,82	4
Listen to Radio 'Ora tis Ypaithrou'	4,13	5
Use e-mail	4,43	6
Read e-Newspapers/e-Magazines	4,44	7
Use Social Media	4,81	8

Source: own processing

Table 2: Frequency of use.

Variable	Mean	Rank
Voice calls	1,00	1
Calendar/Reminder	2,57	2
SMS	2,72	3
Take photographs	3,92	4
Take video	4,40	5
Used to transfer data	4,40	6
Listen to radio	4,43	7
MMS	4,65	8
3G/WIFI Internet access	4,69	9
Check e-mail	4,72	10
Used as voice recorder	4,77	11
Social network applications	4,82	12
GPS	4,88	13

Source: own processing

Table 3: Mobile phone applications.

Regarding mobile phone applications and their frequency of use (1 = daily, 2 = weekly, 3 = bi-weekly, 4 = monthly, 5 = never), the results show that, as expected, the most frequently used mobile application is voice calls, followed by calendar/reminder application, sending text messages (SMS), taking photographs and videos, and so on.

To examine if there are any differences between crop farmers and livestock farmers concerning the frequency of mobile phone use, Independent t-test was used. It was found that there are no differences between the two groups, indicating that crop farmers and livestock farmers use mobile phone to the same extent. On the other hand, to examine if there are any differences between farmers educational groups, One-way ANOVA was used. It was found that there are no differences between educational groups in relation to the frequency of mobile phone use. As a result, farmers of all educational levels, use mobile phone for obtaining agricultural information to the same extent.

Conclusion

This paper presents the current situation regarding the use of mobile phones as a source for access to agricultural information by Cypriot farmers. We

surveyed the methods currently used for agricultural information and knowledge sharing, the frequency of use of each information source, and mobile applications most commonly used by farmers.

The results showed that nearly 98% of the farmers in Cyprus use the mobile phone as a mean to access agricultural information. Moreover, farmers use mobile phone on a daily basis to obtain agricultural information. Using inferential statistics, we found no differences between educational groups and between crop farmers and their livestock counterparts, concerning mobile phone usage.

The results of this research provide strong evidence that Extension Service should examine ways of enhancing the sharing of agricultural information and focus on the development applications targeted to farmers and their information needs. This study concluded that mobile phone is a very common source to farmers for obtaining agricultural information. Thus, Extension Service should take advantage of the mobile phone and its applications and use it more extensively for the dissemination of agricultural information to the farmers.

Future research is needed to examine the factors that affect the usage of mobile phones and whether current practices and available mobile applications satisfy the needs of the Cypriot farmers.

Corresponding author:

George Adamides, Senior Agricultural Research Officer

Agricultural Research Institute, P.O. Box 22016, 1516 Nicosia, Cyprus

Phone: +357-22403133, Fax. +357-22316770, E-mail: gadamides@ari.gov.cy

References

- [1] Amponsah, W. Computer Adoption and Use of Information Services by North Carolina Commercial Farmers, *Journal of Agricultural and Applied Economics*, 1995, vol. 27, pp. 565-576, ISSN 1074-0708.
- [2] Anandaraja, N., Rathakrishnan, T., Philip, H. Dissemination of Agricultural Technologies through Interactive Multimedia Compact Disc (IMCD): An innovative Approach, *Computers in Agriculture and Natural Resources*, 2006.
- [3] Aker, Jenny C. Information from Markets Near and Far: Mobile Phones and Agricultural Markets in Niger, *American Economic Journal. Applied Economics*. 2010, 2, p. 46 – 59, ISSN 1945-7782.
- [4] Aker, Jenny C. Dial “A” for agriculture: a review of information and communication technologies for agricultural extension in developing countries, *Agricultural Economics*, 2011, Vol. 42, No. 6, p. 631 – 647, ISSN 0169-5150.
- [5] Ascough II, J. C., Hoag, D. L., McMaster, G. S., Frasier, W. M. . Computers in Agriculture. Computer Use and Satisfaction by Great Plains Producers: Ordered Logit Model Analysis, *Agronomy Journal*, 2002, vol. 94, pp. 1263-1269, ISSN 0002-1962.

- [6] Ballantyne, P. G. Accessing, sharing and communicating agricultural information for development: Emerging trends and issues. 2009, [Online] Available: <http://idv.sagepub.com/content/25/4/260.full.pdf+html> [Accessed May 30, 2013]
- [7] Batte, M.T., Jones, E. Schnitkey, G. D. Computer Use by Ohio Commercial Farmers, *American Journal of Agricultural Economics*, 1990, vol. 72, no. 4, pp. 935-945, ISSN 0002-9092.
- [8] Batte, M. T. Changing computer use in agriculture: evidence from Ohio', *Computers and Electronics in Agriculture*, 2005, No. 47, pp. 1-13, 0168-1699.
- [9] BBC (British Broadcasting Corporation). Mobiles Find Right Price for Farmers. October 6, 2002. <http://news.bbc.co.uk/2/hi/technology/2290540.stm>
- [10] DOA, Rural Development Programme for Cyprus 2007-2013. With vision and perspective for the Cypriot farmer. ed 4th, Ministry of Agriculture, Natural Resources and Environment, (in Greek), 2010, p. 268.
- [11] European Commission, Future networks and the internet. Indexing Broadband Performance, 2008, p. 16.
- [12] Gloy, B., Akridge, J. Computer and internet adoption on large U.S. farms', *International Food and Agribusiness Management Review*, 2000, vol. 3, pp. 323-338, ISSN 0168-1699.
- [13] Hoag, D. L., Ascough II, J. C., Frasier, W. M. Farm Computer Adoption in the Great Plains', *Journal of Agricultural and Applied Economics*, 1999, vol. 31, pp. 57-67, ISSN 1074-0708.
- [14] Koutsouris, A. The emergence of the intra-rural digital divide: A critical review of the adoption of ICTs in rural areas and the farming community. in 9th European IFSA Symposium, 4-7 July, Vienna, 2010, pp. 23-32.
- [15] Madden, G. Coble-Neal, G. ,Internet use in rural and remote Western Australia', *Telecommunication Policy*, 2003, vol. 27, pp. 253-266.
- [16] Michailidis, A., Loizou, E., Nasts, S., Mattas, K. Mobile Telephony as a change driver in rural areas. Paper prepared for presentation at the 118th seminar of the European Association of Agricultural Economists, Ljubljana, Slovenia 2010.
- [17] Michailidis, A., Partalidou, M., Nastis, S. A. Papadaki-Klavdianou, A. Charatsari, C. Who goes online? Evidence of internet use patterns from rural Greece', *Telecommunication Policy*, 2011, vol. 35, no. 4, pp. 333-343, ISSN 0308-5961.
- [18] Papadavid, G. Review of agricultural economics and agricultural trade integration into the wider European market (in Greek), *Agricultural Research Institute*, 2008, p. 38.
- [19] Planning Bureau. Strategic Development Plan 2007-2013, Republic of Cyprus, Nicosia (in Greek), 2006.
- [20] Ramirez, R. A model for rural and remote information and communication technologies: a Canadian exploration', *Telecommunication Policy*, 2001, vol. 25, pp. 315-330. ISSN 0308-5961.
- [21] Rashid, A. T., Elder, L. Mobile phones and development: An Analysis of IDRC-supported projects. *The Electronic Journal of Information Systems in Developing Countries*, 2009, p. 36.
- [22] Statistical Service of Cyprus. Cyprus in figure (2010-11 edition). *General Statistics Series II*, 2012, No. 17.
- [23] Statistical Service of Cyprus. Information and Communication Technologies (ICT) usage survey in households and by individuals, 2012.
- [24] The International Communications Union (ITU). The World in 2013: ICT facts and figures. 2013. [Online] Available: <http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2013.pdf> [Accessed May 29, 2013]

- [25] Vakakis and Associates. The effects of accession in the EU and the future and dynamic of the Cypriot agricultural sector Department of Agriculture. Ministry of Agriculture, Natural Resources and Environment, (in Greek), 2010.
- [26] Vaněk, J., Jarolímek, J., Šimek, P. Development of communication infrastructure in rural areas of the Czech Republic. *Agricultural Economics (Zemědělská ekonomika)*, 2008, vol. 54, No. 3, p. 129-134. ISSN: 0139-570X.
- [27] Vaněk, J., Kánská, E., Jarolímek, J., Šimek, P. State and evaluation of information and communication technologies development in agricultural enterprises in Czech Republic. *Plant, Soil and Environment*, 2010, vol. 56 (2010), No. 3, p. 143-147. ISSN: 1214-1178.
- [28] Wade, R. H. Bridging the Digital Divide: new Route to Development or new Form of Dependency, in the *Social Study of Information and Communication Technology Innovation, Actors and Contexts*, Avgerou, C. Ciborra, C., Land, F. (eds), 2004, p. 185-206. New York: Oxford University Press.