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ICT an Important information Tool for Sustainable Agriculture Productivity

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Abstract

Recently ICT tools have a critical role to deliver extension services to the farming communities on time. The current research was carried out in the District Lodhran, Pakistan–an ideal area for sustainable crop production due to its prevailing irrigation system and fertile soils. The survey study was conducted to assess the impact of information and communication technologies (ICT) on the productivity of main crops i.e. wheat, cotton, chilies and cucumber. The data were collected randomly selecting 193 farmers and through a validated, pre-tested and well- structured questionnaire. Data were statistically analyzed using SPSS-21. The findings of the study revealed that ICT had a positive and significant impact on crop productivity of wheat, cucumber and chilies. However; ICT has not a significant impact on cotton productivity due to water shortage and pest infestation in that year. The main barriers preventing the adoption of ICT possibly could be lack of infrastructure, low education and English proficiency and power shortfall. Therefore, it would be appropriate to further investigate into reasons that prevent farmers, to use ICT.

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Introduction

To combat the challenges of a new era and to fulfill the food demands of the growing population, ICT tools are being used in several countries to promote agriculture productivity, as well as in Pakistan in the dissemination of critical information from sowing until marketing. The focus of the traditional extension system is large farmers, while the extension staff is unable to reach the remote areas due to a lack of transport facilities and` the absence of infrastructure (Baig and Aldosari, 2013). ICT enables the extension department to provide agriculture information about production technology, input supply, weather forecast, pest or disease outbreak and market information to a mass number of smallholder farmers at a minimal cost.

There is a direct impact of effective flow and transfer of information on agricultural development (Kalusopa, 2006). Muhammad Yunus (2006), a Nobel Peace Prize winner, for poverty alleviation as cited in (Nair, 2012) indicated that "The fastest way to get out of poverty now is to have one mobile phone". Using mobile phones, farmers can bypass middlemen, thus can obtain higher profit and save their efforts, time, and resources, further, reduce extra travel to obtain banking services – they get financial transactions using mobile banking services (Nair, 2012).

The use of ICTs can enhance farmers' bargaining power to buy inputs and sell farm produce, smallholder farmers are better position to compete with the larger operators. An online forum could guarantee the shortening of the unnecessary long value chain. Virtualization enables farmers to put the farm produce in a virtual market when the crop is not yet harvested. When he received online order, he harvests, packs and ships to the consumer which ensure maximum return to the farmer. Sending SMS messages with agricultural advice to smallholder farmers increased yields by 11.5% relative to a control group with no messages (Casaburi *et al.*, 2014). ICTs facilitate technology adoption, transmit information, improved seed varieties, inputs and new markets and relatively low-cost market prices, hence make a contribution to agricultural growth significantly (Chavula, 2014).

Most of the available literature, studies focused on the impact of ICT on markets and prices. There are only a few studies that focus on the impact of ICT enabled information services on modification of crop production practices, crop patterns, new technology adoption and productivity (Asenso-Okyere and Mekonnen, 2012). However, this study focus on the impact of ICT on crop productivity.

Methodology

Study area

The study was carried out in District Lodhran Pakistan, comprising three Tehsils and 72 union councils. The district sustains an estimated population of 1.7 million, about 80 percent of them living in rural areas. The income and education of these rural people are low as compared to an urban area, which is why they face poverty, being unskilled workers who work in the industry in nearby small and big cities. Important crops of the area include: cotton, wheat, sugarcane, and rice, making about 75% of the total crop production. Wheat happens to be the staple food crop whereas cotton remains the prime fiber crop.

Study population and sample size

District Lodhran consists of three Tehsils, and randomly one of them was selected for the study purposes. On average, about 24 Union Councils (UC, s) are in each Tehsil. The selected tehsil was divided into the eastern and western parts. Each part has on average 12 UCs. After two UC were selected randomly from each part. Each Union Council has six to twelve villages. A list of farmers of each UC was obtained from the local Agriculture Extension Officer. By using a random table in Microsoft excel, some 193 farmers were selected for the study purposes.

Data collection

By using a questionnaire, data collected from the randomly selected farmers. The questionnaire

contained 3 segments. The first, was to collect information on farmers' demographic characteristics; the second part was to gather information on the use of electronic communication means as sources of agricultural information; whereas the third component was designed to know about the farming system and agriculture production. The questionnaire was phrased in the very simple Urdu and English languages, avoiding technical complex and scientific terms.

Afterward, data collected for the study purposes through the survey were coded and screened for errors before analysis. All the variables were clearly defined and labeled. Statistical Package for Social Sciences (SPSS-21) was used for data analysis. Both descriptive as well as inferential statistical tools were employed to analyze the data. For summarizing demographic characteristics and perceptions of the farmers, descriptive statistics such as frequency distribution and means were used and to determine relationships between variables measured at an ordinal level, Spearman's Rank-order Correlation was used (Spearman, 1904). It is a non-parametric measure of statistical dependence between two variables, and it measures the strength and direction of association between two ranked (ordinal) variables.

Study variables

Area of residence, education, age group, income and level of ICT use included in Independent variables while perceived advantages of ICT, level of ICT use and productivity of different crops were included as independent variables. To explain the interaction of variables descriptive statistics, correlation and analysis of variance (ANOVA) were used.

Results

Table 1 shows the socioeconomic characteristics of the respondent's area of residence, education, age and income. It shows that the majority of respondents living in rural areas, and low education. However, some farmers living in a small town away from the farms, but their occupation is farming. About 19.2% of farmers are illiterate and only 3.6% of farmers have a university education. While most of the farmers are young in the age group of 26-50 years. As for farmer's income concerns, about 46.6% of the farmers lie in the low-income group. While only 21.2% of farmers have a high income.

Table 1. Socioeconomic characteristics of respondents.

Area of Residence	%age	Education	%age	Age groups (Years)	%age	Income (Annual) PKR	%age
Small town	25.9	Illiterate	19.2	16-25	8.3	Less than 300k	46.6
		Primary	13.5	26-40	65.3		
		Middle	26.9	41-55	24.4	Less than 900k	32.1
Rural Area	74.1	High School	25.9				
		College	10.9	56 or above	2.1	More than 900k	21.2
		University	3.6				

Level of use of ICT

Uses of ICT by respondents

Table (2) shows the farmer's level of use of ICT, that for only 9.2% of the respondents, the level of use of ICT (mobile and internet) was high, while the majority of the farmers (66.1%) were using ICT at the limited level. This is determined by computing variables in SPSS. This shows quite low ICT use among respondents. Table (3) indicates that respondents use ICT to obtain different types of agricultural information. It was found that 65.8% of the respondents use a mobile phone to know input prices, 29% use mobile to get weather information, 35.8% to obtain information about production technology and 81.3% to obtain market information.

Table (4) shows that respondents' education is positively and significantly correlated with their perception of the advantages of ICT. On the other hand, respondents' experience in agriculture is negative and significantly correlated with their perception of the advantages of ICT.

Effect of ICT on the productivity of crops

Table (5) shows that the use of ICT is positively and significantly correlated with the productivity of crops like wheat cucumber and chilies. However, ICT has no significant impact on cotton productivity.

Table 2. Level of use of ICT by Respondents to obtain agricultural information.

Level of use of ICT	Percent %
High use of ICT	9.2
Average use of ICT	9.2
Limited use of ICT	66.1
Not use of IC	14.4
Total	100

Discussion

The level of ICT use in the study area is quite low. The reasons for the low level of use of the ICT tools could be due to the high cost of ICT, low farmer education, lack of and uncertain electricity supply and unavailability of high-speed internet. Lack of confidence to learn and use ICT could also be an important reason for low ICT adoption. However, the results of the present study are inconsistent with the findings of Hayrol *et al.* (2009), They found out that the farmers in Malaysia preferred to use the traditional sources of information instead of using ICT in their agro-business such as ask from neighbors and were by relying on television, radio and newspapers. It is clear from Table (3) that the highest portion of respondents use the mobile phone to get market information, followed by input prices, production technology and weather information because to buy inputs and sell farm produce are of critical economic importance for farmers.

Table 3. Type of uses of electronic communication technologies by respondents to obtain agriculture information (N=193).

Communication Technology	Use ICT to get			
	Input Prices%	Weather information%	Production Technology%	Market information%
Mobile Phone	65.8	29	35.8	81.3
Internet	9.3	19.7	10.4	8.3

The highest percentage of respondents use the internet to get weather information. Farmers require proper information to plan for their activities, choose the inputs and eventually on when and where to sell their products. Thus, it is argued that there is a direct relationship between the availability of information and agricultural development (Babu *et al.*, 2012). To enhance agricultural development, the information needs of farmers have to be met conveniently and at an affordable cost while ensuring their availability on time.

Table 4. Correlation between socioeconomic characteristics and Advantages of ICT in agriculture.

Dependent Variable	Independent Variable	Correlation coefficient R
Perceived advantages of ICT in agriculture	Age	- 0.004
	Education	0.179*
	Experience in agriculture(Years)	-0.145*

*Correlation is significant at the 0.05 level.

As discussed above that ICT is biased towards young and educated people and they perceive the advantages of ICT while aged and less educated respondents perceive no advantages of ICT and their situation remain unchanged. The literature revealed that the decision to use ICT is affected by age, the

primary occupation of the farmer, the cost of transport to the output market, availability of electricity for charging phone batteries, farming experience, literacy levels, income from agricultural and asset value (Okello *et al.*, 2012). As mentioned above that ICT has a significant impact on the productivity of wheat, cucumber and chilies. However, due to pest infestation and water shortage in summer, the overall production of cotton might be the reason for no significant impact of ICT on cotton productivity. Similarly, Houghton (2009) also found that the use of ICT tools i.e. mobile phones caused a significant influence on realizing sustainable crop yields. By analyzing the micro-level data collected from Swaziland, Cambodia, and Honduras, they realized that mobile phones had a significant impact on the agricultural production of various crops. Similarly.

Table 5. Spearman correlation between level of use of ICT and productivity of agriculture crops.

Dependent Variable (Productivity of crops)	Independent Variable	Correlation coefficient R
Wheat	Level of Use of ICT to obtain Agricultural information	0.145*
Cotton		0.129
Cucumber (Tunnel Technology)		0.476**
Chilies		0.327**

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.01 level.

Conclusion

ICT helps to make information available on agriculture and related activities like inputs availability and prices, sowing time, fertilizer, pesticide and irrigation application time, early weather forecast, pests and diseases attack, market information are that helps farmers for timely decision making, and all these factors, in turn, improve the productivity of crops and minimize risks. However, the study revealed that only 9.2% of the respondents were using a high level of ICT (i.e. mobile and internet) while the majority of the farmers (66.1%) were using ICT at a limited level.

The prime possible barriers to the adoption of ICT in the study area could be lack of infrastructure, low education and English literacy, high cost to obtain ICT and un-certain and interrupted power (electricity) supply. By addressing these hurdles the productivity of the agriculture sector can be elevated. Extension service providing agencies should also take advantage of the outcomes of the study and use the ICT tools to and upgrade their skills on the use of ICT to enhance their effectiveness and efficiency. ICT itself couldn't play role in the agriculture process, but facilitate the ongoing process by increasing linkage.

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