Sustainability Failures of Rural Telecenters: Challenges from the Sustainable Access in Rural India (SARI) Project

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Abstract

We have examined longitudinally an ICT for development project in rural India, closely watching activities and surveying users at as many as 100 Internet facilities in more than 50 different villages. The Sustainable Access in Rural India (SARI) project in Tamil Nadu, India, enjoyed many successes, including palpable—albeit localized—social and economic development impacts as well as the incubation of an—albeit inconsistently—celebrated ICT for development start-up company (n-Logue Communications Pvt. Ltd.). Ultimately, however, the SARI project did not sustain itself. In the particular outcomes reported here, we follow the prospects of 36 private telecenters which were opened at various times between November 2001 and February 2004. By May 2005, 32 of these 36 telecenters had closed. However, in the same time period, most of 42 telecenters in the same area that were opened and run by a local NGO continued to function. We provide a comparative analysis between these two groups of facilities. We find that the best explanation for variation in a kiosk lifespan was their level of satisfaction with n-Logue Communications. Moreover, those sites that did express satisfaction with their institutional and technical support were in service for, on average, an additional year compared with dissatisfied sites. In addition to technical and operational support issues, we find that the lack of long-term financial viability was a major reason for the closure of the private telecenters. Financial sustainability was not realized by many centers; indeed, 85% of the operators interviewed cited finances as a major cause for their closure. Finally, telecenters that were owned by individuals with prior training in computers, or that had a separate trained operator, remained operational for a longer period.

Keywords

Information technology, international development, India, sustainability failure, telecenters, rural development

Introduction

There has been a huge increase during the last decade in the number of projects in developing countries that use information and communication
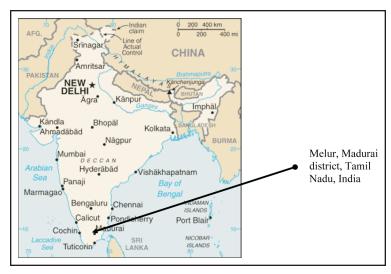

Figure 1. Location of the Melur subdistrict in India.

technologies (ICTs) for social, economic, and political development. A number of these projects aim at bringing the benefits of ICTs to communities where individual ownership of computers is low and use of the Internet is infrequent. Among the methods employed by these projects, "telecenters" occupy a prominent place (Gomez et al., 1999; Heeks, 2008). These centers provide shared public access, often intermediated by an operator, to information and communication technologies and services via computers and the Internet.

This article examines an ICT for development project in India, the Sustainable Access in Rural India (SARI) project in Tamil Nadu, India, over more than four years. Here, privately-owned telecenters operated successfully for over three years, but failed to sustain operations thereafter. The SARI project aimed at rural social, economic, and political development by providing comprehensive information and communication services through computer and Internet kiosks in rural communities. The project started in November 2001 with four computer and Internet kiosks[3] run by self-employed rural entrepreneurs. By June 2004, it had established 78 such kiosks in rural communities in Melur Taluk, an administrative subunit of Madurai district in Tamil

Nadu. Figure 1 shows the location of Melur within India.

These Internet kiosks offered a number of services, including basic computer education, e-mail, web browsing, e-government, health, and agricultural and veterinary services, mostly on a fee-for-service basis. Thirty-six of the 78 kiosks were run by rural self-employed entrepreneurs, while the remaining 42 were run by a local NGO called the Dhan Foundation. After over three years of operation, most of the self-employed entrepreneurs had closed down their kiosks. By May 2005, 32 of the 36 kiosks run by local entrepreneurs had closed. At the same time, the Dhan kiosks mostly continued to operate.

In this paper, we examine the reasons for the sustainability failure of the kiosks run by the self-employed entrepreneurs. We also make a comparative analysis of the two sets of kiosks and examine why the Dhan kiosks continued to operate while the other kiosks had closed down. We focus on the systemic and institutional factors responsible for the initial success and subsequent sustainability failure of the privately owned and operated kiosks and attempt to draw generic lessons from these factors. The lessons learned can help us understand how best to enhance the efficiency and effectiveness of such projects and to realize their long-term sustainability. We end with a general sustainability failure model that captures the principle reasons for failure of this project.

The rest of the paper is organized as follows: First, we overview some of the related work; then, we describe the overall project briefly and how it succeeded initially in meeting the objectives of its stakeholders by forging institutional partnerships with the government and other agencies (both public and private) for delivery of services; next we discuss the methods employed in our empirical study; then we discuss the results including an analysis of

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3. These kiosks are similar in concept and operation to a telecenter, but are usually smaller, with often only one or two computers.

the reasons for the closure of the kiosks; finally, we analyze the critical failure factors and propose a general conceptual framework for examining sustainability failures in this type of project.

Related Works

A number of studies have examined the broad telecenter/telekiosk phenomena and we will not attempt a review of this broad literature here. An existing summary and assessment of telecenter research has been conducted by Kuriyan and Toyama (2007).

And while telecenters have been in existence for well over a decade now, researchers have only recently paid attention to the *long-term sustainability* of such projects. The results of such research has been sobering; it has been noted that a *majority* of ICT for development projects have failed either totally or partially in achieving their stated objectives (Heeks, 2003). Investigators have proposed a number of theoretical frameworks for understanding the reasons for success or failure of such projects, including the critical success factor (CSF) and critical failure factor (CFF) models (Heeks & Bhatnagar, 1999); the "design-actuality" (Heeks, 2002) or "design-reality" gaps (Heeks, 2003); scenario analysis for long-term sustainability problems (Aichholzer, 2004); economic and financial sustainability models (Best & Maclay, 2002); and political and institutional models that underline the lack of commitment on the part of political leaders and public managers (Bhatnagar, 2000). In previous work, we (Kumar & Best, 2006a) have presented a sustainability failure model built upon the work of Heeks and Bhatnagar to help explain why projects that succeed initially can still fail to enjoy long-term sustainability.

While researchers have proposed a number of theoretical frameworks to help understand the reasons for the failure of such projects, there are relatively few empirical case studies that examine long-term sustainability. The few examples that do exist include a study of the Gyandoot rural e-government project in India, which found that although service satisfaction was high, usage over time was low, and the poorest people were not using the services (Cecchini & Raina, 2003). In another case study, lack of regularly updated content and interactivity led to the failure of a community-based e-government initiative in South Africa within a year despite its initial success (Benjamin, 2001). Heeks (2002) has offered brief overviews of several more cases of total or partial failure of ICT initiatives in developing countries.

A number of earlier studies have examined the SARI project itself. We (Kumar & Best, 2006) have studied a subset of facilities and have shown that, in their communities, 5% of the population had been telekiosk users (a significant increase in usage compared to villages without a facility). This community described a predictable diffusion of use pattern. In particular, we found that diffusion was biased along lines of gender (more males than females), age (users are usually younger than 30), caste (scheduled caste members[4] are less likely to use the facilities save in those villages where the facility is located in a scheduled caste 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). In another study, we looked particularly at diffusion of use (or lack thereof) among females (Best & Maier, 2007). Our findings suggest four main conclusions: 1) rural women in this study find ICTs useful; 2) there are gender-specific usage patterns and perceptions of ICTs; 3) obstacles to ICT use are generally structural (time, location, illiteracy) and not personal (for example, a prohibition from a relative); and 4) manifestations of gender awareness correlate with perceptions of obstacles to ICT use.

In a focused study, we examined the success and ultimate collapse of an e-government service offered at some of the telekiosks (Kumar & Best, 2006a). Through these facilities, village members were able to access various citizen services, such as birth and death certifications, old age pension services, public grievances, and more. Through a series of data-driven models, we demonstrated that the presence of these services over the Internet served to increase access to these important government programs and that this access was particularly pro-poor. Ulti-

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4. These people, who Mahatma Ghandi christened the "children of God," are members of castes who have historically been discriminated against in India. They are referred to as "scheduled castes" as they have specific set-asides (essentially affirmative action programs) detailed for them in the constitution of India.

Figure 2. Students in front of a Chirag telekiosk with a Chirag signboard in back.
Photo credit: David Desousa.

mately, however, these e-government services were closed as new political officers, who did not appreciate or share the project's vision, shifted into the region and undermined the project's existence.

Description of the Project

The SARI project has been a collaborative venture of several organizations: the Indian Institute of Technology, Madras; Berkman Center for Internet and Society, Harvard University; Georgia Institute of Technology; I-Gyan Foundation; and n-Logue Communications Pvt. Ltd. Initially, researchers at the Massachusetts Institute of Technology were also partners.

In the project, Internet and computer services were offered to members of the village community at kiosks run as a self-sustained business with fees levied for various services. These kiosks were managed by two sets of operators: in some, a private entrepreneur was in charge, while in others an NGO, called Dhan Foundation, ran the kiosk. Dhan aimed specifically at reaching the most socially and economically disadvantaged communities in rural areas with their kiosks, and oversaw 42 facilities. The other 36 kiosks were owned by self-employed rural

entrepreneurs. In a majority of the kiosks, the owner operated the kiosk directly. In several cases, however, the owners employed a separately trained and paid operator to manage the kiosks. There were 15 locations where the owner and the operator were different persons. All of the kiosks received Internet connectivity from n-Logue Communications Pvt. Ltd., a rural Internet start-up that was incubated through the SARI project and spun out of the Indian Institute of Technology, Madras. Network connectivity was provided via a wireless in local loop (WLL) technology, called corDECT, also developed at IIT Madras (Bhatia, 2003). In addition, n-Logue was tasked to provide technical support and maintenance services to the kiosks and also developed new services, recruited new owners and operators, trained operators and support staff, and assisted in financing of some facilities.

We will refer to the 36 kiosks owned and operated by local entrepreneurs as "Chirag kiosks"; Chirag is a branding concept developed by n-Logue Communications (Figure 2). The other facilities will be referred to as "Dhan kiosks."

Achieving long-term financial and operational sustainability, where the facilities operate without external financial support and become a long-lived feature of the community, was one of the major goals of the SARI project (witness the "S" in "SARI"!). However, after more than three years of operation, most of the self-employed entrepreneurs had closed down their kiosks. By May 2005, a total of 29 of the 36 Chirag kiosks had closed down. At the same time, most of the kiosks run by the Dhan Foundation were still operating.[5]

Partnerships for Project Management and Delivery of Services

Ostensibly, the SARI project was composed of a "board" based at the four principal initiating institu-

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5. We should note that during this time period, n-Logue replicated and scaled the SARI model into additional districts and states throughout India, at various times operating more than 10 additional projects. These additional projects are, however, outside of the scope of this paper.
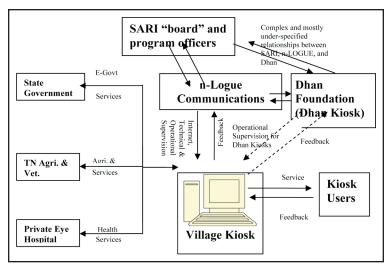
Figure 3. SARI Project Partnerships.

tions (Harvard, MIT, IIT Madras, and McKinsey) as well as a project management staff based at IIT Madras in Chennai. Initial support for the SARI program came from the Mumbai-based commercial bank, ICICI, as well as a gift from the CEO of Analog Devices, Ray Stata.

This SARI team worked with n-Logue Communications as the local implementing partner with n-Logue assuming most of the day-to-day project and network management tasks. The Dhan Foundation was selected by the SARI board to serve as the local NGO partner. At first it was envisioned that Dhan would have a hand in all kiosks deployed within Madurai district. However, differences in management style and implementation philosophies meant that ultimately there were two independent sets of kiosks operating in parallel, with n-Logue focusing attention on the Chirag kiosks. In particular, n-Logue insisted on a business focus limiting donor largesse while the Dhan Foundation adopted what they called a "pro-poor" approach demanding larger and more sustained donor support.

Additionally, the SARI project had developed partnerships with different agencies—both public

and private—to provide various services to community members. These included tie-ups with the Tamil Nadu Agricultural and Veterinary University for providing remote agricultural and veterinary services, and with a private eye hospital, Arvind, for providing telemedicine eye check-ups. The state government supported the project from the beginning with official orders providing for bureaucratic assistance and regular contact with the program.[6] In addition, the State government, at times, offered e-government services through the kiosks for the issuance of birth and death certificates, income certification, copies of land and cultivation records, complaints regarding civic services, and general petitions on other issues.

The scope of the partnership with the local government was limited to two aspects: first, it allowed the kiosks to send applications electronically to the Melur Taluk office (the sub-district government seat) for various e-government services, and, second, it established a coordinating mechanism for monitoring the processing of such applications. This coordination and monitoring was to be executed by the District Collector through regular meetings with SARI or n-Logue project officials. While these coordination meetings were conducted regularly until the end of 2002, they virtually stopped after the incumbent District Collector was transferred out of the district in February 2003. At around the same time, the administrative head of the Melur Taluk office was also transferred out. The transfer of these two key officials was one of the major reasons for the collapse of the e-government services at the Taluk office (see Kumar & Best, 2006a).

Failure of these partnerships to sustain themselves over a long term period was one of the major

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6. *The union government in Delhi offered support, in principle, to the project. However, it also delayed implementation of the program for more than a year by refusing to sanction a backhaul fiber connection to Madurai City, claiming that we intended to illegally provide VoIP services. The fiber backhaul was owned and operated by BSNL, the state incumbent operator. Fiber connectivity was finally provided after a meeting with the Minister of Telecommunications, the Managing Director of BSNL, and the head of the Indian communications regulatory agency, TRAI. The request made by the government at this meeting was that SARI deploy the project in the state of Bihar, in the North of India, where the then-Minister had his constituency. This was never agreed to nor done.*

reasons for the closure of the kiosks. We discuss this aspect in more detail later. Figure 3 shows some of these partnerships in the management and delivery of services.

Institutional Framework for Operation of the Kiosks

The project was launched within the broad institutional and legal framework as laid out through an executive order of the Tamil Nadu state government in February 2001. This order permitted the sponsors of the SARI project to launch in Madurai district. The order mentioned that the rural kiosks would aim at providing a host of services, such as agriculture, health, telemedicine, and e-government programs, for the benefit of the rural population. To ensure smooth implementation of the e-government component of the project within the district, the Madurai District Collector, the chief government administrator of the district, was asked to play a lead role.

Business Model of the Kiosks

As already mentioned, the kiosks were established as self-sustained businesses, based on full-cost recovery through user charges for the services offered. The charges levied for the services ranged from Rs. 10 (US$0.02) for sending an e-mail to Rs. 100 per month for a basic computer course for school children. The basket of services and popularity of various applications varied considerably from kiosk to kiosk. Above, we mentioned agriculture, medical, and government services. These services were all offered in collaboration with external institutions. Some locations also focused on "cybercafé-"type activities such as e-mail, voice mail, and Web surfing. Additionally, many sites had a brisk computer training business mostly focused on basic Windows and Web literacy. Some sites also had entertainment offerings, such as video clubs and games.

The basic cost and revenue model for these facilities was compelling: For a simple facility, the break-even point, not including staff costs, would be just US$3 a day, according to our analysis (Best, 2003). This was computed, based on an extremely simple cost model that included capital expenses of roughly US$1,500 (which would cover a computer, basic furniture, and a fan, and assumes that the center is situated otherwise within an existing business or home). Assuming the equipment was purchased on credit, using the concessionary terms on offer to the project, led to a monthly charge on the capital of approximately $30 over five years. Average rent and electricity charges were $25 and n-Logue charged exactly $15 per month for network connectivity.[7] This resulted in a total monthly cost of roughly $70 and a per-day break-even point of approximately $3 (assuming a six-day work week standard for India). Operator salary averaged $1–$2 per day which would increase the break-even point; alternatively, if the facility was operated directly by the owner, all income beyond $3 per day would be booked as profit.

This business model is described with greater detail in Best (2003). With the addition of voice services, it is argued that a SARI telekiosk should have been able to be financially self-sustainable, servicing an area with as few as 100 households, given the income profiles and ICT spending patterns of the Maduri district.

Research Methods

Our primary variable of interest is, broadly, the duration of time that each of the telekiosks were "active"—those months when they were open and being used for online services. There was considerable variation in the duration of activity among the Chirag kiosks, ranging from a site that survived for only 46 days to one that was open for more than three years before closing. In addition, four centers remained in operation at the end of our study period. It is this substantial variation that we wish to explain: Why did some facilities thrive while others quickly folded?

In order to understand this variation, we have employed a set of qualitative and quantitative approaches. While quantitative methods helped us to understand the relevant statistical associations and correlations among the different variables, qualitative methods helped us in analyzing the institutional, organizational, and individualized factors responsible for the site closures.

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7. There were times when n-Logue proposed to charge up to $25 per month for Internet connectivity. It was not clear to the SARI project exactly where their break-even point lay. In the end, the SARI board was able to insist on the $15 per month fee consistently applied.
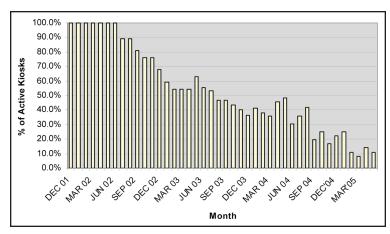
Figure 4. Percentage of active Chirag kiosks in Melur, relative to those opened during that month.

Our most important source of data was a structured survey of 27 kiosk owners who had closed down their kiosks after operating them for periods ranging from one month to three years. We conducted this survey in the months of August and September 2005. These surveys were conducted in the local language by two trained interviewers. We also collected quantitative data from the records maintained by SARI and n-Logue project officials on the performance of the kiosks. The period for the data collected was from December 2001 to May 2005. Finally, we conducted semi-structured interviews with other stakeholders of the project, such as SARI project officials, n-Logue officials, government officials, and Dhan Foundation managers. The officials we interviewed included the then-Secretary of the Information Technology Department, Tamil Nadu Government in Chennai; n-Logue officials in Melur; the District Collector and the head of the National Informatics Center (NIC) in Madurai; and the Executive Director and other officials of the Dhan Foundation in Madurai. We conducted 10 such elite interviews. These interviews were conducted in English during July and August 2005 by one of the authors (Kumar).

Data Analysis

Active and Inactive Kiosks

The number of operational kiosks in Melur increased rapidly during the first two and a half years of the project. The number of Chirag kiosks reached its peak of 36 in March 2004, while the Dhan kiosks increased to a high of 42 in June 2004. However, when we analyze the number of "active" versus "inactive" kiosks, a different picture emerges. We define a kiosk as active in a month if it had used at least one hour of Internet time during the month under consideration. This unit of analysis is particularly attractive as our measurement of it is perfect. We had full access, provided by n-Logue, to all network traffic data. A weakness of this variable is that it could miss "active" sites only with offline applications such as video clubs or offline training. Empirically, however, we noted no instances of this.

Analysis of this data reveals that the portion of active Chirag kiosks declined precipitously during the period of study. As can be seen from Figure 4, the percentage of active Chirag kiosks at the end of our study period was only 11.1% of the number of facilities at its peak.

A similar analysis for the Dhan kiosks presents a different result. The total cumulative number of Dhan kiosks was 42 in May 2005, while the number of active kiosks was 30; thus the percentage of active Dhan kiosks was 71.4% in May 2005 (Figure 5). Note that the absence of active Dhan kiosks from March to May 2003 was due to suspension of the Internet connections by n-Logue over a payment dispute.

The above analysis indicates that the Dhan kiosks have remained more active when compared to the Chirag kiosks during the research period. While the proportion of active Chirag kiosks was just over 10% in May 2005, more than 70% of the Dhan kiosks remained active during the same month. This holds true even if we consider the entire period of operation of the kiosks (from December 2001 to May 2005). While the mean of the monthly percentages of active Chirag kiosks for the entire period was 53.7%, it was 78.1% for the Dhan kiosks.

Factors Associated with the Length of Time a Kiosk Remained in Operation

Above, we described a precipitous decline in activity among Chirag telekiosks. This activity decline culminated in the eventual closure of most of these ki-
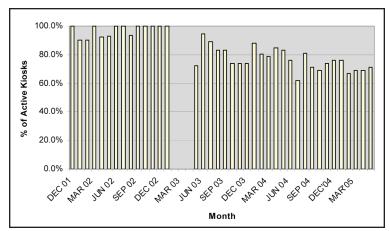
Figure 5. Percentage of active Dhan kiosks in Melur, relative to those opened by that month.
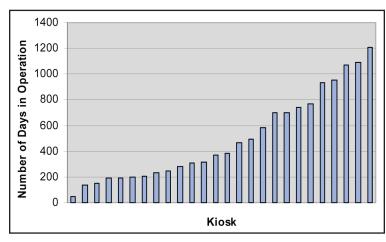

Figure 6. Range of days in operation, measured as time from official opening to official close (among 26 Chirag kiosks).

a kiosk's lifespan. Using a two-sample statistical t-test and assuming unequal variances, we find that the most salient factor associated with the duration that the kiosks functioned is the institutional, operational, and technical support provided by n-Logue. For instance, Chirag kiosks that reported receiving adequate support from n-Logue operated on average for 753 days ($n = 9$) while those reporting no such assistance operated on average for 345 days ($n = 18$, $t = -2.97$, $p = 0.01$).

Another important factor associated with the duration a kiosk remained in operation is the time at which it started initially functioning. We find that the kiosks that opened within the first eight months of the start of the project (between November 2001 and June 2002) stayed open for 679 days on average ($n = 10$) compared to only 364 days on average ($n = 17$) for the kiosks that opened later ($t = -2.16$, $p = 0.05$). The start date for a kiosk does correlate strongly with a kiosk's impression of n-Logue (with older sites approving more of n-Logue). Thus, these two findings may be speaking of the same explanatory circumstances.

The next important factor associated with the duration a kiosk operated was whether the owner and operator was the same person. We found that those kiosks having a different owner from operator functioned for a longer time, remaining open on average for 597 days ($n = 15$), while those with the owners working also as operators remained open, on an average, for only 335 days ($n = 12$, $t = -2.16$, $p = 0.04$).

Next, we found that prior training of the kiosk owners was also important, though at a lower level of statistical significance ($t = -1.91$, $p = 0.07$). The kiosks whose owners had prior training in computers remained functional for 645 days on average

osks. Reliable data on 26 of the closed or idle kiosks showed that 52% of these kiosks closed down within 12 months of starting operations, while 22% closed within 24 months and an equal percentage closed after 24 months, but before 36 months of opening. Only one kiosk managed to operate for more than 36 months. This range in lifetime among the kiosks that closed is charted in Figure 6.

In order to understand why the Chirag kiosks closed after varying periods of activity, we analyzed the factors that may be responsible for these differences. We start with simple bivariate analysis between owner survey responses and this measure of
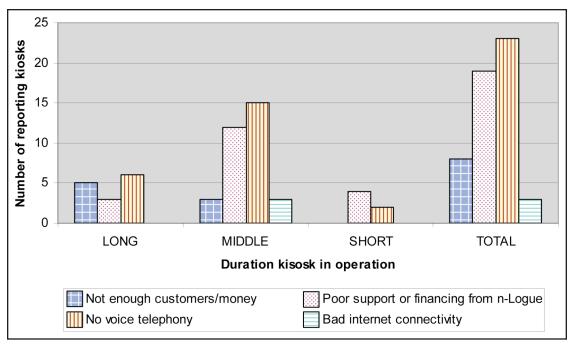
Figure 7. Self-reported explanations for failure given by kiosk owners.

($n = 10$), while those whose owners had no prior training remained open only for 393 days ($n = 10$).

On a more qualitative set of assessments, we found that when the owner reported that the villagers *liked* their kiosk the facility was likely to remain in operation longer ($n = 26$, F = 3.3, P = 0.04). Owners reporting that the village "did not like" the kiosk remained in operation on average 149 days. If an owner reported that the village "strongly liked" the kiosk they were in operation for an average of 1,071 days.

We also asked the owners to offer their own opinions on the closure of their kiosk. Respondents were given a list of 10 reasons and asked to identify those that they felt contributed to the closing of their site. The results are indicated in Figure 7. If we look at all 27 respondents, many of them (23) cited the lack of voice telephony as a major reason for their closing. The second most cited reason was poor support by n-Logue, with seven mentioning this reason, and the third reason, still with a fair number of respondents attesting to this cause, was the lack of financial returns, with six positive responses.

In Figure 7, we also show these results grouped by those kiosks that stayed open[8] for a "long" period of time (defined as being one standard deviation above the mean, or having stayed open more than 896 days), "middle" (below 896 and above 172 days) and "short" (below 172 days, or one standard deviation below the mean). The most salient change apparent in this figure is the variation in the role of n-Logue and the level of financial returns reported as reasons. We find a particularly significant, and perhaps counterintuitive, difference in reporting concern with financial returns. Considerably more respondents who stayed open for a long period of time reported financial returns as a reason for their closure (4 out of 7), while only one out of 13 and one out of five respondents reported this reason if they stayed open for middle or short period of times respectively ($n = 27$, ChiSq = 6.4, p = 0.04).

Multivariate Regression Model
Next, we perform a simple multivariate linear regression to further study the association of these various factors with the lifespan of a kiosk. A multivariate

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8. "Days open" is measured as number of days from a facility's official open to its official closure.

analysis helps in controlling for other explanatory factors and thus in eliminating any omitted variable biases. In particular, we want to examine if the perceived level of support from n-Logue significantly explains variation in number of days in service even when we account for the other significant bivariate factors, such as levels of prior training. The model that we used is specified as:

Kiosk number of days open = β_0 + β_1*(Difference in the actual versus expected profits) + β_2*(Owner and operator different) + β_3*(Prior training of owners in computers) + β_4*(Gender of operator) + β_5*(Support from n-Logue) + β_6*(Support from elected representatives) + ϵ

In the above model, all the explanatory variables except the first one (difference in the actual versus expected profits) are dummy variables taking a value of either 1 or 0 for affirmative and negative replies, respectively. For gender of the operator, we use 1 for males and 0 for females. We must note here that, although the level of some of the independent variables could vary from one kiosk to another (for example, owners can have different levels of prior training in computers, the quality of support from n-Logue and elected representatives could vary from one kiosk to another, etc.), we have classified all responses indicating satisfactory or better support as 1. We believe that this method adequately captures the association of these variables with the functioning of the kiosks, without creating potential statistical artifacts that arise from the use of ordinal or nominal variables in a multivariate model.

It is useful to further discuss the first explanatory variable, namely, the difference in the actual versus expected profits. The expected profit for a kiosk is the amount that the kiosk owner expected as profits per month before starting the kiosk, based on the projections provided by n-Logue. The actual profit is as self-reported by the owners.

We ran the above model with data from 26 Chirag kiosks that operated for various lengths of time between November 2001 and May 2005. Results show that coefficients on three variables are statistically significant at 10% or higher levels. These variables are: technical and operational support from n-Logue, owner and operator being two different persons, and owners having prior training in computers. Support from n-Logue is the most significant variable. The significant variables here are similar to those found to be significant in our bivariate analysis. Furthermore, we find support from n-Logue as the most significant explanatory variable when controlling for these other variables of interest.

We present the results of the regression in the Table 1.

As Table 1 shows, kiosks that reported satisfactory or better support from n-Logue remained open, on an average, for 327 days more than the kiosks that reported little or no support, keeping the other significant factors constant. This variable has both the largest effect and the strongest statistical significance.

Similarly, the owner and operator being different is associated with the kiosk remaining open for 218 days more on average, controlling for these other factors. Prior training of owners in computers is another factor that is positively associated with the kiosk remaining open for more days. The overall model is statistically significant and explains 48% of the variation in the dependent variable.

The results of the statistical analysis above were corroborated by the qualitative evidence collected during the interviews. All kiosk owners stated that technical and operational support for delivery of services from n-Logue was crucial for the successful operation of the kiosks. The finding that kiosks lasted longer if they had an operator different from the owner was also confirmed by qualitative responses during our interviews. Most of the kiosk owners stated that having a different operator facilitated the task of coordinating with the public and private agencies for delivery of services. It also made following up for technical and operational support with n-Logue personnel in Melur easier.

If we assume that the owner self-reports are accurate, why was support from n-Logue not uniform for all the kiosks? In other words, why did some kiosks (a majority) report receiving inadequate support while others reported receiving satisfactory support? We found that while all kiosk owners reported good technical and operational support through the end of 2003, the support declined significantly after that. The quality of support deteriorated in both technical and operational areas. Four owners reported that equipment failures were not rectified for over six months. This forced them to close their kiosks as they were unable to provide most of the services. Operational support also declined significantly as the number of support staff was reduced and the

Table 1. Regression results (with robust standard errors) for duration of functioning of the Chirag kiosks

Explanatory Variable	Dependent variable: Duration the kiosks remained open (number of days)
Difference in the actual and the expected profits	0.022 (0.89)[a]
Different owner and operator	218.14* (1.94)[a]
Prior training of owner in computers	212.32* (1.75)
Gender of operator	63.66 (0.71)
Support from n-Logue	326.60** (2.35)
Support from elected representatives	53.15 (0.29)
Constant	172.75* (1.93)
Observations	26
R^2	0.481
F-Statistic	4.30***

[a] *t-statistics in parentheses*
* Signification at 0.10 by the standard criteria
** Significant at 0.05 by the standard criteria
*** Significant at 0.001 by the standard criteria

frequency of coordination meetings with the kiosk owners and operators declined.

We also found that technical and operational support from n-Logue was closely linked to financial sustainability of the kiosk. As the support from n-Logue deteriorated, the kiosks were unable to provide the services dependent on access to the Internet, such as e-mail, voice chat, health, e-government, and agricultural and veterinary services. This contributed to a decline in the number of users at the kiosks, resulting in financial losses.

Kiosk owners also cited lack of voice telephony at the kiosk as one of the reasons for insufficient profits. They initially were given to understand that voice telephony would be provided at the kiosks to attract more users. However, a suitable voice license from the government was never issued to SARI to interconnect to the public switched telephone network. As many as 23 out of the 27 (85.2%) kiosk owners stated this as the main reason for lack of financial sustainability of the kiosks. However, as this service was never provided at the kiosks, this is not related to any actual decline in revenues of the kiosks over their period of operation. We think that this factor probably only raised the *expected* profits of the owners. However, this does not appear to be a significant factor in explaining the variation in the duration of functioning of the kiosks, as explained in the multivariate regression model above. Qualitative evidence suggests that if the owners had been making modest profits from the kiosks, they would have kept the kiosks operational regardless of initial expectations of a broader set of services, including voice telephony.

To conclude, we think that the major reasons for closure of the Chirag kiosks were two-fold: lack of financial viability of the kiosks in the long run and poor technical and operational support by n-Logue. We analyze the financial sustainability failures of the kiosks in more detail in the next section.

Financial Sustainability Failures

We will now move from our data analysis to a broader view of the project failures informed by our

survey results, as well as informal interviews and direct experience and participation with the project. When we consider the financial conditions of the kiosks, a number of issues seemed to contribute to the lack of sustainability. We find two main issues: an informational factor (content and services) and a technological factor (support).

Lack of Adequate Technical Support for the Kiosks

As noted before, technical support for the kiosks was provided by n-Logue Communications. A number of kiosks cited the lack of consistent technical support as a negative factor on their bottom line. One specific example was the maintenance of a relay base station (RBS) which delivered wireless connectivity to some more remote kiosks. The RBS sat between the primary local Internet connection and these remote facilities, with the job of relaying messages between the two. Four Chirag kiosks reported lack of connectivity for more than six months due to failure of the RBS and cited this as the major reason for closing down. During July 2005, six Dhan kiosks also had no connectivity due to failure of the RBS. We also noted, through interview responses, a range of service level that was delivered by n-Logue in which some sites were given better and more prompt technical service. The exact cause of this "favoritism" is not immediately known.

Lack of New and Relevant Content

The Chirag kiosks had to mostly limit themselves to offering the same basket of services during their entire period of operation. There was no real success in developing new and relevant content or services for the kiosks. Interviews with the SARI project officials reveal that developing new content and services was an expectation when the project was launched. However, the Chirag kiosks did not succeed in this task. This was primarily due to lack of adequate organizational efforts in this direction on the part of SARI, despite continuous feedback on the need for new content and services by the kiosk operators. However, the Dhan kiosks were able to offer some new services due to the efforts of the Dhan Foundation in this direction. One example was the new weekly online video-conferencing facility offered to the farmers, where they spoke directly with agricultural experts instead of sending an e-mail. According to the Dhan officials, this new service proved quite successful in some villages.

Institutional Sustainability Failures

While direct financial concerns were central to a lack of sustainability, many of these financial failures were rooted in institutional and political failures. These failures had contributing political, cultural, and management factors.

Lack of Continued Support for e-Government Services

As mentioned, the kiosks initially provided a number of e-government services. This included successful programs offering caste, birth, and death certificates. In earlier work, we showed that these programs enhanced service efficiency and resulted in a consumer surplus (Kumar & Best, 2006). For the first year of operation, the Taluk office in Melur provided good support for these e-government services. The district administration also supported this initiative through regular meetings to monitor the processing of applications received in the Taluk office. However, this support came to a virtual end with the transfer of the Tahsildar (head of the Taluk office) in January 2003 and the District Collector in February 2003. The Indian Administrative Service is a legacy of the former British colonial presence and has maintained their bureaucratic model, where government officers are "generalists" who take on short-term positions. They are then systematically moved through positions and locations; therefore, the kiosk project knew in advance that these key administrative officers had limited time periods in the district with purview to oversee the e-government program. It was predictable that, when they left, the e-government program would be at risk, and indeed, we found that the program disintegrated in their absence. The termination of this program deprived the kiosks of a significant source of revenue and a well-appreciated service offering.

Lack of Adequate Institutional Partnerships for Delivery of Services

Much as the e-government service failed to maintain itself due to institutional and political flux, other institutional linkages failed, resulting in the end of profit-earning services. For example, early partnerships with a private eye hospital at Madurai created a well-received telediagnosis program, focusing on locally important health concerns, such as early cataract detection. Similarly, collaboration with the Tamil Nadu Agricultural and Veterinary College created a

program in which local farmers could consult with agricultural experts via video conference. The program generated international attention after it was reported to have facilitated a remote diagnosis that saved the crops and livelihoods for 10 households (*Financial Express,* 2002, 13 Nov.). These initial successes notwithstanding, both services had virtually ended by the end of 2004 and most of the Chirag kiosks had stopped using these partnerships for delivery of services. Interviews with the SARI project officials and kiosk operators indicate that the main reason for the failure of these partnerships was lack of incentives for the outside organizations to continue. They were not paid any money for providing these services to the kiosks and there was no regular follow-up by the SARI project officials.

Differential Performance of Dhan and Chirag Kiosks

Why did the Dhan kiosks outlive the Chirag kiosks? Detailed interviews with the Dhan and n-Logue officials and kiosk owners revealed a number of reasons for this.

Additional Financial Support for Dhan Kiosks

Interviews with the Dhan officials in Madurai revealed that the Dhan kiosks have remained functional mainly due to additional financial support given to them by the Dhan Foundation. The average monthly total revenue for Dhan kiosks was approximately Rs. 1,200 ($24) per kiosk, whereas the average total cost per kiosk (including the fixed and variable costs) was approximately Rs. 3,000 per month. Hence, these kiosks were able to recover only around 40% of their monthly costs. The balance was met through financial support by Dhan. In contrast to this, the Chirag kiosks received no similar support.

Better Institutional Support

The Dhan Foundation also provided better institutional support to its kiosks in two forms: appointing kiosk operators centrally and developing its own locally relevant content for the kiosk services. These centrally hired operators were placed at kiosks based on need. The operators were paid their monthly salaries irrespective of the revenues from their kiosks. This helped the operators to focus on delivering services to the disadvantaged sections of the commu-

nity rather than on generating additional revenue alone.

Dhan also focused on developing content for the kiosk services independent of the services supported institutionally by n-Logue. As mentioned earlier, one such service provided by the Dhan kiosks was the weekly online video-conferencing facility between local farmers and agricultural experts at Melur.

Comparative analysis of the two sets of kiosks suggests that expecting financial sustainability in ICT projects in rural communities may be unrealistic, at least in the short term. As noted before, both Chirag and Dhan kiosks suffered from financial sustainability problem. However, it is important to realize that the main reasons for the lack of financial sustainability of both Chirag and Dhan kiosks were common: lack of technical and operational support by n-Logue, failure of the e-government services, and collapse of the institutional partnerships for delivery of services to the users. Where Dhan kiosks differed was in receiving financial subsidy from the parent organization to cover the operational losses and in obtaining institutional and organizational support in the appointment of operators and maintenance of equipments. This centralized support was missing for the Chirag kiosks. We still think that both sets of kiosks could have shown better financial sustainability if the issues mentioned above had been adequately addressed. Financial sustainability of such projects in rural communities in developing countries can still be a viable proposition if the institutional and informational sustainability is adequately addressed.

Critical Failure Factors

Researchers have proposed that success or failure of an ICT project can be understood in terms of several critical factors. Heeks and Bhatnagar (1999) propose 10 such critical factors that can be summarized as follows: information, technical, people, management, process, culture, structure, strategy, politics, and environment. According to their framework, our analysis above falls within a number of these factors as shown in Table 2.

Though the critical failure factors described above capture the principle reasons for failure of the project, they do not take into account the ongoing or long-term sustainability of the project. Basically, these factors provide an analytic framework to ex-

Table 2.

Critical Failure	Heeks & Bhatnagar "Factor"
Lack of institutional support	Management, cultural, and structural factors
Lack of technical support	Technical factor
Lack of institutional partnerships	Management, process, and strategic factors
Lack of new and relevant content	Information factors

amine a project at one point in time. To examine the long-term sustainability of the project, we employ the sustainability failure model presented by Kumar and Best (2006a).

In Kumar and Best (2006) we describe a simple sustainability failure model that explicitly codes for the ongoing or long-term survivability of a project. We argue that sustainability failure of a project can take five principal modes: financial/economic sustainability failure, cultural/social sustainability failure, technological sustainability failure, political/institutional sustainability failure, and environmental sustainability failure. Considering the critical failures of the project described in the preceding section, we find that the Chirag kiosks failed due to financial, technological/informational (due to lack of content), and institutional failures. Bringing together the critical failure factors and the sustainability failures, we find that the project suffered from financial, technological, informational, and institutional failures due to management, information, technical, cultural, structural, process, and strategic factors.

Conclusion

It is clear from the discussion in the preceding sections that the Chirag kiosks suffered sustainability failures due to a host of factors. The foremost reason was an expressed lack of adequate institutional and technical support from n-Logue. Additionally, financial issues caused by the failure to sustain institutional partnerships for the delivery of a number of services, as well as the failure to develop new and relevant content for new services, also seemed to contribute to the failure rates. Thus, these kiosks suffered sustainability failure due to financial, technological, informational, and institutional factors. In contrast, we found that the Dhan Foundation was able to absorb the financial losses for its kiosks and had also been able to provide better institutional

support to them in terms of developing new content and offering new services. Though this analysis may suggest that it might be difficult to ensure financial sustainability of such projects, we think that such projects can still be made financially viable, if the institutional and informational sustainability issues are adequately addressed. ■

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