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Assessing farmers access to ICT and non-ICT sources for agricultural development in Semi-Arid Region in India

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A B S T R A C T

This study examines farmers' access to Information and Communication Technologies (ICT) and Non-ICT systems in the semi-arid region in the state of Rajasthan in India. The Primary data was collected from 133 farmers consisting of 68 ICT users, 62 Non-ICT users, and three moderate users. The empirical results of the multiple regression analysis revealed that education level and landholding size (in acres) influences farmers' access to ICT and non-ICT systems. However, household labor variable adversely affects access to technology. It also concludes that comparatively female farmers have lesser access to ICT. The empirical results of the multiple regression analysis revealed that education level and landholding size (in acres) positively influences farmers' access to ICT systems. However, household labor variable adversely affects access to ICT technology. It also concludes that comparatively female farmers have lesser access to ICT. Consequently, there was significant positive influence of land holding size (acres) and negative influence of education level on Non-ICT access.

The study recommends educating and sensitizing farmers about the benefits of ICT, coordination between government and private sectors for the effectual development of ICT, creating effective linkages of Krishi Vigyan Kendras (Farm Science Centers) (KVKs), Agriculture Extension as a profession for farmers and 24×7 television and radio channels dedicated to agriculture. This study can be used for productive implementation of ICT and Non-ICT sources considering the socio-economic characteristics of farmers in the similar situation.

1. Introduction

India is a growing economy with agriculture forming the backbone of the Indian economy. Despite the concentration of industrialization, agriculture remains in a place of pride (Kumar and Sankarakumar, 2012). Agriculture in the western arid region of Rajasthan is mainly rain fed. Drought, insufficient rainfall, and dry soil are the characteristics of this region. Lack of information coupled with factors like environment affect yield, quality, and price as a result farmers suffer.

ICT make a significant contribution to economic growth of agrarian sector by empowering farmers with modern technologies and creating new employment opportunities (Malhan et al., 2007). In India, KVKs and Agricultural Extension Division provide agricultural training to farmers. For sustainable growth, ICT system should be implemented in the agriculture and allied sectors as it will not only enhance traditional farming but farmers will also benefit by adopting new technologies. It has been

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comprehended that the implementation of ICTs in agriculture extension would help in sensitizing farmers about the relevant information.

Agrarian community prefers traditional communication channels such as radio, television, and newspapers instead of adopting ICT (Rechandson, 2006; IICD, 2006; Hayrol et al., 2009). One of the major impediments hampering adaptation of ICT is language (Telg et al., 2005) as most of the farmers in the western Rajasthan are illiterate. Majority of the ICT application runs in English; therefore, it is challenging for the central and the state governments to empower farmers through ICT and equip them to reap the benefit of services. For the successful implementation of ICT services, government intervention is necessary to synchronize and govern the efforts of the private sector that make infrastructure and development investments. In short, Indian agriculture can improve dramatically by endorsing ICT. All farmers, including small and marginal, can be benefited.

The objectives of this study are:

1. Find socio-economic characteristics of the respondents

2. Analyze the influence of education of each respondent and employment type

3. How education influences ICT adoption

4. Find effective ICT and Non-ICT sources to assess agricultural information

5. Find factors influencing adoption of ICT sources and percentage of Non-ICT sources accessed

To meet their farming needs, farmers source agricultural knowledge from varied sources (Rees et al., 2000; Stefano et al., 2005; Karamagi Akiiki, 2006). Some are ICT and some are Non-ICT sources.

ICT Sources

Heeks (1999) elucidated ICT as "recording, tackling, storing and disseminating" information through computers and communicating systems. ICTs mean implementation of technological advancement and modernization. The ICT sources are those which accommodate information services and disseminate knowledge through steady modes such as articles, news reports, and e-mail communications.

ICT sources encourage people to communicate competently, overcome obstacles of time and space, empower individuals through knowledge and information, learn revenue-generating skills, strengthen government capabilities and encourage active participation of masses in decision-making (Asian Development Bank, 2004). ICT can be a key enabler in harmonizing the supply chain by ensuring real-time knowledge dissemination across the chain, augmenting performance and curbing unpredictability of the supply chain (Pereira, 2009).

Traditional communication used to spread agricultural knowledge include radio, television, video, fax and telephone. Television (Best et al., 2005; Stefano et al., 2005; Kwake, 2007) and Radio (Rivera et al., 2005; Byamugisha et al., 2008) are envisioned as useful communication channels. Radio is seen as one of the most effective media to share knowledge and empower marginal and illiterate farmers (Chapman et al., 2003; Harris, 2004; Best et al., 2005).

Television is also considered a vital source for circulating agricultural information (Leach, 2001; Chapman et al., 2003). The TV ads enables the audience to notice and understand the message, thus, making the medium more effective (Leach, 2001). The study by Best et al. (2005) in Bangladesh considerably judged TV and highlighted hurdles such as insufficient TV sets and inadequate supply of electricity in rural areas. Even though in the past rural societies challenged television's capacity to disseminate information (Leach, 2001).

The video is also an effective medium of sharing agricultural knowledge in rural areas. This medium is flourishing as it overcomes illiteracy barrier and exhibits compassion while sharing modern agriculture techniques with the viewers (Colle and Roman, 2003).

Studies have manifested that the print media (books, advertisements, pamphlets, handbooks, newspaper, and leaflets) is beneficial for transferring agricultural knowledge to farmers (Stefano,

2004; Stefano et al., 2005; Klein, 2009). The print media is considered more sensible as compared to broadcast media. However, most of the print materials are not easily accessible to the farmers because these materials are primarily in English language and several authors have rued about language restriction (Leach, 2001).

ICT should upgrade and use new means such as mobile and Internet-based services to share information. It has been observed that modern ICTs have a better prospect in agricultural information (Mehra et al., 2004; Rivera et al., 2005; Gray, 2010). The e-Choupal was initiated to enhance market accessibility and knowledge (Qiang et al., 2009).

The Agriculture Extension organizes meetings, group discussions, lectures, workshops, conferences and regional training sessions utilizing ICT resources such as computers, slides and snapshots (Isife and Ofuoku, 2008). It has been observed that computers used by the extension specialists have played a vital role in the growth of the extension (Martin et al., 2001). The implementation of digital podium and ICT applications in Agricultural Extension have entailed various benefits such as boosting learning operation, improving retention time and cementing the beginners' treading (Meera et al., 2004; Park et al., 2007).

ICTs can be a counterpart of the conventional extension plan for transferring "Knowledge Resource" to the millions of the farmers (Koehnen, 2011).

Non- ICT Sources

The non-ICT sources impart information through training, extension specialists, government exhibitions, KVKs, village exhibitions, modern farmers, study visits, output dealers/commission agents, private advisors, relatives, friends, and others. In most of the developing nations, farmers do not have faith in extension specialists because of the representative's lack of knowledge and skills in modern farming techniques (Dutta, 2009).

The non-ICT sources are not equipped to provide knowledge services and communicate information verbally. Non-ICT sources comprise interactions with friends, other farmers, relatives, input dealers and output traders (Steve et al., 1999; Just et al., 2002; Mittal, 2013). Most of the farmers advocate non-ICT interpersonal sources (Rees et al., 2000; Solano et al., 2003; Stefano et al., 2005). Farmers encourage verbal communication due to conventions and low literacy rate (Meyer, 2000; Leach, 2001; Stefano et al., 2005). Apart from that, non-ICT sources of agricultural information are rural elders and community leaders (Alewis, 2008), cooperatives (Neubert et al., 2007; Chambo, 2009), local and bigger markets (Pokhrel and Thapa, 2007; Byamugisha et al., 2008), corporations (Chisenga et al., 2007), private federations and agencies (Rees et al., 2000; Klerks, 2009).

Factors Affecting Adoption of ICT-based Agricultural Information

According to Michiels and Van Crowder (2001), in comparison to conventional communication, acceptance of ICT have prospects of two-way and horizontal discourse and gaining latest communication routes for rural areas, intermediaries and development enterprises. With the acceptance of ICT sources, Agricultural Extension is envisioned to become knowledge intensifier, broader and demand-driven and thus more fruitful in meeting farmers' requirement for information (Gelb et al., 2008).

Four prerequisites for the sustainability of ICT hubs and acceptance of ICT by the locals are debated. They are the viability of funds, recognition, the staff's potential and distribution of services (Harris, 2004).

It was found that the consequence of aging is not clear for the acceptance of ICT (Putler and Zilberman, 1988; Gibbon and Warren, 1992; Warren et al., 1996), still several research technologists found a contradictory impact of age on acceptance of ICT (Batte et al., 1990; Warren et al., 2000). The adoption of ICT is interrelated to education and farm dimension of farmers (e.g. Putler and Zilberman, 1988; Batte et al., 1990; Bonny, 1992; Gibbon and Warren, 1992; Warren et al., 2000).

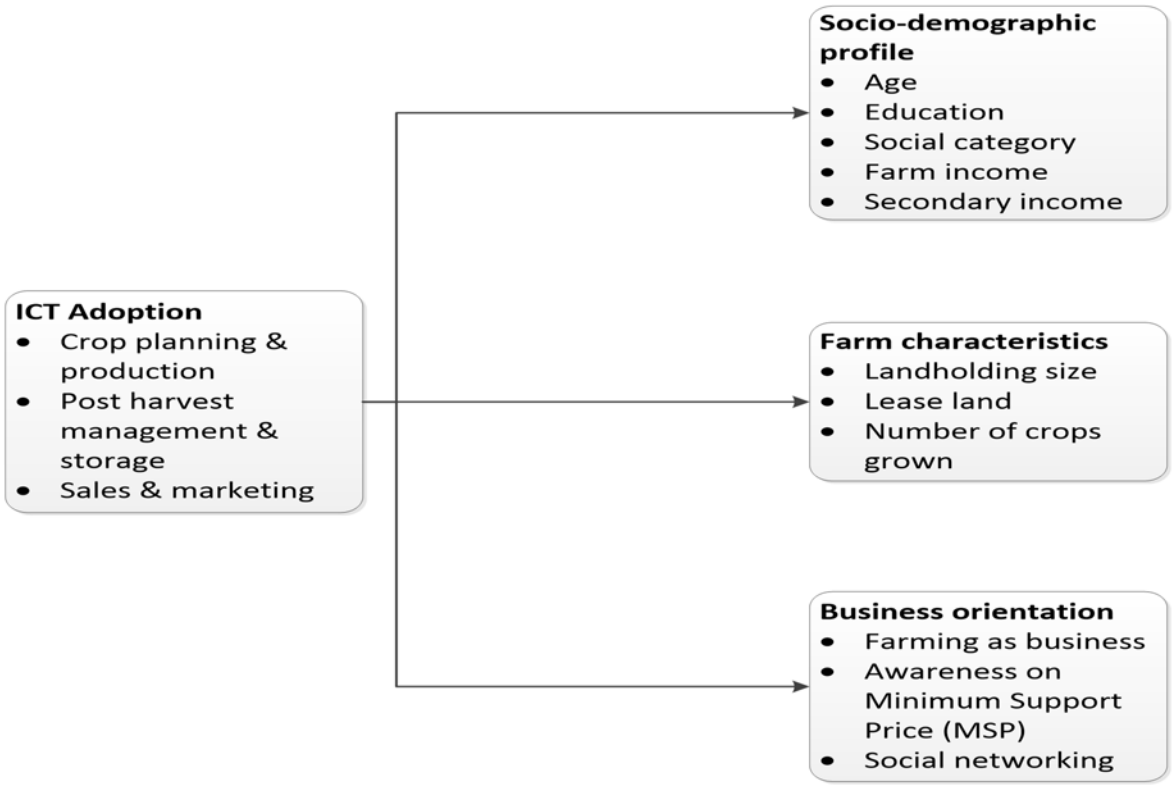

Figure 1 Conceptual framework- factors affecting adoption of ICT based agricultural information

Source: Redrawn after Jabir Ali (2012)

2. Materials and Methods

2.1. Area of Study

The study was conducted in the semi-arid region of the state of the Rajasthan in India during May 2016 to July 2016 to evaluate the accessibility of ICT and Non-ICT sources for agricultural information. The study used the survey approach consisting of various data collection strategies, including field task, documents, and findings.

2.2. Sampling and Data

The sample households for data collection were chosen using multistage sampling technique. In the first stage, a goal-directed selection was adopted to choose three districts - Jalore, Pali, and Sirohi– in the south-west region of Rajasthan. A simple random sampling was chosen to collect samples of farm households from each district. In this research, out of 133 randomly selected farm households from three districts, 3 were moderate users, 68 were ICT users, and 62 were Non-ICT.

2.3. Methods of Analysis

The research is predominantly based on primary data collected from farm households. Relevant secondary data from trustworthy sources were also used. Both quantitative and qualitative analysis techniques were used to achieve the research objectives.

Descriptive statistic's techniques such as frequency, mean, percentage and standard deviation were used to symbolize comprehensive information about the sampled households' socio-economic characteristics. Furthermore, different charts were used to present data illustratively.

Multiple regressions were used to identify the factors influencing the equivalent percentage of ICT and Non-ICT sources accessed. The qualitative data analysis was executed on the basis of the information collected from key informants' interviews, focus group discussion and field observations to make logical arguments and to draw appropriate conclusions.

2.4. Justification of variables

Two types of sources were accessed by the sampled farmers:

ICT Sources: Eight ICT sources, particularly Television, Radio, Mobile Phones, Landline Phones, Community Loudspeakers, Computer, Internet and Newspaper.

(a). Percentage Equivalent of ICT sources accessed out of Total ICT sources:

$= ((\sum S_iF_i) / SF) *100$

where,

S_i = ICT source i

F_i (Frequency of ICT source i) can be:

0 – None

1 – Yearly

2 – Seasonal

3 – Monthly

4 – Fortnight

5 – Weekly

6 – Daily

S = Total ICT sources

F = Maximum frequency = 6 (daily)

Non-ICT Sources: Eight Non-ICT sources, particularly KVKs, Public Extension Agent, Input Dealers, Output Dealers, Private Consultants, Other Farmers, Relatives, Friends, and Others.

(b). Percentage Equivalent of Non-ICT sources accessed out of total Non-ICT sources:

$= ((\sum S_iF_i) / SF) *100$

where,

S_i = Non-ICT source i

F_i (Frequency of Non-ICT source i) can be:

0 – None

1 – Yearly

2 – Seasonal

3 – Monthly

4 – Fortnight

5 – Weekly

6 – Daily

S = Total Non-ICT sources

F = Maximum frequency = 6 (daily)

(c). Percentage Equivalent of total ICT sources accessed out of total (ICT + Non-ICT sources)

= (Percentage Equivalent of ICT sources accessed out of total ICT sources) / 2

(d). Percentage Equivalent of total Non-ICT sources accessed out of total (ICT + Non-ICT sources)

= (Percentage Equivalent of Non-ICT sources accessed out of total Non-ICT sources) / 2

Note: As there were equal numbers of ICT and Non-ICT sources so both expressions (a) and (b) were divided by 2 to calculate (c) and (d).

(e). Percentage Equivalent of information through personal knowledge and experience= 100 – ((Percentage Equivalent of total ICT sources accessed out of total (ICT + Non-ICT sources) + (Percentage Equivalent of total Non-ICT sources accessed out of total (ICT + Non-ICT sources))

To evaluate the factors allied with the Percentage Equivalent of ICT and Non-ICT sources accessed as dependent variables (Y), the following multiple regression models have been achieved.

$$Y= \alpha+ \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + U$$

where, αconstant term; β is the regression coefficients; X_i the socioeconomic factors; U the random disturbance term.

The explanatory variables (X_i) used in this analysis comprised:

X_1 – Gender

X_2 – Education Level

X_3 – Family Labor

X_4 – Years of farming experience/ age (years)

X_5 – Land holding size (acres)

X_6 – Off - Farm income (Rs.)

X_7 – Employment type

3. Empirical Results and Discussion

The percentage of male and female in the farm households were 95% and 5% respectively. Closely equivalent proportions of male and female were stated by Degu et al. (2015) in non-participant case; Babu et al. (2011).Nearly 94% respondents were married and the seven women in the sampled region were widows. Nearly identical results were given by Babu et al. (2011). Almost the same percentage of widow respondents was reported by Adefalu et al. (2013).

Of the sampled households, the secondary level education was the highest at 29%. Nearly same percentage equivalent of secondary level users was observed in a study by Gandhi (2014) whereas farmers with the Masters' degree or higher education - was the lowest at 2%.Also, many sampled farmers have had formal education. This manifests high literacy rate in the sampled region. This result is in conformity with of the Naveed and Anwar (2013).

Almost 73% sampled farmers were aged 34-59 years. The results of existing study are in coordination with the Rehman et al. (2013); Demiryurek et al. (2008); Omobolanle (2008); Ofuoku et al. (2008); Fawole (2006) who observed that most of the sampled farmers were in the middle-age category.

Majority of the respondents (58%) had 21-39 years of farming experience, and nearly 19% farmers had 40-58 years of farming experience. Most of the experienced farmers were involved in the advancement of innovation.

A minority of sampled farmers had land holding sizes greater than 25 acres. Analogous results by Naveed and Anwar (2013). Most farmers had low off-farm income, i.e., less than Rs.40,000 per year. Most of the sampled respondents (69%) work on a part-time basis in agriculture to earn the livelihood.

3.1. Association between Education Level and Employment Type of Sampled Farmers

The findings of the above test reveal that χ^2 (5) =24.557, p = 0.000. On the basis of this, it can be interpreted that there is a statistically significant association between education level and employment type; when the respondents attain higher educational, they prefer agriculture as a part-time source of income (Appendix A1).

Table 1 Results of chi-square tests and symmetric measures between education level and employment type

		Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square		24.557	5	0.000
Nominal by Nominal	Phi	0.430		0.000
	Cramer's V	0.430		0.000

Source: Computed from field survey, 2016

From the Phi and Cramer's V test, it can be concluded that the strength of association between variables is very high.

3.2. Influence of Education Level on Adoption of ICT

From the one-way analysis of variance (ANOVA), designated percentage equivalent of ICT sources accessed (Out of total ICT + Non-ICT) as a dependent variable and level of education as a fixed factor, it was found that adoption of ICT sources was higher for educated farmers (Appendix A2 and A3).

The analogous influence of education level was notified by Feder et al. (1985); Moghaddam and Abadi (2013); and Senthilkumar et al. (2013). The frequency and usefulness of information services of ICT projects in India, viz., Gyandoot and Warana are correlated to the farmers' education as indicated in Meera et al. (2004).

One more inference can be drawn by taking percentage equivalent of ICT sources accessed (Out of Total ICT + Non-ICT) as a dependent variable and education level as an independent variable in linear regression that is 64.2% variation in the dependent variable can be elucidated by education level of sampled farmers (Adjusted $R^2 = 0.642$).

3.3. Multicollinearity Conditions for Multiple Regression model of % equivalent of ICT sources accessed and % equivalent of Non-ICT sources accessed

Out of eight independent variables, two variables, i.e., age (years) and years of farming experience had tolerance value less than 0.1 and VIF>10. The multicollinearity statistics of age and years of farming experience is indicated in Table 2.

Table 2 Multicollinearity statistics for age and years of farming experience out of 8 independent variables

Variables	Collinearity Statistics	
	Tolerance	VIF
Age (Years)	0.069	14.506
Years of farming Experience	0.060	16.736

Source: Computed from field survey, 2016

For an independent variable's age, Tolerance = 0.069, i.e., (1-0.069) = 0.931 or 93.1% variation in age is explained by 7 other independent variables by considering them as a dependent variable.

Similarly, for years of farming experience, (1-0.060) = 0.94 or 94% variation in years of farming experience as a dependent variable can be explained by 7other independent variables including age.

To reduce multicollinearity effect, it is not possible to increase sample size; therefore, a new independent variable, i.e., years of farming experience/age (years) was used instead of using both age and years of farming experience separately. Adoption of this method shows no multicollinearity effect.

3.4. Utilizing ICT and Non-ICT Sources

For receiving agricultural information, the sampled farmers used ICT sources, Non-ICT sources and their own knowledge and experience.

Access to Agricultural Information by using of personal Knowledge and Experience

From Figure 2, it can be deduced that there is a phenomenal decrease in the percentage equivalent of information received through personal knowledge and experience on increasing equivalent rank of sampled farmers, i.e., rank from low to high ICT access.

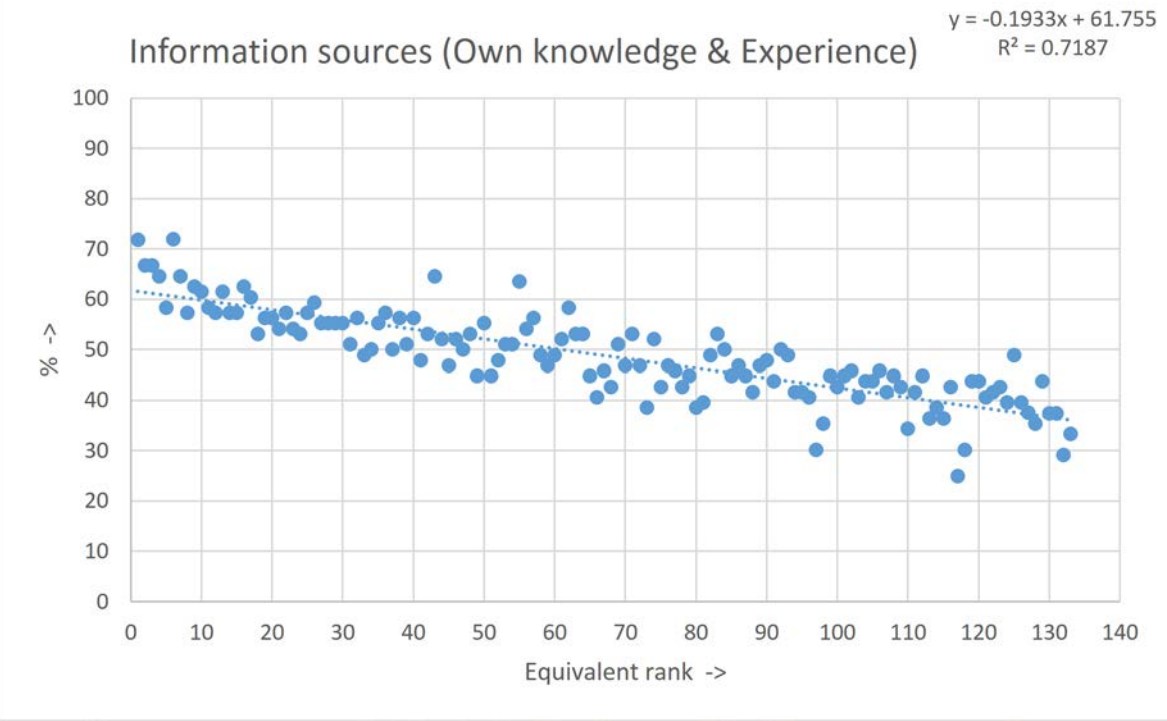

Figure 2 Percentage equivalent of information through own knowledge and experience vs. equivalent ICT rank

Factors influencing percentage equivalent of ICT sources accessed (Out of total ICT+Non-ICT)

Table 3 shows that the adjusted R^2 value of the fitted regression equation was 0.692, which indicated that 69.2 % of the variation in the percentage equivalent of ICT sources accessed (Out of total ICT + Non-ICT sources accessed) can be explained by the 7 independent variables used within the analysis.

The table further shows that out of seven independent variables taken as predecessors to the percentage equivalent of ICT sources accessed, four variables- gender, education, family labor and land holding size (acres) - were significantly linked to the percentage equivalent of ICT sources accessed at 0.05 level of probability. Out of 4 variables, the regression coefficients of two variables are positively allied to the percentage equivalent of ICT sources accessed displaying the direct relationship between education level and land holding size (acres) with the percentage equivalent of ICT sources accessed. The regression coefficients of other two variables, i.e., gender and family labor, were negatively interrelated to the percentage equivalent to ICT sources accessed.

The variable coefficients reveal that education level (0.744) is the most important factor impacting the percentage equivalent to ICT sources accessed. It is followed by gender (-0.215), family labor (-0.169) and land holding size (acres) (0.096).

The multiple regression results clearly state that the percentage equivalent of ICT sources accessed, i.e., adoption of ICT higher among the sampled farmers with higher education and bigger land holdings (acres). The homogeneous results were reported by Putler and Zilberman (1988); Batte et al. (1990); Bonny (1992); Gibbon and Warren (1992); Warren et al. (2000); Senthilkumar et al. (2013). The comparable positive influence of the farm size on adoption of modern ICT techniques was detailed by Mittal and Mehar (2013).

Table 3 Factors influencing percentage equivalent of ICT sources accessed

Variables (X_i)		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	Constant (α)	27.16	3.467		7.835	0.000
X_1	Gender	-7.420	1.788	-0.215	-4.151	0.000*
X_2	Education Level	3.406	0.289	0.744	11.766	0.000*
X_3	Family Labor	-0.763	0.266	-0.169	-2.872	0.005*
X_4	Years of farming experience/age(years)	5.462	3.957	0.086	1.380	0.170
X_5	Land holding size (acres)	0.067	0.036	0.096	1.886	0.062*
X_6	Off- farm income (Rs.)	3.369E-6	0.000	0.007	0.101	0.920
X_7	Employment type	-0.888	1.179	-0.053	-0.753	0.453
	R^2		0.708			
	Adjusted R^2		0.692			
	F		43.282			
	N		133			

Dependent Variable: Percentage equivalent to ICT sources accessed (Out of total ICT+Non- ICT)

* Significant at 5% level ($p < 0.05$)

Ali and Kumar (2010) analyzed the impact of e-Choupal, an initiative of Indian Tobacco Company (ITC), and found that education, income and landholding size are important positive factors that influence the use of ICTs decision making. However, it is not clear how age factor impacts ICT adoption. Similar results were observed by Putler and Zilberman (1988); Gibbon and Warren (1992); Warren et al. (1996); Meera et al. (ikisan project) (2004). The percentage equivalent of ICT was found to be less among female farmers, and family with more household labors. The similar negative influence of gender was stated by Moghaddam and Abadi (2013); Senthilkumar et al. (2013).

Factors influencing percentage equivalent of Non-ICT sources accessed

It can observed from the Table 4 that the adjusted R^2 value of the fitted regression equation was 0.092, which indicated 9.2 % variation in the percentage equivalent of Non-ICT sources adopted can be elucidated by the 7 independent variables included in the analysis.

The table further unveils that out of 7 independent variables taken as predecessors to the percentage equivalent of Non-ICT sources accessed, two variables, i.e., education level and land holding size (acres) were significantly linked with the percentage equivalent of Non-ICT sources at 0.05 level of probability. Out of 2 variables, the regression coefficient of education level was negatively associated with the percentage equivalent of Non-ICT sources accessed displaying the indirect relationship of education level with percentage equivalent of Non-ICT sources accessed. The regression coefficient of land holding size (acres) was positively interrelated with the percentage equivalent of Non-ICT sources accessed.

The standardized beta coefficients undoubtedly revealed that education level (-0.258) was the most important factor impacting the percentage equivalent of Non-ICT sources accessed followed by land holding size (acres) (0.200). The multiple regression results clearly designate that as the sampled farmers had more land holding size (acres), the percentage equivalent of Non-ICT sources accessed was found to be more. This percentage equivalent of Non-ICT sources was contemplated to be less in case of educated farmers which showed more centralization of such farmers on information through ICT or own knowledge and experience.

The overall negative influence of significant factor was pointed out to be more compare to the positive influence.

Table 4 Factors influencing percentage equivalent of Non-ICT sources adopted

Variables (X_i)		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	Constant (α)	31.602	3.517		8.985	0.000
X_1	Gender	-1.458	1.813	-0.072	-0.804	0.423
X_2	Education Level	-0.699	0.294	-0.258	-2.381	0.019*
X_3	Family Labor	-0.437	0.269	-0.163	-1.621	0.107
X_4	Years of farming experience/age(years)	-0.894	4.015	-0.024	-0.223	0.824
X_5	Land holding size (acres)	0.083	0.036	0.200	2.286	0.024*
X_6	Off- farm income (Rs.)	-3.536E-5	0.000	-0.132	-1.044	0.299
X_7	Employment type	-1.597	1.196	-0.162	-1.336	0.184
	R^2		0.141			
	Adjusted R^2		0.092			
	F		2.921			
	N		133			

Dependent Variable: Percentage equivalent of total ICT and Non-ICT sources accessed

* Significant at 5% level ($p < 0.05$)

4. Conclusions and Recommendations

Majority of the sampled farmers in the study area were male and married. Most sampled farmers had completed senior-secondary education. Only a few farmers had earned masters or other higher education. Most of the farmers were middle aged. The average family labor was contemplated to be three. Majority of the farmers had 2-6 family members and had fairly long experience in farming. Only a handful of sampled farmers had land holding size greater than 25 acres. Nearly for all farmers, farm income and off-farm income was less than Rs.40, 000 per year separately. Majority of the sampled respondents adopted agriculture as a part-time job to earn their livelihood.

The farmers with higher-education work in the agriculture on a part-time basis and while farmers with a low level of education require better productivity to increase their income in the bestowed research region. There was a positive correlation between education level and ICT adoption, and the major variation in percentage equivalent of ICT sources adopted can be explained by education of sampled farmers. The source of information (own knowledge and experience) was negatively related to equivalent ICT rank of sampled farmers. The education and land holding size (acres) were positively correlated with the percentage equivalent of ICT sources accessed whereas household labor was negatively impacting it. The percentage equivalent of ICT sources accessed was less in case of female farmers. The most influencing factor is education of sampled respondents.

The prominent factors influencing percentage equivalent of Non-ICT sources accessed were education level and land holding size (acres). The educated farmers were more focused on information through own knowledge and experience or ICT sources. The education level was the most influential negative factor and land holding size (acres) had positive influence on the percentage equivalent of Non-ICT sources accessed. The government intervention is mandatory to co-ordinate and regulate the efforts of the private sector as ICT bears infrastructural, developmental and expenditures to ensure mobile networks connect the farmers to information so that highly educated farmers with proper ICT

access can adopt agriculture as a full-time profession and ensure the growth of agricultural mechanization. The influences of both (ICT + Non-ICT) sources and information through personal knowledge and experiences can be used in the research for comparative analysis.

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APPENDIX A

Table A1 Cross-tabulation of education Level * employment type

			Employment type		Total
			Part	Full time	
Education Level	Illiterate	Count	8	18	26
		% within Education Level	30.8%	69.2%	100.0%
		% within Employment	8.7%	43.9%	19.5%
		% of Total	6.0%	13.5%	19.5%
	Primary	Count	22	8	30
		% within Education Level	73.3%	26.7%	100.0%
		% within Employment	23.9%	19.5%	22.6%
		% of Total	16.5%	6.0%	22.6%
	Secondary	Count	29	10	39
		% within Education Level	74.4%	25.6%	100.0%
		% within Employment	31.5%	24.4%	29.3%
		% of Total	21.8%	7.5%	29.3%
	Senior Secondary	Count	13	2	15
		% within Education Level	86.7%	13.3%	100.0%
		% within Employment	14.1%	4.9%	11.3%
		% of Total	9.8%	1.5%	11.3%
	Bachelor	Count	17	3	20
		% within Education Level	85.0%	15.0%	100.0%
		% within Employment	18.5%	7.3%	15.0%
		% of Total	12.8%	2.3%	15.0%
	Master or higher	Count	3	0	3
		% within Education Level	100.0%	0.0%	100.0%
		% within Employment	3.3%	0.0%	2.3%
		% of Total	2.3%	0.0%	2.3%
Total		Count	92	41	133
		% within Education Level	69.2%	30.8%	100.0%
		% within Employment	100.0%	100.0%	100.0%
		% of Total	69.2%	30.8%	100.0%

Table A2 ANOVA for % equivalent of ICT sources accessed (Out of total ICT+ Non-ICT) (dependent variable) and education level (fixed factor)

Source	Sum of Squares	df	Mean Square	F	Sig.
Education level	6133.614	5	1226.723	88.764	0.000
Error	1755.142	127	13.820		
Corrected Total	7888.756	132			

Table A3 Descriptive statistics of Education level

Education Level	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Illiterate	16.230	0.729	14.787	17.673
Primary	21.254	0.679	19.911	22.597
Secondary	30.319	0.595	29.141	31.497
Senior Secondary	30.420	0.960	28.521	32.319
Bachelor	34.587	0.831	32.942	36.232
Master or higher	38.893	2.146	34.646	43.141

Dependent Variable: % equivalent of ICT sources accessed (Out of total ICT+ Non-ICT)

APPENDIX B

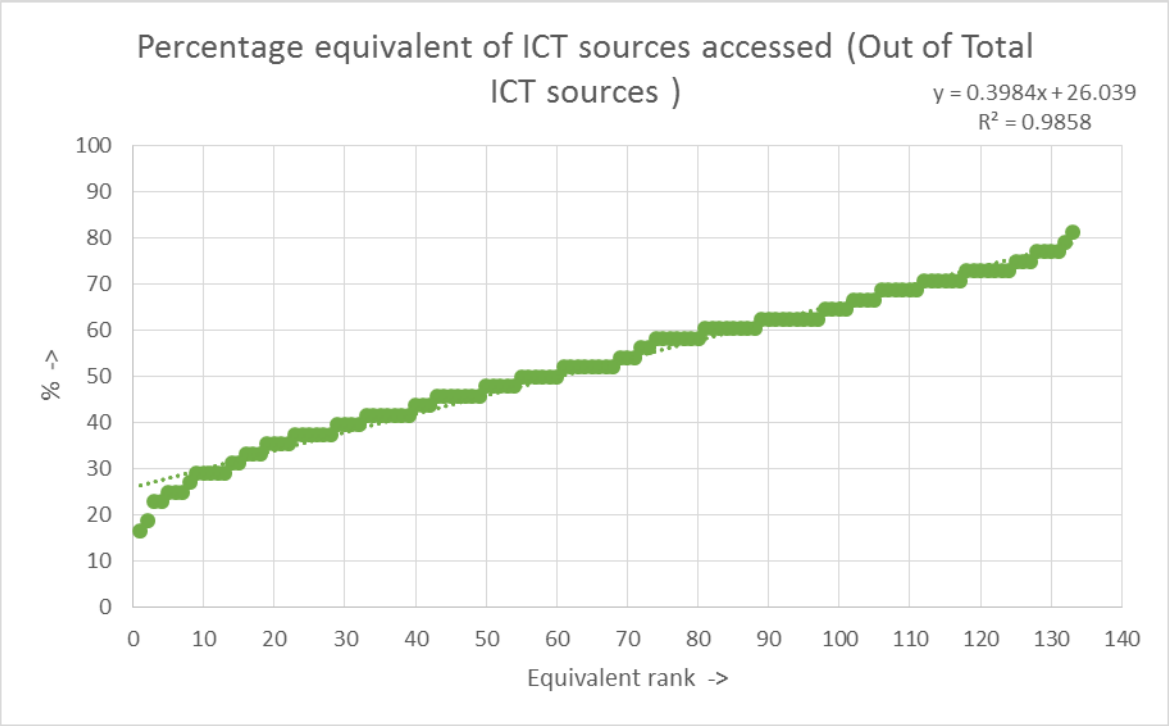

Figure B1 Percentage equivalent of ICT sources accessed (Out of total ICT sources) vs. equivalent rank

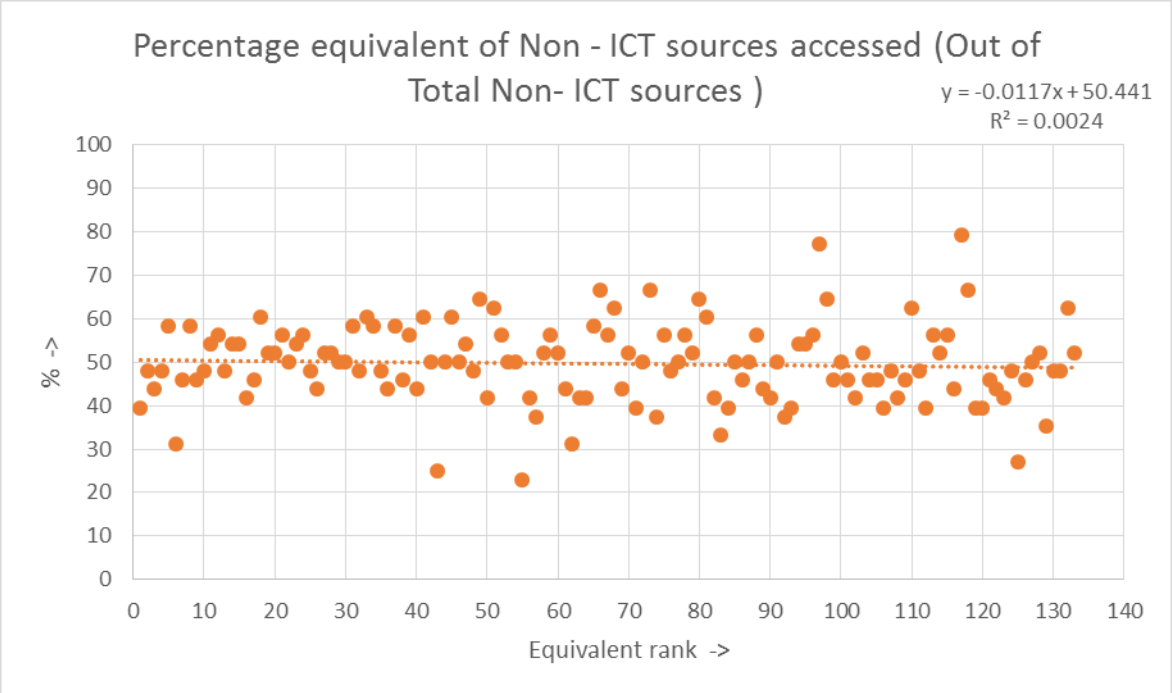

Figure B2 Percentage equivalent of Non-ICT sources accessed (Out of total Non-ICT sources) vs. equivalent rank

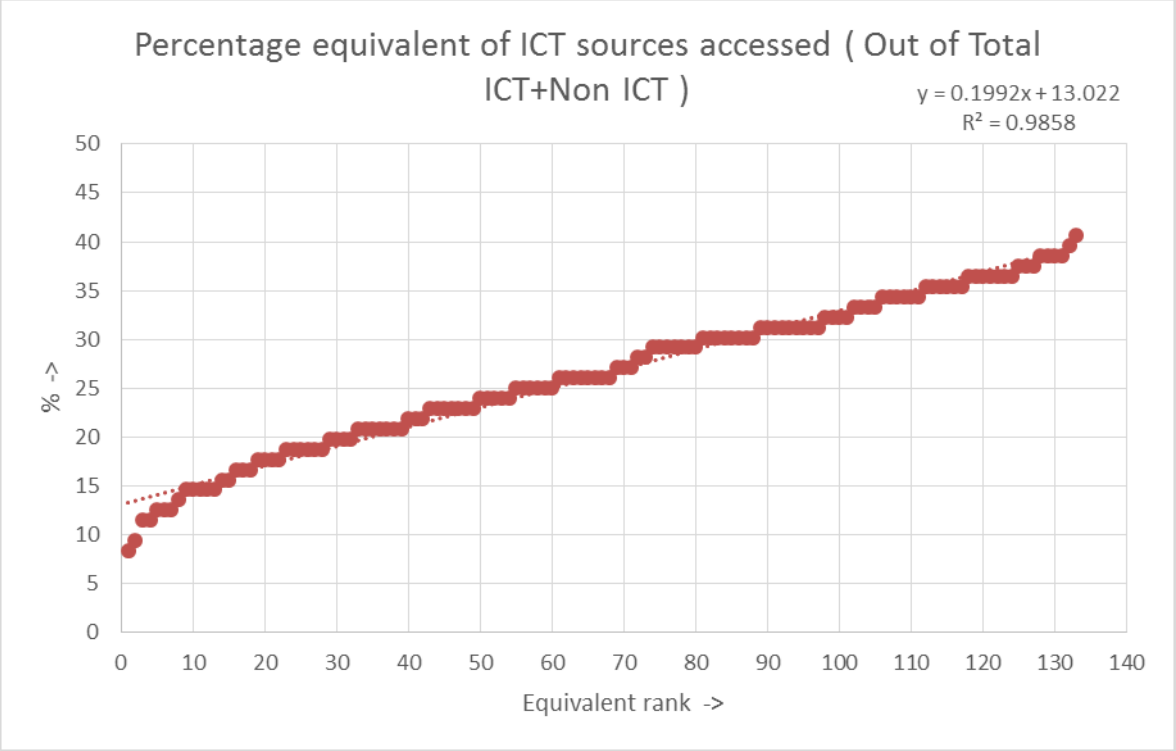

Figure B3 Percentage equivalent of ICT sources accessed (Out of total ICT + Non-ICT) vs. equivalent rank

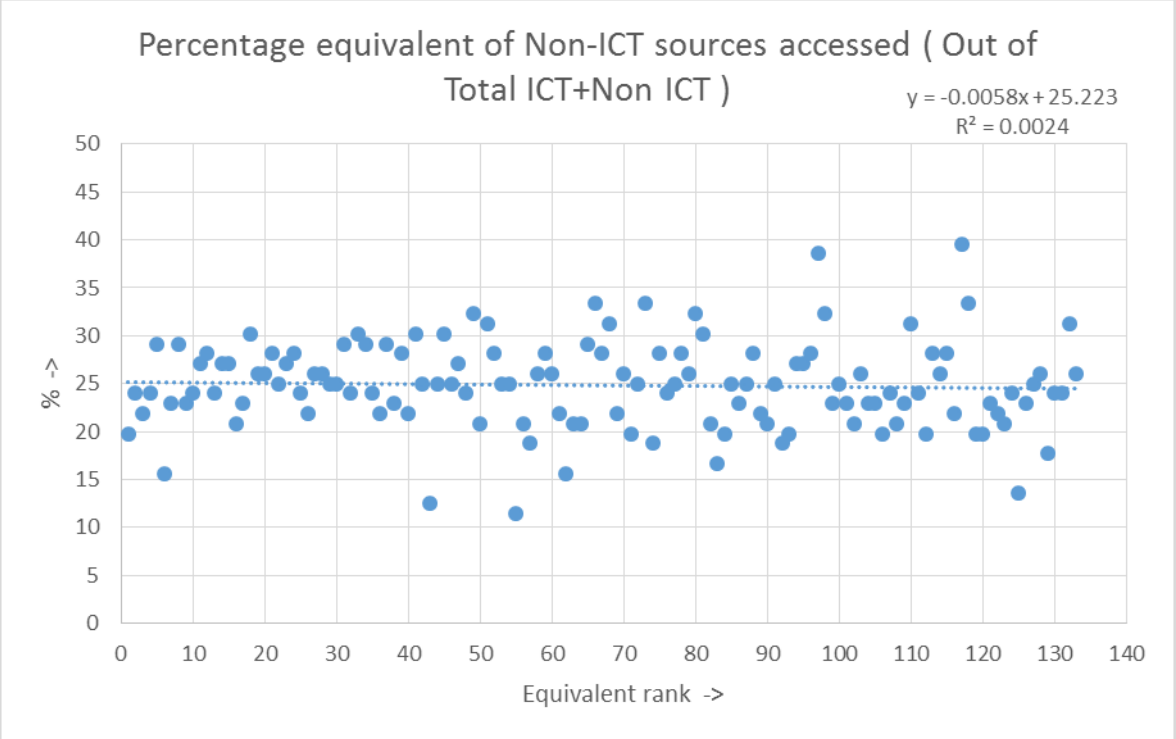

Figure B4 Percentage equivalent of Non-ICT sources accessed (Out of total ICT + Non-ICT) vs. equivalent rank

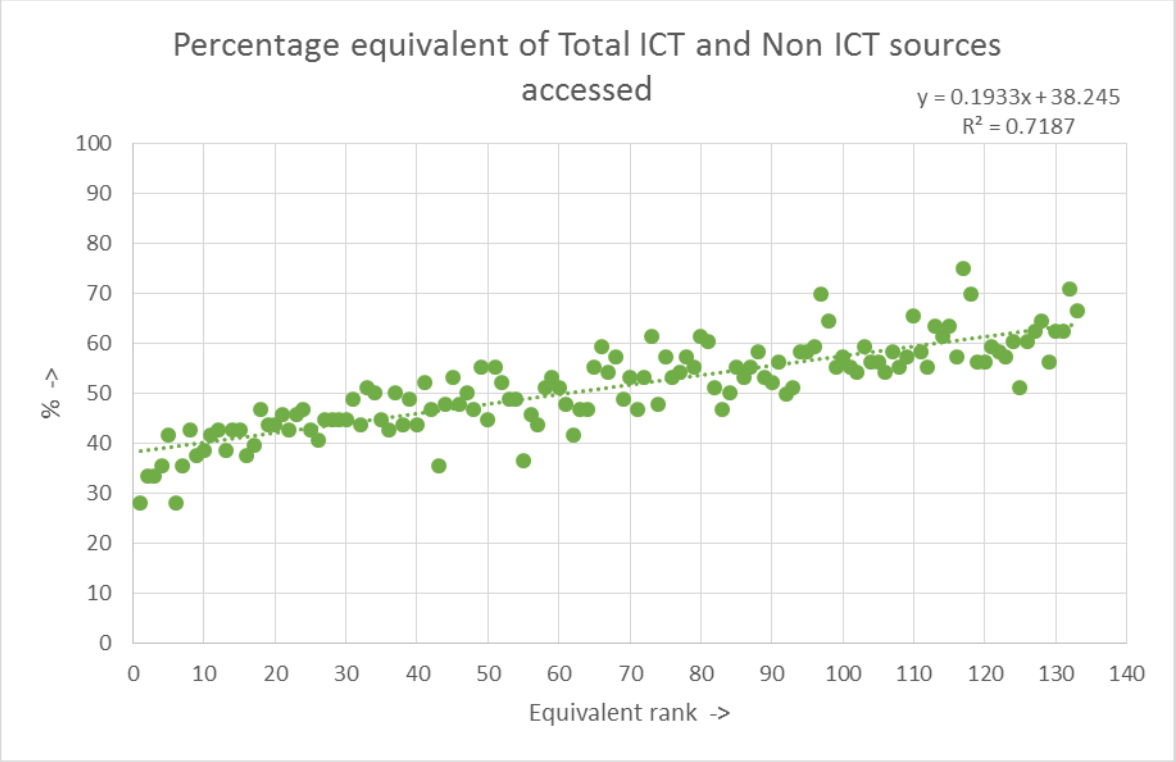

Figure B5 Percentage equivalent of total ICT and Non-ICT sources accessed vs. equivalent rank

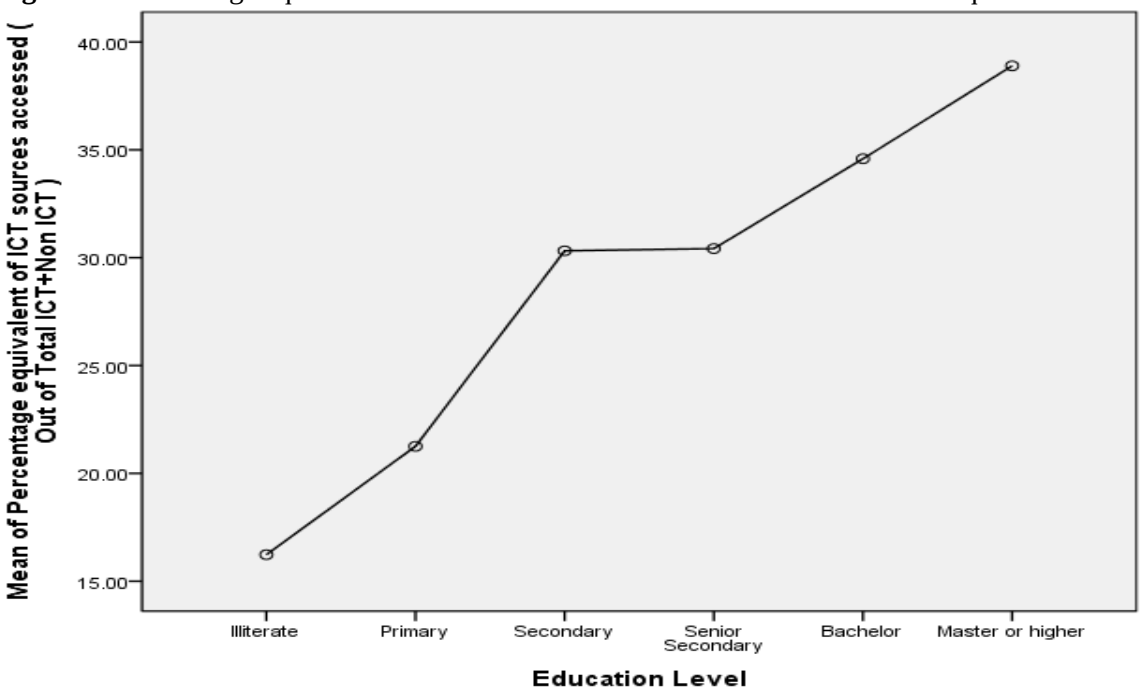

Figure B6 Mean of percentage equivalent of ICT sources accessed (Out of total ICT + Non-ICT) vs. education level