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Information Communication Technologies (ICT) and its Impact on the Livelihood of Communities Involved in the Agriculture: A Case Study of Pakistan

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Abstract: This research is about the implementation of Information Communication Technologies (ICTs) in the rural areas particularly south Punjab, south Sindh and Khyber Pakhtunkhwa of Pakistan. Researchers have conducted the field work in the Thirty three villages of seven districts i.e Rajanpur, Multan, Muzaffargarh, Thatta, Badin, Kohat and Hangu. The objective of this research was to see if the implementation of ICT would have any impact on the livelihood of people involved in the agriculture. Another variable "unemployment" was also added in the designed research tools to see if the ICT can be helpful to unemployed members of these communities. The questionnaire was distributed among the rural population of Rajanpur, Multan, Muzaffargarh, Thatta, Badin, Kohat and Hangu on the basis of convenient sampling. In case of agriculture, participants filled out 24-item questionnaire. There were 250 questionnaires distributed among the participant and 212 were usable for analysis purpose. In addition to launching the surveys in the thirty three villages, JFK Institute of Technology and Management research team organized focus group discussion in Islamabad where policy makers, ministry officials, civil society representatives and university professors were invited to get their opinion on the implementation of ICT in the stated communities. The panel stressed the need to launch the ICT project on priority basis to enhance the economic opportunities for south Sindh and south Punjab and Khyber Pahtunkhwa. Researchers analyzed the data using the SPSS software. Reliability Analysis, Principal Component Analysis and Regression Analysis were conducted to analyze the data collected from the thirty three villages. Results show that a vast majority of the population is in favor of ICT implementation in the communities, with the perception that it would help in improving the livelihood of those involved in agriculture.

Key words: Information communication technology · Agriculture · Rural livelihood · ICT & Employment · Health

INTRODUCTION

Information and communication technologies (ICT) offer bright prospects for the developing countries in picking up the pace for economic growth, reducing poverty and promoting sustainable micro development. The role of ICTs in rural areas as an impetus for development has long been acknowledged and therefore numerous public/private sector organizations, donor agencies are involved in ICT related projects with the aim to improve quality of rural life. According to info Dev report [1], as outlined by United Nations Millennium Development Goals, the international donor community has made concerted efforts to bridge the digital gap between the haves and have-nots.

Although Jensen [2] declared the impact of increased access of ICTs to developing societies unclear but recent evidence suggests that ICTs can play a fundamental role in boosting the livelihoods of rural population [3-6]. Further strengthening the case are the views of Kgalema Motlanthe, Deputy President Africa, regarding the solution of joblessness, poverty and health issues in

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Africa, "If you look at countries such as India, they invested a lot in education, IT and ICT and reap the benefits of those investments. That's "what Africa needs to do as well" [7].

The research question framed in this study is:

> *"How does ICT impact the livelihoods of rural population of Pakistan*?"

To attend to this research question, this paper provides an overview of the ICT perceptions of rural population of Southern Sindh (Badin and Thatta), Southern Punjab (Muzafargarh, Multan and Rajanpur) and Khyber Pahtunkhwa (Kohat and Hangu) related to daily life usage, agriculture,. A further component of "unemployment" is added in the research to see how it would have any impact on the lives of unemployed folks in the targeted areas.

The findings of this study would help the donor agencies and government development bodies to understand the ICT need and perceptions of rural population in order to successfully conduct projects in these poverty struck areas.

Literature Review

ICT and Development: Information and Communication Technologies (ICT) refers to the use of electronic and computers based technologies to access information and communicate with others [8]. Thus, the transfer of information takes place electronically through the electronic devices like computers, mobile phones and tablets. The role of ICTs as enabler of socio-economic development is being stressed by the international development communities because of the prospects associated to it for the developing countries.

ICT offers major opportunities to the developing world in accelerating the economic growth, encouraging local development and reduction in poverty [9]. As a result of this, efforts are being made to utilize ICT for achieving development objectives in healthcare, workforce, education, agriculture, government services etc. to improve the livelihood of poor people. The achievement of these objectives is likely to cause a chain reaction instigating positive impact on the position of developing countries in the global economy as a result of improvement in the individual level income.

Some of the researchers have also contended that other than the economic impacts, the ICTs bear positive spillover effects on various aspects of social life. For example, these technologies have been linked to improving education delivery and e-government [10], develop civil infrastructure [11], empower disregarded women [12], maintain good governance [13] and augment health care [14]. Therefore, many researchers argue the significance of ICT infrastructure for the rapid development of emerging economies [15-17].

ICT and Rural Societies: The last two decades have been characterized with the evolution in ICTs that have a profound impact on all aspects of life. The developed countries in particular until now have been able to reap the benefits of this revolution. On the other hand developing countries have lagged behind in adoption of ICT because of unequal access to Internet and wireless telephony between the urban and rural populations. The matter gets further complicated by the fact that this digital divide between the haves and have-nots decreases the value of time as compared to the access costs in developing countries [18]. As a result, limited deprived people will invest in ICT [19].

Pakistan has extreme geographical importance because of its unique strategic position. With a population of 170 million, it is the 6th most populous country in the world ("About Pakistan," n.d.). 67.5% of the population resides in villages and 55% of population is under the age of 24 which is becoming more and more challenging to provide health, education and jobs to the rural areas of Pakistan [5]. Although Teledensity of 71.5% depicts healthy trend in the expansion of telecommunication services but the scenario for the rural residents may be different [20]. According to Universal Service Fund, 480 cities and towns of Pakistan lack broadband services with the major percentage comprising in the rural areas [21]. The long hour power shutdown in the rural areas further complicates the matter. Therefore, even with a flourishing IT industry having an estimated global share of US$2.8 billion, including global sales revenue of US$1.6 billion, ICT expansion in rural Pakistan will be a challenging task [4].The reason can be attributed to the fact that with the evolution of technology extending ICT networks to rural areas has been a persistent challenge [22].

Figure 1 is taken from the Universal Service Fund report published in 2012. The information published shows that 62% rural population has no personal computer or any skill of how to use the PC. At the same time 17% of the population has no access to broadband which consists of 480 cities and town. Only 21% of the nation has access to broadband in Pakistan as per this report.

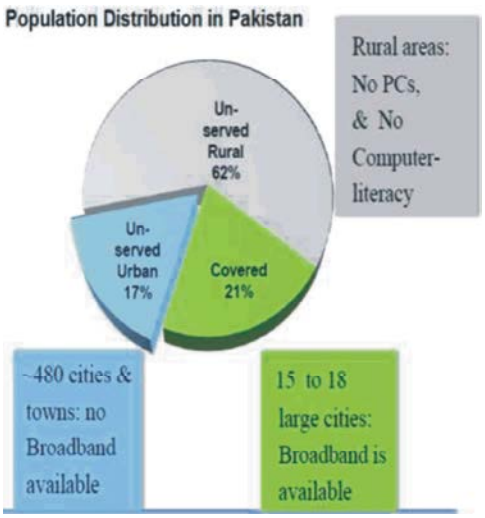

Fig. 1: Source: Research report by Iftikhar, USF.ORG.PK 2012.

Table 1: Percent of those respondents who say they understand English

Education Level	Illiterate	Grades 1-9	Secondary	Post-Secondary
English	3%	10%	47%	79%

Source: BBC Pakistan 2008: survey of adults (15+) n = 4020

Apart from the absence of infrastructure and economic factors, major obstacles are illiteracy and lack of awareness [18]. Unlike other mediums of communications like Radio and Television, Internet requires some basic level of literacy in order to communicate with other people. BBC survey conducted in 2008, indicated 52% of respondents identified themselves as illiterate, thus highlighting illiteracy as an important issue in Pakistan.

Furthermore, the digital gender divide clearly exists with low literacy rate among the women as compared to men. Table 1 indicates the danger of permanent backwardness in rural areas. One of the possible reasons could be the socio-cultural issues in the rural societies which do not allow much ICT access to women.

Transformative Role of ICT: The transformative role of ICT cannot be denied with number of case studies witnessing its power to improve livelihoods by eradicating poverty through empowerment of rural communities. Chapman, Slayaker and Young [23] accentuated significance of ICTs for providing information to rural residents in order to make livelihood strategies decisions and institutions for developing policies and process for these strategies. The following case studies highlight the successful application of ICTs in agriculture, mobile communications, government and education sector.

Table 2: Literacy Rate (10 Years and Above)-Pakistan and Provinces (2010-11).

Province	Male%	Female%	Total%
Punjab			
Urban	80	71	76
Rural	64	42	53
Sindh			
Urban	82	68	75
Rural	60	22	42
KPK			
Urban	77	50	63
Rural	67	29	48

Source: Pakistan Economic Survey 2012

Computerized Milk Collection Centers: Lack of access to information about weather conditions, prices and market opportunities are typically very common among farmers living in rural areas. ICT can remedy such situation by timely access to the relevant information in less time. In Gujrat (India) electronic milk collection centers have been set up which have integrated system to measure weights, test fat and plastic card readers in order to ensure fair prices for the farmers who supply milk to dairy corporations [19]. Therefore, the farmers have been protected against the traditional in transparent pricing practices and delayed payments. Consequently this initiative has allowed 50,000 farmers to benefit from the transparent and cooperative system on daily basis [24].

Improving Health Care: The Telecenters deployed by the United Nations Development Program (UNDP) and the Ministry of Science and Technology (MoST) in Menwangzhuang and Pushang, China, meets the information need of the rural population related to health care such as setting hospital appointments and getting basic health advice [6]. Furthermore, the residents also regarded mobile phones as efficient tools for getting information about jobs and the whereabouts of their friends and family members.

Successful projects like Gyandoot Project and N-Logue Communications in India allow for delivery of wide variety of services related to e-governance, health care information and other services through intranet (Gyandoot) and corDect (N-Logue) which is wireless based communication service [25]. Furthermore, in Malawi, patients of HIV and Aids can receive reminder to take their medicines on schedule through text messages [3].

ICT in Agriculture: E-Choupal is a cost effective initiative by ITC for direct procurement of export products from the farmers of Indian villages through Internet [26]. This technology based intervention provides farmers the

basic knowledge about risk management and logistic related issues, thereby, empowering them to face global challenges [25].

According to Aker and Mbiti [3], mobile phones reduce the search costs for the traders as they are able to know about prices in different regions. For example, in Ghana, farmers are able to learn about the tomato and corn prices over 400 Kilometer away through text messages. Similarly, Muto and Yumano [27] found that mobile phones coverage resulted in 10 percent increase in the likelihood of farmers involvement in market for bananas as compared to maze, thereby signifying the importance of mobile phones for perishable products.

Methodology: Researchers have focused on knowing the perception of ICT by using the two different methodologies i.e. questionnaires and focus group discussions. A focus group discussion was organized in the city of Islamabad where academicians, policy makers and ministry of information officials were invited to discuss and see the pros and cons of bringing ICT in the rural life of South Sindh, South Punjab and Khyber Pahtunkhwa. Interestingly, all panel of experts agreed that there is serious need to implement ICT in the described areas to enhance the livelihood of the communities.

Researchers prepared and launched questionnaire for the communities involved in the agriculture. We also focused on the unemployed workforce in the communities. In the unemployed part, it was checked how community member without job can benefit from the ICT implementation in South Sindh, South Punjab Khyber Pakhtunkhwa.

Data Analysis: Data gathering method, measurement instrument and method of analysis are described in this section. In this research the questionnaires comprised of Five Likert Scale in which 1 indicated "Strongly Disagree" and 5 indicated "Strongly Agree". The sample population comprised of agriculture of the rural areas of south Punjab, south Sindh and Khyber Pakhtunkhwa in order to identify their ICT perception.

For response taking purpose the enumerators were trained in a 9 hour training session in order to provide full understanding of instrument interpretation and customer services skills. The responses from the target audience were then recorded by the enumerators on the questionnaire in a one on one meeting in thirty three villages of south Punjab, south Sindh and Khyber Pakhtunkhwa in Pakistan.

Table 3: Reliability analysis

Variables	No. of items	Cronbach's alpha
ICT - Daily life usage (F1)	3	.798
ICT - Daily life usage (F2)	3	.702
ICT – Health	4	.742
ICT - Agriculture (F1)	4	.731
ICT - Agriculture (F2)	3	.607
ICT – Employment	3	.786
Behavior intention	3	.682

Data Analysis of Agriculture Instrument

Demographic Details: In case of agriculture participants filled out 24-item questionnaire. There were 350 questionnaires distributed among the participant and 312 were usable for analysis purpose. The demographic detail of the respondents revealed that 87.5% of the respondents were male and 12.5% of respondents were female. 37.2% of the respondents were above the age of 32, 34% of the respondents were 27-32 year old, 21.2% of the respondents were 21-26 year old and 7.4% of the respondents were 15 to 20 year old and 34.9% received no formal education, 25% education level are primary and high school, 8% were Matriculation, 23.4% were Intermediate 4.8% are.

Graduation and 3.8 were master. Most of the respondents used 2-or-3 wheeled transport (35.3), public transport (26.3) or travelled on foot (17.9). The monthly income level of 66% of the respondents was Rs. 5,000-15,000. Interestingly 87.5% of the respondents used mobile phones.

Reliability Analysis: Table 3 provided the Cronbach's alpha depicting internal consistency reliability among the items of measurement instrument. The alpha value of ICT- daily life usage (F1).798 and ICT-daily life usage (F2) .702 was found acceptable. Similarly, ICT-health, ICT-agriculture (F1), ICT-agriculture (F2), ICT-employment and behavior intention exhibit high level of reliabilities.

Principal Component Analysis: In order to check the internal consistency reliability among the items the Principal component analysis was conducted on 24-items of the measurement. PCA produced two factors. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value of ICT-daily life usage (F1) is .614 and it explained 71.204% of the total variance. ICT-daily life usage (F2) provided a KMO value of .646 and explained total variance of 62.684%. The total variance explained by ICT-health with a KMO value of .702 it explained 56.344% of the total variance. ICT-agriculture (F1) with KMO value of .591 and ICT-agriculture (F2) with KMO value of .708

Table 4: Principal component analysis

Variables	KMO	Factor loading	Total variance explained
ICT_4 (F1)	.641	.750	71.204
ICT_5 (F1)		.907	
ICT_6 (F1)		.867	
ICT_1 (F2)	.646	.839	62.684
ICT_2 (F2)		.810	
ICT_3 (F2)		.722	
Health_1	.702	.691	56.344
Health_2		.730	
Health_3		.744	
Health_4		.710	
Agriculture_5 (F1)	.591	.819	56.514
Agriculture_6 (F1)		.813	
Agriculture_7 (F1)		.603	
Agriculture_1 (F2)	.708	.738	55.709
Agriculture_2 (F2)		.776	
Agriculture_3 (F2)		.816	
Agriculture_4 (F2)		.644	
ICT_EMP_1	.703	.833	70.452
ICT_EMP_2		.859	
ICT_EMP_3		.826	
BI_1	.629	.691	61.336
BI_2		.840	
BI_3		.811	

explained total variance of 56.514% and 55.709%. Lastly, ICT-employment (KMO= .703) explained total variance of 70.452% and behavior intention (KMO=.629) explained 61.336% of the total variance.

Regression Analysis: Regression analysis revealed good exploratory power of the model indicating R^2 value of .448 i.e. the model explains 41.1% of the variance in behavior intention. In addition, table 26 suggested significant contribution of ICT- employment (β=.210; p=.000), ICT agriculture (F1) (β=.217; p=.000), ICT daily life usage (F1) (β=.171; p=.004) to behavior intention. However, it suggests insignificant contribution of ICT daily life usage (F2) (β=.085; p=.090) and ICT-health (β=.007; p=.995).

Over All Analysis of Agriculture: Reliability analysis: The internal consistency reliability measures whether the different items that are proposed to measure the same concept provide similar scores. The chronbach's alpha value indicates appropriate internal consistency reliability among all the independent variables as the values are above the benchmark 0.6.

KMO Value: It explains if the factor analysis is appropriate or not. The KMO values in table 24 lie between the benchmark of 0.5 and 1.0 which shows the appropriateness of factor analysis.

Total Variance Explained: It indicates how much one unit change in independent variable brings change in to the dependent variable.

R: It is the square root of R square.

R Square: It explains "goodness of fit" of the model i.e. how well the observations fit in to the model. The R square in the model is .411 which means that the independent variables (ICT Usage in Daily Life (F1) (F2), ICT – Health, ICT – Agriculture (F1) (F2) and ICT – Employment) can explain 44.1% of change in the dependent variable.

Table 5: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.641[a]	.411	.399	.78034986

a. Predictors: (Constant), ICT – Employment, ICT-Daily Life Usage (Factor 2), ICT- Agriculture (Factor 2), ICT- Agriculture (Factor 1), ICT – Health, ICT-Daily Life Usage (Factor 1)

Table 6: Coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.008	.045		-.167	.867
	ICT-Daily Life Usage (Factor 1)	.171	.060	.171	2.864	.004
	ICT-Daily Life Usage (Factor 2)	.088	.052	.085	1.702	.090
	ICT – Health	.000	.059	.000	.007	.995
	ICT- Agriculture (Factor 2)	.232	.051	.229	4.520	.000
	ICT- Agriculture (Factor 1)	.221	.056	.217	3.979	.000
	ICT – Employment	.210	.058	.210	3.594	.000

a. Dependent Variable: Behavior Intention

Adjusted R Square: It measures the amount of variance in the dependent variable (Behavior Intention) explained by variations in the independent variables. The adjusted R square demonstrates that 39.9% of the variance was explained in this model.

Std. Error of the Estimate: It explains the standard deviation of the error terms (Factors not included in this model which could affect ICT behavior intention).

Coefficients: In regression with multiple independent variables, the coefficient explains the degree to which dependent variable is expected to increase when the independent variable is increased by one unit, thereby holding all the other independent variables constant.

Standardized Coefficients: In order to compare different variables only standardized estimates will be checked as all the variables in it have the same scale.

Beta and Sig: Beta explains the contribution of each independent variable. ICT-Employment with beta coefficient of .210 and sig. value of .000 makes the strongest unique contribution in explaining behavior intention to use ICT. Similarly ICT agriculture (F1) (β=.221; p=.000), ICT agriculture (F2) (β=.232; p=.000) and ICT daily life usage (F1) (β=.171; p=.004) also impact behavior intention significantly. On the other hand, ICT daily life usage (F2) (β=.088; p=.090) and ICT-health (β=.000; p=.995) with sig. values above 0.5 indicate no significant impact of behavior intention to use ICT.

The statistical tests applied in case of agriculture also suggest there is strong relationship between ICT and agriculture. Therefore, the farmers perceived that ICT implementation would improve the delivery of information related to markets, products and services to agriculture sector enhance employment opportunities and daily activities.

Farmers believe that implementation of ICT in their communities would have direct positive impact on their livelihood.

CONCLUSION

This study revealed that the farmers of southern Sindh, southern Punjab and Khyber Pakhtunkhwa believe that ICT will bring improvement in their work, health, employment opportunities and hence would develop the efficiency and capacity of rural residents. Along with information dissemination through mobile phones investments in other ICT infrastructure would allow access not only to the national but also International markets.

Reliability Analysis, Principal Component Analysis and Regression Analysis were conducted to analyze the data collected from the thirty three villages. In the area (agriculture and unemployment) studied for this research show a strong positive relationship between ICT and livelihood of communities involved in the agriculture.

In addition to SPSS results, researchers organized a focus group discussion in Islamabad where policy makers, ministry officials, civil society representatives and university professors were invited to get their opinion on the implementation of ICT in the stated communities. The panel stressed the need to launch the ICT project on priority basis to enhance the economic opportunities for south Sindh, south Punjab and Khyber Pakhtunkhwa.

Mobile telephone usage is almost 90% in all the seven districts (thirty three villages) included in this study. It would be extremely important to take advantage of this mobile factor. Communities would be better off if they are provided the opportunity to get their tasks completed through the cell phones they carry.

Low income level, high percentage of uneducated rural population and low level of ICT awareness requires the government and non government agencies to collaborate in building sustainable ICT infrastructures. However, success of such initiatives requires involvement of local population representatives as the decision makers throughout the whole process to gain social acceptance.

In nutshell the results of this research has proved that ICT is an important driver to put the communities on the path of economic sustainability. The implementation of ICT would not only help the communities to have better livelihood but total awareness about what's going on in and around their communities.

Recommendations: Based on the results of the study following recommendations are made to the involved stakeholders in the southern Punjab, Southern Sindh and Khyber Pakhtunkhwa.

National level consensus needs to be developed among the stakeholders about such rules and regulations that facilitate the promotion of ICT for improving the livelihoods of rural population. Furthermore, transparency should be maintained in all such initiatives to avoid inequity in the implementation stage.

Dialogues need to be initiated between the government agencies and private development actors to establish standards and protocols for secure information exchange between the involved stakeholders.

Short message service (SMS) in local languages should be used to provide information about market rate of goods; recommended chemicals for pest control; health service reminders; weather forecasts and employment opportunities etc.

Message should be delivered to the rural population in local languages to avoid any resistance to ICT usage. If required such software should be developed that enable display of local language in ICT devices like Cell phones. Moreover, intellectual property should be protected in order to avoid any infringement and ensure fair profits to the developers.

ICT literacy programs should be launched among the farmers to highlight the benefits of ICT for increasing their income and eventually improving their living standards. For this purpose training workshops should be organized to ensure that the users exert minimum effort to utilize ICTs for improving their livelihoods.

ICT centers should be established within each village to allow them easy access to computers, printing and fax facilities. Furthermore interactive website could be designed thereby allowing the rural residents to share their issues online and obtain solutions from experts. In this manner access to medical, employment related information resources can be easily provided.

Capacity building for the ICT center mangers should be conducted to facilitate successful assistance to the rural population.

Monitoring and evaluation teams should quarterly visit the ICT centers and share progress reports with the stakeholders.

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