ICT and e-Governance for Rural Development*

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Abstract

Rural e-Governance applications in the recent past have demonstrated the important role the Information and Communication Technologies (ICT) play in the realm of rural development. Several e-Governance projects have attempted to improve the reach, enhance the base, minimize the processing costs, increase transparency, and reduce the cycle times. Several states have initiated the creation of State Wide Area Networks (SWAN) to facilitate electronic access of the state and district administration services to the citizens in villages. Studies and experiences of Center for Electronic Governance at Indian Institute of Management, Ahmedabad (CEG-IIMA) indicate that significant efforts are required to design, develop and internalize the ICT solutions through well managed reengineering of back-end processes and capacity building efforts to ensure sustainability. Suitable public-private partnership models have to be adopted to ensure rapid development and cost-effective solutions. This paper presents a brief review of the technologies, the rural ICT projects and the issues associated with the use of ICT for rural e-Governance applications.

Introduction

The Information and Communication Technologies (ICT) are being increasingly used by the governments to deliver its services at the locations convenient to the citizens. The rural ICT applications attempt to offer the services of central agencies (like district administration, cooperative union, and state and central government departments) to the citizens at their village door steps. These applications utilize the ICT in offering improved and affordable connectivity and processing solutions. Several Government-Citizen (G-C) e-Government pilot projects have attempted to adopt these technologies to improve the reach, enhance the base, minimize the processing costs, increase transparency, and reduce the cycle times[1,2]. A large number of rural E-Government applications, developed as pilot projects, were aimed at offering easy access to citizen services and improved processing of government-to-citizen transactions. Some of these have drawn international attention and have won prestigious

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awards for their innovative approaches. They have demonstrated the power of ICT in rural context and are seen as reference models for future e-government project implementations[3,4]. Most of these projects have seen developments in the Internet technology and dropping costs of PCs as opportunity to reach remote locations. They used the existing telecom infrastructure and the Internet access through ISPs as inexpensive connectivity solution. They tried to package in all possible information services for the rural citizens as a single point access through PC based kiosks connected to ISPs. Some projects have experimented with the wireless technology to reach the remote locations[5,6].

However, a large number of rural ICT applications have slipped in performance and are facing acute problems of sustenance after their successful launch by the dynamic project champions. Some of the important observations by CEG-IIMA based on its evaluations of some of these projects[7,8] and the experiences on developing proof-of-concept projects[9,10] are:

i. Design of citizen-centric services and dependable service delivery mechanisms.
ii. Selection of appropriate (dependable, maintainable and cost effective) technologies for rural connectivity and information processing solutions.
iii. Design of cost-effective delivery stations (kiosks) to enable private entrepreneurs operate the services profitably and build new services for sustainability
iv. Re-engineering of back-end processes and introduction of changes that take advantage of the storage, processing and distribution powers of the emerging ICTs
v. Ensuring employee participation with well designed change management processes
vi. Demonstration of transparency and efficiency to remove distrust and build confidence among the citizens on the functioning of service delivery mechanisms.
vii. Inviting private participation to reduce the burden on the central servicing agency, bring in the expertise, enhance the speed of implementation, and offer better value proposition to the citizens.
viii. Identifying and preparing project champions, ensuring appropriate tenures, facilitating smooth transition, and internalization of the changed procedures.

In this paper we address these issues through a critical examination of the rural ICT infrastructure, application design, its deployment and delivery processes.

ICT Infrastructure for Rural e-Governance Applications

The typical ICT infrastructure adopted by most of the rural applications is presented in the figure below.

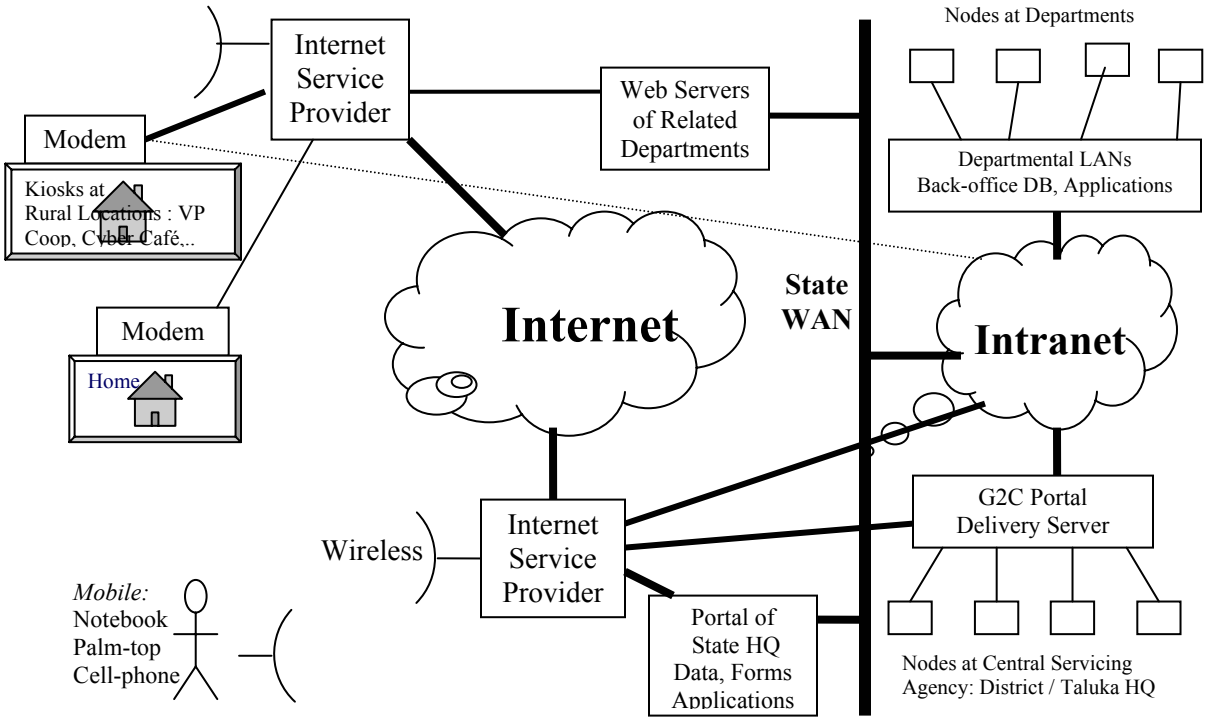

Figure : Typical ICT Infrastructure for Rural Applications

The rural ICT solutions are normally offered through internet portals hosted on a delivery web server to provide access to the citizens through inexpensive internet medium. The information flow between the delivery server and the other departments is accomplished through Intranet / LAN connectivity with servers of those departments (if exist). Often, due to non-computerization of back-end systems, the transactions are manually exchanged and response data is keyed in manually through the nodes on the delivery server.

It may be noticed that the end-to-end connectivity between the central service providers (district administrations, cooperative unions etc.) and the citizens is accomplished through a number of stages involving several agencies. These stages, the technologies and agencies involved in offering the services are presented in the Table below.

Table : Stages of Information Processing in Rural Applications			
Stage	**Connectivity**	**Technology**	**Agency**
1.	Related Departments to Central Servicing Agency	Manual or WAN / Intranet / LAN of individual departments	Individual departments of central, state and district administration
2.	Central Servicing Agency to Delivery Server (web server)	LAN with or without Intranet	Coordination committee offering the service
3.	Deliver Server (web server) to Internet Service Provider (ISP)	Leased or Dedicated line / VSAT	Service deployment agency
4.	Central Servicing Agency's ISP to Rural –ISP	ISP dedicated lines / BSNL / VSNL / Private Telecom	Internet Service Provider(s)
5.	Rural - ISP to Rural Kiosks*	Dial up line / Wireless (WiLL)	Service Delivery Agents (Village Panchayats, Private Entrepreneurs)

** In some applications, rural-connectivity is accomplished directly from Intranet server without involving an ISP eliminating stages 3 and 4.*

From the above table it can be seen that success of any rural ICT solution depends on how well these stages are coordinated and managed. There are several weak links in this chain. First of all, the existing voice based telecom infrastructure is too inadequate to be used for data communication applications. Similarly, the power supply required to run the kiosks in the rural areas is unstable and often interrupted by load-shedding. Although, most of the exchanges are being converted to digital, they have not reached most of the rural locations. That is why connectivity problems plagued most of the rural ICT applications.

In one of the rural ICT application evaluated by CEG-IIMA, connectivity and power supply often became serious constraints. System up time was very low either due to lack of power supply (load shedding) or due to poor connectivity. Alternative power supply (solar) and connectivity (wireless) solutions are being experimented. At this point of time these technologies are too costly in relation to the volume of transactions handled.

The need for improved computer connectivity up to village level was recognized by the central government in 1998 and drafted a National IT Policy[11] recommending the states to create infrastructure to facilitate improved data communications. Adhering to national IT policy, several state governments have set up or in the process of setting up the state wide area networks (SWAN) to support the rural connectivity applications (Annexure). While southern states are quite ahead in building SWANs and utilizing them for e-Government applications, many states are in still in the process of developing such infrastructure.

ICT Availability for Rural Applications

Computers have become more powerful, user friendly and less expensive. The PC revolution has brought them closer to the users to the extent that in number cases users have designed and developed their own applications. However, till recently, it has not become easy to create local content and regional language interfaces, to facilitate their use in villages. In addition, although the hardware costs are coming down, the total cost of ownership for rural applications is quite high. The costs of the minimum required gadgets like PC, Modem, Power stabilizer, and Printer along with the license costs of software (OS, Database, and Application as applicable) does not justify their use for offering government related information services, just on the basis of return-on-investment criterion. These equipments become obsolete too soon, and have high maintenance costs in the rural areas. At the current cost levels, to breakeven, the kiosk operators will have to find alternative revenue generation activities utilizing these equipments. We notice that in many cases such business potential does not exist and even if it existed, the kiosk owners / operators are not trained to develop new solutions.

Several entrepreneurs are attempting to offer inexpensive hardware and software solutions for rural applications. The CorDECT technology by nLogue Communications[12] and the Simputer by PicoPeta Simputers Pvt.Ltd.[13] are good examples of such initiatives. These organizations developed the computer and wireless connectivity solutions with indigenous components, software, and open source systems. It is hoped that large scale production of these systems would bring in appropriate cost effective technologies for rural applications. MSSRF based at Chennai is doing pioneering work in designing appropriate technologies for the rural poor[14].

Application Design and Reengineering of Backend Processes

Rural applications will have to give utmost importance to their offerings to the socially and economically backward communities. These citizens must find the services relevant and beneficial to them. The user interfaces must be in regional language and the services should be designed to offer good responses to their applications and aim at minimizing the need for citizen's trips to district / taluka head-quarters. The applications must record the progress of

user transactions and retrieve them on user's query. They must offer privacy and security to the user data. This becomes more important when the service delivery agents are private partners. All these call for significant reengineering and mechanization of backend processes.

Many ICT applications evaluated by CEG-IIMA were found to be deficient on this dimension. Most of the applications had weak back-end support systems which were not adequately re-engineered and connected to the front-end. Typically, the concerned departments did not process the applications on time. The backend systems required re-engineering, computerization and networking. Under project mode the officers responded to dynamic leadership of the project champion and stretched themselves in the absence of improved back-end systems. They slipped in response times after the project champion was transferred. Since the applications relating the employment generation and livelihood did not get attention, poor rural citizens gradually withdrew from using the kiosks. Subsequently it proved to be most challenging task and needed special attention to ensure sustenance.

Many successful urban ICT applications and rural projects like Bhoomi[15] have exploited the developments in the server, network, and software technologies, to improve the processing of back-end processing applications.

Application design must start with good understanding and documentation of process flows and bottlenecks in the existing system. Application maintenance requires good quality documentation of application and database design at both system and user levels. Ideally they should belong to the central services agency and must be made available to the maintenance and training agencies.

Service Delivery

It is expected that most of the rural ICT applications are meant for socially and economically backward communities. Therefore the service delivery mechanisms must be aligned to this fact. These kiosks must be located in the areas convenient to them to approach and use. The kiosk operators must communicate well with the citizens and cordially deliver the services.

In one of the applications, the citizens have abandoned the kiosk as it was located in the area where upper castes live.

The ambience of service delivery locations is very important. They must be clean, with provisions of drinking water and toilet for ladies and gents separately, to attract the citizens of all communities and genders.

The service delivery operators must be familiar with all user interfaces and must be supported by the central agency in handling the user services. Poor responses of the central agency can put the service delivery agents in embarrassing situation, resulting in abandoning of services.

In one of the applications, poor knowledge of agriculture, forestry, health, and education services packed with the system through GIS interfaces, has limited the kiosk operators to offer the service of selling only the government forms with which they are comfortable.

The service delivery operators therefore must be adequately trained on the application context and on all possible services through the kiosk. There must be a system of record keeping measuring the service utilization and service quality. Periodical reviews are important to monitor and improve the quality of service.

Private Participation

Almost all rural e-Government project champions have found it convenient to involve different private agencies for different tasks through appropriate public-private-partnership (PPP) contractual arrangements. These tasks include design and development of application software, population of data and content in the regional language, procurement and installation of networking and computer systems, deployment of software and delivery of services. Such arrangement seems to have helped in reducing the burden on the government, brought in the expertise, enhanced the speed of implementation, and offered better value proposition to the citizens.

While there are benefits of private participations, it is important to guard the social objective behind these applications. Pure commercial benefit should not determine which services to offer.

In one application, the kiosk operators did not find it remunerative to run the government services due to very low volume of transactions and many of them have closed down their centers.

The private participation in these applications is likely to put very sensitive and valuable data in the hands of the private agencies. Proper judiciary mechanisms will have to be

worked out and put in place before the services are launched, to ensure that no injustice is done to the citizens by misuse of such data.

Capacity Building

A large number of people at various levels have to be trained on the changed environment with ICT applications to meet the citizen expectations.

To start with, it is important to identify and prepare project champions. Functionaries attempting to design e-Government applications must have adequate experience and training to design, implement and manage ICT applications. They must be able to adequately reengineer the existing processes and introduce the desired changes in the system. They must be able to coordinate with number of agencies dealing with technology and citizen services. It is unlikely that the existing functionaries have exposure and adequate knowledge on all these aspects. Therefore, it is desirable for the governments to organize special training programmes which provide formal inputs on the planning and implementation of ICT systems in government[16].

It is equally important to ensure appropriate tenures for project champions to facilitate smooth transition, and internalization of the changed procedures. As observed earlier, the major factor responsible for poor sustenance of many rural ICT applications.

All functionaries of the government departments need undergo training on behavioral issues involving themselves, citizens, and private agencies. It is important that they are trained to accept the changed transparent environment facilitated through ICT based processing, minimizing the paper transactions and reducing cycle time.

Summary of Experiences and Observations

The Information and Communication Technologies have facilitated the design of solutions to deliver government services for social development at the door step of rural poor. Successful ICT projects involved, in the design process, all stakeholders such as government officials, legislators, regulatory agencies, citizens, voluntary organizations, technology consultants and vendors, academics, researchers, funding agencies, and media. Most of

these were accomplished using the public-private-partnership (PPP) model. The benefits derived from such projects were very significant.

Many solutions in the project phase have ambitiously packed several services and were launched successfully under the dynamic leadership of project champions. While these projects offered impressive results during the tenure of the project champions, they slipped in performance after their transfers. Some projects could not retain private entrepreneurs due to poor revenue realization and inadequate quality of responses by the government departments offering the services. Thus, the government as well as project champions need to pay due attention to the organizational, commercial, and legal sustenance issues of these projects. Special emphasis is needed in working out revenue models, ensuring the full implementations through appropriate tenure appointments of project champions, ensuring effective monitoring and maintenance of systems.

Based on these observations and other experiences, we consider the following as major factors responsible for successful implementation and sustenance of ICT projects for social development:

- Degree of efficiency and transparency demonstrated in citizen services
- Extent of reduction in cost and improvement of convenience for citizens
- Extent of reengineering and improvement of back-end services
- Extent of Integration of backend processes with front-end and web site
- Degree of employee involvement and change management
- Amenability for Public Private Partnership (PPP) arrangement
- Strength of PPP arrangement in the application development
- Strength of PPP arrangement in the service delivery
- Enhancement of Revenue for the government and the service provider
- Technological robustness of the project

A detailed discussion on these factors, more related issues, and their assessment is presented in the report: "E-Governance Assessment Frameworks", jointly developed by CEG-IIMA and NISG, for MIT, Government of India[17].

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Annexure

The State Wide Area Networks and Rural Development Applications

S.No.	State	Rural Applications	Status of SWAN
1	Andhra Pradesh	Rural Development Department connectivity over APSWAN APSWAN Connectivity to Police Department across AP RajIV Project	APSWAN, a State-wide network for voice, data and video communication, is the basic information highway for improving government-citizen and government-industry interface. In subsequent phases, APSWAN would be extended to all 'mandal' headquarters, other towns and eventually to all villages. APSWAN makes use of the 2MB dedicated communication network established by AP Telecom from the State Headquarters to all the Districts and the other two important centers viz. Vijayawada and Tirupati.
2	Karnataka	Bhoomi Monitoring Cell: would be responsible for managing the centralized Bhoomi database which would be shortly hosted in the State Data Centre. Kiosks managed by an operator to assist the citizens in rural areas for accessing the services of the government. Rural Digital Services (RDS) to offer value added services, including video conference, to citizens across the state by charging minimal costs.	A satellite network, which is being set up by Revenue Department would connect 177 Bhoomi Data Centres located at various taluk centres. BSNL will set up a wide area network (WAN) for the Karnataka government at an estimated cost of Rs 170-crore. The WAN called Karnataka State Wide Area Network (KSWAN) will provide 2 mbps connectivity from Bangalore to all district headquarters of the state (27 locations) and 64 kbps connectivity to taluk headquarters.
3	Tamil Nadu	The pilot project called Sustainable Access in Rural India (SARI) Project was initially implemented in Melur taluk in Madurai during 2003-04. Its aim was to help villagers harness the power of the Internet for social development, wealth creation and job generation and to establish rural connectivity at a low cost. SARI was later extended to 10 more districts and renamed RASI. Touch screen Internet kiosks had been installed through public-private partnerships in all taluks of the State.	TNSWAN Network will be linking all the Government departments to provide Voice, Data and Video connectivity for improving delivery of services to the citizens and for improving the response-time and transparency. Connectivity will be established for the 29 District HQ to Chennai and also to Taluks and Blocks using the free 2Mbps bandwidth available from Private Communication Providers (PCPs). Each PCP has to provide free Bandwidth of 2Mbps for connecting the State HQ to the District HQ, dynamic bandwidth allocation at State HQ among various Government users and also Intra District bandwidth requirements.
4.	Kerala	Akshaya Project aims to set up a network of 6000 information centers that would be able to impart basic IT literacy to at least one member in each of the 6.5 million families in Kerala; provide services like data-entry, Desk Top Publishing, Computer Training and Internet Telephony; generate and distribute locally relevant content; improve public delivery of services for	Networking and computerising the 1214 local self-governing bodies to expedite transactions like issue of certificates, licenses, tax collection etc. Setting up internet kiosks, accessible to the public in every Panchayat ward. The government is setting up broadband Internet facility to connect all the Akshaya centers. The Kerala State mission is thinking of providing the Akshaya e-centres the facility of

		Government departments like payment collection, e-commerce, e-courier; and create employment opportunities. The Akshaya project is being implemented through Panchayati Raj Institutions, and involves private enterprise in the development of training institutes and content generation.	collecting the government revenue as part of the existing FRIENDSs project.
5.	Maharashtra	SETU: Integrated Citizen's Service Centers SETU has been established in 25 District Headquarters and 225 Taluka places. At this stage these centers provide all the collector office related facilities. Warana Wired Village: covering 70 villages- executed by the NIC and the Warana Vibagh Shikshan Mandal. The existing co-operative structure has been used in concert with State of the art infrastructure (high speed VSATs) to allow Internet access to existing co-operative societies. The project aims to provide agricultural, medical, and educational information to villagers by establishing networked "facilitation booths" in 70 villages.	Several Wide Area Networks are being created for specific tasks. No Mention on any State Wide Area Network.
6.	Gujarat	Gyan Ganga Project with nLogue Communications Pvt. Ltd: 5 Talukas commissioned, 3 Talukas final stages, 70 kiosks connected and operational. Services started: Computer education, photography, email, video-mail, video conference. E-governance, Health, Veterinary – to start soon SWAGAT (Online Grievance Redressal System) Mahiti Shakti in Panchmahals district	All districts HQ are linked with the Secretariat with 2 MBPS leased circuits and all Talukas (TC) linked with the District HQ (DC) with 64 KBPS leased circuits taken from Bharat Sanchar Nigam Limited (BSNL). There are at least 20 other offices at each district HQ, in the process of integration with the district wide area node (DC) through bare copper from BSNL. Each DC has 10 telephone (receive only) lines from PSTN terminating on to dialup services. In all there are 250 dialup ports available through the state enabling units/offices/individuals to hook on to GSWAN just by making a local call, from anywhere within the state.
7.	Madhya Pradesh	Setting up of information kiosks for providing email, internet and other value added services. The existing public grievance redressal system is being upgraded, to facilitate access to citizens through kiosks. Mandi Board has prepared a scheme to computerize its activities and for integration of Mandi network through Internet/Virtual Private Network.	Reliance Industries Ltd. has entered into a Joint Venture (JV) with Madhya Pradesh State Industries Development Corporation (MPSIDC). Reliance will set-up 500 information kiosks by March 31 2001, and 7,300 more in the following year. 80% of these kiosks would be set-up in rural areas for which Reliance will lay an optical fibre cable network of 4500 km in the State.

8.	West Bengal	Government-to-citizen portal: Anybody can download non-saleable government forms and avail many more facilities through the Internet. 82 information kiosks have been created to provide services at a nominal fee. Three major hospitals have been connected to rural hospitals to provide the benefits of their quality healthcare facilities to the rural populace. The systems operate on conventional telephone lines/ISDN—mostly on store and forward technology with live video and data session support. Almost 1,500 people have been treated so far. A GIS databank is being developed to reach the smallest of municipal areas.	The West Bengal State Wide Area Network (WBSWAN), which serves as the backbone for e-governance in West Bengal, connects 18 district headquarters to the state headquarters over a 2 Mbps leased line and transmits data, voice and video. Eight sub-divisions have also been connected to the respective district headquarters over a 2 Mbps-leased line transmitting data and voice. In the pilot WAN project, six districts were connected with government headquarters in Kolkata via fibre optic cable owned by the Union government's department of telecommunications.
9.	Himachal Pradesh	The State Government has recently taken up the implementation of LOKMITRA project on a pilot basis in Hamirpur District. The project envisages the setting-up of a District-wide INTRANET with Servers at the District headquarters, connecting 25 Citizen Information Booths located in the rural areas throughout the District.	The State Government, as a part of its comprehensive Information Technology Plan and for E-Governance, is creating a State Wide Area Network (HPSWAN), which will also be connected to the Internet. This State wide computer network will link all the district headquarters with the State headquarters.
10.	Pondicherry	Information Village Research Project: The project was implemented by the M.S. Swaminathan Research Foundation, for Pondicherry fishermen. Computers were placed in the village center and connected to the Internet, through which regular weather reports of the Indian astronomical office could be accessed. The weather report is broadcast by loudspeakers and through VHF radios which enabled fishermen to determine low and high tide before sailing off to the sea to fish.	Technology for the Internet access was based on a hybrid of 2-way VHF radio and the wired public telephone network, providing integrated voice and data communication capability. The data transmission was restricted to a maximum speed of 14.4 KBPS on the wireless, where Email (SMTP) or fax protocols were used. Through a PBX (office intercom-style), every village center could be connected to this hybrid network. To overcome power outages, a hybrid system of solar photovoltaic panels and grid power, interfaced by a commercially available digital circuit, was used as source of power.

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