A Critical Analysis of E-Learning Agricultural Technical Capacity for Rural Development

E-Learning technologies have clearly emerged as development poles for rural development and food security through growths for access to knowledge and exchange through advance agricultural communication tools. A multistage random sampling technique was used by 300 selected e-Learning users from Pakistan with a simple linear regression model via SPSS. One of the main obstacles/constraints that farmers were not aware and training of technical information flows in rural development. Therefore, ICTs services and applications have been highly significant for agricultural technical capacity in rural development. Government should establish Technology Facilitating Condition (TFC) via Information Hub Center (IHC) to boost up and sustainable rural development.

Keywords: e-Agricultural Technology, Technological Facilitating Condition, Information Hub Center, Rural farmers, Pakistan

Introduction

Agriculture is the main sector to realize the objectives of rural development especially in countries where major share of rural economy associated with agriculture (Abdullah et al., 2014, FAO, 2003). Pakistan is also included in the list of such countries where rural development is associated with agricultural development of the country. For the development of agricultural sector in the country and improving a quality of life of rural peoples. Government of Pakistan introduces different agricultural extension strategies at a national and provincial level during different regimes (Government of Pakistan, 2018; Luqman et al., 2014). A number of studies have shown that extension services show an important share in farming (Ifeanyi-obi et al., 2012, Akinola et al., 2011, Adeniji, 2010). Government of Pakistan has presented various agricultural extension strategies for the development of agricultural sector and improving the quality of life of rural people (Butt, et al., 2017; Luqman et al., 2014). Information is one of the basic aspects of life. According to Stanley (1990), one of the basic human needs is access to information. Transfer of information using different media is referred to as Information and Communication Technologies (ICTs). ICTs mean technologies that facilitate communication, processing, and transmission of information by electronics (DFID, 2004; Marker et al., 2002). According to Qureshi et al., (2013) ICTs provides pace for economic growth, reducing poverty, promoting sustainable micro development and improve the quality of rural life particularly in developing countries. ICTs are divided into conventional/traditional and non-conventional/modern technologies. The conventional technologies include radio, audio/video cassette, television, fixed line telephone, facsimile machine, CD’s (Ejembi et al., 2006; Albarran, 2002). On the other hand non-conventional or modern ICTs includes cellular phone, computer, internet, wireless technologies, Geographic Information Systems (GIS), Global Positioning System (GPS),
Remote Sensing (RS) technologies and other data processing applications (Ashraf et al., 2011). Out of above-mentioned modern ICTs services and applications based technology transfer system have brought about a fundamental shift in patterns of communication (Asogwa, 2013). In rapidly changing local and global agricultural market and price mechanism, it is difficult for traditional and poor farmers to maintain their farm productivity and competitiveness in the local and global market, without using the advanced technological information which is cost efficient which ensures high productivity. Recent challenges faced by agricultural extension generally in the whole world and especially in the developing world mean that extension and its policy need to tackle a diversification in objectives, which lead to transferring new technologies; to reduce farm vulnerability particularly for small-scale farmers (Farrington et al., 2002), and promote environmental conservation (Alex et al., 2004); along with the better approach to market and its prices (Neuchatel Group, 2002).

There is a dire prerequisite to rethink in agricultural extension strategies. In this perspective Rivera et al., (2000) suggested that agricultural technology transfer mechanism must be redefined a modern era. The need for latest communication technology has become authoritative to keep ourselves well-informed about the latest scenario of the world (Qamar, 2005). Among various extension methods and technology transfer strategies, ICTs services/application such like telephone (Toll-free no.), cell phone (Robo calls and SMS) and computer (internet) are very much valuable in creating awareness and with large coverage of the farmers (Government of Punjab 2020a). Depending upon the condition and nature of information provided to the rural community different tools and techniques (individual, group and mass media teaching methods) are being used (Nisha, 2006). Modern ICT in agriculture including toll-free number, ROBO calls, SMS calls, GIS, GPS, RS and data processing have led to a fundamental change in the modes of communication in agriculture (Ashraf et al., 2011; Asogwa, 2013; Mukherjee, 2011).

Currently, in extension education strategies, modern ICTs sources are very much useful for raising awareness and inspiring a large number of farmers within limited time and resources. Government of the Punjab is striving to disseminate latest information to the rural people through different ICT tools to enhance agricultural production, reduce poverty and ultimately for sustainable rural development. Using different ICT tools wide range of extension services are being provided to the rural people in in their local languages (Government of Punjab, 2020a and 2020b). Non-adoption of appropriate agricultural technologies in the changing scenario of climate change and least access to relevant information by the farmers are the major challenges being faced by agricultural information and management system (Abdullah et al., 2014, Butt et al., 2017). Like other parts of Asian region in China also ICT and e-learning tools play significant role in developing agriculture sector on sustained basis that ultimately lead to entire rural development. The main difficulties challenged by farmers are the non-adoption of appropriate technologies, low yield, insect/pest attacks and diseases, climates, high input prices and relevant information in Punjab-Pakistan (Abdullah et al., 2014, Butt et al., 2017). ICT for agricultural development have the impact in rural
development, as well as an important indicator of a country's advance farming in Pakistan (Government of Punjab, 2020b).

By using ICTs, farmers will become able to get information via telephone, toll free no., cell phone, robocalls, SMS, computer and internet for better input application, cropping decisions, management of pest and diseases, animal husbandry and marketing (Government of Punjab, 2020b; Farming First, 2012). ICTs applications can facilitate the availability of information that provides opportunities for diversification from subsistence production of traditional crops to the production of market-oriented high-value agricultural products. Government of Punjab introduced many programs related to latest agricultural transfer technology through ICTs services/application e.g. Agricultural marketing information system, Mobile messaging (database of farmer), Website in local language of agricultural department Punjab and Fruits & vegetables project, Land record spatial data infrastructure, Monitoring extension services (agri. smart), Facebook pages of agricultural extension Punjab, E-reporting and documentation, Mapping soil fertility at village level, Shadbad dehqan project, Zarai baithak project, Fertilizer calculate project, Manteca records through Sap software, update Radio, TV, FM services, Citizen contact center (toll free no.), Revamping agricultural extension services etc. (Government of Punjab, 2020b). These all methods are based on modern ICTs with most active and fast method to ensure that the respondent will be maximum in this program like ICTs to get the information from the department.

Likewise, different public sector universities in Punjab play their role as the University of Agriculture, Faisalabad running a program namely “Fertilizer.com” where agriculture information portal established and run by Institute of Agricultural Extension and Rural Development (IAERD). The other program “Zarai Baithak” is the joint venture of University of Agriculture, Faisalabad and Govt. of Punjab (UAF, 2020; Zarai Baithak, 2020). Side by side the public sector, private sector also playing its role and many private players enter in agriculture information dissemination process where a prominent name is “Pakissan” which is the first and largest agriculture portal of the country (Pakissan, 2019). "Timely and fast information has improved the value of information, while late information cannot deliver the desired outcomes" (Khan, 2010). The above references direct that new ICTs tools are superior gadget for agricultural development, but the current situation in the country shows many gaps in the provision of the communication dissemination system.

Materials and Methods

In Pakistan agricultural production, the Punjab name ranks first among the other provinces (Government of Pakistan, 2016). Compared to other provinces Punjab is found very active in introducing advance agricultural transfer technologies to the farming community. With all these rationales, Punjab province was selected purposively as the study province for the study. In the present study, convenient and simple random sampling techniques were used due to time and finance constraints on the part of the researcher because it was difficult to cover
the whole province of the Punjab. Out of total 36 districts, the study was limited to
three (03) randomly selected districts of the province. Purposeful sampling
 technique was also used by Luqman (2014). As the user-ICTs in all the three
targeted study districts of the Punjab were unevenly distributed in the area,
therefore, it was decided to apply convenient sampling technique (Saunders et al.,
2012; Nachmias and Nachmias, 1996). Many researchers revealed that there is no
hard and fast rule for selection of sample size (Best & Kahnm, 2006; Wimmer &
Dominick, 2003). For the selection of study respondents, a list of all user-ICTs
respondents from each district was collected from Directorate of Information,
Agriculture Lahore-Punjab. Although a large number of respondents were
registered but due to financial and time constraints, the study was limited to three
hundred (300) respondents. Firstly, the researcher telephonically contacted the
respondents and who gave their consent to give interview face to face for present
research study was treated as respondents. From each district one hundred (100),
ICT users were interviewed. Total sample size of the study was three hundred
(300) users. A structured research instrument was developed comprising of both
open and close ended questions to get responses from respondents. This provides
the opportunity to the researcher to get pinpoint responses from respondents
(Acharya et al., 2005; Tucker et al., 2005). A three-point Likert-scale was applied
to assign scores to measure the extent of agreement. Likert-scale was a short
instrument, efficient and easy to use for extensively by the researcher as a tool of
scaling in social science (Vagias and Wade 2006). To establish the face and
content validity of instrument (interview schedule) show the degree to which a
measure covers the range of significance include within an assumed idea (Babbie,
2007), it was presented to given committee of experts from Department of
Agriculture (Extension and Adaptive Research) Punjab and University of
Agriculture, Faisalabad Pakistan. In order to check the reliability of interview
schedule, it was decided to present it in front of to 25 ICTs users’ farmers from
three selected districts for pre-testing. These 25 ICTs user farmers were not
included in the actual sample of the research study. Based on pre-test, some minor
changes were done in interview schedule and were ready for a collection of data.
Both descriptive and inferential statistics were used in analyzing the data collected
for this study. The data were coded and entered into a computer using Microsoft
Office Excel (Office 365 Pro-Plus) and SPSS version (20) utilized for analysis
(Ogunjuyigbe, et al., 2005; Panchanadeswarm & Koverola, 2005). Descriptive
statistics tools (frequency distribution and percentage scores) were used to analyze
the socio-economic characteristics of the respondents. Mean scores and standard
development were computed for each performance indicators and to check the spread
of dispersion within these composite attributes. The findings of correlation
hypotheses test showed that there were meaningful relationships between
dependent with independent variables. The effects of one or more independent
variables combine to determine the response variables. The data analyses
techniques were descriptive statistics and linear regression analysis (Chatterjee and
Hadi, 2006) also apply to see the actual situation. The problems faced by the
researcher e.g. limited time, financial expenses to collect data, busy schedule of
farmers in their routine farm and home tasks and transportation in remote rural areas.

Regression Analysis of Results & Discussion

Table 1 shows that the majority (50.3%) of ICT/eLearning users belong to the middle age category. The youngest respondent was 21 years old while the oldest was 65 years old. The above result displays that the middle age group are more motivated to usage ICT/eLearning for production and decision purposes. 83.7% large majority of respondents were small landowners with 12.5 acres of land holding followed by medium (15.0%). The majority of respondents (97.7%) were landlords followed by the tenant (2.0%) and homeowner (0.3%) respectively. In addition, the majority (53.0%) of the respondents ensured 2-12 years of agricultural experience, followed by 13-22 years (37.7%) and over 23 years (9.3%). Figure 1 shows that the cell phone emerged by 100% of respondents, telephone (84.3%), Internet and computer were emerged by 69.3% of respondents for agricultural information services.

Table 1. Demographic Variables and Description

<table>
<thead>
<tr>
<th>Variable with Description</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Years)</td>
<td></td>
</tr>
<tr>
<td>Young Age (21-40)</td>
<td>142</td>
</tr>
<tr>
<td>Middle Age (41-56)</td>
<td>151</td>
</tr>
<tr>
<td>Old Age (Above 56)</td>
<td>07</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>13</td>
</tr>
<tr>
<td>Primary</td>
<td>34</td>
</tr>
<tr>
<td>Middle</td>
<td>80</td>
</tr>
<tr>
<td>Matric</td>
<td>87</td>
</tr>
<tr>
<td>FA/F.Sc</td>
<td>47</td>
</tr>
<tr>
<td>B.A/B.Sc</td>
<td>12</td>
</tr>
<tr>
<td>Master</td>
<td>09</td>
</tr>
<tr>
<td>Diploma</td>
<td>18</td>
</tr>
<tr>
<td>Land Holding (acre)</td>
<td></td>
</tr>
<tr>
<td>Small (1-12.5)</td>
<td>251</td>
</tr>
<tr>
<td>Medium (12.5-26)</td>
<td>45</td>
</tr>
<tr>
<td>Large (Above 26)</td>
<td>04</td>
</tr>
<tr>
<td>Tenure</td>
<td></td>
</tr>
<tr>
<td>Owner</td>
<td>293</td>
</tr>
<tr>
<td>Tenant</td>
<td>06</td>
</tr>
<tr>
<td>Owner-cum-Tenant</td>
<td>01</td>
</tr>
<tr>
<td>Farming Experience (years)</td>
<td></td>
</tr>
<tr>
<td>2-12 years</td>
<td>153</td>
</tr>
<tr>
<td>13-22 years</td>
<td>113</td>
</tr>
<tr>
<td>above 23 years</td>
<td>28</td>
</tr>
</tbody>
</table>
According to Government of Pakistan's economy survey (2016) 60.4% of the population varies from 15 to 64 years old. People's mental capacity develops with age and then able to make sensible decisions (Sproten et al., 2010). The results above are identical to the findings of Ganeshagonda et al., (2013), while revealing that the majority of the respondents (46.36%) used the mobile phone applications between 25 and 40 years. Likewise, the majority of farmers (46.67%) were conscious usage of ICT as a source of information in Rajasthan, India (Dhaka and Chayal, 2010). Only 4.3% of ICT users surveyed were illiterate, but 95.7% of respondents were well educated, 29.0% were uneducated and so on. Ganeshagouda et al., (2013) reported that an awesome majority (95.5%) had a high level of education while studying the impact of free short message in agricultural product prices in Karnataka, India. The other finding was that the least educated people were more aware of indigenous technical knowledge (ITK) (Pervez et al., 2015). There is no significant relationship between demographic characteristics and communication sources in Pakistan (Ashraf et al., 2015). These results were similar by Khan (2010) showed that majority of respondents (81.21%) recognize up to 12.5 acres of land ownership followed by 15.76% of the property average tenure (12.5-25 acres) respectively.

Studies have shown that the majority of respondents are small landowners in Pakistan (Mahmood and Sheikh, 2005, FAO 1990 and 2000, Hassan et al., 2008, Ghafoor et al., 2010). In a similar situation of the current study by Ganeshagouda et al. (2013) and from the current show that small farmers with small land holdings are very interested in getting up-to-date information and to growth of the production and maximum their profits for better living conditions in regions. According to the Islamic law of inheritance, the land should divide between brothers and sisters after the death of the owner, so the small landowners were mostly against the means and great (Ahmad, 2010 and Al-Qur’an, 2020). Other findings also show that most of the ICT users surveyed were small-scale landholders that per capita landholdings are being reduced day by day (Islam et al.,
The results by Ashraf (2008); Muhammad et al., (2008); Hassan (2008) and Khan (2010) described the majority of respondents in the respective research areas were landowners. According to the tenure status of farmers, Cole and Johnson (2002) indicated that this affects their decision-making process in all stages of agricultural production. PTA (2014) more than reports the above results cellular subscription was 95% and mobile penetration had reached 76.6%. Therefore, PTA (2016) mobile tele-transmission was dropped at 60.7% due to the biometric verification of the sims. According to Ferronic and Zhou (2012) explored the demands of farmers to advance knowledge and information at the critical/technical stage such as timely treatments.

E-Learning extension program objectives to provide technical capacity building of farmers knowledge, which can be utilized in analytical, critical thinking, and the ability to make better decisions within time. Advance technical knowledge, attitude and performance may reveal in farmer cultivation technique, critically decisions time and save crop yields. Table-2 confirmations that a large majority (79.3%) of respondents were satisfied with the services and applications of ICT in attitude change. However, 20.7% of respondents said that the use of ICT is not useful. In this context (Table 2), the above effects with Ganeshagouda et al. (2013) also found that a large majority (96.36%) of respondents were comfortable/satisfied with advance agricultural communication tools. This means that ICT plays a major role in changing farmers' attitudes towards better agricultural production and development. The linear regression in Table 3 displays that toll-free number, robo calls, and text message show a significant relationship with the technical capacity building of the farmers, whereas other variables do not show any significant relations. Farmer desires to advance technical knowledge and information in the stage of the critical stage such like treatments on a timely basis (Government of Punjab, 2020b; Ferroni and Zhou, 2012). The author also acknowledged that technical capacity building is the leading feature other than physical and managerial capacity building of farmers.

### Table 2. Distribution of Respondents according to their Perception about Satisfaction of ICT/E-Learnings Attitude and Behavior

<table>
<thead>
<tr>
<th>Attitude/Behavior</th>
<th>Response f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful</td>
<td>238</td>
<td>79.3</td>
</tr>
<tr>
<td>Un-useful</td>
<td>62</td>
<td>20.7</td>
</tr>
<tr>
<td>Rubbish</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table 3. Regression Results for Agricultural Technical Capacity and ICTs Services/Application
Conceptual Framework

According to a review of literature rural development is very much similar to agricultural development e.g. production/yield, timely decision making, management, confidence building, and better living standard of the farmer. Agricultural productivity is essential to build the capacity of farmers through adopting new ICTs technologies (PEPFAR, 2012; Romanow and Bruce, 2006). Innovation is key to agricultural development. Understanding the potential of agricultural revolution requires research and extension systems and other knowledge organizations to be stronger and well connected with each other and with farmers. Research, education and extension systems play a vital role in agricultural and rural development. Furthermore, they are dominant to realizing the potential of agricultural revolution (Rivera, et al., 2009; FAO, 2017).

Rapid technology transfer system is the prevalent factor behind change in the existing agricultural extension system. There is a huge gap between modern agricultural knowledge and rural communities like information on pest and disease control, especially early warning systems, new varieties, better and timely inputs etc. Therefore, there is need to develop modern ICT tools for better crop production (Ugwuishiwu et al., 2012). The conceptual framework foundation of this study was guided by the United Nation Development Program (UNDP), Agricultural Knowledge and Information System (AKIS) and Tripartite ICT for development model which explained how technological innovation such as ICTs relate to development and sustainable livelihoods. The term agricultural innovation systems (AIS), a moderately new concept and framework, helps as background to deliberate reform and the role of government. The focus of the emerging AIS concept is on strengthening the capacity of the different actors within the AIS to generate, diffuse and use knowledge (World Bank, 2006). In this new view of agricultural innovation, some of the possible roles for extension include: situation the innovation program; establishing producers and the rural poor building their capacities; developing alliances of different stakeholders; encouraging platforms for information sharing; investigating with and learning from new methods, that

<table>
<thead>
<tr>
<th>Constant</th>
<th>B</th>
<th>SE</th>
<th>A</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.584</td>
<td>0.296</td>
<td>12.099</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>-0.052</td>
<td>0.038</td>
<td>-0.058</td>
<td>-1.361</td>
<td>0.175</td>
</tr>
<tr>
<td>Cell phone</td>
<td>0.534</td>
<td>0.262</td>
<td>0.082</td>
<td>2.038</td>
<td>0.042</td>
</tr>
<tr>
<td>Computer</td>
<td>-0.217</td>
<td>0.086</td>
<td>-0.242</td>
<td>-2.517</td>
<td>0.012</td>
</tr>
<tr>
<td>Toll Free Number</td>
<td>-0.099</td>
<td>0.029</td>
<td>-0.150</td>
<td>-3.378</td>
<td>0.001</td>
</tr>
<tr>
<td>Robo Calls</td>
<td>-0.325</td>
<td>0.036</td>
<td>-0.377</td>
<td>-9.051</td>
<td>0.000</td>
</tr>
<tr>
<td>Text Message</td>
<td>-0.266</td>
<td>0.041</td>
<td>-0.299</td>
<td>-6.458</td>
<td>0.000</td>
</tr>
<tr>
<td>Internet</td>
<td>-0.163</td>
<td>0.087</td>
<td>-0.178</td>
<td>-1.864</td>
<td>0.063</td>
</tr>
</tbody>
</table>

R=0.736; R²=0.5

Technical capacity: Recommended seed rate; identification of insects/pest and diseases; recommended dose of fertilizer/irrigation/weedicide/insecticides and fungicide with its applications; spray techniques; management of gardens; pre and post-harvest losses; handling and grading.
provides access to information, knowledge, skills and services from a wide range of organizations (Figure 2).

Figure 2. Information Hub Center (IHC) with Agriculture and Other Sectors

Considering the German concept of capacity building farmers essential to develop their physical, technical and managerial skills, the dependent variables showed that agricultural capacity buildings such as physical capacity (land preparation, ploughing, seed bed preparation, sowing/planting, weather services); technical capacity (recommended seed rate, identification of insects/pest and diseases, recommended dose of fertilizer, weedicide, insecticides/fungicides, number of irrigations and methods of applications, spray techniques, management of gardens, pre-post-harvest losses, handling, and grading) and managerial capacity (agricultural marketing) for agricultural development (plant production, protection, post-harvest technology and weather forecasting etc.). Many other researchers explained that Technological Facilitating Condition (TFC) “an individual believes that organization infrastructure help to explain, needs, demands, request, decision-making process, and expect user behavior of information technology (Legris et al., 2003). Independent variables are input variables while on the other hand dependent variables are referred to as output variables (Penslar et al., 2010; Cramer et al., 2004). Generally in this study the independent variables consisted of modern ICTs and Technical Facilitating Condition (TFC) e.g. telephone; cell phone, computer, toll free no/help no., robo calls, text message, internet, source of awareness, technological access, equipment condition, mode of technology access and other variables consist of farmer demographic characteristics e.g. age, gender, education, farming experience, and land size. The conceptual framework may a powerful tool for farming community through advance ICTs services and application communication for increase agricultural production, capacity buildings of farmers, decision making, self-help, and ultimately rural development sector. Further, the creation of an empowering
situation where the needs and demands of resource-poor farmers and consumers are perceived and their voices influence the nationwide research and extension agenda is a key to achieve sustainable rural development. A brief summary in the form of a sketch of the conceptual framework is given in figure 3. The researcher explained, “a hypothesis is a tentative answer to a research problem, expresses in the form of relationship between independent and dependent variables” (Nachmias and Nachmias, 1996) and furthermore the same ideas were also communicated by Moser and Kalton, 1992). According to Jupp (2006) explained that “an unverified assertion about the relationship between two or more variables.

Conclusions

Pakistan, agricultural extension is a dynamic mechanism for the transfer of information and knowledge as a contribution to agriculture. ICT should sensitize farmers to obtain and use agricultural information for rapid and effective decision-making in farming. The study settled that the information recognized by ICT for respondents was the most effective and meaningful relationship for agricultural technical capacity building. The majority farmers were satisfied with the general "information context" prevailing in the community by ICT/eLearning services and applications.

Recommendations

At present, the recommendation is to recognize that the process of change in the flow of communication and ICT applications is highly significant in response to global changes for agricultural development. The current era has recommended that the government establish Technology Facilitation Conditions (TFC) via Information Hub Center (IHC) in the agricultural information flow. TFC and IHC will play on several aspects of rural progress such as access and availability (Kiosk) mode, timely and improved decision-making, improvement of skills and capacities of the local workforce, the development of agricultural production and productivity, business and entrepreneurship, growth of the public contribution, etc. The study seeks attention to planned investment on IT technology research and extension for sustainable development. Agricultural extension should have mass campaign for increasing awareness to maintain the ecosystem health and improvement of livelihoods. Finally, ICTs will contribute to modern agriculture in Pakistan region.

References


Babbie, E. 2007. The practice of social research (11th ed.). Belmont, Thomson high Education. USA.


Figure 3. Flow of Information (Conceptual Framework)