

Social Impact and Diffusion of Telecenter Use: A Study from the Sustainable Access in Rural India Project

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Abstract

In a study of social diffusion of telecenter use in rural south India, we find that these centers are being used only by a relatively small proportion of the village households despite their having been in operation for well over a year. Based on a survey of the telecenter users, we find that these users are, in general, young, male, school or college students, relatively more educated, belong to relatively higher income households, and come from socially and economically advanced communities. Thus the telecenters may sustain existing socioeconomic inequalities within these communities. However, we find some significant exceptions. We find that location of telecenters close to the residential localities where socially and economically backward communities live and presence of local champions within those communities are associated with attracting more users from those communities. We also find that providing localized content and services and making these services more affordable are other important factors in increasing usage and diffusion. We posit that incorporating these factors in the planning, spatial location, and operation of the telecenters can significantly improve their social diffusion and improve their long-term financial and social sustainability.

Introduction

Telecenters or kiosks have generally been defined as places or centers that provide shared public access to information and communications technologies for meeting the educational, social, personal, economic, and entertainment needs of the community (Fuchs, 1998; Harris, 1999; Proenza, 2001). Telecenters have gained prominence as the primary instruments for bringing the benefits of ICTs to poor communities where the technological infrastructure is inadequate and the costs of individual access to these technologies are relatively high. They provide opportunities for access to information by overcoming the

barriers of distance and location, and by facilitating access to information and communication, they have the potential to foster social cohesion and interaction (Young, Ridley, & Ridley, 2001).

Most of the evaluations of telecenters have focused on their operational aspects, such as their technical, financial, and managerial performance and sustainability (Etta & Wamahiu, 2003; Young, Ridley, & Ridley, 2001). There have been relatively few studies examining the social impacts of these telecentres on the communities in which they are situated. Some researchers have looked at the social impact of the community telecenter initiatives largely through anecdotal evidence (Holmes, 2001) while others have examined their impacts on poverty reduction (Gerster & Zimmerman, 2003; Ulrich, 2004).

As most of the studies on telecenters to date have focused on their operational and sustainability aspects, a sound theoretical and conceptual framework for their planning and evaluation has largely been missing from the debate (Roman, 2003). Roman (2003) provides a very cogent theoretical framework for planning and evaluating telecenters using the Rogers' theory of diffusion of innovations (1995). He describes three principal attributes of innovations which could be very useful in telecenter research: relative advantage, compatibility, and complexity. He also underscores the importance of socio-structural environment in innovation diffusion and adoption. In one of the early attempts to understand telecenters within the diffusion framework, Johnson (2003) examines how incorporating a gender dimension into telecenter design can enhance their adoption among women.

In this study, we examine the social impact and diffusion of telecenters under the Sustainable Access in Rural India (SARI) project in Tamil Nadu, India. This project aims at rural social, economic, and political development by providing comprehensive information and communication services through computer and internet kiosks in rural communities. Starting in November 2001, the project had established 77 such kiosks by June 2004 in rural communities in Melur Taluk (an administrative unit within a district) of Madurai district in Tamil Nadu. The number of kiosks was 39 in June 2003 when this research was conducted. The kiosks offer a number of services including basic computer education, e-mail, web browsing, e-government, health, and agricultural and veterinary applications on a fee-for-service basis.

Though the kiosks have been in operation for well over a year in many communities, they are still being used by only a relatively small percentage of the village population. Our principal focus here is to examine why kiosk use has not been able to diffuse among a wider section of their communities. In examining this, we chiefly employ the theoretical framework for diffusion of innovations by Rogers (1995, 2003). Particularly, we analyze how the principal attributes of innovations, such as relative advantage, compatibility, and complexity, affect diffusion within the community.

This case is of particular interest in that it is one of the first projects in India that aimed at establishing commercially sustainable telecenters in rural communities. The lessons learned from it can help us understand how best to enhance the social acceptability and reach of the telecenters and to realize their long-term social and economic sustainability and development goals.

The remainder of the paper is organized as follows: first, we describe the overall project briefly; next we discuss the methodology employed in our empirical study; then we present our data analysis and discuss the results; next we analyze the findings within the theoretical framework of diffusion of innovations, and finally we end with our conclusions.

Description of the Project

The SARI project is a collaborative research venture including several organizations: the Indian Institute of Technology (I.I.T.), Madras; Berkman Center for Internet and Society, Harvard Law School; Georgia Institute of Technology; I-Gyan Foundation; and n-Logue Communications Pvt. Ltd. It uses a Wireless-in-Local Loop (WLL) technology to provide internet connectivity to rural villages.

Internet connectivity is offered to the local community through kiosks, which are run as self-sustained businesses with cost recovery through service charges. A majority of the kiosks are locally owned and operated by self-employed entrepreneurs, while some are operated by self-help groups from a local non-governmental organization. Technical support for all the kiosks is provided by n-Logue Communications. The project had established 39 village kiosks by August 2003 when this field study was conducted. Out of these 39 kiosks, 20 were being run by local self-employed entrepreneurs while the remaining 19 were being run by the local NGO mentioned above.

Figure 1 shows the location of Melur where the kiosks are located.

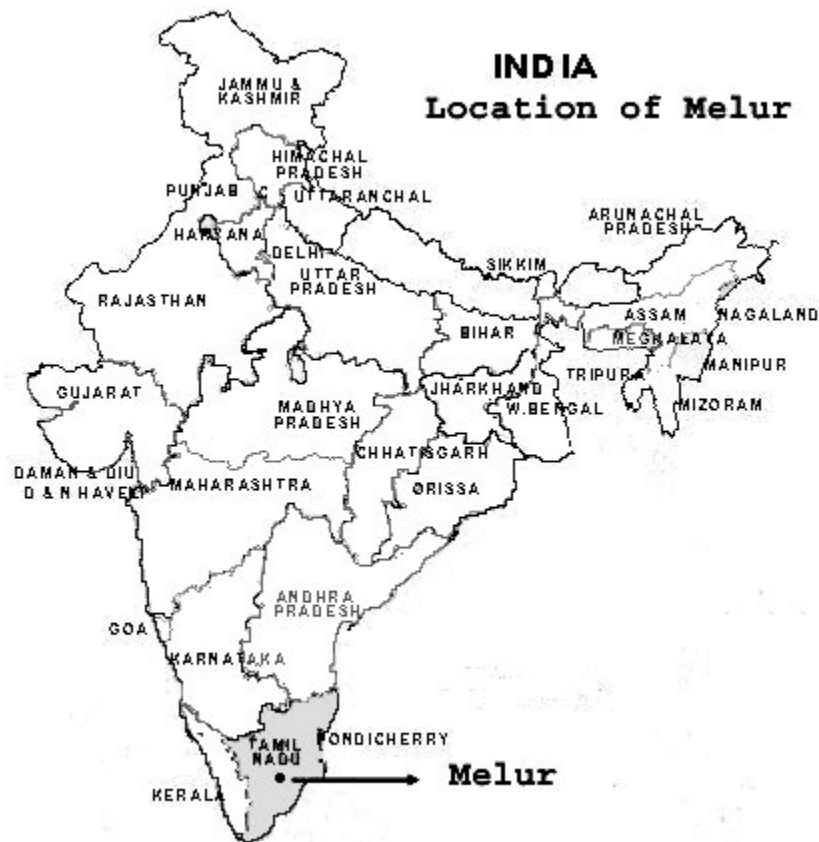


Figure.1: Location of Melur in India

(Source: <http://www.tourindia.com/htm/homepage.htm>, modifications by the authors)

Services Offered by the Kiosks

The kiosks provide a host of applications and services to the rural people, which include computer education; email/voice mail/voice chat; e-government services such as obtaining birth and death certificates from government offices; agricultural, veterinary, and health services; web browsing, etc. They provide internet content in the local language in these areas. The services are based on a self-sustaining commercial model with the charges ranging from Rs. 10 (approx. US \$0.22) for sending an email to Rs. 100 (approx. US \$2.2) for one hour of basic computer education everyday for one month. To deliver these services, the project has developed partnerships with several public and private agencies. These include tie-ups with the state government to provide e-government services, with the Tamil Nadu Agricultural and Veterinary University for providing agricultural and veterinary services, and with a private eye hospital for providing eye check-ups. It is this broad array of services that attract users, including those who are illiterate, to the kiosks.

Research Methods

We have used a combination of quantitative and qualitative techniques for our study. We conducted a comprehensive survey of 132 kiosk users in five villages and collected data on their demographic background, educational status, and the affordability and desirability of the kiosk services. In addition, we used data from a survey conducted by the SARI project officials in these villages which covered all the user and non-user households in the local community served by the kiosks. The selection of the users was done using a two-stage sampling process. In the first stage, we used the purposive sampling technique to select the villages based on the length of operation of the kiosk in the community and whether they were being

run by self-employed entrepreneurs or by the NGO. The five kiosks selected were in operation from 10 to 18 months as of June 2003. Three of the five kiosks were run by the NGO while the remaining two were run by self-employed local entrepreneurs. The villages selected thus represented 12.8% of all villages that had kiosks. In the second stage, we selected the users from the records maintained by the kiosk operators. For this study, we interviewed all visitors who had used the kiosks during the month of May 2003. We found that this sample of users constituted around 10% of all users who had used these five kiosks since their inception. We have no reason to believe that the user population from May was at all unusual and therefore this represents a random sample of users for statistical analysis and for drawing inferences about the user population as a whole for these villages. We also collected quantitative data from the Taluk local government office records, government census records, and surveys of the village kiosk operators. We conducted the field work for this project during July-August 2003 and the data we analyzed was for kiosk usage from November 2001 to June 2003.

Our main sources of qualitative data were from structured and open-ended interviews with kiosk operators, SARI project officials, and government officials in the Taluk and district office. We interviewed eight government officials including the state government Secretary of Information Technology and every official involved in the project at the district and Taluk levels. We also interviewed 4 SARI project officials including the project manager stationed at project headquarters in Chennai and 3 local officials stationed at Melur. Finally, we interviewed the 12 kiosk operators to gain information on the methods they employed to create awareness about the kiosks among the users and the procedures used for provision and delivery of various kiosk services.

The interviews with the users were conducted in the local Tamil language by trained graduate students from a local university. Each of these interviews took approximately 30 minutes to complete. The interviews with the kiosk operators, and the government and project officials were conducted by one of the authors in both English and Tamil. These interviews took approximately one hour each to be completed.

Data Analysis

We have used descriptive statistical techniques to analyze the demographic profiles and the social and educational status of the users. We have also used statistical techniques such as one-sample inference for means and proportions to conduct a comparative analysis of the socio-economic profiles of the kiosk users and their respective village communities. This technique allows us to draw statistically valid conclusions about whether the kiosks are being used by the entire community or whether their usage is limited to only certain segments in them.

Overall Reach of the Kiosks

In the five villages surveyed, the kiosks reached from 3-14% of the village population and around 11-26% of the village households (reliable information for one village, Ulagapitchampatti, on the percentage of households reached was not available) (Figure 2). These results are calculated from the total number of users at these kiosks since their inception. Thus, for example, the total number of users at Thiruvadavur kiosk represents 4.9% of the total population and 20% of the total households within the hamlet. We calculated this based on the records maintained by the kiosk operators. The results show that the majority of the village community has yet to use the kiosk services, though the minority that have used it is sizeable.

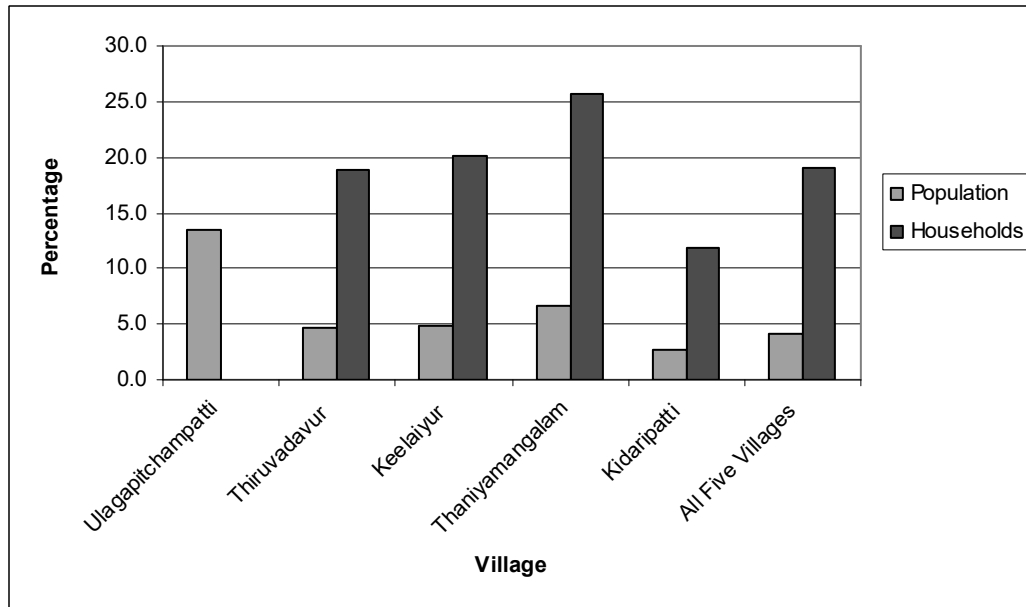


Figure.2: Overall reach of the kiosks within their communities.

Socio-economic profile of the kiosk users and the village community

We first present a comparative analysis of kiosk users and their respective village communities for each of the five kiosks as well as for the five kiosks combined. This analysis is presented in Tables 1 to 6 in the Appendix1. We discuss these results below for seven variables indicating the demographic and socio-economic status of the kiosk users and the overall village population: age, gender, religion, caste, income, ownership of household assets, and educational level.

Age Distribution of Kiosk Users

An overwhelming majority of the kiosk users are young. Most of them are below 30 years (Figure.3). The average age of the users is 20 or below in four of the five villages (Tables 1 to 5)². The average age of all users in all five villages combined is 19.2 years (Table 6). With the sole exception of Ulagapitchampatti, over 90% of the users are below 30 years. This indicates that the kiosk users are significantly younger than the communities as a whole. We think that the significantly different age profile in Ulagapitchampatti, when compared to that in the other four villages, is due to the extra efforts made by the operator in creating awareness about the kiosk services through vigorous canvassing among all sections of the village population.

¹ . The figures show the estimated 95% confidence interval for each of the demographic characteristic based on a one-sample inference for means and proportions and the corresponding population mean and proportion for that characteristic. A population mean lying outside the 95% confidence interval indicates that the overall village community is significantly different in that characteristic from the population of the kiosk users.

² Age with 95% confidence intervals range between 11.8 to 23.2 years.

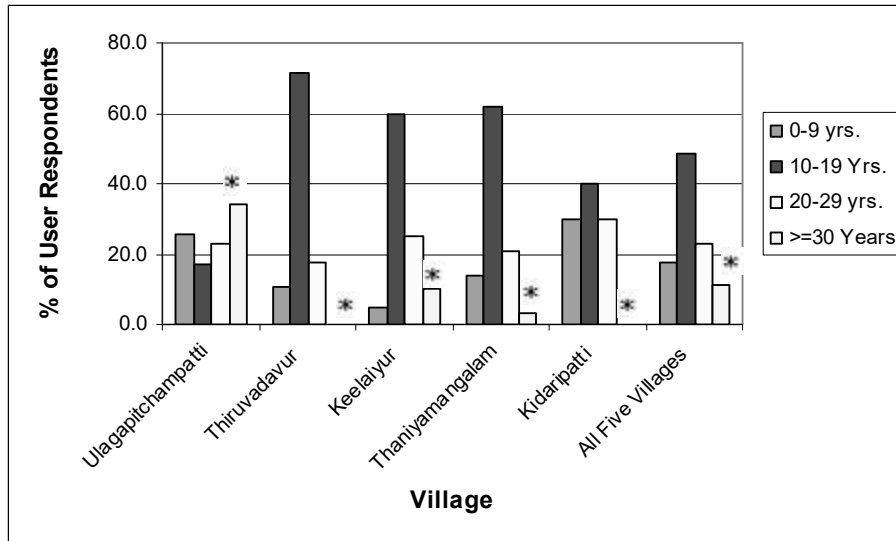


Figure.3: Age distribution of kiosk users.

A (*) indicates that the proportion of users less than 30 years of age is significantly higher than that in the village population.

Gender of Kiosk Users

Most of the kiosk users are male (Figure.4). The proportion of male users varies from 65.5% in Thaniyamangalam to 90% in Kidaripatti and is far higher than the percentage of males in the village population (Tables 1 to 5). The proportion of male kiosk users in all the five villages combined is 74.2%, which again is far higher than the same in the total village population (Table 6). This further indicates a significantly different kiosk user profile compared to the respective village communities. Most of the women users at the kiosks are girl students who come for computer education. (See Best & Maier (2006) for a broader analysis of women's usage patterns within the SARI project.)

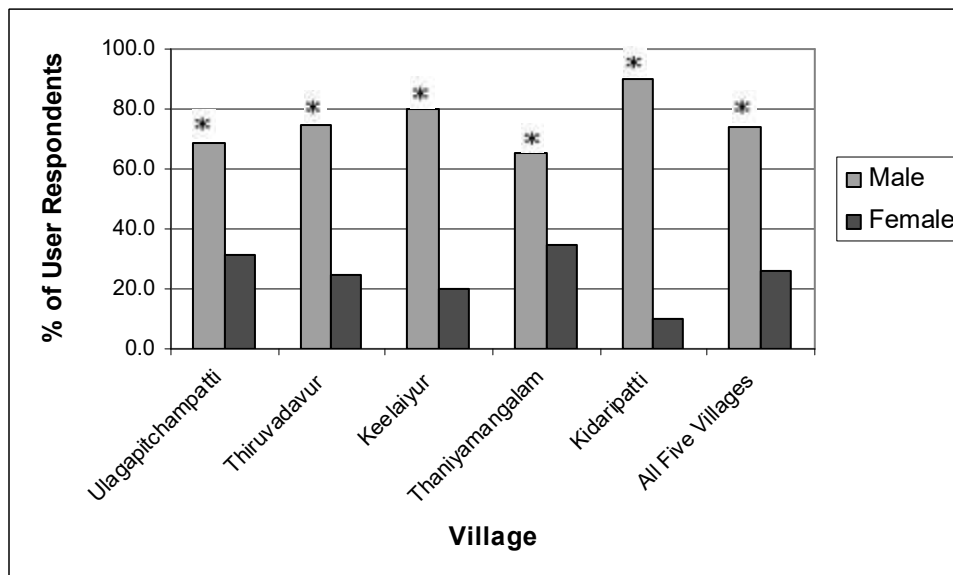


Figure.4: Gender distribution of kiosk users.

A (*) indicates that the proportion of male users is significantly higher than that in the village population at 95% confidence level.

Religion of Kiosk Users

All the kiosk users belong to the majority Hindu religion, except in two kiosks, Ulagapitchampatti and Thiruvadavur (Figure.5). In these two villages, the proportion of non-Hindu users is not statistically different from that in the overall village population (Tables 1 and 2). In Thaniyamangalam, the village population itself contains only 0.2% non-Hindus (Table 4). However, the remaining two kiosk villages, Keelaiyur and Kidaripatti, have significant non-Hindu populations (4.1% and 19.2% respectively) but still have no non-Hindu kiosk users. The proportion of non-Hindu users is lower than that in the overall village population even when we combine the data for all the five villages (Table 6).

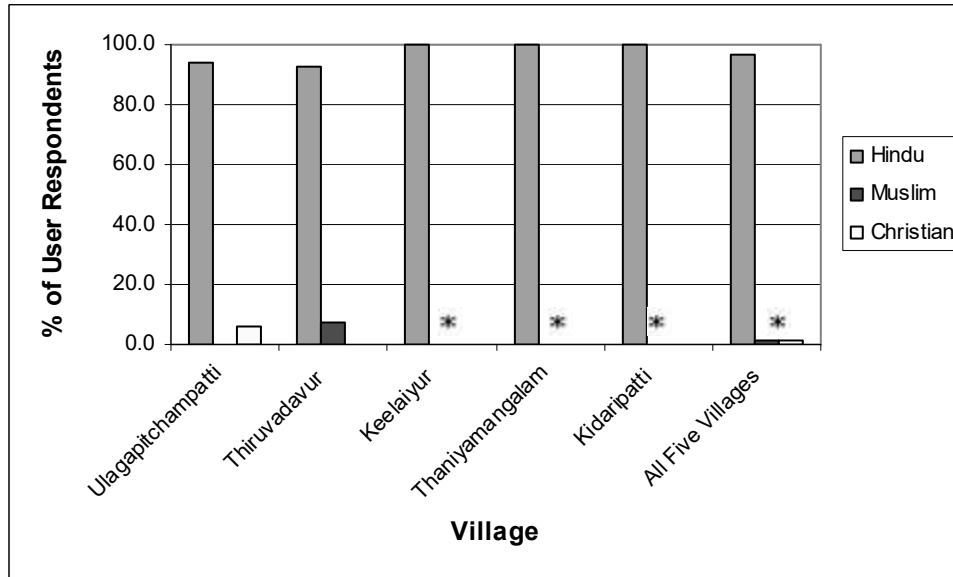


Figure.5: Distribution of religion of kiosk users.

A (*) indicates that the proportion of non-Hindu users is significantly lower than that in the village population.

Caste of Kiosk Users

In collecting data on the caste of the users, we followed the official method of classification of castes into backward castes (BC), most backward castes (MBC), scheduled castes (SC), scheduled tribes (ST), and forward castes (FC) (also classified as 'other'). SCs and STs are traditionally the most socially and economically disadvantaged communities in these villages. Most of the users belong to the numerically dominant castes in these villages, namely, the backward castes (BC) (Figure.6). The proportion of SC users is not significantly differently from that in the overall village population when we combine the data for all the five villages (Table 6). However, the situation is different at the individual village level.

In three villages (Ulagapitchampatti, Thiruvadavur, and Thaniyamangalam), the proportions of SC users are statistically significantly lower when compared to those in the kiosk village population as a whole (Tables 1, 2 and 4). However, in Keelaiyur and Kidaripatti, the majority of the users belong to the scheduled casts and the proportions are significantly higher statistically as compared to those in the total village population. Discussions with the users and the kiosk operators indicate that the location of these two kiosks, closer to the SC households, is an important factor in attracting more SC users. These operators have also made extra efforts in contacting the SC households and motivating them to visit the kiosks. However, just canvassing among the SC households does not appear to be sufficient in attracting them to the kiosk. This was corroborated by the kiosk operator in Thiruvadavur, who stated that despite her best efforts in motivating the SC households to come to the kiosk, not many SC users had availed themselves of the services as they lived far away from the kiosk. Thus, location of the kiosk seems to be a more important factor when attracting SC users compared to marketing and canvassing efforts. .

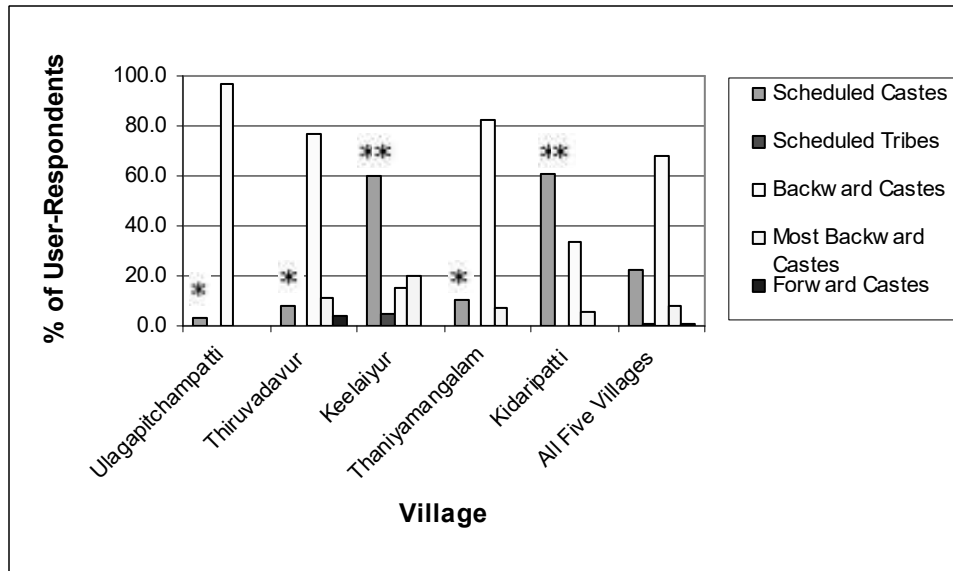


Figure.6: Caste of kiosk users.

A (*) indicates that the proportion of SC users is significantly lower than that in the village population. A (**) indicates that the proportion of SC users is significantly higher than that in the village population.

Income of Kiosk User Households

For the the purposes of this survey, we divided the monthly household incomes into five ranges: less than Rs. 500 (about \$US 11) per month, between Rs. 500 and 1,000, between Rs. 1,000 and 2,500, between Rs. 2,500 and Rs. 5000, and more than Rs. 5,000. Most of the user households are in the middle to upper income groups (with monthly incomes more than Rs. 1,000), except in one village, Ulagapitchampatti (Figure.7). Only Ulagapitchampatti seems to attract a large proportion (78.8%) of low income kiosk users (those with monthly household incomes of Rs. 1000 or below) (Table 1). In the other four villages, this proportion varies from 15.4% in Thiruvadavur to 33.3% in Thaniyamangalam. We think that the significantly higher proportion of low income users in Ulagapitchampatti is due to the extra efforts made by the kiosk operator in contacting the poor households in the village. This was also confirmed by the kiosk users. As no reliable data on actual income levels of the kiosk village area population was available, it was not possible to statistically compare the income levels of the kiosk users with that of their respective village communities. But qualitative evidence (discussions with kiosk operators and SARI project officials) indicates a generally higher income levels among the users when compared to that of the overall village population.

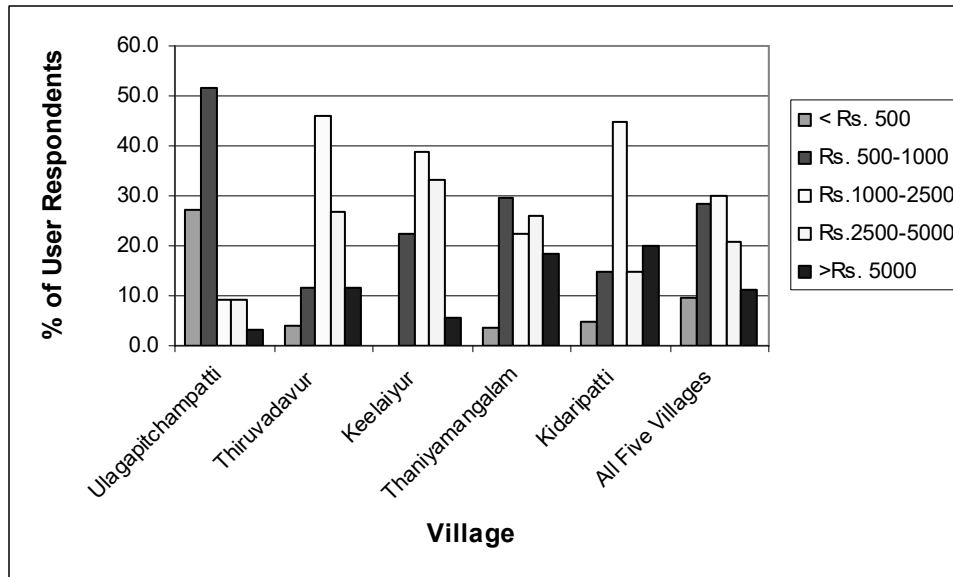


Figure.7: Income distribution of kiosk users

Ownership of Household Assets in Kiosk User Households

In the absence of reliable income data, we used the ownership of household assets to make a comparative analysis of the economic status of the users and the village population. As can be seen in Tables 1 to 6, the kiosk users do seem to come from a higher economic status as they own more household assets compared to the average of their respective communities, though the extent of differences vary in each village. For example, in Keelaiyur, the kiosk users are not statistically different from their community in this regard, while in Ulagapitchampatti and Kidaripatti, they seem to be different only on a few indicators, such as in proportion of cable TV ownership in Ulagapitchampatti and in 2-wheeler (scooter) ownership in both the villages. In the other two villages, the differences are wider. In Thiruvadavur, higher proportions of kiosk users own two-wheelers, color TVs and cable TV, and comparatively far lower percentages live in thatched houses or in houses without electricity. This shows the higher economic status of the users compared to that of the overall village community. The sharpest differences emerge in Thaniyamangalam, where far higher proportions of kiosk users own telephones, radio/transistors, color and cable TV, and far lower proportions live in thatched houses and in houses without electricity.

Figure 8 below presents the distribution of ownership of two-wheelers, which we think is a key indicator of the socio-economic status of the households in these villages.

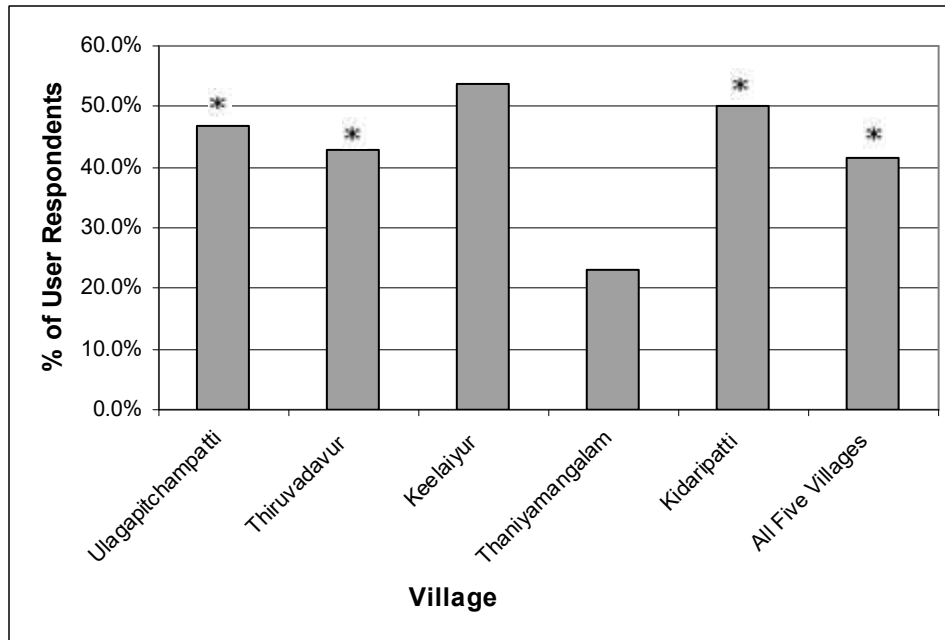


Figure.8: Distribution of two-wheeler ownership among the kiosk users.

A (*) indicates that the proportion of users owning two-wheelers is significantly higher than that in the village population.

Educational Level of Kiosk Users

Most of the kiosk users are school and college students (Figure.9). School includes up to 12th grade. None of the users are illiterate, except in two villages, Ulagapitchampatti and Keelaiyur (Tables 1 and 3). Even in these two villages, the proportions of illiterate users are significantly lower than those in the overall village population. Thus, we can say that the kiosk users are comparatively more literate and educated than their communities.

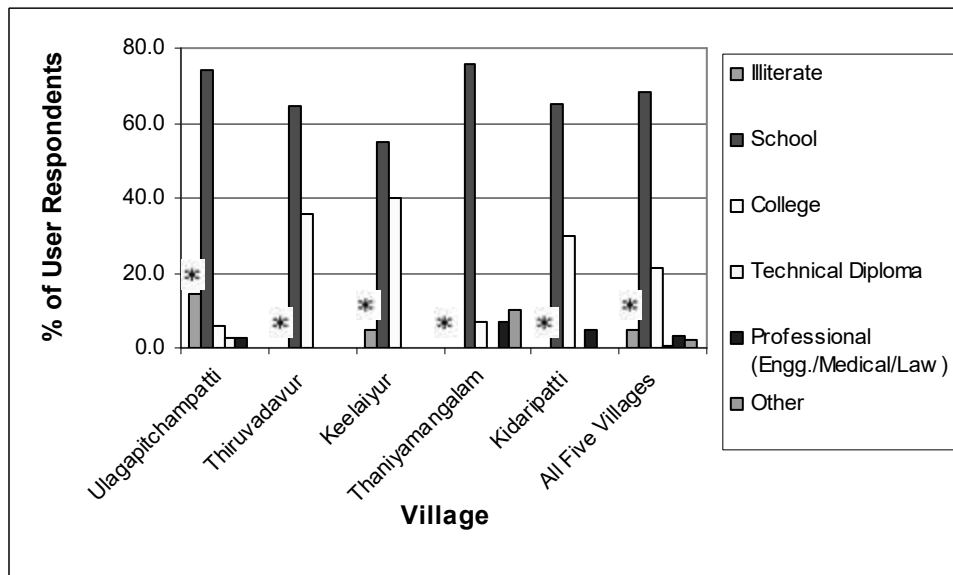


Figure.9: Educational level of kiosk users.

A (*) indicates that the proportion of illiterate users is significantly lower than that in the village population.

In addition to the educational attainment of the kiosk users, we also analyzed the educational attainment of the heads of the user households (Figure.10). Two villages (Ulagapitchampatti and Keelaiyur) show statistically the same profile for the heads of user households when compared to that of their respective village populations (Tables 1 to 5). When we combine the data for all the five villages, we find that the proportion of illiterate heads of user households is significantly lower than that in the overall village population (Table 6). Thus, in general, the heads of the households of kiosk users are comparatively more educated when compared to heads of the households in their respective overall village populations.

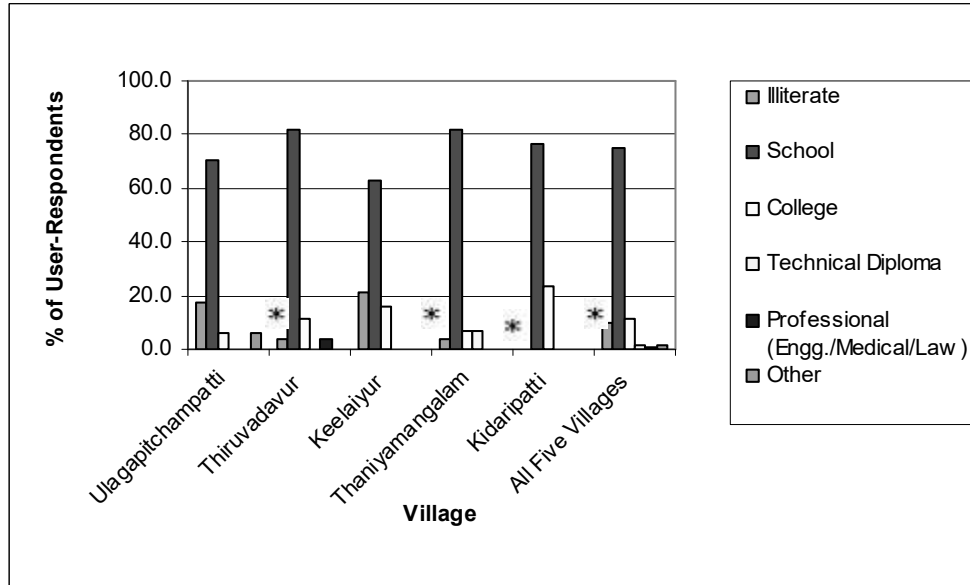


Figure.10: Educational level of heads of kiosk user households.

A (*) indicates that the proportion of illiterate heads of user households is significantly lower than that in the village population.

Summary of Analysis

The analysis indicates that the kiosk users have a socio-economic profile which has statistically significant differences from that of their respective overall village populations for all the seven demographic variables analyzed, though the differences are not uniform across all the five villages. We find that the kiosks have served mainly those sections of their communities that are relatively more educated, enjoy a higher social status, and are economically better off.

How can the kiosks be made more effective in serving a broader set of community members? In the following sections, we examine the diffusion of kiosk use as a technological innovation in the context of the diffusion of innovations framework by Rogers (1995, 2003). We examine why kiosk use has failed to diffuse more widely and present recommendations for enabling broader diffusion. We argue that with appropriate strategies to attract new users, it is possible for the kiosks to broaden their user base by reaching out to socially and economically disadvantaged communities.

Diffusion of Kiosks as a Technological Innovation

Rogers (1995, 2003) provides a very useful framework for analyzing the observed characteristics of kiosk users in terms of adopter categories: innovators, early adopters, early majority, late majority, and laggards. He also provides a framework for analyzing the rate of adoption of the innovation within the social system in terms of perceived attributes of innovations (relative advantage, compatibility, complexity, trialability, observability), type of innovation adoption decision (optional, collective, authority), communication channels (mass media or interpersonal), nature of the social system (its norms, etc.), and the extent of the change agents' promotion efforts (Rogers, 1995, p. 207).

Roman (2003) suggests a number of reasons why Rogers' theory is particularly well-suited to studying telecenter diffusion: "(1) the predictive potential of diffusion theory makes it useful for telecenter planning and design, (2) diffusion theory provides a fertile incentive to stimulate telecenter research – research that, in a circular way, can contribute to further shape the theory, and (3) diffusion theory is versatile and can be adapted to fit the needs of multidisciplinary inquiry." As a middle-range theory (Merton 1968), it is particularly well suited in guiding and evaluating empirical studies and, thus, should be well suited to conceptualizing findings such as those here.

Characteristics of the Kiosk Users

As noted earlier, kiosk users constitute only approximately 3-14% of the village population. Assuming the traditional S-shaped adopter distribution, with a small number of initial users, a rush to use in the middle, and a small number of laggards, the current kiosk users should probably be categorized as 'innovators' and 'early adopters' (Rogers 1995). Rogers (1995, p. 269) notes that earlier adopters usually come from those with relatively higher socio-economic status; they have relatively more years of formal education, are more likely to be literate, and have higher social status than later adopters. The observed socio-economic characteristics of the kiosk users in this study thus closely match these predictions based on theory.

The categorization of the kiosk users into adopter categories gives us some clues for facilitating the use of the kiosks to diffuse more widely among the village population. Evidently, the change agents (the SARI organization and the kiosk operators) have failed to target effectively the individuals and households in the villages with relatively lower socio-economic status. This suggests a need for targeting communication efforts towards those segments of the population who may be the last to adopt the use of the kiosks. At the same time, the theoretical framework from Rogers predicts the results observed under the SARI experiment; it is expected that early adopters will have different social and economic standings from the population at large.

Attributes of the Innovation and its Extent of Adoption

Roman (2003) describes the three most important factors to be considered in explaining the extent of adoption and the socio-economic impacts of the kiosks: the perceived attributes of the innovation (how the kiosks and their services are perceived by the community), the communication of innovation (how the innovation is communicated within the community), and the consequences of adoption (the socio-economic impacts of the kiosks). In the following sections, we attempt to place the kiosks and their observed socio-economic impacts within this framework.

Perceived Attributes of Innovations

Roman (2003) goes on to describe the three most important perceived attributes of innovations in the context of telecenters: relative advantage which indicates the costs and benefits associated with the adoption of an innovation; compatibility, which indicates the perceived match of the innovation with the value system and social norms of the potential adopters; and complexity, which is the perceived degree of difficulty of the innovations in their understanding and use.

Relative Advantage

In the context of the SARI kiosks, we think that relative advantage has been a key factor in the use of the kiosk services. The most reliable evidence of this comes from the case of the e-government services, where savings in time, effort, and costs are associated with higher levels of their usage for two e-government services: birth certificates and old age pensions (Kumar & Best, 2006). We found that the same is true for other services, such as computer education, email, and voice chat. In other words, the costs associated with these services were less, and the benefit accrued greater, than the alternatives (a postal letter, telephone call, and so forth).

Compatibility

The issue of compatibility is closely linked to the existing socio-cultural environment for these communities and may help explain the observed socio-economic profile of the users. We think that one major finding that it helps explain is the relative absence of women users from the kiosks. Though the

technology itself may be considered to be gender-neutral, how it is perceived and used within the community is clearly associated with the social norms within the community. We find that women in these households often don't have decision-making power or control over the use of financial resources. Generally the kiosks are not thought to be useful to the women, except perhaps in accessing health services. However, the households do allow girl students to come to the kiosks for computer education, which is widely perceived to be useful to them. This indicates the importance of relevant content and services for attracting women users (Best & Maier, 2006).

Compatibility is closely linked to the issue of relevant content. Researchers have made considerable efforts in assessment of needs and relevant applications for the kiosks in Melur (Sinan, Marcela, & Randal, 2001). However, even if the broad areas where relevant content can be provided are known, far greater efforts are required in narrowing these down, and actually developing and delivering them to the communities. One example that repeatedly occurred during this study concerns e-government services. E-government services started well and were delivered relatively successfully through these kiosks for over a year, but then collapsed due to lack of institutionalization, shifting of the initial champions, and resistance from the local government officials (Kumar & Best, 2006). For instance, when the initial Taluk officer and District Collector (who had both championed the e-government program) were shifted out of Melur these services ended. Thus developing and delivering relevant services are keys to the sustainability of the kiosks, but sustaining the services themselves requires ongoing political and institutional support.

Complexity

Complexity of the innovation is closely linked to the perception in the community that it is meant only for those who are educated. We found this to be true in many discussions with the users and think it would certainly be true among the non-users. The image of a computer which can only be used with the help of an external operator is one of great complexity. Efforts are required to demystify the kiosks, an issue intimately linked to how the innovation is communicated within the community. Furthermore, simpler interfaces, applications, and appliances should be developed.

Communication of Innovation

Communication is the exchange of information through which new ideas are propagated from one individual to others (Rogers, 2003). It is the very essence of diffusion of innovations. The two most important ways through which ideas are communicated are through mass media and interpersonal communication. Theory suggests that mass media are best for creating awareness about innovations, whereas interpersonal communication is more important for the final decision to adopt (Roman, 2003). Research also suggests that diffusion is linked to existing social networks (Rogers & Kincaid, 1981) and that the concept of homophily is very important in the propagation of new ideas (Rogers, 2003). Homophily refers to similarity in socio-economic status, educational attainments, etc. among individuals. The theory suggests that diffusion is likely to take place more effectively in a social system where individuals are similar in their socio-economic status, educational attainment, beliefs, etc.

As the analysis presented earlier shows, kiosks have been used mainly by those who enjoy a comparatively higher socio-economic status (with some exceptions) and is yet to reach the majority of the village population. Discussions with the kiosk operators and the SARI project officials reveal that a good amount of effort has been put towards creating awareness about the kiosks, both through mass media and through interpersonal communication by the kiosk operators. Then, why have they not succeeded in having a wider reach?

We think it is important to consider this question in the socio-cultural context of rural communities in India and how this affects diffusion. There is considerable residential segregation by community (caste) in the villages, often cutting across income levels. Individuals belonging to the same caste also enjoy a high degree of homophily in their socio-economic status and social value systems. This is where the crucial role of the local leaders - kiosk operator or other influential opinion makers - in promoting adoption and use comes in. We found sufficient evidence to suggest that the kiosk operator played a crucial role in promoting adoption and use of the kiosks. However, wider diffusion of the kiosks among communities having a comparatively lower socio-economic status requires local champions from within those communities, not just the kiosk operator who seems to be able to influence mainly those from his or her own community. Absence of local champions from within the communities belonging to comparatively

lower socio-economic status appears to be one of the main reasons for lack of diffusion of the use of the kiosks among them.

We also found two additional factors that are important in the diffusion of kiosks. We found that the location of the facility influenced whether scheduled caste community members used them. The question of locating the kiosks closer to the SC habitations thus becomes very important in attracting more SC users. We found evidence of this in the success of two kiosks (Keelaiyur and Kidaripatti) in attracting the SC users; these kiosks are located close to the SC habitations.

The second important factor in the diffusion of the kiosks is affordability. Discussions with users reveal that this is an important aspect in their use of the kiosks, even when they are aware of the services and its benefits. The usage of the kiosks so far seems to be driven by its relative advantage: savings in time, costs, and efforts when compared to traditional modes of accessing the same services. However, affordability of the kiosk services in absolute terms is perceived to be an important factor by the users and is likely to be crucial in the extent of their ultimate diffusion.

Consequences of Adoption

Researchers have noted that it is difficult to theorize the consequences of adoption of innovations because it is prone to be led by value judgments (Roman, 2003). Rogers (2003) points out that diffusion is likely to widen the existing socio-economic inequalities within a social system. Empirical research on telecenters supports this finding (Blattman, Jensen, & Roman, 2003; Holmes, 2001; Hudson, 2002).

Our finding in this study that the kiosks are being used mainly by those enjoying a higher socio-economic status is in line with the knowledge gap hypothesis (Tichenor, 1970). However, this should be interpreted with caution due to the problematic nature of diffusion of innovations in the context of the complex socio-economic and cultural realities in rural India. In other words, it is not a simple cause and effect relationship with the 'gap' in knowledge and adoption, but it is intricately woven into the historical social and cultural relationships among communities in rural areas, e.g., social and psychological barriers in access to facilities and affordability, and compatibility with existing socio-cultural value systems (for example, in diffusion among women, as noted earlier).

Conclusion

We have studied the social diffusion of internet kiosk use among people residing in several rural Indian villages. This study includes an evaluation of five villages in Melur district, Tamil Nadu, India, that were a part of the Sustainable Access in Rural India (SARI) project. Our principal empirical project has been to study the users of these facilities within the five villages and to compare their demographic makeup (age, caste, gender, etc.) to the village populations as a whole. We find that in a number of cases the demographic makeup of the kiosk users is statistically different from the makeup of the village overall. Thus, while we find that roughly 5% of the population in the villages studied has used the kiosk, this 5% was clearly not selected "at random" from the village population as a whole; some selection biases drove kiosk use. In particular, we find these diffusion biases along dimensions of gender (more males than females), age (users are usually younger than 30), caste (scheduled caste members are less likely to use the facilities save in those villages where the facility is located in an SC area), religion (Muslims and Christians are under-represented as users in some villages), educational attainment (with few illiterate users), and income (users are richer as measured by standard surrogate indicators).

Rogers' theory of diffusion of innovation offers an explanatory framework for the diffusion biases we have measured. Indeed, the theory is well suited for this sort of empirical testing and (perhaps) falsification (Roman 2003). In particular, in earlier work we demonstrated that diffusion of the use of e-government services was best explained through the perceived relative advantage (Kumar & Best, 2006) of the service. Our findings here, however, seem best explained by the notion of perceived compatibility and complexity of the innovation as well as how the innovation has been communicated and shared within the communities.

In particular, we posit that the lack of female participation (for instance) can be explained due to a lack of perceived compatibility between the innovation and the overall context for women in these villages. Similarly, the lack of scheduled caste users in some villages can be explained both as a matter of social incompatibility as well as weak communication channels that exist between higher caste operators situated

in upper caste hamlets and scheduled caste communities. Finally, we argue that the presence of generally more educated users can be explained with Rogers' notion of complexity – where the perception amongst village members is that this innovation is highly complex and difficult to adopt and thus only appropriate to people with higher levels of education.

As argued above, this theoretical framework not only can help explain our empirical results but should be able to help inform the planning and design of telecenter interventions going forward. Our findings, that complexity, compatibility, and communication can inform the diffusion among a broad set of users (in addition to the relative advantage studied elsewhere) should be instructive in future design. In particular it suggests that attention be paid to developing transparent and well-designed applications (and, indeed appliances) in order to mitigate perceptions of complexity. Furthermore, it indicates that local context and social compatibility can be paramount. Content and systems need to address these issues directly (for instance by placing the system within a context compatible with women's adoption). Finally, we find that communication of the innovation, especially as performed by the kiosk operator, can be particularly critical to biasing the diffusion of the innovation. For example, if the operator excludes marketing to members of the scheduled castes this can easily discourage their use.

As the research for this study was conducted in mid-2003, we again conducted field research during July 2005 to validate the findings of this study. We found that of the 77 kiosks that were established in the region by June 2004, 29 of the 35 kiosks run by self-employed entrepreneurs had closed down. At the same time, 42 kiosks being run by the NGO were still operating (Best & Kumar, In Preparation). The main reasons behind the closure of the kiosks being run by self-employed entrepreneurs were lack of long-term financial viability and lack of adequate operational and technical support by n-Logue, the internet service provider and organization responsible for coordinating with other entities for delivery of services. The lack of long-term financial viability was mainly due to the inability of the kiosks to diffuse widely within their communities and attract more users. As pointed out in this study, the kiosks continued to attract users mainly from the relatively higher socio-economic strata within their communities and failed to upgrade their content to make it more relevant to a wider section of the village population. On the other hand, the kiosks being run by the NGO received financial subsidies for them to remain viable and also introduced more and better services to attract more users. These findings confirm the main conclusions of this study and underscore the importance of making the kiosks diffuse more widely among their communities for long-term economic and social sustainability.

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Appendix

Table 1: Ulagapitchampatti Village

Characteristic	Sample Size	Sample Mean/ Proportion	95% Confidence Interval		Village Population Mean ⁺
			Lower Limit	Upper Limit	
Demography:					
Average Age of Users	35	25.9	20.7	31.1	
Proportion of Users < 30 Yrs.	35	65.7%	49.4%	82.0%	68.0% ⁺⁺⁺
Proportion of Male Users	35	68.6%	52.6%	84.5%	50.5% ⁺⁺
Proportion of SC/ST ^a Users	35	2.9%	-2.9%	8.6%	23.6%
Proportion of Minorities (Muslims, Christians)	35	5.7%	-2.3%	13.7%	2.8%
Proportion of Illiterate Users	35	14.3%	2.3%	26.3%	29.0% ⁺⁺
Proportion of Illiterate Heads of User Households	34	17.6%	4.3%	30.9%	29.0% ⁺⁺
Income and Assets:					
Proportion of User Household Income <=Rs. 1000	33	78.8%	64.3%	93.3%	
Proportion of 2-Wheeler Owners	30	46.7%	28.0%	65.3%	18.44%
Proportion of Telephone Ownership	30	3.3%	-3.4%	10.0%	3.21%
Proportion of Radio/Transistor Ownership	30	46.7%	28.0%	65.3%	60.52%
Proportion of B&W TV Ownership	30	63.3%	45.3%	81.3%	51.10%
Proportion of Color TV Ownership	30	10.0%	-1.2%	21.2%	14.23%
Proportion of Cable TV Ownership	30	3.3%	-3.4%	10.0%	22.24%
Proportion of Users Owning House	35	77.1%	62.7%	91.6%	90.58%
Proportion of Users Owning Thatched House	35	22.9%	8.4%	37.3%	26.65%
Proportion of Users Not Having Electrified House	34	32.4%	16.0%	48.7%	30.9%

+ Source: Household Survey, 2003 conducted by SARI for the entire population of the hamlet

++ Source: Census of India, 2001 for Thiruvadavur

+++ Based on figures for Madurai district for 1991 census

a SC/ST means scheduled castes and scheduled tribes. They are traditionally the most socially and economically disadvantaged communities in these villages.

Table 2: Thiruvadavur Village

Characteristic	Sample Size	Sample Mean/ Proportion	95% Confidence Interval		Village Population Mean
			Lower Limit	Upper Limit	
Demography:					
Average Age of Users	28	16.29	14.3	18.3	
Proportion of Users < 30 Yrs.	28	100.0%	100.0%	100.0%	68.0% ⁺⁺⁺
Proportion of Male Users	28	75.0%	58.2%	91.8%	50.5% ⁺
Proportion of SC/ST Users	26	7.7%	-3.1%	18.5%	18.6% ⁺
Proportion of Minorities (Muslims, Christians)	28	7.1%	-2.8%	17.1%	2.8% ⁺⁺
Proportion of Illiterate Users	28	0.0%	0.0%	0.0%	29.0% ⁺
Proportion of Illiterate Heads of User Households	27	3.7%	-3.8%	11.2%	29.0% ⁺

Income and Assets:					
Proportion of User Household Income <=Rs. 1000	26	15.4%	0.8%	30.0%	
Proportion of 2-Wheeler Owners	21	42.9%	20.3%	65.4%	18.44% ⁺⁺
Proportion of Telephone Ownership	21	9.5%	-3.8%	22.9%	3.21% ⁺⁺
Proportion of Radio/Transistor Ownership	21	66.7%	45.2%	88.1%	60.52% ⁺⁺
Proportion of B&W TV Ownership	21	47.6%	24.9%	70.4%	51.10% ⁺⁺
Proportion of Color TV Ownership	21	42.9%	20.3%	65.4%	14.23% ⁺⁺
Proportion of Cable TV Ownership	21	47.6%	24.9%	70.4%	22.24% ⁺⁺
Proportion of Users Owning House	28	78.6%	62.7%	94.5%	90.58% ⁺⁺
Proportion of Users Owning Thatched House	28	3.6%	-3.6%	10.8%	26.65% ⁺⁺
Proportion of Users Not Having Electrified House	28	7.1%	-2.8%	17.1%	30.9% ⁺⁺

+ Source: Census, 2001 for Thiruvadavur

++Source: SARI Household Survey, 2003 for Ulagapitchampatti

+++Based on figures for Madurai district for 1991 census

Table 3: Keelaiyur Village

Characteristic	Sample Size	Sample Mean/ Proportion	95% Confidence Interval		Village Population Mean*
			Lower Limit	Upper Limit	
Demography:					
Average Age of Users	20	20.25	17.3	23.2	
Proportion of Users < 30 Yrs.	20	90.0%	76.0%	104.0%	68.0% ⁺⁺⁺
Proportion of Male Users	20	80.0%	61.3%	98.7%	50.3% ⁺⁺
Proportion of SC/ST Users	20	65.0%	42.7%	87.3%	25.1%
Proportion of Minorities (Muslims, Christians)	20	0.0%	0.0%	0.0%	4.05%
Proportion of Illiterate Users	20	5.0%	-5.2%	15.2%	28.4% ⁺⁺
Proportion of Illiterate Heads of User Households	19	21.1%	1.4%	40.7%	28.4% ⁺⁺
Income and Assets:					
Proportion of User Household Income <=Rs. 1000	18	22.2%	1.5%	42.9%	
Proportion of 2-Wheeler Owners	13	53.8%	23.7%	84.0%	38.9%
Proportion of Telephone Ownership	13	38.5%	9.1%	67.9%	14.6%
Proportion of Radio/Transistor Ownership	13	84.6%	62.8%	106.4%	77.1%
Proportion of B&W TV Ownership	13	46.2%	16.0%	76.3%	69.8%
Proportion of Color TV Ownership	13	38.5%	9.1%	67.9%	27.5%
Proportion of Cable TV Ownership	13	53.8%	23.7%	84.0%	57.4%
Proportion of Users Owning House	20	95.0%	84.8%	105.2%	96.4%
Proportion of Users Owning Thatched House	20	5.0%	-5.2%	15.2%	11.1%
Proportion of Users Not Having Electrified House	17	17.6%	-2.0%	37.2%	11.4%

+ Source: SARI Household Survey 2003 based on a population survey of 500 households conducted by SARI

++ Source: Census, 2001

+++ Based on figures for Madurai district for 1991 census

Table 4: Thaniyamangalam Village

Characteristic	Sample Size	Sample Mean/ Proportion	95% Confidence Interval		Village Population Mean ⁺
			Lower Limit	Upper Limit	
Demography:					
Average Age of Users	29	16.1	13.9	18.3	
Proportion of Users < 30 Yrs.	29	96.6%	89.6%	103.5%	68.0% ⁺⁺⁺
Proportion of Male Users	29	65.5%	47.4%	83.6%	46.9% ⁺⁺
Proportion of SC/ST Users	29	10.3%	18.9%	42.0%	47.3%
Proportion of Minorities (Muslims, Christians)	29	0.0%	0.0%	0.0%	0.2%
Proportion of Illiterate Users	29	0.0%	0.0%	0.0%	24.2% ⁺⁺
Proportion of Illiterate Heads of User Households	28	3.6%	-3.6%	10.8%	24.2% ⁺⁺
Income and Assets:					
Proportion of User Household Income <=Rs. 1000	27	33.3%	14.7%	52.0%	
Proportion of 2-Wheeler Owners	26	23.1%	6.1%	40.1%	15.8%
Proportion of Telephone Ownership	26	42.3%	22.4%	62.3%	3.3%
Proportion of Radio/Transistor Ownership	26	80.8%	64.9%	96.7%	44.2%
Proportion of B&W TV Ownership	26	19.2%	3.3%	35.1%	36.9%
Proportion of Color TV Ownership	26	69.2%	50.6%	87.9%	21.8%
Proportion of Cable TV Ownership	26	61.5%	41.9%	81.2%	24.4%
Proportion of Users Owning House	29	96.6%	89.6%	103.5%	96.2%
Proportion of Users Owning Thatched House	29	6.9%	-2.7%	16.5%	31.8%
Proportion of Users Not Having Electrified House	24	4.2%	-4.3%	12.6%	46.7%

+Source: SARI Household Survey 2003 based on a population survey of 500 households conducted by SARI

++ Source: Census, 2001

+++ Based on figures for Madurai district for 1991 census

Table 5: Kidaripatti Village

Characteristic	Sample Size	Sample Mean/ Proportion	95% Confidence Interval		Village Population Mean ⁺
			Lower Limit	Upper Limit	
Demography:					
Average Age of Users	20	15.1	11.8	18.3	
Proportion of Users < 30 Yrs.	20	100.0%	100.0%	100.0%	68.0% ⁺⁺⁺
Proportion of Male Users	20	90.0%	76.0%	104.0%	52.7% ⁺⁺
Proportion of SC/ST Users	18	61.1%	36.9%	85.4%	21.4%
Proportion of Minorities (Muslims, Christians)	20	0.0%	0.0%	0.0%	19.2%
Proportion of Illiterate Users	20	0.0%	0.0%	0.0%	39.1% ⁺⁺
Proportion of Illiterate Heads of User Households	17	0.0%	0.0%	0.0%	39.1% ⁺⁺

Income and Assets:					
Proportion of User Household Income <=Rs. 1000	20	20.0%	1.3%	38.7%	
Proportion of 2-Wheeler Owners	18	50.0%	25.1%	74.9%	10.6%
Proportion of Telephone Ownership	18	0.0%	0.0%	0.0%	1.8%
Proportion of Radio/Transistor Ownership	18	38.9%	14.6%	63.1%	61.6%
Proportion of B&W TV Ownership	18	22.2%	1.5%	42.9%	47.4%
Proportion of Color TV Ownership	18	38.9%	14.6%	63.1%	23.0%
Proportion of Cable TV Ownership	18	38.9%	14.6%	63.1%	42.0%
Proportion of Users Owning House	20	85.0%	68.3%	101.7%	95.6%
Proportion of Users Owning Thatched House	20	0.0%	0.0%	0.0%	24.2%
Proportion of Users Not Having Electrified House	15	6.7%	-7.1%	20.5%	58.8%

+ Source: SARI Household Survey 2003 based on a population survey of 500 households conducted by SARI

++ Source: Census, 2001

+++ Based on figures for Madurai district for 1991 census

Table 6: All Five Villages Combined

Characteristic	Sample Size	Sample Mean/ Proportion	95% Confidence Interval		Village Population Mean ⁺
Demography:			Lower Limit	Upper Limit	
Average Age of Users	132	19.2	14.0	24.4	
Proportion of Users < 30 Yrs.	132	88.6%	83.2%	94.2%	68.0% ⁺⁺⁺
Proportion of Male Users	132	74.2%	66.7%	81.8%	50.2% ⁺⁺
Proportion of SC/ST Users	128	23.4%	16.0%	30.8%	28.4%
Proportion of Minorities (Muslims, Christians)	128	3.0%	0.1%	6.0%	6.7%
Proportion of Illiterate Users	132	4.5%	1.0%	8.1%	30.3% ⁺⁺
Proportion of Illiterate Heads of User Households	132	9.6%	4.4%	14.8%	30.3% ⁺⁺
Income and Assets:					
Proportion of User Household Income <=Rs. 1000	124	37.9%	29.3%	46.5%	
Proportion of 2-Wheeler Owners	108	41.7%	32.3%	51.1%	21.0%
Proportion of Telephone Ownership	108	17.6%	10.3%	24.9%	5.8%
Proportion of Radio/Transistor Ownership	108	62.0%	52.8%	71.3%	61.2%
Proportion of B&W TV Ownership	108	40.7%	31.4%	50.1%	51.6%
Proportion of Color TV Ownership	108	38.9%	29.6%	48.2%	21.6%
Proportion of Cable TV Ownership	108	38.0%	28.7%	47.2%	36.8%
Proportion of Users Owning House	132	85.6%	79.6%	91.7%	94.6%
Proportion of Users Owning Thatched House	132	9.1%	4.1%	14.0%	23.3%
Proportion of Users Not Having Electrified House	118	15.3%	8.75	21.8%	45.9%

+ Source: SARI Household Survey 2003 based on a population survey of 500 households conducted by SARI

++ Source: Census, 2001

+++ Based on figures for Madurai district for 1991 census