A Critical Analysis of Agricultural Information Communication Technology (ICT) Projects in India: Implications for Developing World

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ABSTRACT. The new agricultural paradigm necessitates the use of Information Communication Technologies in Agricultural Extension systems. For developing strategy, the existing isolated ICT projects need to be studied critically on some parameters. Such critical issues include process impacts, factors related to farmers influencing the success of ICT project, effectiveness of functionaries involved in such projects. To investigate into these researchable issues, the present study was carried out. For conducting the present research, three major Agricultural ICT projects were selected namely Gyandoot Project (Madhya Pradesh), Warna Wired Project (Maharashtra) and Ikisan Project (Andhra Pradesh). The sample respondents were drawn from user farmers and project functionaries of the three projects. Data related to the process impacts, various factors related to farmers, their information needs and effectiveness of functionaries were collected. Analyses of process impacts revealed that these projects have made effective contribution and were adequately equipped in carrying out the activities. It was found that majority of the users were small and marginal farmers. The study outlined the important information needs for these three different regions of India. The study also revealed that irrespective of computer illiteracy, ICT could be harnessed effectively with the human interfaces in the form of functionaries at kiosks. The effectiveness of the functionaries was found to be moderate to high. Based on the study it is recommended that, government should take up ICT initiatives in large scale to back-up resource poor farmers. Future initiatives should have effective functionaries who have high orientation towards ICT extension, faith in people and basic agricultural education. It is also recommended that similar research need to be carried out extensively to evolve a platform to design strategies in developing world to harness ICT in agricultural development.

INTRODUCTION

Access to Information and Communication Technologies (ICT) implies access to the channels and modes of communication that are not bound by the barriers. New forms of social organizations and of productive activity emerge, which if nurtured, could become transformational factors as important as the technology itself (IDRC, 1996).

The Information and Communication Technologies (ICTs) can create new opportunities to bridge the gap between information haves and information have-nots in the developing countries (Government of India (GOI), 2000). The task force on India as Knowledge Superpower (GOI, 2001) emphasized the need to harness ICTs for

societal transformation. The agriculturally rich developing countries like India cannot overlook agriculture in such transformation. The emerging ICTs have significant role to perform in agricultural development, as was evident from the interdisciplinary dialogue on Information Technology: Reaching the Unreached (Swaminathan, 1993). Use of ICTs in agricultural and rural development was explained by Richardson (1996). There are many possibilities of incorporation of ICTs in agricultural extension, for the overall agricultural and rural development (Zijp, 1994).

In spite of the tremendous potentials of ICTs in agricultural development, the developing countries have not adapted a sound strategy in harnessing ICTs. There have been some isolated ICT projects initiated in the developing world to harness ICT in agricultural development on location specific basis. But, there is not enough effort to formulate a strategy for incorporating ICTs in agricultural extension systems. For evolving such a strategy, agricultural extension research has to be carried out to get the insights into working of such isolated ICT projects. Such extension research should focus on evaluation of process impacts of existing ICT projects, factors related to farming community influencing the success of such projects and effectiveness of functionaries involved in such projects (human interfaces).

In this backdrop, for the first time in India, the present research was conducted with the objectives of, to evaluate the process impacts of selected agricultural ICT projects of India, to study the factors related to farmers influencing success of such ICT projects and assess the effectiveness of grass root level ICT functionaries

METHODOLOGY

For conducting the study three ICT projects, out of six major ICT projects in India, were selected. The selection of the projects was purposive in nature. The ICT projects thus selected were; *Gyandoot* ICT Project in Madhya Pradesh State, *Warna* Wired village ICT Project in Maharastra State and *IKisan* ICT Project in Andhra Pradesh State.

These three ICT projects were purposively selected for the following reasons. To generalize the findings of any research, the research is supposed to be carried out in heterogeneous conditions. In India, the ICT initiatives for agricultural development can be broadly classified into three categories. They are Govt. initiatives, Cooperative initiatives and Private initiatives. Hence, for conducting the study, *Gyandoot* ICT project as Govt. initiated, *Warna* Wired Village ICT project as Cooperative initiated and *IKisan* ICT project as Private initiated were selected. Another reason was geographical and agro-climatic conditions under which they were operating. *Gyandoot* project was started in tribal dominated drought prone area. *Warna* project being operated in agriculturally prosperous area and *Ikisan* in agriculturally commercialised area.

All the farmers using the ICT services (irrespective of their level of usage) and the functionaries of these three projects constituted the population of the study. Out of that, 80 farmers and 60 functionaries from each project were randomly selected. Thus, the total sample comprised 240 farmers and 180 functionaries in the selected ICT projects.

Data Collection Tools

In order to collect relevant information, two types of structured interview schedules were developed. One schedule was meant for collecting data from the farmers and the second from the functionaries.

Variables and Measurement

Various variables to fit in line with the objectives were considered for this purpose. The variables and their measurement are mentioned below.

To evaluate the process impacts of ICT projects, Scott Mc Connel's Model (2001) was used for the first time in India. The model comprises indicators for the process impacts of the ICT projects. In the present study, several variables were studied such as number of farmers accessing services, gender equity, user equity, technical aspects, etc. To study factors related to farmers influencing the success of ICT projects, the variables such as frequency of use, computer literacy, landholding of farmers, information needs of farmers, goal commitment, age etc were studied. To assess effectiveness of functionaries, the variables such as effectiveness, orientation to ICT extension, training received, faith in people, professional qualifications in computer were considered. In the present study, effectiveness of the functionary with respect to his job refers to the extent to which he considers himself as a competent individual to carry out the job. For measuring effectiveness of functionaries the scale developed by Singh and Kumari (1997) was used with some modifications so as to fit into the context of ICT. The modified scale comprised 10 statements, each statement carrying five levels of responses with the scores ranging from one to five. The total score thus ranged from 10 to 50. For measuring orientation to ICT extension, orientation scale developed by Anil Kumar (1997) was used with some modifications. To assess faith in people, scale developed by Mehta (1989) was used. For other variables, schedules were developed. Method of Data Collection.

Each of the selected respondents (farmers, functionaries) was personally interviewed by the researcher using the two structured schedules. This was supported by the personal observations and informal talks. For collecting data related to process impacts, the official records of projects were also consulted.

Research Design and Statistical Analysis

Survey research design was used for the study. The data were entered and analysed using SPSS (Statistical Package for Social Sciences). Descriptive statistics (frequency tables, simple percentage, standard deviation, mean) and correlations were worked out for analysing and interpreting the data.

RESULTS AND DISCUSSION

The major findings regarding the process impacts of the three ICT projects based on the Mc Connel's Model (2001) are depicted in Table-1. Perusal of Table 1 reveals that, the number of farmers accessing the ICT services was found to be encouraging in all the three project areas. The user equity of the projects services was determined on two dimensions. One was gender equality among the users and the other

one was economic equality (based on poverty line). It was revealed that there was no user equity as far as gender was concerned, in all the project areas. For effectively harnessing the benefits of ICT services, the initiatives in developing countries should try to encourage participation of women in such initiatives. Interestingly, based on the poverty line (economic status), the user equity was found to be very high. From these ratios, it can be concluded, even though all the three projects were successful in reaching out to farmers below poverty line, the extent of penetration was relatively more in case of Government Project (*Gyandoot*) and Cooperative Project (*Warna* Project) compared to a Private Sector project (*Ikisan* project).

Table 1.   Process Impacts of ICT Projects Based on Mc Connell's Model.

Indicators	Gyandoot	Warna	Ikisan
Number of Kiosks	39	56	18
Number of farmers accessing ICT Services per week	2340	4250	810
User Equity Male to Female Ratio	85.5:14.5	86:14	98:2
Ratio between the Users from Below poverty line and Above poverty line	34:66	28:72	16:84
Degree to which ICT used as information gathering tool	Very Rare (Once a month)	Rare (Once a fortnight)	Rare (once a fortnight)
As information sharing tool	Very frequent (Once a day)	Very frequent	Very frequent
Technical Evaluation Data base Management System	Application Server Type	Application Server & Internet Server	Application Server and Internet Server
Local language software	Hindi	Marathi	Telugu
Network connectivity	Fiber Optics Wireless in local loop	Fiber Optics, wireless in local loop	Fiber optics, leased line
Scalability	21 to 39	51 to 56	9 to 18

Mc Connell's indicators revealed that the degree to which ICT is used, as an information-gathering tool was ranging from very rare to rare. Whereas ICT use as an information-sharing tool was 'very frequent'. The technical evaluation as per the Mc Connell's indicators revealed that the Data base Management System ·(DBMS), Connective aspects and the use of local language (vernacular) software were adequate and made the projects efficient. Interestingly, the scalability aspects were found to be encouraging in all the three projects. Within a short span of two years after the projects were initiated, the number of Kiosks (Computer Centres) were found to be increasing at a significant rate. In case of *Gyandoot*, the number of Kiosks was increased from 21 to 39, in *Warna* project 51 to 56 and in *Ikisan* the number rose from 9 to 18. This scalability revealed that because of the process impacts made by these projects, more and more number of Kiosks was being established by the projects. The important link in the whole chain of ICT networks and their applications are the ultimate beneficiaries of the ICT services i.e. farmers. Hence, the factors related to farmers are important to make any effort to incorporate ICTs in agricultural extension. Accordingly, the present

study focussed on age, economic status (land holding), frequency of use of ICT services, computer literacy and information needs of the farmers.

Distribution of the respondents is presented in Table. 2. The frequency distribution of ICT users was highly skewed towards younger age. In the total sample, about 38% of farmers belonged to young age and nearly 52% belonged to middle-aged group. However, the % of old farmers who were using ICT services was not insignificant. This is in fact, an encouraging sign. Another interesting finding, which has far reaching consequence particularly in the ICT initiatives of developing countries, is the distribution of farmer users based on landholdings. In the total sample, nearly 21% of the farmer users were possessing marginal land holdings and about 47% possessing small landholdings. The fact that 68% of the users of ICT services were small and marginal would shatter the myth that ICT is not for small and marginal. However, the % of small and marginal farmer users was lower in case of private ICT project i.e. *Ikisan*. Hence, there is a need to incorporate ICTs in Govt. agricultural extension system to develop a strong bias towards resource poor and marginal farmers.

Table 2.   Percentage Distribution of Farmers based on Age, landholding, frequency of use and computer literacy.

Variables	Gyandoot n=80	Warna n=80	Ikisan n=80	Total Sample n=240
Age				
Young (<35 years)	45.00	35.00	32.50	37.50
Middle (35 – 50 years)	45.00	62.50	47.50	51.66
Old (>50 years)	10.00	2.50	20.00	10.83
Land Holding				
Marginal (< iha)	20.00	35.00	5.00	20.80
Small (1-2 ha)	50.00	42.50	50.00	46.70
Medium (2-5 ha)	25.00)	22.50	42.50	29.16
Large (>5 ha)	5.00	0.00	2.50	3.33
Frequency In Use				
More than twice per week	0.00	5.00	0.00	1.66
Once a week	2.50	5.00	7.50	95.00
Once a fortnight	45.00	45.00	40.00	43.33
Once a month	52.50	45.00	52.50	50.00
Computer Literacy				
Computer Literates	7.50	12.50	15.00	11.66
Computer Illiterates	92.50	87.50	85.00	88.33

Table. 2 also reveals the frequency of use of ICT services by the farmer users. This revealed that all the users were accessing ICT services at least once in a month, if not more than that.

Another interesting finding was that only 11% of the farmer users were having some knowledge about computers. Majority of the farmers (89%) were completely computer illiterates. This implies that in developing countries, farmers need not be computer literate to harness the ICT in agricultural development.

Table. 3 depicts some specific correlations found in the data analysis, which are worth mentioning in the context. Most importantly, the frequency of use of ICT services was not at all correlated significantly with the land holding of the farmers. This indicates that irrespective of the land holding ICTs were helpful to all sections of the farmers. In case of *IKisan*, the farmers in this region were all progressive irrespective of their age and education. Hence the correlation coefficients were not significant in *IKisan*.

Table 3.   Some Specific Correlations found in Data Analysis.

	Correlation Coefficient 'r' value			
Correlation between variables	*Gyandoot* n=80	*Warna* n=80	*Ikisan* n=80	*Total Sample* n=240
Frequency of use and Age	-0.685**	-0.610**	0.180	-0.500**
Frequency of use and Education	0.588**	0.5212**	0.132	0.375**
Frequency of use and Landholding	0.277	0.163	0.414	0.121

** Significant at 0.01 level of probability

Current evidences suggest that, to achieve sustainability and success, ICT project for agricultural development must begin with the real needs of the local community of farmers (Richardson, 1996). Unfortunately, the task of understanding the clientele farmers and their information need had been subsided by the technological enthusiasm that is prevailing in developing countries. The information needs of the farmers with respect to their perceptions about importance attached are presented in Tables 4, 5 and 6.

In case of *Gyandoot* project, majority farmers perceived market information, facilitation of land record, question-answer services, information on rural development programs and weather forecasting as the most important and essential information needs. Likewise information needs like best package of practices, information on post-harvest technology, agricultural news and crop insurance information were rated as somewhat important. Farmers did not perceive the remaining information needs as that essential (see Table. 4).

In case of *Warna* project, majority of farmers perceived question-answer services, accounting payments of cooperative best practices and market information as the most essential and important information needs. Similarly, information needs like input prices/availability, early warning systems, information on RD programs and general agricultural news were perceived as somewhat important information needs. Remaining information needs were not perceived as that essential.

In *Ikisan* project area, majority farmers perceived early warning systems, information on RD programs, question-answer services, information on cropping systems and planning, and best practices as the most essential and important information needs.

Table 4. **Information Needs of Farmers – *Gyandoot* Project : Percentage Distribution of Farmers based on their perceptions about information needs.**

Information Needs	Most important	Important	Less Important
Question Answer Services	67.50	32.50	0
Market Information	90.00	7.50	2.50
Latest (best) package of practices	12.50	70.00	17.50
Disease/Pest early warning system and management	0	30.00	70.00
Weather forecasting	47.50	45.00	7.50
Information on RD programs/subsidies	57.50	27.50	15.00
Directory and Information on Crop Insurances	5.00	55.00	40.00
General Agricultural News	2.50	67.50	30.00
Post harvest technology	10.00	70.00	20.00
Facilitation of land records/registration online	82.50	17.50	0

Table 5. **Information needs of farmers – *Warna* : Percentage Distribution of farmers based on their perceptions about information needs.**

Information Needs	Most important	Important	Less Important
Question Answer Services	87.50	12.50	0
Market Information	50.00	45.00	5.00
Latest (best) package of practices	67.50	32.50	0
Disease/Pest early warning system and management	47.50	52.50	0
Input prices and availability	17.50	57.50	25.00
Weather forecasting	17.50	37.50	45.00
Information on RD programs/subsidies	15.00	52.50	32.50
General Agricultural News	12.50	47.50	40.00
Facilitation of land records/registration online	30.00	30.00	40.00
Accounting and easy payment services	75.00	25.00	0

Table 6.   Information needs of farmers – *IKisan* : Percentage Distribution of farmers based on their perceptions about information needs.

Information Needs	Most important	Important	Less Important
Question Answer Services	60.00	40.00	0
Market Information	35.00	50.00	15.00
Latest (best) package of practices	52.50	42.50	5.00
Disease/Pest early warning system and management	65.50	32.50	2.50
Input prices and availability	32.50	40.00	27.50
Weather forecasting	27.50	60.00	12.50
Information on RD programs/subsidies	65.00	30.00	5.00
Directory and Information on Crop Insurances	32.50	42.50	25.00
General Agricultural News	5.00	57.50	37.50
Information on Cropping systems and planning	45.00	50.00	5.00
Facilitation of land records/registration online	60.00	35.00	5.00

Table 7.   Percentage Distribution of Functionaries based on Effectiveness, Orientation to ICT Extension, Education and Professional qualification.

Variable	Gyandoot n = 60	Warna n = 60	iKisan n = 60	Total n = 180
Effectiveness				
Low	13.30	23.30	20.00	17.70
Medium	73.30	50.00	70.00	65.50
High	13.30	26.60	10.00	16.66
Orientation to ICT Extension				
Less	34.40	16.60	16.60	11.10
Medium	50.00	56.60	70.00	75.50
High	16.66	26.66	13.33	13.33
Education				
Middle School	3.33	0	0	1.11
High School	50.00	23.33	6.66	26.66
Graduate	33.33	50.00	36.66	40.00
Professional Degree (Ag. B.Sc.)	13.33	26.66	56.66	32.22
Professional Qualification in Computers				
No qualification	16.66	26.66	30.00	24.44
Diploma	56.66	73.33	53.55	61.11
Degree	26.66	0	16.66	14.44

Table 7 presents the results regarding the distribution of functionaries based on effectiveness, orientation to ICT extension, education and professional qualifications in computers. About 65% of functionaries working in ICT projects showed moderate effectiveness and 18% showed higher level of effectives.

Skewedness towards higher level of effectiveness is a good indicator for the organizational performance of ICT Projects. Likewise, in case of orientation towards ICT extension, majority of the functionaries showed either medium or higher favourable orientation, which should be the pre-requisite for success of ICT projects. Table 7 also provides frequency distribution of functionaries based on education and professional qualifications in computers. This revealed that, the human interfaces between ICT networks and farmers need not be having higher level of education and professional qualification in computers. To explore into the factors associated with effectiveness of functionaries, correlation analysis was carried out. Table 8 provides results regarding the same.

Table 8. **Correlation Coefficients of Effectiveness of Functionaries with other Variables.**

Variables	'r' value			
	Gyandoot	Warna	iKisan	Total Sample
Education	0.648**	0.352	0.420*	0.515**
Professional qualification	-0.423**	0.086	0.130	0.237*
Orientation to ICT Extension	0.644**	0.523	0.665**	0.600**
Faith in People	0.738**	0.614	0.637**	0.694**

*   Significant at 0.05 level of probability
**   Significant at 0.01 level of probability

In case of total sample, education, orientation towards ICT extension and faith in people are significantly and positively correlated with effectiveness, at 0.01 level of significance. Whereas professional qualification was correlated significantly at 0.05 level of significance.

CONCLUSIONS AND RECOMMENDATIONS

The study revealed encouraging signs of harnessing ICTs in India in particular and developing countries in general. Based on the findings related to process impacts, factors related to farmers influencing success of ICT initiatives and the effectiveness of functionaries, following conclusions are made:

1. Since the process impacts of ICT projects of ICT were encouraging on different indicators of Mc Connell Model, it is recommended that ICTs are to be incorporated in all endeavours of agricultural development.

2. Generating awareness about availability of ICT services among young and middle age farmers, first step to be considered soon after initiating ICT projects in future. The old farmers should be brought into the chain of ICT networks in the later stages.

3. Since all the categories of farmers were using ICT services irrespective of land holding, all the farmers can be reached using ICT. However, in case of Govt. initiative and Cooperative initiatives, number of small and marginal farmers were

using ICT services. There is a need to incorporate ICT in Govt. extension system to develop a strong bias towards resource-poor farmers.

4. The findings revealed that even though majority of farmers were computer illiterate, if the human interfaces (Kiosk operators/functionaries) were established, ICTs could be a success. In developing countries, hence, all the future ICT endeavours should focus on how to build as sustainable human interfaces.

5. The ICT project must take into account the information needs of the farmers. In the less endowed areas, agriculturally commercialised areas and in the areas where cooperative set-ups exist, the information needs of farmers, as revealed by the study, must be integrated in respective ICT projects.

6. The future ICT project/initiatives should have highly effective functionaries who act as interfaces. While manning such projects, factors like their orientation towards ICT extension, faith in people, education and professional qualifications will have to be considered.

7. Based on the success of ICT projects in reaching farmers as revealed in the study, lit is recommended that Government have to re-orient their agricultural policies so that a full-fledged strategy is developed to harness ICT at all levels.

It is also recommended that based on the methodologies adopted in this study, similar researches should be carried out in all the project areas of India and other developing counties. This will help in developing insights and draw lessons. A series of similar researches should be carried out to develop a new research paradigm *viz.* ICTs in agricultural development.

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