Original Research Article

Empowering Farmers through ICT: Unveiling Access and Competency gaps and associated factors in Puri District, Odisha

Abstract

In developing country like India on one hand there are plethora of ICT initiatives operational across various areas, but on the other the persistent issues of crop loss, lack of market, vulnerability of small holder farmers etc. continues to prevail. These persistent situations do give rise to basic questions that in spite of large-scale ICT initiatives, whether farmers have access to these ICT? If they have access, are they competent in using the ICT? There could be multiple factors affecting the access and competency of farmers rendering most of the ICT initiative as ineffective. Previous researches provide limited understating of how socio-economic factors such as education levels, wealth status, and diversification of income sources influence farmers' ability to effectively utilize ICT tools. Additionally, there are limited studies examining the role of local extension services, such as those provided by KVKs, in bridging the ICT access and competency gap, particularly among smallholder farmers in vulnerable regions. Based on these the study was conducted in Puri district of Odisha on119 farmers. The study reports that the respondent farmers in the area were majorly smallholders and have been marred by agriculture issues like crop failures, pest attacks and market failure. The study examined the socio-economic profiles of these farmers and tries to relate it with the ICT competency levels and information access levels of the farmers. The results from the study shows that the major factors affecting competency and access of information included the level of education of the farmers, Wealth ranks and also the presence of non-farm income source. The local extension workers from KVK, Puri also played a vital role in improving the access and competency level.

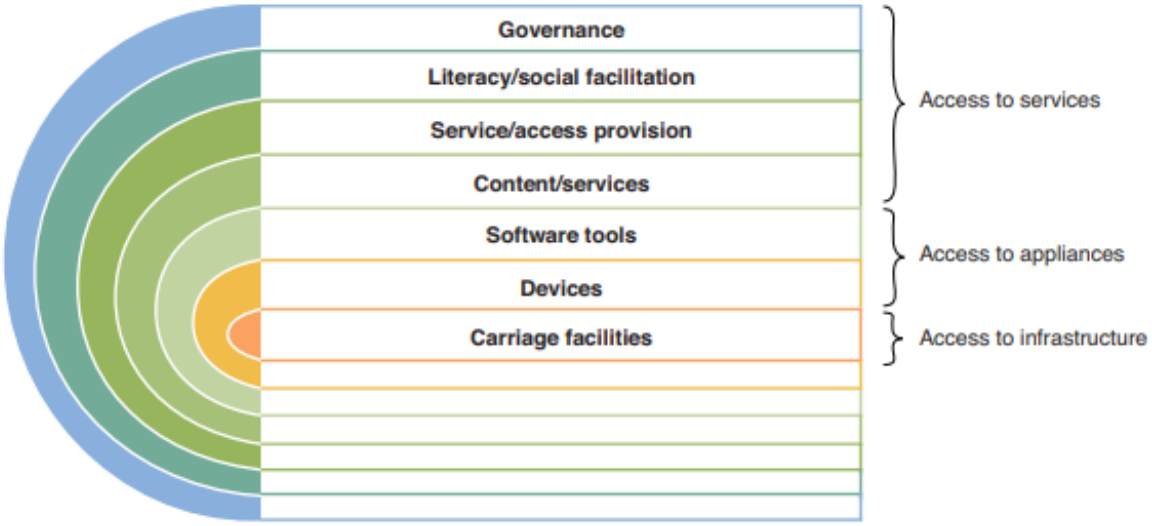
Keywords: ***Agricultural Extension, Access to ICT tools, Digital Competency, Digital Divide, Socio-Economic Factors, Wealth ranking***

Introduction

ICT plays a significant role in agricultural development because unlike mechanization, it would reach all sections of the farming community (marginal, small holder or large farmers). According to Rao, 2007 and Shalendra et al., 2011, ICT has been even referred to as a paradigm shift in context of agricultural development. ICTs are a means of disseminating information through a combination of complementary technologies (ITU, 2007; Upadhyay et.

al. 2010; FAO, 2011; Bankole, Shirazi, & Brown, 2011; Alderete, M.V. 2017). This study is based on the theory of ICT based intervention in smallholder setup. There are many models and framework (e.g. Technology Acceptance Model (TAM), Diffusion of Innovation Framework) for dissemination of information based on ICT use. However, the present study deals with the basic concepts of ICT competency level and access level and the various interpretation of these. ICT adoption has always been a big challenge for smallholder farmers. The investment cost, lack of skills, lack of setup would prevent the appropriate use of ICT. However, Recent developments in information and communications technology (ICT) offers a great opportunity to facilitate the flow of information and technology services delivery especially to the small holder farmers (Flor, 2001; Maningas, 2006; Rao, 2007). Treating ICT as a cultural capital of the students, Tounder et al, 2010, tried to see the variations in distribution of cultural capital between the classes and class fractions. In line with Bourdieu's vision of socio-cultural capital, the possession and use of ICT would vary in cases of different target groups as well (Bourdieu, 1986; Tounder et al 2010). Thus, the variations across class fractions would be true in case of farming community as well. Hence, the competence level or the access would be different across the demographics of the target group. This view has been supported by several studies i.e., Yahay 2002; Akpabio et al 2007; Anastasios et al 2010. Most studies are concerned about access to Internet and computers and their impact on economic growth with no reference to the ICT use and skills needed to properly exploit these new technologies. These Assessment is possible through competency (low-level individual know-how for elementary uses of ICT) and access" (availability of devices and connectivity, existence and quality of wired and wireless infrastructures Fig. 1 (Barret & Salvova, 2013).

Figure 1: ICT access (rainbow diagram taken from ICT & agriculture, Ch. 2; Barret & Salvova, 2013)



Previous research provides limited information regarding the relationship between demographic like age, education, marital status, gender etc. with ICT access and competency (Hafkin & Hueuer, 2007; Shiferaw, B. A., Okello, J., & Reddy, R. V. 2009; Gillwald et al 2010; Kameshwari 2011; Chauhan, 2016; Olsson 2017). Besides, the competency of farmers in rural areas is not known when it comes to efficient use of ICT tools. Keeping all above issues in mind this research study was done to understand the relationship between level of access to ICT and socio-economic characteristics. Also, efforts has been made to assess factors that affect ICT competency of respondents.

Material and Methods

The Study was envisaged as an exploratory and a descriptive one. The study was conducted in Puri district of Odisha. Puri district was chosen as the study area based on its agricultural diversity, socio-economic challenges, ICT initiatives and strategic relevance to the objectives of the research. The district comprises of seven blocks and has 1707 villages spanning over an area of 3479 sq km. The two villages Dumukipur (in Pipili block) and Otarakhera (in Satyabadi block) have been chosen purposively in consultation with the KVK authority and keeping in mind the feasibility and accessibility context. The scales and scoring system has been developed by modifying some of the earlier works on access level and competency level of ICT (Acker, 2010; Goktas & Demirel, 2012; Miller, Saroja & Linder, 2013; Abdullah & Samah, 2013). From the village Dumukipur 63 farmer respondents and from the village Otarakhera 56 farmer respondents were interviewed. In all study covers 119 respondents. The data was collected through wealth ranking, interviews (structured and closed ended), informal discussion and Focussed group discussion. The regression modelling was used to understand the relationship between access level and ICT competency level w.r.t the socio economic parameters. The regression equation thus formed was as follows:

$$X = (a_1A + a_2S + a_3N + a_4E + a_5LR\ldots.)$$

Results

The three main common types of ICT used for farming purposes were the mobile call-up, the television and the mobile SMS (Table No. 1).

Table 1: Inventory of ICT initiatives

Sl. no	Name	Mode	Organization	Description
1	Agro-advisory	SMS	KVK-OUAT	SMS service is used to broadcast information regarding market price, agriculture input, weather information, information related to pest attacks.
2	Kisaan call centre	Dial-up	Ministry of agriculture	Telephonic service which aims at answering farmers queries in their own dialect. The respondents in the area used this mode for seeking information about market, prices, and the use of pesticides.
3	Krishi - Darshan	TV	Ministry of agriculture	TV program for disseminating agricultural information to rural, farming audiences. Information normally accrued from this mode includes:- new farm machinery, new farm fertilizer, new farming methods

Village and Respondents profile

Out of the two villages, Dumukipur has been adopted for a period of three years and the village Otarakhera is undergoing the adoption process by the KVK. The KVK, disseminates information through SMS service to various block of the districts and both these villages come under the ambit of these services (Table 2a). Dumukipur Village comprises of 80 households and out of which only 69 respondents were cultivators. From the respondents it was found that the mean age of the farmers was 50.38. The Otarakhera Village comprises of 86 households. As per Census 2011, the number of cultivators were 23 in number but it was found that there were many others who practiced agriculture. From the respondents it was found that the mean age of the farmers was 49.75 (Table 2b).

Table 2: Profile of village

2a. Dumukipur

S. No.	Dumukipur	Figures
1.	No of households	80
2.	No of individuals	333
3.	No of literates	274
4.	No of cultivators	69 (all males)
5.	No of cultivators (Marginal)	2

2b. Otarakhera

S. No.	Otarakhera	Figures
1.	No of households	86
2.	No of individuals	472
3.	No of literates	330
4.	No of cultivators	53 (all males)
5.	No of cultivators (Marginal)	0

In Dumukipur village the average land size of the area comes out to be 1.88 acre. The distribution of farmers in the area has been represented by the chart (fig 2 a). From the figure it is evident that 81% of the respondents are marginal farmers and the rest are small holder farmers. The average years of farming experience in the study, area was 32.33 Years. Thus upon examination, it was found that around 50.79% of the respondents have a source of income other than the agriculture produce (Table 3a). The average land size of the area in Otarakhera village comes out to be 2.41 acre. The distribution of farmers in the area has been represented by the chart (fig 2 b). From the figure it is evident that 55% of the respondents are marginal farmers and 39% are small holder farmers. Only a handful have land more than

5 acres but that too is less than 8 acres. The Average farming experience in the study area comes out to be 29.43 (Table 3b).

Table 3: Respondents profile
3a. Dumukipur village (n=63)

S. No.	Parameters	Figures
1.	Mean age	50.38 Years
2.	Mean years of education	7
3.	Mean land size	1.88 Acre
4.	Mean years of farming experience	32.33
5.	% having non-farm income sources	50.79

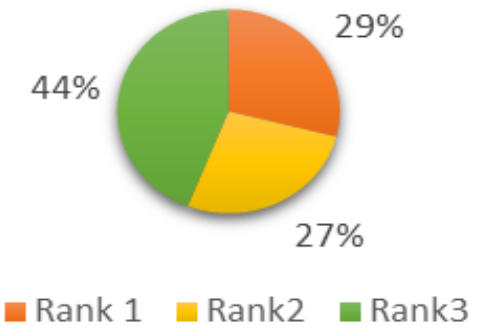
3b. Otarakhera village (n=56)

S. No.	Parameters	Figures
1.	Mean age	49.75 Years
2.	Mean years of education	8
3.	Mean land size	2.41 Acre
4.	Mean years of farming experience	29.43
5.	% having non-farm income sources	55.75

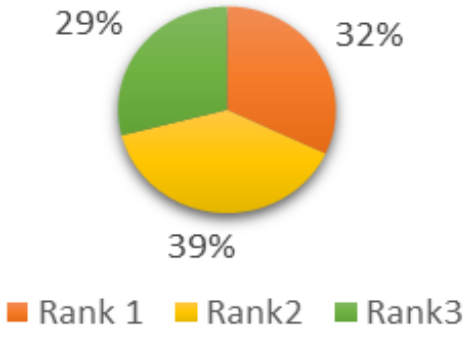
In order to capture the socio-economic factor wealth ranking was performed. Based on the ranking exercise the distribution was found as 44% of the respondents belonged to the rank one category (Lowest strata) comprised of the economically weaker section in Dumukipur. In Otarakhera village in wealth ranking exercise the distribution of the sample was found as 32% of the respondents belonged to the Lowest strata. 29% of the respondents belonged to the Rank three (economically better off strata).

Figure 2: Distribution of the farmers on the basis of Wealth Ranking

2a. Dumukipur (n=63)



2b. Otarakhera (n=56)



Respondents ICT use pattern

The respondents in Dumukipur village preferred the use of mobile phones and indirect sources like acquaintances and middlemen for accruing agriculture information. All the respondents, even though they use direct sources, do make use of middle men and indirect sources in gathering information. This shows that the farmers who used traditional forms to seek information are still dependent on them because of their positive perception. Very few respondents had internet facility and out of which roughly 57.14% percent of them used it frequently for seeking agricultural information. TV is also favoured as a source of information, but due to the timeliness and the availability of the information the farmers still prefer mobile. Radio is considered as a redundant source as none of the respondents claim to use this for agricultural purpose. Even though the farmers are moving towards ICT use yet the dependency on middlemen have not completely worn out (Table 4a).

Table 4: Usage pattern of various ICT modes

4a. Dumukipur Village (n=63)

ICT Tools	Using for agriculture information	Very Frequently	Moderate frequency	Rarely
TV	74.60% (47)	17.02%(8)	42.55%(20)	40.43%(19)
Mobile	88.88% (56)	61.11%(38)	27.78%(14)	11.11%(6)
Internet	15.87% (10)	57.14%(6)	28.57%(4)	14.28%(1)

Computer	0	0	0	0
Other sources	100% (63)	44.44%(28)	15.87%(10)	39.68%(25)

4b. Otarakhera village (n=56)

	Using for agriculture information	**Very Frequently**	**Moderate frequency**	**Rarely**
TV	83.90%(47)	59.57%(28)	38.29%(18)	2.10%(1)
Mobile	89.28%(50)	62%(31)	38%(19)	0%
Internet	25%(14)	57.14%(8)	28.57%(4)	14.28%(2)
Computer	0%	0%	0%	0%
Other sources	100% (56)	19.64%(11)	50%(28)	30.36%(17)

The respondents in Otarakhera preferred the use of mobile phones and indirect sources like acquaintances and middle men for acquiring agriculture information. Around 89% of the respondents make use of mobile phones for seeking agriculture related information. All the respondents, even though they use direct sources, do make use of middle men and indirect sources in gathering information. TV is also favoured as a source of information as 83% of the respondents use TV for information. As compared to Dumukipur the respondents in Otarakhera use TV at a higher frequency rate. Radio is considered as a redundant source. In Otarakhera, the respondents do not tend to use computer for seeking information. As compared to Dumukipur more number of respondents use internet service for seeking information (Table 4b).

Relationship of access and competency w.r.t socio-economic characteristics

The various socio economic parameters have been considered for this study are age, years of education, farm size, non-farm income source and wealth rank.

Access

In order to get results two aspects of access were formulated, which are namely number of tools and level of access. The number of tools refers to the possession of number of ICT devices by a respondent. The ICT devices include Computer, internet, TV, mobile phone, Radio. The level of access takes into account the possession, usage pattern and frequency. This method is based on some of the earlier studies about ICT access (Ajuwon & Rhine, 2008; Aboh C.L. 2008; Saroja & Linder, 2013; Syiem & Raj, 2015).

Dumukipur

Number of tools

The relationship between the number of tools used and the socio economic parameters has been modelled (Table 5).

Table 5: Regression modelling (Number of ICT tools ~ socio economic parameters) Village Dumukipur

Residuals:

Min	1Q	Median	3Q	Max
-1.8768	-0.4337	0.1427	0.3505	1.7047

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.519118	1.336624	0.388	0.6992
Age	-0.162306	0.033762	-0.157	0.8757
Education	0.097683	0.0437	2.235	0.0294 *
Farm size	0.032873	0.098007	0.335	0.7386
Farming experience	0.02474	0.028604	0.865	0.3908
Wealth rank	-0.004419	0.160197	-0.028	0.9781

Significance. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.362[a]	.131	.038	.72036	.131	1.403	5	56	.230	2.206

a. Predictors: (Constant), Rank, Age, Farm size, Education, Farming experience

b. Dependent Variable: no of tools

Multiple R-squared: 0.1307, Adjusted R-squared: 0.03756, F-statistic: 1.403 on 6 and 56 DF, p-value: 0.2296

Chi square tabulation between Number of ICT tools and Non-farm income source

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent

No of Tools * NFI	63	100.0%	0	0.0%	63	100.0%

No of Tools – Non Farm Income source Cross tabulation Count

		NFI	Total
		no	yes	
No Of Tools	0	6	0	6
	1	11	3	14
	2	13	20	33
	3	1	9	10
Total		31	32	63

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.445[a]	3	.000
Likelihood Ratio	22.019	3	.000
Linear-by-Linear Association	17.885	1	.000
N of Valid Cases	63		

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 2.95.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.537	.078	4.973	.000[c]
Ordinal by Ordinal	Spearman Correlation	.539	.086	4.997	.000[c]
N of Valid Cases		63			

a. Not assuming the null Hypothesis (No relation between Non-farm source of income and No of tools).

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

The results of the model show that in case of Dumukipur village, the factor education is important in determining the usage of number of tools. From the F statistics it has been found that the model is statistically not significant and is not a good fit model predicting almost around 4% of the variations i.e. roughly 4% of the variance found in the response variable can be explained by the predictor variable. The relation between the Non-farm income source and the number of tools used has been cross tabulated and through this the chi square test of association was done and also the relation was studied. The result came out to be significant and the null hypothesis, that there is no relation between availability of non-farm sources of

income and number of ICT tools used has been rejected thereby signifying a relation between the two. A moderate value of correlation signifying that the presence of non-farm income source means that the farmer would be using more number of ICT tools.

Level of access

The relationship between the level of access used and the socio economic parameters has been modelled (Table 6).

Table 6: Regression modelling (level of access ~ socio economic parameters) Village Dumukipur

Residuals:

Min	1Q	Median	3Q	Max
-10.0045	-3.6210	-0.1434	3.5736	9.1660

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	3.82274	9.36841	0.408	0.6848
Age	0.09085	0.23664	0.384	0.7025
Education	0.56882	0.30629	1.857	0.0686 .
Farm size	0.67465	0.68693	0.982	0.3303
Farming experience	-0.02831	0.20049	-0.141	0.8882
Wealth rank	-0.62352	1.12283	-0.555	0.5809

Significance. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

Multiple R-squared: 0.1214, Adjusted R-squared: 0.02729

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.348[a]	.121	.027	5.04903	.121	1.290	5	56	.277	2.269

a. Predictors: (Constant), Rank, Age, Farm size, Education, Farming Experience

b. Dependent Variable: access level

The results of the model show that in case of Dumukipur village, the factors age and education are important in determining the usage of number of tools. From the F statistics (1.29 on 6 and 56 DF), it has been found that the model is statistically not significant (p-value: 0.2769) and is a good fit model predicting almost around 2.7 % of the variations i.e. roughly 3% of the variance found in the response variable can be explained by the predictor variable. However, on relaxing the level of confidence we find that the education does comes out to be a determining factor in this case.

Otarakhera

Number of tools

The relationship between the number of tools used and the socio-economic parameters has been modelled (Table 7).

Table 7: Regression modelling number of tools ~ socio economic parameters Otarakhera)

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	2.546665	0.709649	3.589	0.000767 ***
Age	-0.049875	0.019208	-2.597	0.012397 *
education	0.088552	0.02874	3.081	0.003378 **
Farm size	0.009736	0.054488	0.179	0.85892
Farming experience	0.0332	0.018758	1.77	0.082965
Wealth rank	0.026577	0.11275	0.236	0.814633

Coefficients: Estimate Std. Error t value Pr(>|t|)
Significance. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Multiple R-squared: 0.4778, Adjusted R-squared: 0.4138

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.691[a]	.478	.414	.57464	.478	7.471	5	49	.000	2.012

a. Predictors: (Constant), Rank, Farm Size, Farming Experience, Education, Age
b. Dependent Variable: No of ICT Tools

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
No Of Tools * nfi	56	100.0%	0	0.0%	56	100.0%

No Of Tools * nfi Cross tabulation

Count

		nfi		Total
		no	YES	
NoOfTools	0	2	0	2
	1	7	3	10
	2	14	17	31
	3	2	11	13
Total		25	31	56

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.588[a]	3	.022
Likelihood Ratio	10.924	3	.012
Linear-by-Linear Association	9.385	1	.002

N of Valid Cases	56			

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is .89.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.413	.102	3.333	.002[c]
Ordinal by Ordinal	Spearman Correlation	.407	.109	3.273	.002[c]
N of Valid Cases		56			

a. Not assuming the null hypothesis (No relation between Non-farm source of income and number of tools used).
b. Using the asymptotic standard error assuming the null hypothesis.
c. Based on normal approximation.

The results of the model show that in case of Otarakhera village the factors age and education are important in determining the usage of number of tools. From the F statistics (7.471 on 6 and 49 DF) it has been found that the model is statistically significant (p-value: 1.029e-05) and is a good fit model predicting almost around 41% of the variations. The relation between the non-farm income source and the no of tools used has been cross tabulated and through this the chi square test of association and result came out to be significant thereby the null hypothesis has been rejected, signifying a relation between the two.

Level of access

The relationship between the level of access and the socio-economic parameters has been modelled (Table 8).

Table 8: Regression modelling Level of access~ socio-economic parameters of Otarakhera village

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	17.8604	6.4527	2.768	0.00794 **
Age	-0.2782	0.1747	-1.593	0.11764
Education	0.8503	0.2613	3.254	0.00207 **
Farm size	0.3062	0.4955	0.618	0.53947
Farming experience	0.1167	0.1706	0.684	0.49708
Wealth rank	0.0634	1.0252	0.062	0.95094

Significance. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Multiple R-squared: 0.4205, Adjusted R-squared: 0.3496
F-statistic: 5.927 on 6 and 49 DF, p-value: 0.0001041

Model Summary[b]

Model	R	R	Adjusted	Std.	Change Statistics	Durbin-

		Square	R Square	Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Watson
1	.648[a]	.421	.350	5.22504	.421	5.927	5	49	.000	1.693

a. Predictors: (Constant), Rank, Farm Size, Farm Experience, Education, Age
b. Dependent Variable: Access level

The results of the model show that in case of Otarakhera village the factors age and education are important in determining the usage of number of tools. From the F statistics it has been found that the model is statistically significant (p-value: 0.0001041) and is a good fit model predicting almost around 35% of the variations i.e. roughly 35% of the variance found in the response variable can be explained by the predictor variable. The factors age and education do play an important role in determining the usage of ICT tools since the younger generation who have completed more years in education have a tendency to use more number of ICT tools. This has been shown across various studies (Koutsouris 2010; Yahya 2012, Olsson 2017; Aldosari et al. 2017).

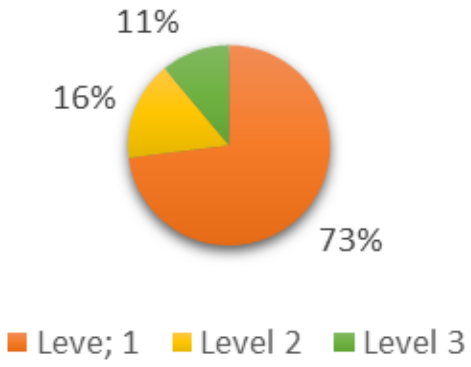
However, the variations in the two villages could be because of the reason that Dumukipur had been chosen as an adopted village by the KVK hence they have trained the village residents making them aware about the various ICT modes. Thus, we see that the variation in the levels of access being represented across two villages. Moreover, the findings go in line with the literature that the number of small holders and marginal are more in case of Dumukipur.

Competency

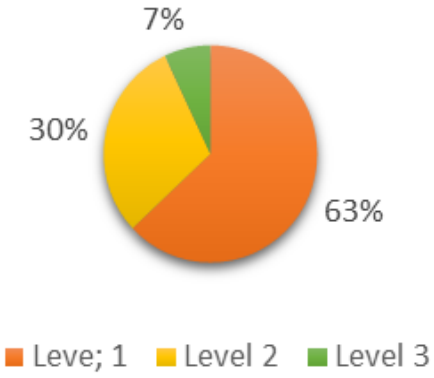
The competency levels were measured using a scoring system. Based on the scoring systems the three levels where formulated, namely competency level One (1), Two (2) and Three (3). The numeral strength signified the competency of the respondents hence the level three individual showcased a higher competency in handling ICT tools as compared to the lower levels.

Figure 3: Distribution of the respondents w.r.t. different levels of competency

3a. Dumukipur (n=63)



3b. Otarakhera (n=56)



Through the analysis in Dumukipur (fig. 3a), it was found that seven respondents had a competency level 3, 10 individuals had competency level 2 and the rest of the respondents belonged to the level one category. In Otarakhera (fig. 3b) it was found that 4 respondents had a competency level 3, 30% individuals had competency level 2 and the rest of the respondents belonged to the level 1 category.

Dumukipur

In order to understand the relation between the various socio economic parameters taken into consideration a regression model was formulated (Table 9). For the regression model the dependent variable was the competency level and the independent variables were age, farming experience, years of education, wealth rank and the farm size.

Table 9: Regression modelling of competency level ~ Socioeconomic parameters Village Dumukipur

Residuals:

Min	1Q	Median	3Q	Max
-0.83456	-0.29831	-0.00962	0.31986	1.04505

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.724979	0.851641	2.025	0.04759
Age	0.023331	0.021512	-1.085	0.28276
Education	0.074048	0.027844	2.659	0.01019*
Farm size	-0.162062	0.062466	-2.595	0.01205*
Farming experience	0.001844	0.018225	0.101	0.91975
Wealth rank	0.349511	0.102071	3.424	0.00116 **

Significance. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.769[a]	.591	.547	.45898	.591	13.497	5	56	.000	2.108

a. Predictors: (Constant), Rank, Age, Farm size, Education, Farming experience

b. Dependent Variable: Competency score/level

As per the modelling exercise it was found that the Adjusted R-squared is 0.5474. Thus, the model is a good fit model having the ability to predict around 54.74% of the variance. The F-statistic on a degree a freedom 6 and 56 DF was found to be 13.5 with a (significance) p-value of 2.116e-09. This result signifies the relationship between the independent and dependent variables. The intercept value shows a significant result, and on close inspection it was found that the number of years of education and the wealth rank of the respondents were the determinant factor for the significant relations. The Nature of the relation could be garnered from the t values in the analysis table. In both the cases the t values were sufficiently large and positive in nature, hence it determined a positive correlation between the two factors and the dependent variable i.e. the competency levels. The factor of wealth rank was examined to a further detail to understand the distribution among the farmers (Table 10). It was evident that the wealthier families tend to have more competency level.

Table 10: Cross tabulation of Competency Level and Wealth Rank

Competency Level * Wealth Rank Cross tabulation

Count

		Wealth Rank			Total
		low rank	mid rank	high rank	
Competency Level	LOW	26	12	8	46
	MID	1	5	4	10
	HIGH	0	1	6	7
Total		27	18	18	63

Otarakhera

In order to understand the relation between the various socio economic parameters taken into consideration a regression model was formulated (Table 11).

Table 41: Regression modelling of competency level ~ socio economic parameter Village Otarakhera

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.323251	0.595288	2.223	0.03087 *
Age	-0.008538	0.016113	-0.53	0.59858
Farm size	-0.029115	0.045707	-0.637	0.5271
Education	0.06102	0.024108	2.531	0.01463 *
Farming experience	-0.012486	0.015735	-0.794	0.4313
Wealth rank	0.278634	0.09458	2.946	0.00491 **

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.482 on 49 degrees of freedom
Multiple R-squared: 0.4787, Adjusted R-squared: 0.4148
F-statistic: 7.498 on 6 and 49 DF, p-value: 9.889e-06

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.692[a]	.479	.415	.48204	.479	7.498	5	49	.000	2.386

a. Predictors: (Constant), Rank, FarmSize, Farming Experience, Education, Age
b. Dependent Variable: Comptency score/level

Chi square test

Chi square test between non-farm income source and competency level

Competency Level * Non- farm income source Cross tabulation

Count

		nfi		Total
		no	YES	
Competency Level	MIN	22	19	41
	MOD	3	8	11
	MAX	0	4	4
Total		25	31	56

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.917[a]	2	.052
Likelihood Ratio	7.479	2	.024
Linear-by-Linear Association	5.811	1	.016
N of Valid Cases	56		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is 1.79.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.325	.095	2.526	.015[c]
Ordinal by Ordinal	Spearman Correlation	.314	.111	2.432	.018[c]
N of Valid Cases		56			

a. Not assuming the null hypothesis (No relation between non-farm source of income and competency level).
b. Using the asymptotic standard error assuming the null hypothesis.
c. Based on normal approximation.

As per the modelling exercise it was found that the Adjusted R-squared is 0.4148. Thus the model is a good fit model having the ability to predict around 41.48% of the variance. The F-statistic on a degree a freedom 6 and 56 DF was found to be 7.498 with a (significance) p-value of 9.889e-06. This result signifies the relationship between the independent and dependent variables. The intercept value shows a significant result, and on close inspection, it was found that the no of years of education and the wealth rank of the respondents were the determinant factor for the significant relations. The Nature of the relation could be garnered from the t values in the analysis table. In both the cases the t values were sufficiently large and positive in nature hence it determined a positive correlation between the two factors and the dependent variable i.e. the competency levels. From the chi square test of association b/w non-farm income source and competency level it was found that the level of competency is associated with the presence of non-farm income source in the household. The correlation results also have come out to be significant. Thus, it goes by the fact that the presence of non-farm in come source does have an impact on the competency levels of the farmers. Since the member associated with the non-farm income source would be more exposed to the ICT devices and could be the key to transfer of technology in the rural area.

To further examine the wealth rank quotient, cross tabulation (Table 12) was done between wealth rank and competency level.

Table 52: Cross tabulation between Competency Level and Wealth Rank

Competency Level * Wealth Rank Cross tabulation

Count

		Wealth Rank			Total
		low rank	mid rank	high rank	
Competency Level	LOW	16	19	6	41
	MID	3	2	6	11
	HIGH	1	0	3	4
Total		20	21	15	56

From the cross tabulation, it was evident that the lower rank had lower competency level. Thus, it is evident that wealth rank does play an important role in determining the

competency level. The one odd case in Otarakhera is because the family does farming in the village but is based on the nearby town of Puri. The family has non-farm income source in the form of salaried job thus the wealth rank could not capture the accurate income or financial status. So, it could be said that the wealth rank is a determining factor for the competency levels based on the data set from both the villages. Based on the results from the modelling exercise it could be said that wealth ranking and education level determine the competency level in the study area. This result comes in line with the existing work (Syiem & Raj, 2015; Chauhan 2016; Olsson, 2017).

Discussion

Previous works have shown that the years of education, age, land size do play an important role in determining the access to ICT. The number of tools used is dependent on the age factor and the years of education signifying that the younger farmers and the farmers who are more educated tend to have better access to ICT tools. The land size does not play a significant role since the most of the farmers are small or marginal. The cellular setups have become very affordable hence many of the farmers could afford mobiles and use if frequently to seek information. Very few have internet connectivity and computer (mostly laptops). Radio has been considered redundant; however, the farmers do use radio of the phone. Since the access to tools was very evenly distributed, the ICT access level would also be not so much dependent on the wealth or income status of the respondents. In the study area the physical access and financial access was there for mobile phones. People who could not afford TV, computers and do not have internet services had mobile connection. Thus, it could be said that the physical and financial access to mobile phones are much more as compared to the other forms of ICT devices or modes in the area. There were readily available channels of information from mobile services like Agro-advisiory services, Kisan call centre. The content of the information from these were in the local language and so most

of the farmers could comprehend the inputs given to them. The mobile based services for disseminating information creates a social inclusiveness in the area. However, the digital divide in these two villages is more because of education levels in line with many of the research work across various developing nations.

The respondents having more years of education tend to use more number of ICT tools and have a higher access level. To measure the access level two features were considered because the possession did not imply the use of the tool for agriculture purpose. For instance, study on Kapurthala by Sharma et al. (2012) found that every farm family was possessing the television set but its use was only about 49 per cent for watching agricultural related programmes. Same was the case with Personal computer as well. Hence the access was assessed by the number of ICT tools and the level of access of information (related to agricultural practices). The features of cognitive access, physical access, financial access, embedded access and content access is observed across the two villages. However, these observations do not signify that the level of access has reached the pinnacle. Most of the farmers are still undergoing the transition and so work has to be done as part of the extension exercise to make sure that respondents could cross the digital barriers.

The competency level has been found to be having a relation w.r.t. all the socio-economic factors taken into consideration for the study. However, through the analysis it was evident that in case of these two villages it is the number of years of education, presence of non-farm income and the wealth rank of the individual which plays a major role in determining the competency. Since the wealth ranks are for a local setting, hence comparison of the two villages would not be possible across the two settings. The education factor is common to all across the area, so the competency level of the village Dumukipur is less as compared to the village Otarakhera, since more percentage of individuals are there in the level one in the Village Dumukipur as compared to Otarakhera. In case of competency level, in Dumukipur

village the land size along with level of education and wealth rank are the determinant factors. In Dumukipur village the farmers have a lower land size level. As per the mean levels, an average farmer in Dumukipur falls under the category of marginal farmer where as in case of Otrakhera an average farmers' touches the small holder's margin. The other reason which could be valid in this case is the intervention of the local extension workers especially towards the marginal farmers. From the results it is evident that the access and competency differed across the socio-economic background. However, there are other factors which affect the ICT usage as well.

Conclusion

The two study villages have similar socio-economic profile in the area. Both have small and marginal landholders, the average farming experience is also similar, the years of education in case of Dumukipur is a unit less compared to Otrakhera. The percentage of families having non-farm income source along with farm-based income is also different with more number of such families present in Otrakhera. From the two villages, it was found that in Dumukipur the number of ICT tools used and the access level of information for the use of agricultural purpose is dependent on the level of education but the dependence is not so significant as compared to Otarakhera. The low levels of Adjusted R square determine the fact that the socio-economic parameters like education, farm size, farming experience wealth rank does not necessarily decide the no of tools used and the level of access in Dumukipur. However, the possession of ICT tools is related to the fact that whether the household has income source from non-farm activities or not. This implication comes from the fact that the KVK has been effective in the TOT (transfer of Technology) mechanism in the area. In case of Otarakhera village the scenario is different. The village data has shown a significant association with age and level of education w.r.t no of ICT tools used and levels of education w.r.t. level of access. The level of education is another factor which determines that more

educated individuals/farmers have more knowledge about the use and benefits of ICT hence are more inclined towards. The study tries to understand the case of competency and level of access in rural area by taking the case of two villages. The findings show the importance of local extension workers in improving the ICT access and the competency levels. The local extension bodies hold the key to digital revolution in agriculture sector. However, the one important factor is to look more into the case of 'sub-divisions' among the existing groups. This is very important for the spread of ICT tools, information access which ultimately leads to sustainable development of the agricultural sector. Hence, it is suggested that, in order to acquire a more nuanced account of the 'sub-divides' within rural areas, future research will have to address issues such as the 'second level divide'. It is recommended that future research may focus on addressing the 'second-level divide' within rural communities, particularly examining sub-divisions among smallholder farmers to better understand disparities in ICT access and competency. Strengthening local extension services should be prioritised and target interventions that consider socio-economic differences, particularly education levels and non-farm income sources, to ensure equitable access and effective use of ICT tools for agricultural development.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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