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ABSTRACT

In this paper, we use key concepts in strategic management, such as value, and use the conceptual framework of diffusion of innovations to understand factors underlying the lack of demand for rural telecenters. We present a background of ICT use in rural areas, examining both the prospects and current situation. We then develop a framework that explains rural telecenter performance using literature from strategic management, and information systems (notably diffusion of innovation). We then present the results of a pilot study of farmers in India who used/did not use ICT telecenters. We chose India as it has a large number of the world's poor, and is pioneering in the use of technology in rural areas and has by far the largest number of ICT telecenters. Findings indicate the research questions are mostly supported.

Keywords

Diffusion of innovation, computer use, rural telecenters, strategic management.

INTRODUCTION

Recent evaluations of the utilization and impact of rural telecenters in developing nations have emphasized the widespread existence of telecenters and suggested that while some telecenters have been successful, a majority of ICT telecenters in rural areas have not been successful. Sey (2008, p. 7) in a view of over 100 studies, concluded that many rural public access venues were underutilized, especially from the disadvantaged people who could benefit the most. Further, the demand for the underutilized services did not have a trend to increase over time (Parkinson, 2005). In recent years, a majority of rural telecenters have failed to live up to their potential, and a number have closed down (Rangaswamy, 2007; Kuriyan and Toyama, 2007). Many rural telecenters have not been sustainable or scalable (Etta and Parvyn-Wamahiu, 2003). These problems are applicable to Indian rural villages. In India, having the computing and internet technology itself will not in itself grow revenue or increase value, nor will they tend to stimulate demand for generic content (Gollakota, 2008). A primary underlying factor was observed to be lack of demand from the rural community in India (Dossani, Mishra and Jhaveri, 2005; Rangaswamy, 2006). We hold that costs are not the primary issue - costs of computers are dropping rapidly, and the shared model drops the price, further many telecenters offer subsidized or even offer free access. Even with free access, there is not high demand. Lack of computer skills could be an issue for complex internet search, but many of the telecenters offer help through intermediaries. What then has resulted in lack of demand for a technology that has proved to have transformative potential in other contexts?

RURAL ICT TELECENTERS

There is considerable diversity in the structure, goals and business models of rural ICT telecenters. At its most basic level, a rural ICT telecenter is a physical location that provides computer and Internet access for the rural community. Access to the Internet allows farmers to get information on better agricultural techniques, market prices for produce, availability of credit and other inputs essential for agriculture. For example, ITC, a leading agri-business company in India, provided farmers in their procurement area with access to market prices through its rural ICT telecenter the e-Choupal, and offered to buy the produce directly from the farmer instead of through an intermediary as was the practice. Farmers were free to sell to whosoever offered the best price – the company offered to purchase the product at the closing price on the market the previous day (Annamalai and Rao, 2003).

The potential of the rural telecenter lies in being able to provide a wide variety of agricultural information. In theory, a rural ICT telecenter could (1) provide information to help improve productivity, (2) provide market related information, (3) provide other important information ancillary to farming, and (4) further the potential for farmers to share or rent machinery, transportation etc. via the internet.

Performance of Telecenters

Despite the potential, in recent years, a majority of telecenters have failed to live up to their potential, and a number of them have either closed down or report low turnout of users (Rangaswamy, 2006). Further, the few studies evaluating rural telecenters report that with some notable exceptions, many rural telecenters have not been sustainable or scalable. In a detailed study of multiple projects in India, Dossani et al. (2005) observed that "usage was disappointingly low, with some sites averaging five users per day, and most having less than twenty five." Similarly, a study of more than 50 telecenters in South Africa and Uganda showed low utilization of ICT services especially in rural areas. Further, it was observed that the demand for these underused services did not show any tendency to increase over time.

MODEL FOR SUCCESS OF RURAL TELECENTERS

A telecenter is successful if it meets its two major goals: (a) To be sustainable, and (b) To have an impact. Sustainability comes from having and executing a viable business model. We use strategic management theory to develop this section of the model. Impact comes from widespread use. We build on research on diffusion of innovation as it relates to individuals. We draw considerably from the IS literature here. It should be noted that these goals are related. The greater the use, the greater the demand, and that increases the sustainability of the telecenter. A diagrammatic representation of this model is provided in Figure 1.

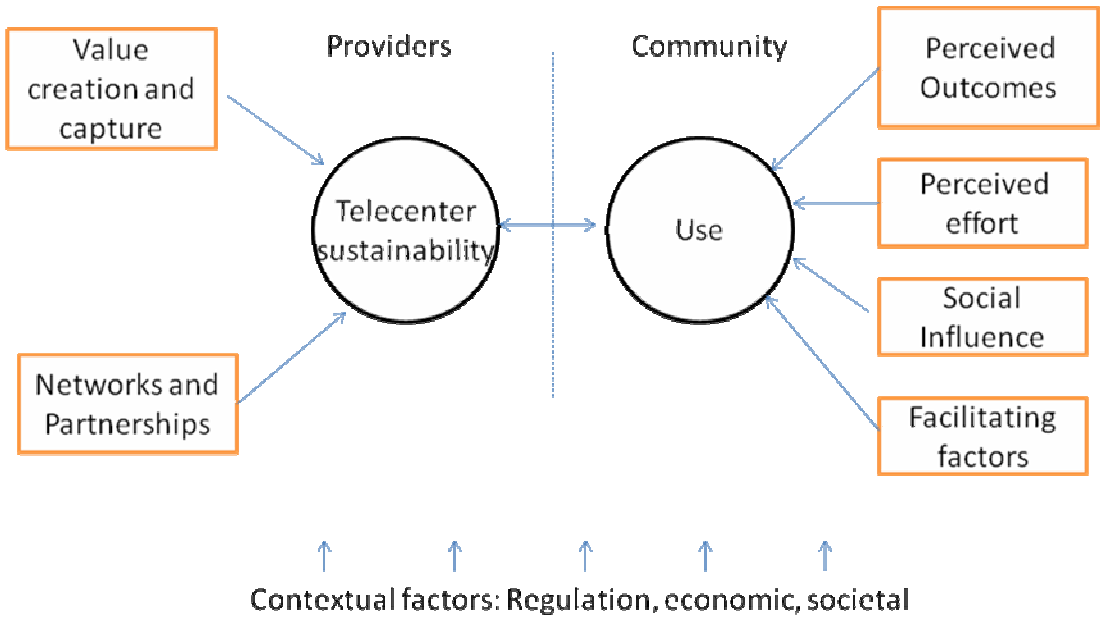

Figure 1. Model of Telecenter Success

Sustainability

Fundamental to the success of a telecenter is its sustainability. If a telecenter does not have a viable business model it will not survive. There are numerous definitions of a business model (Shafer, Smith and Linder, 2005). We use a broad conceptualization and base our analysis on the following key components of business models in terms of their relevance to telecenters: (a) Value Creation and Capture and (b) Networks and Partnerships.

Value Creation and Capture

Creating and capturing value is fundamental to doing business (Porter, 1985). The dominant perspectives in strategic management – positioning (Porter, 1985), transaction cost economics, and the resource based view, focus on creating value and capturing some of it for the organization. Thus, for long term survival and success, any business has to identify ways that it creates value and captures it.

A rural telecenter does not add sufficient value by merely providing access to a computer with internet access. Value needs to be added in important additional ways. In an urban setting, where there are people who have an awareness of the potential of the computer and have skills to use it, providing a center with computers for rent might be of value. However in a rural setting, where a majority of the potential users do not have an awareness of the potential of a computer or the internet, and do not have skills to use the technology, just providing access to a computer does not add sufficient value. The knowledge required to adopt is endogenous to the adoption (Weigelt and Sarkar, 2009). In such situations, the providers of the technology need to help clients overcome the challenges that prevent adoption .

Various complementary value adding activities need to be performed. Providers need to create awareness of the availability of the computer at the telecenter (Dossani et. al, 2005). Providers need to educate users on the benefits that might be derived from using the computer and make the computer easy to use either through intermediaries helping with access or providing training to users. Prior research has also suggested that general information is unlikely to be of interest to people who do not use the computer regularly (Dossani et. al, 2005). Providers need to find ways to provide locally relevant information.

Providers also need to recognize that information is not the only issue holding back progress in a rural community (Gollakota, 2008). There are numerous infrastructural limitations that prevent a farmer from using information.

Network: Partnerships

Delivering value to customers who are economically disadvantaged and live in remote rural areas can be expensive. As discussed earlier, a telecenter has to go beyond just providing internet access and many of the value adding solutions are expensive. Since the capacity to pay of the target customers is low, incurring all these costs alone is unsustainable for any organization. Partnerships are very useful in such situations (Brugman & Prahalad, 2007).

Partners can range from business organizations supplying agriculture related products, or banks and insurance agencies to local universities, non-governmental organizations (NGOs), philanthropic organizations, sometimes even the local government. Partnerships have the potential of adding considerable value to a firm through the building of social capital and institutional networks.

Use

If rural telecenters have to create an impact and change the lives of the rural community, they need to be widely used. A more detailed representation of factors influencing Use is presented in Figure 2.

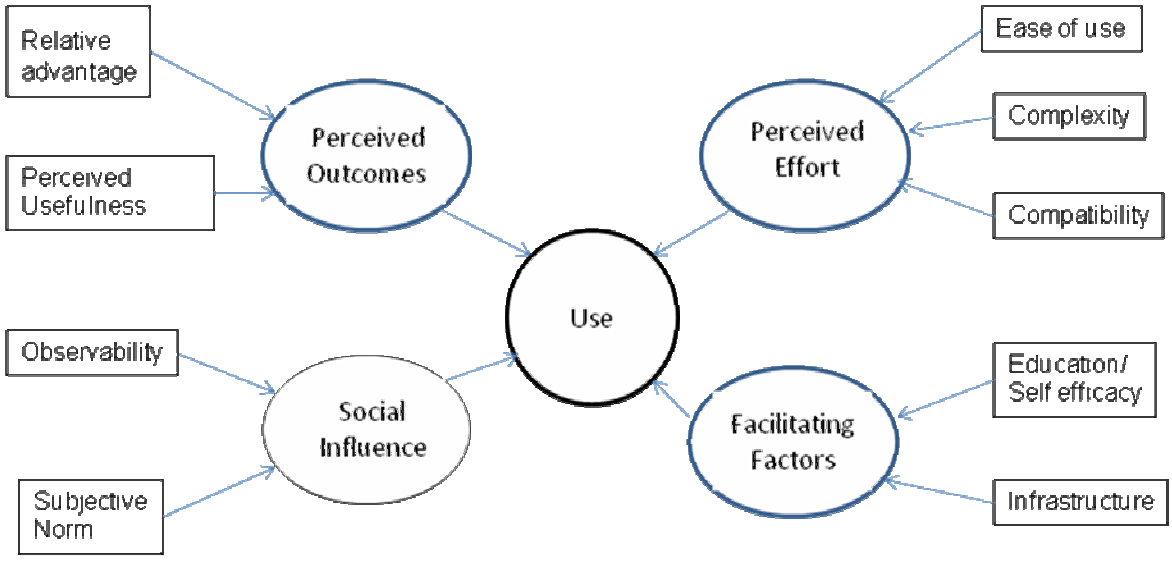

Figure 2. Use of Rural Telecenters

The creation of a rural telecenter provides access to ICT technology. However, providing access to technology is does not necessarily result in use of the technology. Prior research on a variety of ICT applications, such as e-mail, the web, data-

bases, and business software indicates that providing access to technology does not guarantee its use (Agarwal & Prasad, 1997; Hsieh, Rai & Keil, 2008; Karahanna, Straub & Chervany, 1999).

Diffusion of an innovation is the process by which an innovation is communicated through certain channels among members of a social system, and adoption of an innovation is a decision to make full use of an innovation (Rogers, 2003). For understanding the diffusion of telecenters, we focus on research that helps understand individual adoption of technology.

Rogers (2003) considered the adoption of an innovation in a social and communication context. After early adopters have accepted the innovation, it is communicated to others, using social channels. Eventually it diffuses to a significant number of users in the social system, who experience varied levels of satisfaction and positive attitude. Five attributes that favor adoption are identified and have been shown empirically to account for a high rate of adoption. They are relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003).

Perceived outcomes

Perceived outcomes refers to user perceptions of the benefits that they might be able to get from using the telecenter. Almost all prior models of use of technology have included a construct that focuses on the benefits that a user expects to get from using the technology. Venkatesh et. al. (2003) observed that the construct that they identified as performance expectancy (which is similar to this) is the strongest predictor of intention. Their construct included the following dimensions from previous models: perceived usefulness, extrinsic motivation, relative advantage, job-fit and outcome expectations.

Of these, perceived usefulness, and relative advantage are relevant to the utilization of rural telecenters. Extrinsic motivation, outcome expectations and job-fit are similar to usefulness (Davis et. al, 1989, 1992). Perceived usefulness is determined by the quality, reliability and currency of information that can be obtained from using the computer. Relative advantage refers to perceptions of advantages from using the information provided by the computer over current sources of information. Thus, for our model we use the two dimensions of usefulness "perceived usefulness" and "relative advantage" as indicating perceived benefits from using the telecenter. Thus, farmers and the rural community are likely to use the telecenter if they perceive that the information from the telecenter is useful and gives them an advantage over current sources of information.

Research Question 1: Is perceived performance associated with increased use of the telecenter?

Perceived effort

Perceived effort is the extent of difficulty associated with the use of the system. Most prior models have included this as a determinant of use of the system and is particularly relevant in rural populations dealing with unfamiliar technology. Venkatesh et al. (2003) identified the following components in their unified model: perceived ease of use, complexity and ease of use. Perceived ease of use and ease of use are conceptually similar, except in the latter the focus is on how the experience of use determines future use. In this framework we use the perceived ease of use and perceived complexity. In addition, we add Rogers' (2003) dimension of compatibility since there are traditional sources of information (cultivation techniques learned from other farmers). Thus, when (a) the greater is the perceived ease of use, (b) lower the perceived complexity, and (c) the greater the compatibility, the more farmers will be likely to use the telecenter.

Research Question 2: Is lower perceived effort associated with increased use of the telecenter?

Social Influence

Most research on diffusion has incorporated a social dimension of innovation that influences adoption and use of a technology – "subjective norm," or the social context (Rogers, 2003). In essence, this dimension brings attention to the fact that technology is diffused through the social network. If people in a person's social or reference group who use the technology report satisfaction and advocate its use to non-users, they motivate non-users to try the system. Rogers (2003) identified the dimension of observability or the visibility of the innovation to the society using it. This is likely to be relevant to telecenter use. The more visible the benefits of using the telecenter in the community, the more likely are people to use it. Thus, a person is more likely to use a telecenter if it is perceived that people in his/her network are satisfied with the use of the telecenter and the use of the telecenter is observable.

Research question 3: Is social influence associated with increased use of the telecenter?

Facilitating conditions

Research suggests that when certain conditions such as training and guidance in usage of a system exist, or users feel self confident or have complementary resources, there is an increased likelihood of the technology being used. Venkatesh et. al., (2003) found the following constructs to be relevant: perceived behavioral control, facilitating conditions and compatibility.

One of the reasons for the low utilization of rural telecenters is that often, farmers are unable to implement the solutions they might identify from the computer. For example, information on soil testing is useless if the kit for soil testing is not available, or if the chemicals needed for pest control are not available (Gollakota, 2008). A further influence on the extent of use of a telecenter will depend on the level of education and self efficacy of individuals. Thus the greater level of education and self efficacy, greater availability of infrastructure, better location, and better management of a telecenter, the greater the likelihood that it will be used.

Research question 4: Is the facilitating factor of farmer's education associated with increased use of the telecenter?

Research question 5: Is better location of the telecenter's infrastructure associated with increased access to the telecenter?

Research question 6: Is improved management by the provider associated with increased access to the telecenter?

PILOT STUDY

Methods

Data for this pilot study were collected using questionnaires. Questionnaires were translated into the local language – Tamil. Since some subjects were likely to be illiterate, it was decided that questionnaires would be completed by trained interviewers. Interviews based on the questionnaires were conducted with the farmers from the following villages in Tamilnadu, India: Thukkanampakkam, Embalam, Naduveerapattu, Pattampakkam, and Maalgaimedu. The villages were selected based on the presence of rural telecenters initiated by EID Parry and n-Logue. EID Parry India Ltd. is part of a 220 year old corporate group primarily in agri-business.

The farmers considered for the study constitute two categories: (a) users of ICT telecenters and (b) non-users of ICT telecenters. Convenience sampling was used to select both kinds of farmers. Initially, we planned to approach users only at the rural telecenters. However, since the turnout at the telecenters was low, we decided to interview farmers both at the telecenters and local stores. On various days interviewers waited at a telecenter or store and interviewed all the farmers who were willing to be interviewed. A farmer was interviewed for the study only once. Interviews followed a protocol of administering either (a) a questionnaire for users of the telecenter, or (b) a questionnaire for non-users of the telecenter.

The pilot survey yielded 45 usable responses from farmers in a rural community, 21 from ICT users and 24 from ICT non-users, as well as four usable responses from franchisees who owned rural telecenters. The questionnaires for farmers were analyzed by descriptive statistics, t-tests, correlations, and cross tabulation analysis, based on SPSS software, as well as qualitative analysis of open-ended questions. The franchisee questionnaire responses were analyzed by descriptive statistics and analysis of qualitative responses.

Cross tabulation analysis was utilized for the testing of the model for the pilot survey. For this analysis, four survey questions were re-coded from 4-category to 2-category variables in order to satisfy sample size limitations. Each cross tabulation consists of a 2 by 2 table, with significance levels determined by Pearson Chi Square statistics.

FINDINGS OF PILOT SURVEY

This is a pilot study that provides limited analysis of the validity of the research model. It is the first part of a large-scale project that will analyze much larger samples of users, non-users, franchisees, and other key stakeholders.

The ICT user and ICT non-user subsamples are similar in demographic characteristics. The ICT users are five years younger, had three and half years less experience in farming, are more educated by two years in schooling, and have nearly double the land acreage farmed. For the five demographic characteristics, gender is entirely male and identical for the subsamples. Independent t tests indicates that only education differs significantly ($p=0.011$). Overall, this demonstrates respondents in the two subsamples are quite similar demographically.

Correlation analysis of the four demographic attributes excluding gender reveal that for both ICT users and non-users, farm acreage and years in farming are strongly related, with the possible explanation that a farmer accumulates more acreage with time. For non-ICT users, there is a significant association ($p=0.05$) between acres farmed and education. By contrast, this association is inverse for ICT users ($p=0.05$). We cannot explain why more educated ICT users would have less acreage; it might be specific to conditions in the villages surveyed.

Key descriptive findings reveal how ICT users became interested in ICT, what is useful to them at telecenters, what their sources of information are from telecenters and elsewhere, and why non-ICT farmers choose not to use telecenters. Farmers' interest in ICT stems primarily from their own interest or that of other farmers who use ICT. This finding corroborates that

farmers primarily want to use ICT for farming purposes. This is reinforced by their responses that the three most useful information sources are on better cultivation techniques, market prices for produce, and agricultural inputs (see Table 1). On the other hand, information on dealings with company is only moderately useful, and the weather not at all so, possibly because weather does not change as dramatically except for rains, and this information is widely available.

Item	Mean
Information on better cultivation techniques	1.62
Information on market prices for produce	1.86
Information related to agricultural inputs	1.95
Information regarding subsidies and benefits from government	2.14
Overall information rating	2.38
Loan and financial information	2.57
Information related to dealings with the company	3.00
Information related to weather	3.76
Respondent Sample Size =21	
Scale varies between 1 (extremely useful) to 3 (useful) to 5 (not useful)	

Table 1. Usefulness Ratings of Computer at Telecenter, ICT Users

For ICT users, gathering information from the computer is only one of various sources of information, including other farmers, newspapers, radio and TV, and company employees. For some types of information sought, the computer dominates as primary source, but is minor for others. For ICT users, the computer at the telecenter accounts for about half of primary use for market prices of agricultural products, 20 percent of use for improving cultivation techniques, 19 percent for information on dealings with EID Parry company, 14 percent for information on agricultural inputs, while only five percent for financial and loan information (see Table 2). For the latter, information comes from EID Parry company employees or from other sources, including loan agents. For crucial farming information on cultivation techniques, the computer is the primary source for a fifth of users, while other farmers, newspapers, and company employees each account for an equivalent amount. For non-ICT users, information source patterns are similar to those described, except the computer drops to zero. Examples of several specific computer-based functions for four of the respondents were to get information on the availability of fertilizer, to gain information "on the treatment of diseased cotton," to "know new methods of cultivation," and to "verify the re-cultivating times and seasons."

Primary source of Information on:		
Improved Cultivation Techniques		
	Percent of Responses	
Sources	ICT Users	ICT Non-Users
other farmers	29	52
newspapers, radios, TV	24	12
computer	20	0
company employees	24	22
other sources	0	14
	100	100
Latest Market Prices for Products		
	Percent of Responses	
Sources	ICT Users	ICT Non-Users
other farmers	14	25
newpapers, radios, TV	8	12
computer (Parry's corners)	43	0
company employees	19	38
others	14	25
	100	100
Information on Agricultural Inputs		
	Percent of Responses	
Sources	ICT Users	ICT Non-Users
other farmers	38	12
newspapers, radios, TV	5	18
computer (Parry's corners)	14	0
company employees	29	30
other sources	23	40
	100	100
Information on Dealings with the Company		
	Percent of Responses	
Sources	ICT Users	ICT Non-Users
other farmers	9	0
newpapers, radios, TV	5	0
computer (Parry's corners)	19	0
company employees	48	59
others	19	41
	100	100
Financial and Loan Information		
	Percent of Responses	
Sources	ICT Users	ICT Non-Users
Other farmers	5	0
newspapers, radios, TV	0	8
computer (Parry's corners)	5	0
company employees	38	37
other sources	52	55
	100	100
Subample sizes. ICT Users, 21. ICT Non Users, 24.		

Table 5. Primary sources of Information for ICT Users and Non-Users, by Information Type.

Qualitative responses from ICT-user farmers suggest that farmers come primarily to know more about sugarcane cultivation, cultivation methods, and fertilizer use, topics that are very practical. Only two respondents cited the reason of individual use

of the computer. Barriers to computer use consist mostly of perceived difficulty in use, followed by inconvenience. Cost as a barrier was mentioned by only one respondent.

Non-ICT farmers have diverse self-ascribed reasons for not using a telecenter. Top reasons are lack of knowledge of the telecenter, competing sources of information, lack of confidence in skills, lack of reinforcement that others use it, cost, and poor location. Most of these concerns are documented in technology adoption and IT change management literature, while the locational reason is known from retail marketing studies. This is further supported by responses to the question, "what do you think is the information that one can get from the computer at the telecenter"? The answers show that the information is available through other community and company sources.

Findings on Testing of the Research Model for Pilot Survey

The research model for the pilot survey is tested by cross-tabulation analysis of ICT users (Table 3). Further qualitative support for interpretation of findings is provided from the EID Parry franchisee survey for research questions 5 and 6.

Research Question	Variable 1		Variable 2	Pearson Chi-Square Value	Significance (2-sided)	N of valid cases
1	Use of computer information on better cultivation techniques	x	Frequency of use of telecenter	7.953	0.005	21
1	Use of computer information on market prices for produce	x	Frequency of use of telecenter	2.036	0.154	21
2	Computer information is too complex to understand	x	Frequency of use of telecenter	0.297	0.586	21
3	Social influence	x	Frequency of use of telecenter	9.377	0.002	21
4	Educational level	x	Frequency of use of telecenter	0.940	0.332	21
5	Telecenter staff provides the information, rather than direct access	x	Process of accessing the information is too complicated	7.138	0.008	21
5	Access the computer using someone else's help at telecenter	x	Process of accessing the information is too complicated	12.353	0.000	21
6	Inconvenient location of telecenter	x	Process of accessing the information is too complicated	5.147	0.023	21

Table 3. Results of Cross Tabulation Analysis

Research Question 1

The findings for influences on Use, seen in Table 3 and arranged by Research Question (RQ), confirm RQ1 is partially supported. For RQ1, each of the two leading computer information sources, better cultivation techniques (CT) and market prices for produce (MKT) are tested for association with frequency of use of the telecenter (FUT). CT was significant but MKT was not. From the qualitative findings also, CT is the information we assume would have the greatest and direct impact on performance enhancement. MKT could be obtained from other sources such as company employees and newspapers, without reducing performance, but the up-to-date cultivation methods available online, especially for the lead crop of sugarcane, would be crucial to performance and productivity enhancement.

Research Question 2

RQ2 is unsupported. Complexity of information is not associated with frequency of telecenter use. This differs from the inverse effect posited by Adoption-Diffusion theory (Rogers, 2003). At the rural telecenters, complexity may be mitigated for the use by the assistance provided by telecenter staff to about three quarters of users, so the user does not have to contend directly with complexity differences in applications.

Research Question 3.

Social influence is defined as presence of a farmer's interest in using the computer coming from other farmers who used it and/or neighbors and friends who used it. It is very significantly associated with the frequency of use. RQ3 is supported.

Research Question 4

RQ4 is unsupported. For RQ4, we assigned educational level as the facilitating factor. Studies in IT and internet use have frequently confirmed educational level to be associated with level of use. For these reasons we operationalized education as the facilitation factor. We interpret this as an anomaly in the ICT user pilot sample. Education is acting oppositely to expected ways, recalling that it is also inversely associated with size of farm. The reason is unknown but might be due to unknown forces in the local community.

Research Question 5

For the Providers side of the model in Figure 2, we have limited the determinants of Access to Management and Infrastructure Location. The telecenters are very small, often with one or two employees. One aspect of good management of such a tiny enterprise is the help and support available to clients. We tested provision by telecenter staff of the information sought versus complication of the access process (AP), finding a highly significant association. Likewise, we tested a similar indicator of access to the computer using someone else's help versus AP and again found a very significant association. The RQ5 findings were further corroborated by responses from franchisees to the open-ended question, "How have you overcome the challenge in managing the facility?" All the responses concerned provision of services to clients, including "to make them (farmers) understand" and "if possible we go directly and try to understand the farmers."

Research Question 6

For RQ6, the aspect of infrastructure examined was convenience of infrastructure location, namely the telecenter, to the user. It is significantly associated with the access process (AP). The RQ6 findings are corroborated by responses to a survey question from franchisees, which showed that "convenient location of facility" was the highest rated of seven factors in "increasing the rural community's usage of the telecenter computer and other information available through it."

In summary, the research questions on the pilot survey model are mostly supported by statistical testing with the pilot survey.

DISCUSSION AND IMPLICATIONS

The present research aimed at obtaining insights into the reasons why a tool with as great a potential as ICT technology via a telecenter has not been widely adopted in the rural community even when access costs are low with a shared model (or sometimes free) and when assistance to use the computer. We provided a framework that explains the success of telecenters in terms of its two related goals: sustainability and use (impact).

Our pilot study indicated that the most important reason non-users gave for not using the telecenter, is their lack of awareness of the telecenter, followed by the availability of alternate acceptable sources of information, and a lack of confidence in their abilities to use the technology. They also felt incorrectly, that it would be expensive to use the telecenter. Telecenter owners need to ensure that the local community is aware of the existence of the telecenter and its low pricing (in shared or subsidized models as is most common) as well as the potential to benefit from the information via the computer. Our results show that farmers who have used the telecenter have found it fairly useful. This finding is a reason for optimism. However, for those who have not used it, the perception was that other sources of information are adequate. These results reinforce the theoretical framework which posited that for a technology to be adopted, it must show relative advantage, be perceived to be useful and be easy to use.

It is important to note that usefulness of agricultural techniques or market prices depend on the availability of complementary products and infrastructure. Providing this might not be easy for a telecenter provider. We have not been able to test this empirically.

Our results also show that ICT is seen to be difficult to use – high perceived effort. Non users felt they did not have skills to use it, that it was difficult to use etc. Users however, even those without an educational advantage did not feel it was such an effort. With suitable intermediaries available, the community should not perceive high effort to use. Telecenter owners need to spread the message about use through intermediaries.

The importance of the social network was also evident from our pilot study. A number of users first got interested in the ICT technology when they saw other farmers use it. Non users also indicated that they either did not know people using it, or those who used it felt it was not useful. Telecenter providers need to recognize the importance of the social network.

This study has implications for sponsoring organizations. Organizations need to recognize that providing the technology to a franchisee and hoping that it will be used by the community is not a winning strategy. Unless the telecenter owner is very

entrepreneurial, the organization needs to guide the owner to actively think about how to add value. Proactive awareness creation and education on the potential as well as the support of users is important.

Overall, our findings leave us with optimism. Our research suggests that ICT technology has potential to alleviate rural poverty, and that the problems underlying slow diffusion are those that can be managed. The underlying feature common to the problems of slow diffusion is that the problems can be fixed.

Limitations

This study is limited by the data that we were able to obtain at this point. This is a pilot study that is the first stage of a large sample design that includes farmers and other stakeholders. The results of the empirical study are based on data collected in the pilot. In subsequent research studies with larger samples, the conceptual model enlarged can be tested with more powerful statistical techniques than were applied in this study, including multivariate analysis, path modeling, and structural equation modeling.

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