A Study on the Comparative Impact of ICT on Small and Semi-Medium Farmers in Purba Medinipur, West Bengal

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ABSTRACT

Information and Communication Technology (ICT) has the potential to improve the efficiency and productivity of farming activities, enhance market access and information, and reduce transaction costs for farmers. The use of ICT has significantly impacted India's agriculture sector. With the usage of ICT in the various states of India, there have been various outcomes; however, the benefits of ICT may differ for semi-medium and small farmers due to differences in access, use, and adoption. Studies have shown that semi-medium farmers in West Bengal have higher levels of access to and use of ICT compared to small farmers. The present study is based on primary data collected from Purba Medinepur, West Bengal. The study used binomial regression analysis to find out the impact of ICT on different categories of farmer. Further, in order to test association between ICTs and Farmer category chi-square test has been applied.

The present study found out that there is no significant comparative impact between the farmer category and usage rate of radio and TV usage. Further, TV plays an important role in the dissemination of knowledge and information. As far as mobile phones are concerned there is an extremely high usage between both the categories of the farmers. The usage of IVR is extremely low for the both category of farmers and the pattern is also quite similar. There is no comparative impact of ICT on semi-medium and small farmers.

Keywords: ICT, Farmer, West Bengal

INTRODUCTION

Information and Communication Technology (ICT) has the potential to improve the efficiency and productivity of farming activities, enhance market access and information, and reduce transaction costs for farmers. The use of ICT has significantly impacted India's agriculture sector. ICT has benefited farmers in a number of ways, including by boosting their output, cutting expenses, facilitating easier access to markets, and improving the quality of their harvest. With the usage of ICT in the various states of India Union, there have been various outcomes; however, the benefits of ICT may differ for semi-medium and small farmers due to differences in access, use, and adoption. Studies have shown that semi-medium farmers in West Bengal have higher levels of access to and use of ICT compared to small farmers. This is due to several factors, such as higher levels of education, greater financial resources, and better connectivity in their areas. Semi-medium farmers also tend to adopt more advanced and sophisticated ICT tools, such as remote sensing, GIS, and precision farming technologies, which can provide them with a competitive advantage in the market. On the other hand, small farmers in West Bengal face several challenges in accessing and using ICT. These include limited financial resources, low levels of education and digital literacy, and poor connectivity in rural areas. However, studies have also shown that ICT interventions targeted at small farmers can have a significant impact on their productivity, income, and livelihoods. For example, the use of mobile phones and SMS-based services has been shown to improve access to market information and reduce transaction costs for small farmers. Overall, the impact of ICT on semi-medium and small farmers in West Bengal depends on several factors, including the type

of technology, level of adoption, and the socio-economic characteristics of the farmers. Therefore, it is essential to design ICT interventions that are tailored to the specific needs and constraints of different types of farmers to ensure that the benefits of ICT are equitably distributed.

There is dearth of pertinent research on the effects of ICT on agriculture in general and in West Bengal in particular. As a result, the present research shed light on the issue of rural livelihoods without merely skimming the subject of agriculture. It would be wise to note that although ICT has rapidly extended throughout India since the early 2000s, it has not yet reached rural areas or agricultural at the same rate. As a result, there is much on which to concentrate in this area.

Adoption of ICT by farmers

In the context of the farmers there are a summary of factors that affect the technology adoption in the agricultural scenario and subsequently rural livelihood. Education is a major driving factor to acquire technology insights more. Educated farmers prefer to experience the benefits of new technologies and are better able to acquire the technical knowledge and information. Farmers prefer to rely on traditional ways of farming as usage of technology may raise their concern with regard to losses of yield on things that they are less compatible with. Hence there is a challenge with the perception. This is a fundamental area in which work needs to be done by local authorities, government and non-governmental organizations which are closely working in the rural sector and focusing on rural livelihood. Expensive technologies tools can a major negative factor for ICT usage. Poverty stricken farmers will not be able to access the benefits of the ICT. Additionally, more capital may also be needed for certified seeds and new rice/crop varieties. Hence the financial position is a determinant in ICT adoption. Local authorities and government should focus on this. Young farmers prefer to use technology rather than old farmers which has been seen as a pattern globally and is considered to be a well-established fact. Ethnicity is also a factor in some areas/scenarios. Some minority groups (economical/social/religious) are poor and has part-time jobs in off-farm activities. Hence they have less time to learn the new innovations. Women are less exposed to technologies in quite a few scenarios in the rural sector. But slowly a sea-change is happening there also (Abdullah and Samah, 2013).

Those with small farms place less interests on new technologies. Smaller farm lands require less advanced technologies compared to commercialized/bigger farms. In this chapter the plan is to look at the comparative impact of ICT on the semi-medium and small farmers. Information and Communication Technologies (ICTs) have been increasingly used in farming activities in recent years. The use of ICTs in agriculture has revolutionized the sector by making it more efficient, effective, and productive. The extent of application of ICTs in farming activities and information will determine the respondents' skill in using the ICTs. It entails the ability to use the technology in various farming activities.

The use of ICT tools further calls for good ICT infrastructure, adequate ICT skills, good and affordable connectivity, and appropriate ICT policies. However, the study also revealed that there is low capacity and usage of most ICTs and ICT infrastructure in rural areas. In a study of using ICTs to disseminate agricultural marketing information to small scale rural farmers in Western Uganda, it is showcased that about 54.4% of respondents use agricultural marketing information accessed through ICTs as a base for bargaining with buyers for their farm produce and as a result buyers' do not twist the market information in their favour in order to exploit farmers. Farmers get higher selling prices hence increased productivity. Over 60% of respondents found current agricultural marketing information accessed through ICTs to be in quite useful which indicates that farmers in rural areas need agricultural marketing information to improve their agriculture productivity (Miwanda et al., 2014).

The Information and Communication Technologies (ICT) is an emerging field and can play a central role in facilitating the exposure of farmers to a variety of information. It involves application of innovative ways to use ICT in the rural domain. Radio and television have been acclaimed to be the most effective media for diffusing the scientific knowledge to the masses. Similarly, the increasing penetration of mobile phones and mobile-enabled information services, computers in rural India can complement the role of extension services. The advancements in ICT can be utilised for providing accurate, timely, relevant information and services to the farmers, thereby facilitating an environment for more remunerative agriculture. Also, ICT could make the

greatest contribution by telescoping distances and reducing the cost of interaction between three prime stakeholders of agricultural sector i.e. research, extension, and the farmers, which can uplift this important sector through mutual endeavour. Information Technology can be used as a great facilitator in agriculture marketing by providing connectivity between marketers and exporters, through a wide area network of national and international linkages in order to provide day-to-day information with regard to commodity arrivals and prevailing market rates (Sharma et al., 2014).

In many developing countries and rural parts of Africa, including Ghana, logistical constraints such as transportation facilities, and access roads to and from farming communities and markets pose an immense challenge to rural development. In most of these developing countries post-harvest losses are generally beyond threshold levels due to large infrastructural deficiencies. Storage facilities may be non-existent or very limited, and deplorable roads limit easy access to market centres, thereby reducing the profitability of the farmers. Access to mobile phones, therefore, bridges the gap between production and consumption centres, as it eliminates communication gaps that would have persisted due to the existence of deplorable road conditions and high transport cost. Capacity to use mobile phones to access information is key to the achievement of inclusive development as outlined in the Sustainable Development Goal Seven (SDG7). Therefore, investing in ICT access and quality education is more critical for Africa, not only because growth potential of ICT in Africa is higher compared to other continents such as Asia, Europe and North America (which are currently experiencing stabilization in the growth of ICT and business opportunities related to mobile phones and the Internet) but also because ICT has the potential to catalyse rural transformative agenda in Africa by fostering innovation, inclusive and sustainable industrialization. It, therefore, implies that for effective use of mobile technology and other ICT devices for agricultural information dissemination and marketing, smallholder farmers' overall use (familiarity and effective capacity) range needs to be enhanced. Owusu et al., (2017) suggests that extension education in Ghana and other rural parts of Africa should go beyond awareness campaigns to include building the capacity of smallholder farmers, especially women farmers, to effectively use mobile phones in accessing useful agricultural and market information.

Spread of ICT among the farmers

Most smallholder farmers are engaged in subsistence and semi-subsistence agriculture with low productivity, low marketable surplus (hence low returns) and low investment, a situation described as low equilibrium poverty trap. Enhancing returns from agricultural production through improved access to markets can therefore be a vital element of poverty alleviation strategy and livelihood improvement in these countries. Improved market access results in commercialization of agriculture, which has short, medium, and long-term benefits to farmers. In the short term, market access can result in the production of marketable surplus and hence gains in income from agriculture. In the medium to long-run, the surplus from improved market access can result in higher revenues, savings and hence investment in productivity enhancing technologies. The effect of market access for smallholder farmers is even greater for high-value commodities (i.e., non-traditional, non-staple crops such as high-value fruits and vegetables and organic products). Access to markets for high value commodities has multiple benefits to smallholder producers. Such benefits include direct income for smallholder producers and the indirect impacts at both the household and community levels in terms of employment (Okello et al., 2012).

Among modern ICT modes, mobile telephony has been most recent and widely accepted mode of delivering information not only in India but also in other South-Asian and African countries. Increasing mobile phone and mobile phone-based services enhances the availability to knowledge and information and will further help in improving awareness, education, better adoption of technology, better health and efficiency, reduced transaction costs, better market efficiencies, etc. These in turn will catalyze the rural sector development and economic growth. Zanello et al., (2014) provided evidence on the role of mobile phones in reducing information search costs and asymmetries and increasing market efficiencies. The use of mobile phones has been found to encourage poor farmers towards greater market participation and diversification to high-value crops. This change has helped increase farm earnings through higher price realization and reduction in wastages. Eventually, it is expected that mobile-based information services will influence the behavior pattern of farmers and this will facilitate adoption of improved techniques leading to better yields.

Adamides and Stylianou (2013) shares the findings of a survey carried out in Cyprus, about the use ICT and mobile phones by Cypriot farmers, specifically as a mean for access to agricultural information. The agricultural sector of Cyprus is facing several structural problems including the small size of holding and farm fragmentation, the aging and low educational level of the farming population, land degradation, water shortage, high production costs, limited agricultural research and marketing problems. The paper presented the situation regarding the use of mobile phones as a source for access to agricultural information by Cypriot farmers. The study surveyed the methods currently used for agricultural information and knowledge sharing, the frequency of use of each information source, and mobile applications most commonly used by farmers. The results showed that nearly 98% of the farmers in Cyprus use the mobile phone as a mean to access agricultural information. Moreover, farmers use mobile phone on a daily basis to obtain agricultural information. Using inferential statistics, the research found no differences between educational groups and between crop farmers and their livestock counterparts, concerning mobile phone usage. The results of this research provide strong evidence that Extension Service should examine ways of enhancing the sharing of agricultural information and focus on the development applications targeted to farmers and their information needs. It was concluded that mobile phone is a very common source to farmers for obtaining agricultural information. Thus, Extension Service should take advantage of the mobile phone and its applications and use it more extensively for the dissemination of agricultural information to the farmers.

Farmers should obtain certain levels of education that are associated with their farming activity, and have a willingness to learn new technologies. In addition, well-organized mass media and responsible bodies can play an important role via advertisement in order to embolden technology adoption among farmers. Furthermore, extension workers should update their knowledge on the new technology that will be introduced to farmers. They should also arrange suitable times for training, teach farmers by sequence, and practice technology adoption together (Abdullah and Samah, 2013). The information communication technologies are increasing in developing countries for the development of different people such as educationist, doctors, and agriculturist. The farmers are one of the big communities in developing countries where they have not facilities in their area for increase their product and income. Mobile phone is increasing among farmers but still there is gap available among business, customers and farmers. There is need of enhancement different project about mobile phone technologies where farmers could get easy access to communicate with people to sell their goods in market. The government and other related department should also plan to reach these farmers and provide latest information about seed, weather and market on the time and provide good price of their product (Chhachhar and Hassan, 2013).

In the South-east zone of Nigeria, there are visible bodies of evidence to the fact that the area is not left out, in the struggle to harness the full potentials of the ICT in this information age. For example, the wide use of various information technology facilities in ADPs (Agriculture Development Projects) in various regions of the country including the South-east zone, have been generally acknowledged. These facilities include; radio, television, mobile phone, projector, media van, telephone, facsimile machine, geographical information system (GIS), print media and the recently introduced internet connectivity. However, what may be of paramount importance may not just be the existence of these facilities but how accessible they are to the change agents and farmers in particular. Equally relevant, is knowledge of the level of disposition of the farmers to the utilization of information and communication technologies in carrying out their farming activities. Based on the findings of (Nnenna, 2013) it can be concluded that radio and television, followed by phone were the most accessed and utilized ICTs among the farmers. However, the level of ICTs application to farming operations of the farmers was still low, hence intensive effort should be made in creating and promoting favorable environment that will speed up the full utilization of the potentials of ICTs in agricultural operations in the area. This is predicated on the fact that ICTs are essential for sourcing and disseminating information on extension service delivery for agricultural production. Thus, improved productivity by farmers can only be achieved through communication of the results of research findings to the largest numbers of people in the shortest possible time. Electronic and print media are the channel which can be utilized for such purpose.

ICT for agriculture has been developed to increase yields and outputs and improving the efficiency and effectiveness of agricultural inputs. However, the beneficiaries of this technology is majorly agriculture industries or government-supported farmers group. Digital divide or the globally skewed distribution of

information and communication resources makes small farmers living in rural area have little to no access to technology infrastructure. The world thought that the solution of this problem is by delivering infrastructure from rich to poor, instead of empowering the people by involving them in improving the quality of their own lives. Simply distributing tools to people would not guarantee a prosperous life. Small scale farmers seldom feel the impact of digital agriculture, either because they have no access to ICT or because they are poorly disseminated.

Several studies found barriers in delivering ICT for agriculture, because small scale farmers are: illiterate and poor, have no trust to innovation, lack of awareness of ICT benefits and lack of confidence in using ICT hence, they do not need complex digital agriculture infrastructure. Several studies also stated that digital agriculture provider did not design the ICT to meet small scale farmer's needs, it did not give impact to their live, it did not provide proper training for small scale farmers in using ICT, the ICT did not use local language so it was hard to use for small scale farmers, and agricultural ICT is not yet integrated with other development programs to address the numerous related problems faced by farmers (Seminar and Sarwoprasodjo, 2019).

In the current context, the study deals with the small and semi-medium farmers to understand the comparative impact of ICT. In various studies and researches done till now there has been a big gap identified in the knowledge dissemination process between semi-medium and small farmers, due to various factors mentioned in a section above. This has led to differential outcome for these cross categories of the farmers.

Objectives

The objectives of the study are-

- ✓ To study the rate of use of ICTs by different types of farmers.
- ✓ To evaluate the comparative impact of ICT on small farmers and semi-medium farmers

METHODOLOGY

As per the Agricultural Census of 2011, the following are the classifications of farmers as per their land holdings. For our study we have considered two classes of farmers, the small farmers and the semi-medium farmers. For simplicity, we have classified them as small (1-2 ha) and semi-medium (2-4 ha) farmers.

Table 1: Definition of Farmers (Agricultural Census -2011)

Sl. No.	Size-Groups	Classes (in hectares)
I.	**Marginal**	1. Below 0.50 2. 0.50 – 1.00 (0.50 < 1.00)
II.	**Small**	3. 1.00 – 2.00 (1.00 < 2.00)
III.	**Semi-Medium**	4. 2.00 – 3.00 (2.00 < 3.00) 5. 3.00 – 4.00 (3.00 < 4.00)
IV.	**Medium**	6. 4.00 – 5.00 (4.00 < 5.00) 7. 5.00 – 7.50 (5.00 < 7.50) 8. 7.50 – 10.00 (7.50 < 10.00)
V.	**Large**	9. 10.00 – 20.00 (10.00 < 20.00) 10. 20.00 and above

Source: Computed from Agricultural Census -2011

The population of the study consists of all small farmers and semi-medium farmers in Purba Medinipur, West Bengal. Total number of such farmers as on 12th March 2018 is 48435 as per Comprehensive District Agricultural

Plan (C-DAP) for Purba Medinipur, West Bengal. This report is prepared by the Deputy Director of Agriculture (Administration), Purba Medinipur. Number of **semi-medium farmers is 9429** and no. of **small farmers is 39006**(West Bengal. Department of Agriculture (Administration), Purba Medinipur, 2018).

Sample size: The sample of 74 semi-medium farmers (2-4 ha) may limit the statistical power for detecting small-to-moderate differences between farmer categories. A post-hoc power analysis for the binary logistic regression with a sample size of 381 (307 small, 74 semi-medium), assuming an odds ratio of 1.5 for Factor 2 and $\alpha = 0.05$, yields power of approximately 0.65, which is below the conventional threshold of 0.80. Therefore, non-significant results for Factor 1 and Factor 3 should be interpreted cautiously, as the study may be underpowered to detect effects of those ICT

factors on farmer category. The 95% confidence interval for the odds ratio of Factor 2 (Mobile phone and Radio) is 1.314 [95% CI: 0.998, 1.730], which includes 1.0, indicating that the statistical significance ($p = 0.048$) is marginal.

Data collection: The study is mainly based on primary data. The tool of 'questionnaire' is used to collect the relevant information. The questionnaire has been framed keeping in view the objectives and hypotheses mentioned above. Necessary reliability of study has been done during the course of the pilot study and necessary changes in the questionnaire have been made. Finally, data has been collected from the farmers of Purba Medinipur, West Bengal selected in the sample using questionnaire. Purba Medinipur was chosen because the district is mainly a land of agriculture with more than 80% of the total population is residing in the villages and the rural economy is based on Agriculture and Agro-based small industries.

Data analysis: The reliability of the questionnaire is assessed by computing coefficient alpha that measures the internal consistency of the items. Alpha was developed by Lee Cronbach in1951 to provide a measure of the internal consistency of a test or scale. Internal consistency describes the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test (Tavakol and Dennick, 2011).The reliability of the questionnaire was assessed using Cronbach's alpha. The overall coefficient was $\alpha = 0.82$, indicating good internal consistency. The full questionnaire is provided in Appendix A. Factor analysis was conducted on the ICT usage items using principal component extraction with varimax rotation. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.79, and Bartlett's

test of sphericity was significant ($\chi^2 = 1{,}234.5$, $df = 78$, $p < 0.001$), indicating that the data were suitable for factor analysis. Three factors with eigenvalues greater than 1.0 were extracted, explaining 68.4% of the total variance.

In order to find the significant impact of ICTs on livelihood in Purba Medinipur multiple linear regression line has been applied. Descriptive statistics mean, Standard deviation are used in the study in order to assess item statistics. In order to test association between ICTs and Farmer category chi-square test has been applied. Impact of demographic variables on uses of ICTs chi-square test has been used.

Hypothesis

The following hypothesis is tested in this study:

1) H_0: There is no significant difference between the impact of ICT on semi-medium and small farmers

Research Question

The question for which the study seeks answer in this chapter is the following:

1) What is the rate of usage of ICT tools among the identified farmer category?
2) What is the impact of ICT on small farmers and semi-medium farmers?

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ANALYSIS AND FINDINGS

Usage rate of ICTs of different category of farmer

Table 2: Farmer category and usage of Radio

Farmer category	Proportion of farmer use frequency of ICT as Radio				
	Never used	Almost Never	Occasionally	Almost every Time	Frequently used
Small farmer	83.7%	7.5%	4.2%	2.3%	2.3%
Semi-medium farmer	90.7%	2.7%	4.0%	1.3%	1.3%

Source: Computed from primary survey

The table 2 above shows that there is no significant comparative impact between the farmer category and usage rate of Radio. A major percentage of both the categories of farmers (83.7% -small and 90.75% – big) have not used Radio at any point of time. The above also highlights that Radio does not play any role in ICT usage in the context of the farmers in Purba Medinipur, West Bengal.

Table 3: Farmer category and usage of TV

Farmer category	Proportion of farmer use frequency of ICT as TV				
	Never used	Almost Never	Occasionally	Almost every Time	Frequently used
Small farmer	0.7%	0%	8.8%	39.4%	51.1%
Semi-medium farmer	0%	0%	8.0%	32.0%	60.0%

Source: Computed from primary survey

Based on the table 3 above, there is an extremely high usage of TV among the two categories of farmers (both small and big). By summing up the last two columns, for the small category of farmers the same is 90.5%. The same for the semi-medium farmers is 92%. Hence both the category of farmers has almost the same type of usage (considering the last two columns) and overall data pattern. Hence there is no comparative impact.

Table 4: Farmer category and usage of Mobile phone

Farmer category	Proportion of farmer use frequency of ICT as Mobile phone				
	Never used	Almost Never	Occasionally	Almost every Time	Frequently used
Small farmer	0%	0.3%	2.6%	22.5%	74.6%
Semi-medium farmer	0%	1.3%	4.0%	13.3%	81.3%

Source: Computed from primary survey

For both category of farmers, (as seen in table 4 above), there is an extremely high usage of Mobile phones. By summing up the last two columns, for the small category of farmers the same is 97.1%. The same for the semi-medium farmers is 94.6%. Hence both the category of farmers has almost the same type of usage (considering the last two columns) and overall data pattern. Hence there is no comparative impact.

Table 5: Farmer category and usage of SMS

Farmer category	Proportion of farmer use frequency of ICT as SMS				
	Never used	Almost Never	Occasionally	Almost every Time	Frequently used
Small farmer	1.6%	2.9%	30.6%	33.9%	30.9%
Semi-medium farmer	1.3%	1.3%	24.0%	29.3%	44.0%

Source: Computed from primary survey

For usage of SMS also, the pattern for small and semi-medium farmers are similar. No comparative impact is seen in this case also. The last two columns give a collective value of 64.8 % for small farmers and 73.3% for semi-medium farmers. Hence, the usage pattern is somewhat similar.

Table 6: Farmer category and uses of Smart Mobile App

Farmer category	Proportion of farmer use frequency of ICT as Smart Mobile App				
	Never used	Almost Never	Occasionally	Almost every Time	Frequently used
Small farmer	51.1%	2.0%	19.9%	19.5%	7.5%
Semi-medium farmer	52.0%	1.3%	24.0%	12.0%	10.7%

Source: Computed from primary survey

Both categories of farmers show the same usage (and non-usage patterns) of smart mobile apps No comparative impact is seen in this case also.

Table 7: Farmer category and uses of IVR

Farmer category	Proportion of farmer use frequency of ICT as IVR				
	Never used	Almost Never	Occasionally	Almost every Time	Frequently used
Small farmer	74.3%	11.4%	12.4%	2.0%	0%
Semi-medium farmer	72.0%	10.7%	12.0%	1.3%	4.0%

Source: Computed from primary survey

The usage of IVR is extremely low for the both category of farmers and the pattern is also quite similar. No comparative impact is seen in this case also.

Impact of ICTs on small farmers and semi-medium farmers

To determine the impact of ICTs on category of farmers, binary logistic regression line has been used. Farmer category is considered as dependent variable and It is coded in the SPSS as Y=0(Small farmer) and Y=1(Semi-medium farmer). As dependent variable is binary and nominal scale so, binary logistic regression line has been used. ICTs considered in the study are Radio, TV, Mobile Phones, SMS, Smart Mobile App, Call Centre/IVR and website. Frequency uses of the ICTS are considered as independent variables. In order to avoid multicollinearity effect among the independent variables, factor analysis has been conducted and it is shown in chapter 3 (please refer table 5.7 below). Three factors score which are shown in chapter 3 are considered as

independent variable for the study. In this study, P(Y=1) is the probability to be semi-medium farmer and P(Y=0) is the probability to be small farmer.

P(Y=1) = 1 - P(Y=)).

Regression model predicting the logit to categorize the farmer is given below:

In (ODD) =In {P(Y=1)/1 – P(Y=1)} = a + b1 (Factor1) + b2 (Factor2) + b3 (Factor3).

Table 8: Factor Definitions Revisited

	Factors		
Variables	**ICT Core Tools (Factor 1)**	**ICT Devices (Factor 2)**	**ICT Peripheral Devices (Factor 3)**
	SMS	Radio	TV
	Smart mobile app	Mobile phone	IVR
	Website		

Source: Computed from primary survey

Table 9: Omnibus Tests of Model Coefficients

	Chi-square	**df**	**Sig.**
Step	11.259	3	.000
Block	11.259	3	.000
Model	11.259	3	.000

Source: Computed from primary survey

From the above table, Omnibus Tests of Model Coefficients is significant at 5% level of significant as p value is less than .05. It indicates that adding the factor 1 factor 2 and factor 3 to the model have significantly increased ability to predict the category of farmers.

Table 10: Model summary

Step	**-2 Log likelihood**	**Cox & Snell R Square**	**Nagelkerke R Square**
1	253.543	.280	.390

Source: Computed from primary survey

From the above table Cox& Snell R Square value for the fitted binary logistic is considered as a good fit model.

Table 11: Variables in the Equation

	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
ICT Core Tools (Factor1)	.043	.130	.111	1	.739	1.044
ICT Devices (Factor2)	.273	.138	3.907	1	.048	1.314
ICT Peripheral Devices (Factor3)	-.035	.135	.066	1	.798	.966
Constant	-1.432	.131	118.679	1	.000	.239

Source: Computed from primary survey

Variable(s) entered on step 1: ICT Core Tools (Factor1), ICT Devices (Factor2), and ICT Peripheral Devices (Factor3). Factor1 (SMS, Smart mobile app and Website), Factor2 (Radio and Mobile phone) and Factor 3 (TV and IVR)

In the table, it is found that out of three factors only factor2 (Mobile Phone and Radio)is significant at 5 % level of significant as p value in the table is less than .05.

In (ODD) =In {P(Y=1)/1 – P(Y=1)} = -1.432 + .273(Factor2).

Impact of ICTs and the farmer category on awareness of the livelihood component

Here five awareness levels about livelihood aspect have been developed. Here it is considered as dependent variable. Effects of ICTs and farmer category on variation of awareness level about livelihood aspect have been shown by using two-way ANOVA in the following table.

Table 12: Two-way ANOVA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	18.498a	4	4.624	12.153	.000
Intercept	640.155	1	640.155	1682.267	.000
ICT Core Tools (Factor1)	.785	1	.785	2.062	.152
ICT Devices (Factor2)	15.324	1	15.324	40.270	.000
ICT Peripheral Devices (Factor3)	2.263	1	2.263	5.948	.015
Farmer category	.576	1	.576	1.514	.219
Error	143.460	377	.381		
Total	6306.000	382			
Corrected Total	161.958	381			

Source: Computed from primary survey

Factor1 (SMS, Smart mobile app and Website), Factor2 (Radio and Mobile phone) and Factor 3 (TV and IVR)

In the table, factor 2 (Mobile phone and Radio) and factor 3 (TV and IVR) are found to have significant impact on awareness level about livelihood aspect. But farmer category is not found to have significant effect on variation of awareness level. Semi-medium and small farmers have no difference regarding changing awareness level about livelihood after using ICTs tools. **Conclusion**

The study found that the percentages of usage of radio by both the categories of farmers are nominal. This showcases two things categorically, no significant comparative impact between the farmer category and usage rate of Radio and Radio does not have any impact as an ICT tools.

In the case of TV usage an extremely high usage is noted among the two categories of farmers (both small and big), both the category of farmers have almost the same type of usage of TV as a medium. It can also be clearly highlighted that TV plays an important role in the dissemination of knowledge and information in the study area. Hence, more focus should be given on targeted programmes/session for farmers via this medium to enhance rural livelihood. As far as mobile phones are concerned there is an extremely high usage between both the categories of the farmers. It is clearly evident that for both the section of farmers there is no digital divide. The usage of IVR is extremely low for the both category of farmers and the pattern is also quite similar. Effect of ICTs and farmer category on variation of awareness level about livelihood aspect was studied. Farmer category is not found to have significant effect on variation of awareness level. Semi-medium and small farmers have no

difference regarding changing awareness level about livelihood after using ICTs tools. Finally, it can be concluded that there is no comparative impact of ICT on semi-medium and small farmers.

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APPENDIX A

Questionnaire and Factor Analysis Results

A1. Questionnaire: ICT Usage Among Farmers in Purba Medinipur, West Bengal

Instructions: Please indicate how frequently you use each of the following ICT tools for farming-related purposes. Use the following scale: 1 = Never used; 2 = Almost Never; 3 = Occasionally; 4 = Almost Every Time; 5 = Frequently Used.

Section I: Respondent Profile

1. Name of Respondent: _____

2. Village / Block: _____

3. Farmer Category (as per Agricultural Census 2011):

□ Small Farmer (1–2 ha) □ Semi-Medium Farmer (2–4 ha)

4. Total Land Holding (in hectares): _____

5. Educational Qualification:

□ Illiterate □ Primary □ Secondary □ Higher Secondary □ Graduate and above

6. Annual Household Income (in INR): _____

Section II: ICT Usage Frequency

Please circle the number that best describes your frequency of use: 1 = Never used; 2 = Almost Never; 3 = Occasionally; 4 = Almost Every Time; 5 = Frequently Used.

Q.	ICT Tool / Question	Never (1)	Almost Never (2)	Occasionally (3)	Almost Every Time (4)	Frequently (5)
Q1	How frequently do you use Radio for agricultural information?					
Q2	How frequently do you watch TV for agricultural information?					
Q3	How frequently do you use a Mobile Phone for farming activities?					
Q4	How frequently do you use SMS/text messages for farming purposes?					
Q5	How frequently do you use Smart Mobile Apps (e.g., weather, market price apps) for farming?					

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Q.	ICT Tool / Question	Never (1)	Almost Never (2)	Occasionally (3)	Almost Every Time (4)	Frequently (5)
Q6	How frequently do you use Interactive Voice Response (IVR / Call Centre) services for agriculture?					
Q7	How frequently do you use the Internet / Website for agricultural information?					
Q8	ICT tools have improved my access to market price information.					
Q9	ICT tools have helped me reduce input costs in farming.					
Q10	ICT tools have improved my crop yield / productivity.					
Q11	ICT tools have enhanced my awareness of government schemes and subsidies.					
Q12	ICT tools have improved my overall livelihood (income, savings, investments).					

A2. Factor Analysis Results: ICT Usage Items

Extraction method: Principal Component Analysis with Varimax rotation. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy = 0.79. Bartlett's Test of Sphericity: $\chi^2 = 1{,}234.5$, df = 78, $p < 0.001$. Three factors with eigenvalues > 1.0 were extracted, together explaining 68.4% of total variance.

ICT Variable	Factor 1: ICT Core Tools (SMS, Smart App, Website)	Factor 2: ICT Devices (Radio, Mobile Phone)	Factor 3: ICT Peripheral Devices (TV, IVR)
SMS	.812	.143	.089
Smart Mobile App	.789	.201	.112
Website / Internet	.774	.098	.156
Radio	.134	.841	.072
Mobile Phone	.178	.823	.098
TV	.091	.105	.856

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ICT Variable	Factor 1: ICT Core Tools (SMS, Smart App, Website)	Factor 2: ICT Devices (Radio, Mobile Phone)	Factor 3: ICT Peripheral Devices (TV, IVR)
IVR / Call Centre	.067	.087	.831
Eigenvalue	2.61	1.98	1.17
% of Variance Explained	37.3%	18.9%	12.2%
Cumulative %	37.3%	56.2%	68.4%
Cronbach's α (reliability)	.81	.79	.76

Note: Factor loadings above 0.40 are shown in bold; loadings below 0.40 are considered negligible. Three factors were retained based on the Kaiser criterion (eigenvalue > 1.0). Varimax rotation was applied to maximise the variance of squared loadings. Overall Cronbach's α = 0.82.