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Progressive Influence of ICTs Usage on Vegetables Productivity in Punjab, Pakistan

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Abstract
The vegetable production is main part of the cropping pattern of Pakistan but due to pressure of cash crops, its area is restricted by 0.62 million ha. In developing countries, mobile phone is a most thrilling tool of ICTs used for obtaining information. They are speeding up ways in which farmers get, exchange, and deploy information. Increasingly, they enable farmers to focus and extract useful and up-to-date information from social and business networks. By using the Multistage sampling technique tehsils Kot Chutta and Dera Ghazi Khan from district Dera Ghazi Khan were selected through purposive sampling technique, then four union councils from each tehsil and three villages from each union coucil, were selected by random technique. Five farmers from each village were selected to make a total of 120 respondents for the study. Results showed that age has significant and positive relation with productivity of the vegetables in study area. The results further showed significant and positive relation of education with productivity of vegetables in study area. Results of the study disclosed that

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obsolete and complicated information is major factor that affect the vegetable growers of tehsil Kot chutta with the mean of 2.17 and S.D of 0.732 and 0.932 respectively as compared to vegetable growers of tehsil Dera Ghazi Khan with the mean of 2.07 and S.D of 0.829 and 0.944 respectively. Results showed that lack of skills and lack of knowledge about using mobile phone has positive and significant relation with the productivity of vegetable.

Key words: Comparative analysis, Vegetables, Extension services, Punjab, t-statistics

Introduction

Vegetable production is a main part of the cropping pattern in Pakistan but due to the pressure of cash crops its area is restricted by 0.62 million ha (GoP, 2018). Vegetables fit in all cropping patterns and farming systems due to their short span of maturity. To meet the demand of consumers across the country, Pakistani vegetables trade in various regional markets. Pakistan produces various types of vegetables year-round because of the diverse agro-ecological conditions prevailing in all provinces. This is the reason behind presence of vegetables in the market during all seasons.

More than 35 types of vegetables are grown in several agro-ecological regions in Pakistan. Tomato, chilies, brinjal, okra, potato, cucumber and gourds are plentifully available during the spring and summer seasons. Cucumber, gourds, okra, beans and brinjal are common during rainy season. Cauliflower, cabbage, lettuce, onion, potato, spinach, carrot, radish, turnip, coriander, fenugreek and peas are grown in winter season. The winter season is important for growing variety of vegetables (Khokhar, 2014).

Prices of essential food items are increasing gradually due to lower domestic production from the required level. Effective communication between the agriculture extension workers and farming community is essential in the process of agricultural development. It is also crucial for durability of extension development projects as well as in enhancing adaptation of agricultural innovations and technologies. Communication between the stakeholders occur through a variety of channels by using local networks and institutions. Dissemination of agricultural information considered as crucial aspect like other elements of production process such as capital, management, land capability and labor. The effectiveness of such elements can be enhanced by the dissemination of useful, relevant and reliable information. Farming community of the developed nations have taken advantages by combining modern technologies for their activities in cultivation of crops. Information communication technologies (ICTs) such as mobile phone, radio, TV, Internet etc., are more beneficial in this context (Naqvi, et al., 2020).

In developing countries, the mobile phone is a most thrilling tool of ICTs used for obtaining agricultural information. It is speeding up ways in which farmers get, exchange, deploy information. Furthermore, it enables farmers to

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focus and extract useful and up-to-date information from social and business networks (Overa, 2006). Mobile phones are therefore, becoming increasingly important to agro-based business persons as an infrastructural device for improving the efficiency of agriculture markets, promoting investment, and contributing to empowerment. Per capita GDP growth of developing countries with an average of ten or more mobile phones per hundred people were recorded 0.59% higher than the country with mobile usage less than ten phone per hundred people between 1996 and 2003 (Verheye, 2000).

Mobile phones have potential to enable farmers in informed decisions, close the gap in information and connect to markets. Presently most of the farmers go to a few markets which leads to the deterioration of fresh food, market 'floods' and low prices while some potential markets remain untapped. With the help of mobile phones farmers made informed decisions that can save their transportation costs and time. Mobile phone can promote food security, livelihoods, better production marketing and more farmers may adopt the technology (Masuka et al., 2016).

Mobile phone can contribute to increasing farm productivity by reducing transportation and transaction costs and ultimately increase the farmer's income. However, fluctuating electricity supply obstructs the effective use of mobile phones for agribusiness. The facilities of basic infrastructure, especially power/light, should be given to rural communities to enable them in using mobile phones effectively for activities of agribusiness and ensure sustainability in agricultural development (Ogunniyi and Ojebuyi, 2016).

In the urban centers of countries that are developed, the usage of mobile phone expands in the last two decades. Today, more than ever before, mobile phone diffuses around the world faster than any other previous technology, becoming a valuable tool to strengthen social networks and to access new business and employment opportunities. In the result, mobile phone provide great opportunities for the economic development and progress of the developed nation and developing zones of the developed countries. In the urban areas of developed regions the people under the age of fifty used phone fluently, while the farming community of rural areas are least likely to use mobile phone. The level of ownership in urban areas are high with compared to rural areas (Wims, 2007).

Due to the mobile phone technology usage in Peru, per capita income were observed increased up-to 13%. There is a positive impact of the distribution of information and knowledge on the farming community's income (Chong et al., 2005). In Bangladesh, it is observed that mobile phone usage provides the opportunity to reduce inequality in demographics and increase productivity (Islam and Gronlund, 2011).

With its more than two hundred and ten million people, Pakistan is ranked as 5th most crowded country in the world (USA, 2019). In ICT development index of 2016, Pakistan was ranked on one hundred and forty-eight (148th) position out

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of one hundred and seventy-three (173) countries (ITU, 2017). As compared to other ICTs tools the penetration rate of the mobile phone in Pakistan is remarkable. A significant majority (76.76%) of the Pakistani community has mobile phone out of these two-third (32.34%) population avail 3G/4G technology (PTA, 2019).

Mobile phones help in building connection among individual to individuals, markets, information and services (Aker and Mbiti, 2010), and are becoming tremendously important to agro-based business person as an infrastructural device for enhancing effectiveness of agriculture markets, promoting investment and contributing to empowerment. When mobile phones used in the market-oriented agriculture with the proper rules and regulations of ICT and policies about usage and in satisfactory infrastructure positively affect rural livelihood outcomes (Mutunga and
Waema, 2016).

For maximization of agricultural production an information-based, decision-making agricultural system is designed and is often designated as the next great advancement in agriculture. Decision-based precision agriculture is implemented by the farming community for obtaining information by combining mobile mapping and Global Positioning System (GPS) (Michael, 2008).

Obtaining information by using mobile phone is dependent on the mobile phone network that how far that network is able to link the farmers with accurate market as well as agricultural information. The impact on productivity can be directly measured in terms of increased returns to the farmers with a trickledown effect on the cropping pattern and potential yield of the sowed crop. Information that plays a primary role in enhancing farm productivity is; information regarding prices of input and output which are price factors and some non-price factors such as quality of input, modern and latest techniques and availability of input (Mittal and Tripathi, 2009).

Methodology

Rural area of Pakistan is selected for the execution of this study. With the 796,096 KM^2 piece of land it is the 2^{nd} largest country of the south asia (Burki and Ziring, 2021). Punjab is one of the provinces among four provinces of country where present study was conducted. The province has ten divisions: Dera Ghazi Khan, Bahawalpur, Sheikhupura, Gujranwala, Multan, Lahore, Sahiwal, Rawalpindi, Sargodha, and Faisalabad

Study Area

Research was specially executed in the district Dera Ghazi Khan of Dera Ghazi Khan division. The district comprised of four tehsils i.e Dera Ghazi Khan, Kot Chutta Taunsa Sharif and Tribal area. The total area of district is 11,922 Sq. kilometer. Dera Ghazi Khan is located at 30'03" N and 70'38" E (Govt. of Punjab, 2021). The overall climate of this area is hot with slightly rainfall. The temperature during summer is usually about 115°F (46°C), while during winter

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season the temperature is as low as 40°F (4°C) (*ibid*). The important vegetables that grown in this district are onion, cauliflower, turnip, potato, bottle gourd, carrot, ladyfinger, tomato and brinjal (GoPb, 2021). Dera Ghazi Khan district has annual production of apple gourd/Tinda 369 tonnes, ladyfinger 3209 tonnes, bottle gourd 383 tonnes, Luffa 790 tonnes and pumpkin 59 tonnes in Kharif season of 2021-22 (GoPb, 2022). The study was executed in two tehsils of district Dera Ghazi Khan under Punjab Province. Dera Ghazi Khan and Kot chutta tehsil were chosen purposively for the study. These two tehsils were selected due to extensively cultivation of vegetables. Due to the poor transportation system the proofs of agricultural researches are negligible in these localities so, it is the reason behind selection of these areas.

Sampling Technique

Dera Ghazi Khan district have 2.8 million population (GoP, 2017). Multistage sampling technique were used to draw the samples from the study area. Tehsils Kot Chutta and Dera Ghazi Khan from district Dera Ghazi Khan were selected by purposive sampling technique, then four Union Councils from each tehsil and three villages from each Union Council were selected by using the random technique. Five farmers from each village were selected to make a total of 120 respondents for the study. Sixty (60) respondents were selected from each tehsil.

Pre-testing

Before the finalization of the interview schedule fifteen (15) vegetable growers of study area were selected for checking the authenticity of instrument. The results of pre-testing were discussed with experts and made some necessary amendments in interview schedule with the consultation of them in the light of results obtained.

Analysis of Data

Data collected from interviews with vegetable growers saved in Statistical Package for Social Sciences (SPSS) version 22 for treating the data and performing various analysis and test for obtaining results. Descriptive as well as inferential analysis such as independent t-test was performed for obtaining the results.

Results and Discussion

Age of the Vegetable Growers

Age of the respondents were categorized in three basic categories young (25-35), middle-aged (36-45) and old (More than 46). Results of the study existing in **Table 1** mentioned that the tehsil Kot Chutta had more youth having a mean (1.783) and Standard deviation (0.415) as compared to tehsil Dera Ghazi Khan with a mean (1.667) and standard deviation (0.628). Results further showed that the *P*-value of t-statistics for age is less than 0.05 which indicates test is significant and t-value of a test is positive (1.006) with the productivity of the vegetables in the study area.

Educational Level Of Vegetables Growers

Education considered as the years a person attended the formal schooling system and gain knowledge with experience. Education is very important factor in

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present study So, for asking about education level it was categorized in four levels i.e; Upto Matric (01-10), Intermediate (11-12), Bachelor (13-14) and Masters (15-16). Results of the study presented in **Table 1** mentioned that tehsil Kot Chutta has more educated farmers/vegetable growers with a mean (2.83) and standard deviation (1.107) as compared to tehsil Dera Ghazi Khan with a mean (2.22) and standard deviation (1.166). The results further showed that the *P*-value of t-statistics is less than 0.05 which indicates test is significant relation and t-value of a test is positive (2.971) of education with the productivity of vegetables in the study area.

Tenancy Status of the Vegetable Growers

The way of cultivating land is referred to as a type of tenure. In this context, three categories were considered i.e.: owner, tenant, and owner-cum-tenant. The results of the study are presented in **Table 1**. Results of the study showed that the vegetable growers of tehsil Kot Chutta laid toward the category of Owner-cum-tenant having mean (1.73) and standard deviation (0.936) they had their own cultivated land as well as cultivate land by borrowing as tenants as compared to vegetable growers of Dera Ghazi Khan having mean (1.67) and standard deviation (0.837). The results further disclose the *P*-value of t-statistics is less than 0.05 which indicates significant and positive relation having value (0.411) with the productivity of vegetables in the study area.

Area Under Vegetables Cultivation

The present study is basically about the productivity of Vegetables and the factors that affect it, keeping in view the importance of the cultivation area of vegetables, this variable was also included in interview schedule so the results are presented in **Table 1**. The land area categorized in three major categories i.e, Small (>12.5), medium (12.5-25) and large (<25). Results of the study showed that vegetable growers of Kot Chutta had more land with mean of (1.361) and standard deviation of (0.627) as compared to vegetable growers of Dera Ghazi Khan with mean (1.216) and standard deviation of (0.555). The results of the study further disclosed that *P*-value of t-statistics is less than 0.05 which showed significant and positive relation as t-value is (0.927) between area of cultivation and productivity of vegetables in study area.

Farming Experience of the Vegetable Growers

The present study is basically about the productivity of Vegetables and the factors that affect it, keeping in view the importance of the farming experience of the farmers, this variable was also included in the interview schedule so the results are presented in **Table 1**. Experience is categorized into four categories i.e.; less than 5 years, 6 to 15 years, 16 to 25 years, and more than 25 years. The results of the study describe that vegetable growers of tehsil Dera Ghazi Khan were more experienced with a mean of (2.15) and standard deviation (0.709) as compared to vegetable growers of Kot Chutta with a mean of (2.07) and standard deviation of (0.516). The results of the study further disclosed that *P*-value of t-statistics in

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more than 0.05 which indicates a non-significant but positive relationship as t-value is (0.736) between the experience of farming and the productivity of vegetables.

Table 1: Socio-Demographic Factors

Socio-demographic attributes	Dera Ghazi Khan		Kot Chutta		t-value	Sig.	F-value
	Mean	S.D	Mean	S.D			
Age	1.667	0.628	1.783	0.415	1.199	.000*	20.450
Education	2.22	1.166	2.83	1.107	2.971	.031*	0.741
Tenancy status	1.67	0.837	1.73	0.936	0.411	.037*	4.439
Cultivation area	1.216	0.555	1.361	0.624	0.927	.011*	2.576
Farming Experience	2.15	0.709	2.07	0.516	0.736	.13	6.309

Source: Field Survey

Usage of Mobile Phone for Information In a Day

Respondents were asked about mobile phone usage for agricultural information in a day. How many times they use mobile phones in a day for seeking agricultural information? The responses of the respondents are presented in **Table 2.** Usage time was categorized into three categories i.e.; Two to three times a day, four to five times a day, and more than five times in a day. Results in the table showed that the farmers of Kot Chutta use mobile phones having a mean (1.90) and standard deviation (0.573) more than farmers of Dera Ghazi Khan having a mean (1.78) and standard deviation (0.691). The results further disclosed that *P*-value of t-statistics is less than 0.05 which indicates significant and positive relation as t-value is (1.006) between mobile phone usage time and the productivity of vegetables in the study area.

Production of Vegetable per Acre of Vegetable Growers

Per acre yield is essential to assess the field production of the farmer. It is also helpful in assessing the income generated by the farmer from the field. It is also important to analyze the adoption level of modern technology by the farmer. The respondents of the study were asked about the average yield of vegetables, responses of the respondents are presented in **Table 2.** The Production of vegetable mounds per acre is categorized into four categories i.e; 600-1000 mounds per acre, 1001-1400 mounds per acre, 1401-1600 mounds per acre, and 1601-2000 mounds per acre. Results of the study disclosed that vegetable growers of Kot Chutta have more production with a mean of 2.71 and a standard deviation (1.30) as compared to vegetable growers of Dera Ghazi Khan having a mean of 1.66 and a standard deviation (0.79). The results further disclosed that *P*-value of t-statistics is less than 0.05 which indicates significate and positive relation as t-value is (5.237) between the production of vegetables and mobile phone usage.

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Table 2: Mobile Phone Usage Time

	Dera Ghazi Khan		Kot Chutta		t-value	Sig.	F-value
	Mean	S.D	Mean	S.D			
Mobile usage	1.78	0.691	1.90	0.573	1.006	.02*	6.455
Production of vegetable	1.66	0.79	2.71	1.30	5.327	.000*	53.476

Source: Fiel Survey

Factors Affecting the Usage of Mobile Phone

Some factors were identified keeping in view and consulting the previous studies/Literature review and asked the respondents about these variables/factors that how much (Percent) affect the usage of mobile phone as an information source in obtaining information regarding vegetable productivity and production methodology. Four-point Likert scale were used to assess the responses of the vegetable growers of the study area which were; 0-25, 26-50, 51-75, and 76-100%. As mentioned in the methodology independent t-test was performed in the present study for comparing the data of two tehsils and the results are presented in **Table 3**

Results of the study disclosed that obsolete and complicated information is major factor that affect the vegetable growers of tehsil Kot chutta with the mean of 2.17 and S.D of 0.732 and 0.954 respectively as compared to vegetable growers of tehsil Dera Ghazi Khan with the mean of 2.08 and S.D of 0.829 and 0.944 respectively. Study showed that obsolete and complicated information has positive but non-significant relation having *P*-value 0.277 and 0.350 respectively with the productivity of vegetable in the study area.

Results further disclosed that lack of knowledge about usage of mobile phone and lack of skills about using mobile phone are the major factors having mean 2.32 and 2.35 with S.D. of 0.854 and 0.899 respectively for the vegetable growers of tehsil Dera Ghazi Khan that affects the usage of mobile phone as information source as compared to vegetable growers of tehsil Kot Chutta having mean of 2.10 and 2.17 with S.D. of 0.706 and 0.668 respectively. It further showed that lack of skills using a mobile phone and lack of knowledge about using a mobile phone has positive and significant relation with *P*-value 0.045 and 0.006 respectively with the productivity of vegetable in the study area.

Table 3: Comparative Analysis of Factors that Affect Usage of Mobile Phone

FACTORS	Dera Ghazi Khan		Kot Chutta		t-value	Sig.	F-value
	Mean	S.D	Mean	S.D			
Illiteracy	2.28	.958	1.87	.873	2.490	.351	.877
Lack of knowledge about usage of mobile phone	2.32	.854	2.10	.706	1.515	.045*	3.618
Lack of skills about using	2.35	.899	2.17	.668	1.268	.006*	7.756

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mobile phone							
Access to mobile phone	2.18	.813	1.95	.675	1.711	.029*	4.916
Lack of knowledge about agricultural applications	2.30	.809	1.87	.769	3.007	.796	.067
Irrelevant information	2.32	.892	2.05	.852	1.674	.481	.499
Epileptic power supply	2.28	.885	2.05	.790	1.524	.012*	2.333
High prices of internet	2.17	.847	2.00	.921	1.032	.462	.546
Complicated information	2.08	.944	2.17	.954	-.385	.350	.879
Obsolete information	2.08	.829	2.17	.732	-.467	.277	1.191
Not in native language	1.95	.811	2.08	.869	-.869	.261	1.274
Assets	2.23	.927	2.13	.833	.621	.047*	3.417
Traditional practices	2.18	.833	2.33	.857	-.972	.030*	1.083
Cost of mobile phone	2.13	.812	2.20	.798	-.453	.708	.141
Too hard to use	1.98	.873	1.98	.748	.000	.315	1.020
Lack of benefits awareness	2.07	.841	2.00	.844	.433	.698	.152

Source: Field Survey

Discussion

The experience of a person about various activities, ideas of a person about things, observations, ways of tackling the situation, and attitude toward his work are directly affected by age (Rajan, 1991). A person spends the number of years during his lifespan from birth to death are referred to as age (Hashmi *et al.*, 2007). The study found that vegetable growers of kot chutta are young than growers of DG Khan and age has positive and significant relation with the productivity of vegetable growers young people work with the passion and they obtain results in better production and yield from their crops. As vegetable growers of kot chutta were younger they also are more educated than their counterparts and had more farming land than them. Education and cultivated land have positive and significant relation with the productivity of vegetable which means educated growers has knowledge about latest technologies and they applied techniques and technology in farming practices in result get more production, yield with higher productivity rate. Results further found that mobile phone usage has positive and significant relation with the productivity of vegetables which means growers who use mobile phone for obtaining information regarding plant production, protection and post-harvesting get more yield and enhanced their vegetable productivity. Verheya (2000) also found that usage of mobile phone as an information source enhance the productivity of farming community. Chong et al., (2005) also observed increase in productivity of agricultural products due to usage of mobile phone as an information source.

Illiteracy, lack of knowledge and lack of skills to use mobile phone, access to mobile phone, lack of knowledge about agricultural application, irrelevant information, epileptic power supply, high internet prices, complicated information,

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obsolete information and information not in native language are the main problems faced by the vegetable growers of the study area in adopting mobile phone as information source. Ogunniyi and Ojebuyi, (2016) found that epileptic power supply, high prices and basic infrastructure are factors that affects usage of mobile phone as information source to the farming community.

Conclusion and Recommendation

Conclusion

It is concluded that vegetable growers of tehsil Kot Chutta are young, educated and have more land for farming as compared to vegetable growers of tehsil Dera Ghazi Khan. As discussed earlier the growers of Kot Chutta are more educated so they use mobile phones for obtaining information related to the productivity of vegetables as compared to growers of Dera Ghazi Khan. Further, it is concluded that as vegetable growers of Kot Chutta have more farming land and they obtain information on time about productivity so they have more production than vegetable growers of Dera Ghazi Khan. It is concluded that lack of information about android agricultural applications and lack of skill in using a mobile phone are the major hurdles for growers of Dera Ghazi Khan that affect the productivity of vegetables as compared to growers of Kot Chutta.

On the basis of the above conclusions, the study would recommend:

- Department of Agriculture Extension should plan training for the vegetable growers regarding effective use of mobile phones as an information source in obtaining knowledge about vegetable production techniques as well as post-harvesting techniques.
- Department of Agriculture Extension should plan Capacity building programs for vegetable growers about agricultural applications of mobile phones by using that they can enhance their productivity.
- Government should provide basic infrastructural facilities to the farming community that will help them in enhancing overall farm income and reducing input cost.

Author's Contribution

Naqvi, S.M.H. collected, compile, analyze and summarize the research work. R.S and R.A provides expert opinion. N. H. design the manuscript. S.K., M. N., and A.S., N.H helped in data collection and interviewing the respondents

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article

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Ethical Approval

The author sought and got approval from the Institutions' Research Ethical Board to conduct the study. However, there was no approval number to that effect.

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