

***Nicaragua Case Study
Review of Agricultural Information System and Proposals for
Future Development***

First Report in a Series on
Investment Support to the Development of Information and Communication Technologies
(ICTs) to Combat Rural Poverty in Latin America and the Caribbean

FAO Investment Centre
Rome, 14 December 2004

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Introduction

The Bank sponsored **Proyecto de Tecnología Agrícola (PTA)** started in 2000 and is scheduled to end 30 June 2005. Its objective is to increase agricultural productivity and the incomes of small and medium rural producers through effective systems of knowledge and innovation.

This study reports the findings of a short visit to Nicaragua, undertaken in connection with the PTA's agricultural information system component.¹ A summary of the *Sistema de Información Agrícola* (SIA) is first presented. This is followed by a review of the main challenges faced by the SIA and recommendations for future development.

SIA Target Audience and Achievements

At appraisal, SIA's target audience was defined as: i. agricultural researchers, technical staff, subject matter specialists and trainers; ii. farmers, through technical assistance agents, and iii. decision-makers and program design and monitoring units. (World Bank [2000,] p. 9)

Expectations have been largely met (World Bank [2004b]). The SIA has been established and is managed by a special unit within the Ministry of Agriculture and Livestock (MAGFOR). A summary list of SIA's achievements follows.

1. A web portal (www.sia.net.ni) has been in operation since March 2003 and was formally launched October 2003. The system is fed with Ag sector information through partnership agreements established with 33 different agencies.
2. Development of a separate portal – not envisaged at appraisal – where community leaders can maintain information about their municipalities, including local diagnostic reports for the various communities that make up each *municipio* and that were prepared with support from the SIA training program.
(www.municipiosnicaragua.org.ni/menuapa.htm)
3. Two pilot areas for testing the system were envisaged at appraisal. In practice, seven telecenters, locally known as *Centros de Información para el Desarrollo Local* (CIDEL), have been established in small communities throughout the country, thus enabling an expansion in the outreach of the SIA (Table 1). An additional three telecenters are to be installed before the project's end.
4. Training of 2,200 people as part of SIA's outreach program.

This case study was prepared by Francisco J. Proenza, in connection with a Mission to Nicaragua (8-12 November 2004) in Support to the Implementation of the *Plan Nacional de Desarrollo Operativo (PND-O) para el Sector Productivo Rural* (PRORURAL). The invaluable information and insights provided by Juan Ramón Rosales Chow, Mavela del Socorro Mejía Enríquez, Andy Mayelli Barrera Morán, Yader Adrián Burgos Sancho, Michele Bruni, Cornelio Hopmann and Luis Ignacio López Silva is gratefully acknowledged.

Table 1. Selected Features of SIA Sponsored CIDELs

Location of CIDEL	Urban Population in Seat of Municipality	Poverty Status of Municipality	Partner Institution	Web page of CIDEL
Nueva Guinea, R.A.S.S.	15,269	High	Universidad de las Regiones Autónomas de la Costa Caribe Nicaragüense (URACCAN)	http://nuevaguinea.municipiosnicaragua.org.ni/
Muy Muy, Matagalpa	4,000	High	Municipal government	http://muymuy.municipio.nicaragua.org.ni
San Juan del Rio Coco, Madriz	4,612	High	Cooperativa Regional de Cafetaleros de San Juan del Rio Coco (CORCASAN)	http://sanjuanrc.municipiosnicaragua.org.ni
El Sauce, León	8,130	Medium	Instituto de Investigaciones y Gestión Social (INGES) http://sianicportal.web.aplus.net/inges/	http://elsauce.municipiosnicaragua.org.ni
Posoltega, Chinandega	4,189	Medium	Instituto Nacional de Tecnología Agrícola (INTA) http://www.inta.gob.ni/	http://posoltega.municipiosnicaragua.org.ni
San Dionisio, Matagalpa	3,017	High	Municipal government	http://sandionisio.municipiosnicaragua.org.ni
Quilali, Nueva Segovia	4,805	Severe	Conor 3.80 (agricultural cooperative)	http://quilali.municipiosnicaragua.org.ni
Sources: Population figures are based on 1995 Census data, sometimes updated to 1998-2000. (www.inifom.gob.ni/municipios.html). Poverty classifications are those of the <i>Mapa de Pobreza de Nicaragua</i> 1998, presented in Banco Central 2000.				

Challenges

SIA's accomplishments are best appreciated by considering the challenges it faces and how it has tried to address them.

Access and Outreach

Negligible access to the information and communications technology (ICT) infrastructure in rural areas severely limit SIA's ability to reach technical its target group.² (Annex 1). Access to the Internet is low among technical staff, negligible in small towns, and practically nonexistent in rural areas (Table 2). In Nueva Guinea, for example, there are fewer than 10 computers available for public use (Itztani [2004]). Telecommunications services are even more deficient in the other 6 smaller towns where CIDELs have been set up. In November 2004 there were only 3 public telephone booths in Muy Muy.

Table 2. Access to the Internet and Familiarity with SIA's Portal

Regions	% with access to Internet		% familiar with www.sia.net.ni	
	Technical staff	Urban dwellers	Technical staff	Urban dwellers
Las Segovias	25.0	4.5	16.7	-
Pacífico Norte	75.9	14.5	31.0	7.3
Pacífico Sur	46.7	24.5	6.7	1.3
Centro Sur	16.7	17.0	8.3	1.9
Centro Norte	85.7	9.1	71.4	1.5
RAAN	50.0	-	-	-
RAAS	40.0	33.3	20.0	6.7
Total	52.4	16.8	23.7	2.3

Source: Itztani [2004]

Aware of access limitations, the PTA appraisal document envisaged that farmers would be reached primarily through technical staff. SIA has targeted staff mainly through training (Table 3). The extent to which ICT extension staff are actually using ICTs to service queries from farmers is not known.

Table 3. SIA Training Activities

Type of training	Institutions (public and NGOs)	Local Leaders Promoters Producers
Participatory diagnostic in 5 specific municipalities		1669
Web page making	63	
Use of the SIA portal	130	
Training of trainers in development of training materials	206	
Use of information for agro-entrepreneurship		92
Training in means of communication for development	23	
Organization and Motivation Methodologies	20	
Training of telecenter (CIDEL) administrators	10	
Total number of trainees		2,213

From time to time CIDELs operators act as intermediaries to farmers. The Muy Muy operator reports he has helped a couple of farmers connect with buyers for their products by searching in the US Food and Drug Administration website, Nicaraguan firms that have successfully exported to the US and thus met food safety requirements. The extent to which this type of service is provided is unknown, but it still appears to be only on an occasional basis.³

SIA has also sought to overcome limited access to ICTs by establishing telecenters in partnership with local institutions, and by promoting the existence of these centers and SIA information services through local workshops and the dissemination of publications and flyers. In Nueva Guinea, radio has also been used to advertise CIDEL services.

A survey carried out in October 2004 in Muy Muy, El Sauce and Nueva Guinea, shows that SIA has been reasonably effective in making potential CIDEL users' familiar with their existence, at least in the locations where these have been established (Table 4).

Beyond SIA sponsored training, on their own initiative the CIDELs are also training residents of the small towns they serve. In Nueva Guinea, the CIDEL is administered by the Universidad de las Regiones Autónomas de la Costa Caribe Nicaragüense (URACCAN). Its training activities have included the training of 30 teachers in its own staff in the use of Internet for research activities, of local municipal officers, and of its own students and those from neighboring educational institutions. And all users of the CIDEL are offered training in basic computer – Internet skills on request.

Table 4. Percent Producers and Urban inhabitants of Muy Muy, El Sauce and Nueva Guinea that are aware of the Existence of a CIDEL

Municipality	% aware of the existence of the CIDEL, among		
	producers	urban residents	Total
Muy Muy	59.1	72.6	66.1
El Sauce	28.7	79.4	54.5
Nueva Guinea	61.7	97.9	80.0

Source: Itzitani [2004]

The high costs of establishment and maintenance, and the low levels of education characteristic of Nicaraguan rural communities are two important limitations to expanding rural outreach. Most importantly, however, people do not travel very far **on a regular basis** – i.e. seldom more than 1 km – to use the Internet or to make a telephone call (Proenza, Bastidas-Buch y Montero [2001]). In this sense, a telecenter is more suitable to provide ICT services to an urban area – e.g. a small town – than to serve a widespread low population density rural area.

The SIA has sought to overcome this challenge by partnering with local institutions that work with producers (INTA in Posoltega, producer cooperatives in San Juan del Rio Coco and Quilali) or that have a suitable outreach mandate (municipal governments in Muy Muy and San Dionisio; University in Nueva Guinea; NGO in El Sauce).

SIA has also promoted the formation of local producer networks, each linked to one of the CIDELs, denominated *Unidades de Comunicación para el Desarrollo Local* (UCODEL). An important activity of the UCODELs has been the realization of local participatory diagnostic training exercises in Muy Muy, Villa El Carmen, Nueva Guinea, Quilali and El Sauce, each one covering all of the communities that make up the municipality.⁴

These diagnostics are intended to help communities assess their own situation and resources, identify leadership and start to develop own solutions to their development

requirements. They also helps a CIDEL identify information and communication needs of the community they aim to serve, and prepare their operation and service plans to meet these needs.

Rural outreach is a major challenge for the SIA. An on the spot survey (10 November 2004) of about 20 participants during a local training meeting of the Muy Muy UCODEL reveals that all of the participants were appreciative of the CIDELs as an important factor for "progress and modernization in the municipality"; yet only about 8 of them had actually used the CIDELs telephone services and none had used the Internet (although apparently some of their children had). All of the meeting participants lived farther than 2 km away from the CIDEL.

To try to expand outreach, SIA has complemented its information program using traditional means, including CDs for distribution to farmers and to technical staff with limited or nonexistent access to the Internet, a local community radio set up in the Nueva Guinea CIDEL, and the dissemination of local newsletters prepared by the UCODELs.

Sustainability

To its credit, SIA has promoted a highly decentralized form of management of the CIDELs. The Muy Muy CIDEL, for example, is sited in facilities provided by the Municipality. The CIDEL's Management Council (*Junta Administrativa*) has 6 members:

- the mayor (*Alcaldeza*),
- a municipal delegate of the Ministry of Education
- a representative of the diocesan legal advice commission,
- representatives of 3 rural communities (El Bosque, Venecia and El Carao)

All of the major decisions are taken locally, including pricing and servicing; and all of SIA's telecenters are charging for their services. This enhances the centers prospects for sustainability and, in so doing, has enabled greater outreach through the establishment of more telecenters than initially planned. Understandably, decentralization has not yet taken full hold, with the two principal funding agents, SIA staff and the mayor, playing important lead roles in the decision-making process.

The establishment and running of telecenters in Nicaragua to serve rural communities is very costly. In Nueva Guinea, for example, the provision of connectivity required an initial investment in VSAT technology. Since the service was contracted by SIA to serve only a few connectivity points, the investment costs amounted to US\$ 9,000 per CIDEL.⁵

Perhaps as a result of the CIDELs establishment, which put in evidence the existence of an underserved but lucrative market, an ISP began providing connectivity using microwave technology at relatively lower cost. The VSAT first installed in Nueva Guinea has since been transferred to the San Juan de Rio Coco CIDEL. Nueva Guinea is now connecting through microwave. With no link to a national backbone, however, even this technology's costs are high, representing about 60% of operating expenses (Table 5).⁶

The microwave technology has significantly lowered telecenter investment costs, and have enabled the establishment of a private cybercafe in January 2004, located about half a km away from the Nueva Guinea CIDEL. This has put the CIDEL under competitive pressure to keep costs low and improve services.

Up to now the CIDELs have survived thanks to SIA operational subsidy support, in the form of six months of connectivity costs, equivalent to about US\$ 3000/year. By providing no other subsidy and giving them full reign over pricing, staffing and service

decisions, SIA has motivated the CIDELs to operate as small businesses. The Nueva Guinea CIDEL, for example, purchased two new computers in February 2004 to accommodate more customers with the same overhead expenses. It relies in part on its student body (620 in 2004) to make up a significant part of its clientele. It is also considering the resale of connectivity using wireless links to local residents, to help amortize its own connectivity costs.

Table 5. Investment and Operating Costs of Nueva Guinea CIDEL

	----- US\$ -----	
Investment Cost – 2003 (a)		
Computer equipment (b)	10,300	
VSAT equipment US\$ 9,000 (c)		
Cable and network & firewall equipment	3,323	
Router Software License MAX4 sw	2,011	
Telephone	219	
Furniture and furnishings	2,435	
		18,288
Annual Income from Services – 2004		
Internet-Computer - 6 stations (d)	3,312	
Telephone services	2,406	
Other	2,862	
Sum		8,580
Annual Operating Cost - 2004 (e)		
Connectivity (c)	5,520	
Staff	2,636	
Equipment maintenance	245	
Publicity and promotion	45	
Other expenses	1,061	
Sum		9,507
Annual Operating Cash Flow – 2004		-928
<p>a Additional subsequent investments have been made to support the work of local <i>Unidades de Comunicación para el Desarrollo Local</i> (UCODEL), each of them linked to the various CIDELs. For example, in Nueva Segovia, an investment of US\$ 8,800 has been made to purchase: one computer for digital video editing, multimedia projector, digital camera, screen, DVD/VCR, digital speakers, scanners and UPS.</p> <p>b Includes 4 workstations, 1 server, 1 printer, 5 batteries and 5 electricity stabilizers purchased initially by SIA and 2 workstations subsequently purchased by the Nueva Guinea CIDEL.</p> <p>c VSAT equipment was initially installed but is not included. A shift was made to microwave when it became available in Nueva Segovia, and the VSAT equipment was transferred to Rio Coco CIDEL. Investment costs using VSAT amount to US\$ 9,000 and monthly costs to US\$ 6,000.</p> <p>d The Nueva Guinea CIDEL is a mature telecenter. With 6 workstations it has managed to raise its Internet revenues. Most other CIDELs, at an earlier stage of development, earn a higher proportion of their income from telephony than from the sale of Internet-computer time.</p> <p>e Some operating expenses are covered by partner institution and are therefore not accounted for; e.g. rent, electricity, cleaning.</p>		
<p>Source: Based on data furnished by Juan Ramón Rosales (MAGFOR), Mavela Mejía Enríquez (MAGFOR) and Mayelli Barrera Morán (Director, Nueva Guinea CIDEL).</p>		

Content

Present offer of content by SIA's website is fairly basic (Table 6). Some of the material presented is potentially quite valuable – e.g. weekly prices at wholesale markets – but, with very few farmers with access to the Internet, the practical impact of having this information in cyberspace is probably very small.

Table 6. Present Offer of Content at www.sia.net.ni - 9 December 2004

Section / Subsection	Present Status
News	Links to local media articles with up to date agriculture sector news.
Services	
Knowledge Center	No content.
Prices	Comprehensive and up to date report of weekly prices in major wholesale markets (Matagalpa, Leon Juigalpa, Managua, San Carlos and Estelí)
Links	Extensive set of links to other institutional web pages and resources.
Library	Document repository, containing recent agriculture and rural development sector documents.
Community	
Virtual Market	The most recent sale offers are dated 19 November (alfalfa from Colombia), 15 November (<i>ajonjolí</i> from Guatemala) and 10 November (Chilla, Estelí). The most recent offers to buy are dated 17 June, and 31 May, 22 March (2 offers). ➔ More interest from sellers/buyers in 2003 than presently.
Human Resources	No content.
Events Calendar	No events are shown for December, but several interesting sector and local events are listed and described in November and in earlier months.
Forums	There are many forum topics of discussion open, but except for a couple of messages dated January 2004, the rest were submitted in 2003.
Survey	Asks the question: What is your view of the SIA portal?
Organizations	
Web sites of SIA partners	Links to sites and brief description of 11 SIA partners.
Agricultural Bulletin	No content offered to visitors. Entering section requires registration; but system issued errors when registering or when password assistance is requested.
Agricultural Consultation	No content offered to visitors. Entering requires registration; but system issued errors when registering or when password assistance is requested.

User interest in the SIA portal is limited. As of 20 October 2004, the total number of visitors were 18,708, for an average of 63 per day. A review of user interaction with the SIA website shows that interest was somewhat high in 2003, right after establishment, but waned afterwards (see review of Virtual Market and Community sections in Table 6). This is corroborated by Itzani [2004] with data showing a slight decline from 2003 to 2004 in technical staff awareness of the portal (23.5% in 2003 compared to 23.2% in 2004) and in their perception of the portal as useful (from 18.5% in 2003 to 14.5% in 2004).

The municipal websites (www.municipiosnicaragua.org.ni/menumapa.htm), presently under construction with SIA assistance, seek to strengthen the system's outreach program and to support the local work of the CIDELs and UCODELs. They follow the sound principle that content produced and managed locally by persons with a direct interest in its impact is generally updated more often and in a more timely fashion.

Interagency Coordination

Lack of coordination is a major cause behind the failure of many e-Government initiatives. Lack of coordination commonly leads to: duplication of effort and excess investment, duplicate offers of public content by different agencies, the development of expensive data systems using specialized protocols that do not interact with each other, and the establishment of government sponsored telecenter initiatives that either undermine private development, do not make full use of scarce connectivity resources (a public sponsored telecenter is set up in the vicinity of the school, but has no link to the school) or follow dissimilar rules and send different signals to the public.

There are many instances of interagency coordination failure in ICT development in Nicaragua (Arce and Hopmann [2002]).

There is, for instance, little interaction between the agencies that plan and execute telecenter and rural connectivity initiatives in Nicaragua (Annex Table A2; Manila [2003]). Telcor's telecenters do not charge for services, whereas the CIDELs aim to reach full operational sustainability. The four regional nodes of the *Sistema Nacional de Información Ambiental* (www.sinia.net.ni/que_es_sinia/nod_reg.htm) look like telecenters, have several workstations, for the most part underutilized, but are not open to the public. While there may be good reasons for this, the possibilities to make more intensive use of the facilities should be explored. There is also no evidence that the few existing telecenters are providing scarce connectivity resources to support of the work of schools, notwithstanding the intent of the Ministry of Education and the World Bank's PASEN project [2004c] to do so in the future.

Weak coordination between rural and agriculture development agencies is considered to be a major constraint on SIA's ability to collect and offer valuable content from partners. To try to address this challenge, SIA Management has started several working committees, mainly in connection with content production and management:

- i. an interagency coordinating committee to promote agriculture and rural content integration;
- ii. a systems group, to deal with technological topics to improve interagency data management and information sharing;
- iii. an institutional coordinating committee, to further coherence between MAGFOR policies and SIA activities; and

iv. a support group to marshal political, technical and institutional backing for SIA activities, used to discuss technical plans, concepts and strategies.

SIA's efforts to further coordination are commendable, but unlikely to succeed. Sector agencies and staff have little incentive to coordinate. Accords reached at inter-agency meetings tend to be treated as lesser agreements, to be realized if time permits, but not binding commitments.

Successful interagency coordination in e-government requires the establishment of a central clearing house to peer review and vet e-government initiatives. These units generally rely on committees with broad participation of all segments of society and, when effectively structured, ultimately lead to the establishment of binding e-government protocols and procedures to which all public agencies adhere.⁷ There is not a single unique formula for the underlying institutional arrangements, but they tend to be prominent, well funded, and have full backing from the highest government authority. In Chile the Ministry of Economy plays a major coordination role, in the U.K the lead agency is the Office of the Chief Envoy, in Colombia, it is the Connectivity Agenda, in Canada it is Industry Canada, and in the US it is The Office of Management and Budget (OMB).

In Nicaragua, the *Consejo Nicaragüense de Ciencia y Tecnología*, CONICYT has the mandate to take the lead, but it is understaffed and has not been very active. Donors become engaged in e-government initiatives following a sector approach, as exemplified by the SIA, and tend to discount ICT development and coordination discussions as beyond their scope of work.⁸

Recommendations

Farmers rely on a complex web of neighbors, public officials, associates, and friends, to obtain valuable and reliable information about income earning opportunities and better technology. Personalized attention, personal knowledge, confidence, and frequent interaction are fundamental to the sustainability and success of these networks in bringing about technology transfer and social and economic change. (Barrett [2004], Udry and Conley [2004], Conley and Udry [2004])

Information gathered by farmers through interaction with peers can be of enormous practical value. Much of the information obtained is idiosyncratic, such as, for example, regarding the trustworthiness and reliability of a particular input provider, the credit worthiness of a potential buyer, the price paid for potatoes at farm gate in a neighboring town, the cost of transporting produce from the village to a nearby market, present conditions of a tertiary road linking two villages, weather in the vicinity of the village, the returns achieved by a trusted neighbor from a crop grown under local conditions.

Personalized extension service to producers generally requires face to face interaction with agents. It is often a valuable but expensive service. Every time that a producer has a query or needs advice, he must wait for a visit from the extension agent or, if urgent, physically go and visit the offices of the extension agency.

When planning agriculture information systems the role of content is frequently highlighted, as a means of reaching farmers with a suitable message. The underlying approach is unidirectional, from an extension agent with knowledge to farmers needing this knowledge. What is missed is the significance of social networks; i.e. communications and back and forth exchange between extension agent and farmer and between farmers.⁹ A farmer may read a flyer or hear a radio program about the advantages of a new process or technology; but she cannot talk back and forth to the flier or radio to pursue a specific line of enquiry in order to get a full of understanding of how a recommended practice can best be applied in her own farm.

Traditional media (fliers, newspapers, radio and television) are quite suitable to impart information, but less useful for personal interaction. The Internet and the telephone may be used to broadcast extension information, but when used this way the richness of information and understanding that can be achieved through interactive exchange is lost. The Internet and the mobile phone are no substitute for face to face communications, but they can empower farmers and lower the cost and value of extension services, by enabling greater continuity of direct human interaction.

The most valuable feature of SIA's work to date has been precisely its focus on developing, expanding and strengthening social and productive networks. The recommendations that follow build on SIA's experience. They propose an expansion in farmer access to ICT infrastructure, the empowerment of people by improving their ability to make effective use the new technologies, and a strengthening of SIA's offer of content so that it enables farmers to interact directly with extension agents and other specialists, and thus become more productive.

Expanding Access

SIA has followed a sound approach to public sponsorship of telecenters. It has sought to increase connectivity, lower costs, expand services, maximize impact and outreach among rural people, and stimulate innovation in the delivery of services to remote rural communities. SIA Management has given considerable latitude to CIDEL local partners with respect to day to day management, and has sought to tighten the links between the needs of rural people and the CIDEL's activities. By locating its CIDELs in underserved small towns, insisting on cost recovery through user charges, and subsidizing investment as opposed to operating expenses, it has promoted sustainability and development, without undermining but rather stimulating private entrepreneurship.

Nevertheless, the CIDEL model has its imitations. User charges are high – e.g. about US\$ 1.27/hour in both Muy Muy and Nueva Guinea; much higher than other mature low-income markets (e.g. Lima, where *cabinas públicas* often charge less than US\$ 0.50), and out of reach for the majority of rural residents, especially the rural poor (Arce and López [2003]).

This is in part a result of the low level of telecom infrastructure in Nicaragua, of the low educational and income level of the country's rural population, and of the limitations intrinsic to a center as a point of service to a sparsely inhabited rural space. Still, it is in servicing this difficult to reach but critical segment of the population that the next phase of the program should focus on.

Nicaragua's Telecommunications Investment Fund, Fitel, has two projects in its pipeline (partly funded with World Bank support) that could improve rural telecommunications services significantly. The first will subsidize an expansion in cellular services to 18 municipal headquarters and 365 localities with over 400 inhabitants. The second one, expected to come on board within the next two to three years, will provide for an expansion in the rural telecommunications backbone. Another project, in the Inter-American Development Bank pipeline for Nicaragua (IADB [2004a]), would help ENITEL expand the country's telecommunications backbone. Once implemented, these projects will lower the costs of rural connectivity and should enable both public and private initiatives to establish and operate telecenters throughout the country at a more affordable cost.¹⁰

SIA role in expanding rural connectivity

A difficult phase is coming for SIA Management and the CIDELs.

As connectivity expands in rural areas as a result of investments in the telecommunications backbone, some of the CIDELs SIA has promoted will come under competitive pressure from cybercafes, and it is doubtful that all of the CIDELs will survive. All start-up businesses have a high failure rate and in this sense the CIDELs are no different. If a CIDEL fails because a neighboring entrepreneur has managed to provide better service at lower cost and attract more customers, this should be seen by SIA and its partners as an accomplishment, not as a failure.

R1. Operational support (i.e. paying for half of connectivity costs) should be discontinued after the two year period of start up support (half the cost of connectivity) for each of the 10 first phase CIDELs.

Subsequently, existing CIDELs should benefit from additional operational SIA support, but mainly through demand stimulation and to the same degree as other private (entrepreneurial or NGO) initiatives that are willing and qualified to partner with SIA.

R2. Selective investments should be introduced to support innovative wireless solutions that enable small town telecenters to increase their viability by expanding connectivity service to other local public agencies, private clients and smaller neighboring communities. This would enable rural telecenters to become small local ISPs in underserved markets.¹¹ Funding for these experiments will require careful design, to stimulate competition, avoid undermining private initiative, and ensure compliance with the country's telecommunications regulatory framework.

Establishment of new CIDELs

If the proposed expansion in the telecommunications backbone in the country becomes realized, it will no longer be necessary for the SIA to establish many more CIDELs.

R3. It is hard to predict, but perhaps no more than 10 additional would be needed. Their establishment should proceed after existing CIDELs are fully weaned from SIA support. The new CIDELs should be set up following similar guidelines used to date, i.e. in small towns with an insufficient market to attract private entrepreneurship but having a large enough population (e.g. no fewer than 2,000 people) to justify shared ICT service through a centrally located center.

Empowering People

As connectivity expands and small town commercial telecenters begin to arise, SIA should shift its primary focus of attention to stimulating the demand for ICT services. Incentives to stimulate demand is probably the most successful means of expanding rapidly the effective use of ICTs. Examples of success with demand encouragement include Korea and Chile.

What is required is basic computer-Internet skills training and practice support, aimed at people and organized groups in small rural communities that have the potential to become habitual users of the technology, and thus derive palpable benefits.

The proposed support will: i. facilitate the achievement of sustainability of CIDELs and of other telecenters and cybercafes; ii. increase the impact and value of content offered in SIA's portal; iii. enhance the effectiveness of technological research, development and

extension in Nicaragua; and, most importantly, iv. improve the incomes and living conditions of the population.

In Nicaragua, demand support should target school teachers and (mainly secondary and tertiary) students, small entrepreneurs, and organized farmer and civil society groups.

In small towns with telecenters

“Education is the single most important factor in improving the welfare of rural households” in Nicaragua (Christoplos [2004], page 38; Alwang *et al* [2004], Banco Mundial [2003]). Youngsters readily adopt and use information technology. They are presently the most frequent clients of the CIDELs. With an estimated 40% of the country’s population less than 15 years of age (in 2001), small town telecenters present an exceptional opportunity to improve the quality of teaching and rural education.

R4. The following demand support options, targeted at small towns with telecenters in place, deserve consideration for SIA’s follow up phase:

- i. Training and practice vouchers funded by SIA, to enable participants to acquire basic computer-Internet skills and become proficient in their use. The objective of the training is not short term exposure, but rather to enable participants to become regular users and profit from frequent use of the technology. The target beneficiary group would be small town dwellers who are teachers, local public officials, community leaders, and entrepreneurs. Gender balance should be pursued, not just as a matter of fairness, but because women play a key role in promoting family use of computers and the Internet. To ensure that persons with an interest in the technology, proficiency practice vouchers should only cover a part of the total cost (e.g. no more than 75%).
- ii. Support to local secondary schools, so that they may use the telecenters during morning hours.

Under such a program, operators of telecenters located in the vicinity of a secondary school (e.g. within 500 meters), would be able to approach the local school administrator and offer the use of the telecenter facilities for educational purposes, during up to 4 hours in the morning every school day.¹² A SIA funded reimbursement program would provide a subsidy to the school, equal to the cost of these four hours, discounted by about 20% to keep the value of the subsidy in check and to account for the lower commercial value of morning computer/Internet time. In order to qualify for the school voucher subsidy, school administrators would have to: i) certify that at least one of the school’s teachers is properly trained, and ii) secure written endorsement from the local parent teacher association. SIA support would decline in value over a 3 year execution period. The shortfall in funding would be gradually assumed by parents, school officials, the municipality, and would be negotiated locally by the parties involved.

- iii. Vouchers (awarded in a transparent competitive basis) to fund part of the costs of Internet-computer use at the local telecenter to work on small projects that address specific community needs. Some possibilities include:
 - find buyers, intermediaries and make arrangements to tap the European market for a given organic product,
 - prepare a website to promote tourism and hotels in the community,
 - produce materials for local basic literacy campaign.
 - prepare a proposal for submission to the *Fundación para el Desarrollo Tecnológico Agropecuario y Forestal de Nicaragua* (FUNIAT), or to the *Fondo de Asistencia Técnica* (FAT), or other donor agency.

Deepening Rural outreach

Access to ICTs through telecenters to individual farmers and rural residents of villages with less than 1,000 people is presently not feasible. And even if experimentation with an expansion of connectivity to villages through new wireless technologies proves fruitful (i.e. through successful implementation of R2), access to ICTs is still years away for the majority of Nicaragua's sparsely populated rural population.

R5. SIA can nevertheless make it easier for **organized groups** to access public services offered through the Internet, even if this will require displacement to the nearby small town with a telecenter on a regular basis. For these purposes, delegates of organized groups (i.e. the leaders themselves or their children) could be encouraged to participate in the training and practice vouchers (proposed in R4 i above), and, once they have achieved proficiency, compete for vouchers to carry out group projects (R4 iii).

R6. The potential for building up a local appreciation of what the Internet has to offer for farmers and rural communities deserves closer scrutiny. As a first step, it is recommended that a thorough investigation be undertaken for the purpose of documenting the experience of rural people who have visited the CIDELs and have received valuable assistance in resolving concrete practical problems. Exemplary success stories would do much to motivate increase use of ICTs by the rural population.

R7. For maximum impact, SIA's efforts to promote rural networks through the UCODELs could be further strengthened through low-cost well designed systems of extension support, perhaps following a carefully designed farmer field schools approach.¹³

Content

The shift from a centrally fed content development system to a more participatory system of local content production and management at the CIDEL level is a step in the right direction.

R8. A more direct interaction between farmers and agribusiness people with access to the Internet is also proposed, through an **online advisory service**. Some key features of the proposed system¹⁴ are:

i. Some questions submitted by users will be channeled to institutions but, for the most part, queries will be answered by individuals. Participating advisors would be identified by name, institutional affiliation, and work location. The picture and curriculum of each advisor would be on display.

ii. All queries would be responded within 48 hours. A System Manager will make sure that this response time is achieved, and will redirect any query in the event of illness or vacation of an advisor to whom a question is directed.

iii. The site would be organized by topic groupings, e.g. credit, pest management, crop production, marketing, etc. Topical grouping of advisors would enable a user to compare and choose between advisors the one that best fits her needs.

iv. The questions directed to each advisor and the responses he or she gives will be posted next in the website next to his name. Where the same question is repeated, the advisor will be able to post a standardized answer, in a special section of "frequently asked questions" within his section of the site.

v. The system will allow users to rate the advice they receive, immediately upon receiving the response from the advisor. This will increase transparency, give SIA

immediate feedback on the quality of its online advice, and helps monitor the individual competence of advisors.

vi. The key to the system's success will be the qualifications and competence of the advisors and the quality of the advice given.¹⁵ The system can expand gradually, starting from a basic cadre of MAGFOR and INTA staff, and grow steadily, based on demand and on agreements with other institutions, public and private. Because it relies on individual responsibility, commitment and prestige, the issue of interagency coordination is less of a constraint.

R9. As the SIA becomes consolidated, opportunities for offering training courses online through the portal can be envisaged for the follow-up phase.

R10. As the SIA portal expands in its offers of content, it is important to monitor the number of visitors to the various parts of the site, as a means of identifying what is found useful by visitors and what is not.

Interagency Coordination

A common strategic approach to ICT institutional development could go a long way to encourage and improve interagency dialogue and operational coordination among national institutions. With respect to the SIA's planning of future activities,¹⁶ the World Bank could play a major role in its dialogue with Government if a common approach is adopted by World Bank divisions working in projects where ICTs can make a significant impact; i.e. in education [2004], telecommunications [2004a], agriculture (PTA and follow-up) and the environment (support to the *Sistema Nacional de Información Ambiental*. SINIA).

R11. Some of the critical areas deserving priority attention in Nicaragua are:

i. Establishment of a binding technological interoperability framework for e-government content and data bases. Examples from the UK (Office of the e-Envoy[2004]), Colombia (Agenda [2004]) and Brazil (Governo Brasileiro [2004]) could serve as reference.

ii. Establishment of a working group on rural connectivity, to discuss plans and FTEL project designs; licensing and regulatory liberalization to facilitate wireless solutions in small rural communities (and to prevent regulatory capture by the incumbent operator); governmental telecenter policy with respect to publicly sponsored telecenters, and to ensure that government incentives stimulate and support ICT development and do not undermine private initiative.

iii. Establishment of a high level system of inter-agency peer review to vet large e-government projects.¹⁷ The system would seek to prevent duplication of effort, use of inappropriate technology or overinvestment. Content development policy would emphasize a common governmental approach to citizen's needs, as opposed to sector oriented offerings spread between multiple different systems and Internet entry points. Staff and agency incentives should be built into the process to make interagency cooperation agreements binding.

iv. There is an urgent need for stewardship in support of interagency coordination in the planning, public consultation, vetting, and implementation of e-Government initiatives. An agency with authority, staff and resources must lead the process.¹⁸ It should be an agency with strong support from the Chief Executive, and afforded the means to play a leadership role in steering ICT expenditures by all government agencies.

Notes

1. The other PTA components are: institution building, development of competitive fund to finance agricultural research projects, support to the Nicaraguan Institute of Agricultural Technology (INTA) to help change its role from direct provision of technical assistance to become more of a provider of second tier public services, and development of an agricultural technical education and training system. (World Bank [2000]).

2. Nicaragua's 1995 census classifies a community as rural if it has than 1,000 people. Other countries use a higher benchmark – e.g. 2,000 people is common in Latin America. For practical purposes and project planning, Telcor and FIDEL regard small underserved towns, such as the towns where the CIDELs have been established, as rural.

3. Meera, Jhamtani and Rao [2004] report on three different programs in India that have apparently been successful in assisting farmers by responding to queries from farmers on a fairly regular basis. In all three projects, access to ICTs by farmers is through operators of kiosks who have had training in the use of computers and the Internet.

4. To examine the diagnostic for El Sauce, for example, visit the following link: <http://muymuy.municipiosnicaragua.org.ni/modules.php?op=modload&name=UpDownload&file=index&req=viewdownload&cid=1>.

5. Investment costs fall significantly as the number of VSAT stations rises, say above 100; but these numbers would be difficult to achieve in Nicaragua.

6. Arce and Hoppman [2002]:

“National circuits ... are extremely costly, as there is no national data-transport backbone. Either this obliges ISP to setup their own private Microwave-links or to use individually leased point-to point data-circuits from the national telephone-company. Again, these solutions violate most simple principles of economy of scale. The extension of TV-cable services with bi-directional use reduces some of the problems, though only in a very limited area. Individual usage by means of dial-in outside the metropolitan area or where there is no local PoP, results in prohibitive monthly phone-bills of 98 \$US or more.”

7. Well documented examples of suitable institutional arrangements are available, for instance from RAND (Anderson, et al. [2003]), in reference to State e-government initiatives in the US. See also Schwabe [2000], [2003].

8. Alwang, et al [2004], page 8.

“Multisectoral approaches tend to be more often advocated than implemented... Cross-sectoral cooperation must increase to achieve project impacts. ESSD investments in agricultural technology, forestry, and land administration can be more effective in reducing poverty if they can be properly coordinated with investments in physical and social infrastructure and public services. For example, improvements in agricultural technology and extension should be linked to improved access to education, markets, and infrastructure, such as roads, telecommunications, and finance.”

9. Reminiscent of the early development of snail mail and the telephone, the value of social interaction through e-mail and chatting is often underestimated. Yet these interactions form the basis for socialization, the development of trust and economic integration.

“Only a tiny fraction of the information passing through communications systems has ever been high quality scholarly knowledge. ... sociability was frequently dismissed as idle gossip, and especially in the early days of the telephone, was actively discouraged. ... a 1909 study of telephone service commissioned by the city of Chicago advocated measured rate service as a way to reduce ‘useless calls’. Yet the most successful communication technologies, the mail and the telephone, reached their full potential only when they embraced sociability and those ‘useless calls’ as their goal. That seemingly idle chit-chat not only provided direct revenues, but it encouraged the diffusion of the corresponding technology, and made it more useful for commercial and other applications. Such social interaction frequently function to grease the wheels of commerce. [Odyzko 2000, page 29].

See also Odyzko, 2001.

10. Earlier versions envisaged the establishment of about 60 telecenters under government sponsorship. But present thinking is to subsidize the establishment of the backbone and to let government sponsored telecenters or private cybercafes serve the public.

11. There are considerable expectations regarding municipal provision of connectivity using wireless technology (See for example, Lehr, Sirbu and Gillett [2004] and Barranca [2004]. Many technological options are available – and all should be considered for local experiments in Nicaragua. Two prominent technologies, WiFi and WiMax, illustrate the possibilities.

WiFi (Wireless Fidelity based on the IEEE 802.11 standard) operates in the range of the electromagnetic spectrum that in many countries is unregulated and that is used by microwave ovens and cordless phones. *WiFi* can in principle be used to expand the range of connectivity within a relatively broad radius of about 300 feet; i.e. to retransmit connectivity from a telecenter or any other base station.

Last year (2003) Intel partnered with a Spanish company to provide connectivity to Zamora, a small town of 64,000 people, using *WiFi* to connect paying customers. A system of about 300 hundred antennas were installed throughout the town. For a small initial investment of Euro 100 to purchase of a small box (“somewhat larger than a pack of cigarettes”) connected to a computer’s USB port, plus a monthly fee of \$10/month, customers could achieve broadband speeds of up to 2 Mg/s. Unfortunately, recent news accounts report the commercial failure of the enterprise, as a result of overuse of the system and poor maintenance of the facilities. There are also some efforts on the part of the municipality to revive the project.

(www.zamoraes.com/modules.php?name=News&file=article&sid=284).

Another experiment with *WiFi* is taking place in southern Chile, in Valparaiso and Temuco (www.inalambrico.reuna.cl/). In contrast with the Zamora experiment which was basically a for-profit operation, the Chilean experience is being carried out by an academic institution with competitive funding awarded by Corfo.

WiMax is another promising wireless technology. It is based on the IEEE 802.16 standard. It is expected to deliver broadband over an average area of 3-5 miles at relatively low cost. By requiring fewer antennas it can cover a broader area at lower

administrative and managerial costs. Commercial deployment of WiMax is expected in 2006-2007 in the US. (<http://www.intel.com/netcomms/technologies/wimax/>).

12. Telecenters generally get very little business in the morning, which is when most schools can potentially make use of computer and connectivity services. It is common to find commercial telecenters serving private schools during the day time under private terms.

Public school systems present a greater challenge. Although in principle an ideal way to share scarce connectivity resources, public school-based telecenters that open up its computer labs to the public have in practice proven to be quite difficult to implement. Public school systems are usually run under highly centralized authority, whereas telecenters thrive under local management and decision-making. National school administrators are weary of sharing their school's equipment and connectivity, and they discourage the charging of fees by local school officials. Without the means to pay for operation and maintenance - be it through fees or direct support if governments can afford it - telecenter sustainability is compromised.

Chile is perhaps one of the few developing countries that has put together a reasonable program for sharing the connectivity available at the country's school system with the public at large. (described in Proenza [2003], pages 5-6.).

In the case of Nicaragua, the approach proposed is probably more suitable. It involves giving public support to facilitate the use the existing CIDELs and cybercafes for use by nearby schools, to train teachers, and to improve teaching resources and the local school curriculum. This would only require a general agreement from Ministry of Education officials, to allow local school administrators to negotiate directly with local telecenter operators and thus benefit from the SIA funded program.

13. Farmer field schools have been successful, especially in pilot experiences (Gotland *et al*; albeit not everywhere and the system can be expensive thus undermining sustainability and financial returns (Anderson and Feder [2003]). Barrett [2004] suggests that Farmer Field Schools have been successful because they rely on socialization of the experimentation process. A proposal (Gobierno de Nicaragua [2004]) for supporting SIA's rural outreach program using the Farmer Field School approach merits consideration for the follow-up phase.

14. Systems already in place or being developed following a similar approach include:

In Sri Lanka, the Department of Agriculture pilot Cyber-extension project is outfitting seventeen pilot extension offices with computers and connectivity. The project envisages training of extension agents and village extension workers, and enabling farmers to bring live samples to the extension unit for photographing or scanning, and chatting with experts about specific technical problems they are facing. Expansion to cover the whole country is expected to follow the pilot phase (Sri Lanka [2004]).

In the United Arab Emirates, a small country where practically all farmers have access to the Internet, the Government, with FAO assistance, has introduced an online "Ask the Advisor" service to answer direct queries from farmers.

Chile's advice online service found at - www.redsercotec.cl, offers registered entrepreneurs the possibility of submit specific questions online to more than 80 specialists on 40 different topics and get a response within 48 hours. For each advice category, the site gives the user a choice of several specialists, providing for each of them his or her picture, location, summary curriculum vitae, and a record of the responses that the specialist has already given. Since inception in

March 2002 up to November 2004, over 5,500 queries have been answered and recorded and may be read online. In all, 178,000 people have visited the advice online section of the site. Over 20 private and public institutions have allied with Sercotec to support the service. Queries related to agriculture may, for instance, be addressed to the National Institute of Agricultural Development; legal queries may be directed to upper class students of the University of Chile's Law School; and so on.

The features proposed for SIA are based on the approach proven successful by Chile's advice online service.

15. The Chilean site (www.redsercotec.cl) started enabling the evaluation of advisor's responses in July 2004. Since then, 465 new questions have been received. The average rating by users of their satisfaction with the advice they received through the site during this period is 80% (on a scale of 0 to 100%).

16. "the multiple stakeholders involved in agricultural extension can choose to be transformed by the technologies, or they can choose to be proactive and harness those technologies. ...for these stakeholders to truly harness the technologies they must become actively involved in shaping and monitoring national telecommunications policy and regulation....this is new territory for these stakeholders. (Richardson [2003]).

17. For an example of how such a process might work, see a description of the UK's Gateway Review process at: www.ogc.gov.uk/index.asp?id=377.

18. The leadership could be vested in CONICYT, as provided by the law. If institutionally suitable, an alternative lead agency could be the *Secretaría de Coordinación y Estrategia de la Presidencia* (SECEP), recently strengthened with IADB [2004b] support.

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Annex. ICT Access Infrastructure in Nicaragua

Nicaragua has one of the lowest levels of access and use of information and communication technology in the world (See Table A1 and Hopmann [2002]). In 2002 the country was ranked number 87 out of a total of 104 countries, by the Digital Access Index estimated by the International Telecommunications Union. In Latin America and the Caribbean, only Haiti was ranked lower.

Telecommunications services and connectivity is lowest in rural areas. In 1999, 46% of the population lived in rural areas but 89% of the telephone lines served urban communities (ITU [2003], p. 39). In 2003, the country had a total of only 16,239 Internet accounts, 6,500 public telephones (2002), 205,000 main telephone lines, and total number of Internet accounts in the country. An estimated 750 people with towns of over 500 people have no telephone service, and rural people must travel about 19 km to reach a telephone (World Bank [2004], p. 2).

While the privatization of ENITEL was being pursued (1996-2001) investment in the sector fell drastically. Recent efforts to redress the low level of ICT development include: i. sale of a 40% stake in the country's main operator ENITEL, to a Swedish company, Telia; ii. Creation of a sector regulator, Telcor, entrusted with overseeing the sector and promoting competition, and of FITEL a telecommunications development fund meant to promote ICT development in underserved low-profit rural areas [World Bank 2004a].

Table A1. ICT Infrastructure Indicators - 2003 - LAC and Selected Countries

	Internet Users	PCs	Main Lines	Cellular subs.		Internet Users	PCs	Main Lines	Cellular subs.
per 100 inhabitants					per 100 inhabitants				
South America					Central America and Mexico				
Argentina *	11.2	8.2	21.9	17.8	Belize	10.9	12.7	11.3	20.5
Bolivia	3.2	2.3	7.1	16.7	Costa Rica *	19.3	19.7	25.1	11.1
Brazil *	8.2	7.5	22.3	26.4	El Salvador	8.4	2.5	7.1	7.1
Chile *	27.2	11.9	23.0	42.8	Guatemala *	3.3	1.4	4.8	13.2
Colombia	6.2	4.9	20.0	14.1	Honduras *	1.7	1.4	4.8	4.9
Ecuador	4.4	3.1	11.9	18.4	Nicaragua *	1.7	2.8	3.2	3.8
Guyana *	14.2	2.7	9.2	9.9	Panamá *	4.1	3.8	12.9	26.8
Paraguay	2.0	3.5	4.6	29.9	México *	11.8	8.2	14.7	25.5
Perú	10.4	4.3	6.7	10.6	Caribbean				
Suriname	415.7	4.6	15.2	32.0	Cuba *	1.1	3.2	5.1	0.2
Uruguay *	11.9	11.0	28.0	19.3	Grenada *	16.9	13.2	31.7	7.1
Venezuela *	5.1	6.1	11.3	25.6	Haití *	1.0	-	1.6	1.7
OECD and other high ICT countries					Jamaica *	22.8	5.4	16.9	53.3
U.K. *	51.3	48.7	59.1	84.1	Rep. Dom.	6.4	-	11.5	27.1
U.S.A.	55.1	65.9	62.1	54.3	Trinidad & T. *	10.6	8.0	25.0	27.8
Australia	56.7	56.5	54.2	72.0	Germany	47.3	43.1	65.9	78.5
Ireland	31.3	42.1	48.4	84.5	Norway *	34.6	52.8	73.4	90.9
France	36.6	34.7	56.6	69.6	Finland	50.9	44.2	48.8	90.1
Canada	51.3	48.7	62.9	41.7	Japan *	48.3	38.2	55.8	68.0
Spain	23.9	19.6	42.9	91.6	Rep. Korea	61.0	55.8	47.2	69.4
Italy	33.7	23.1	48.6	101.8	Estonia *	32.8	31.0	35.1	65.0
					Portugal	19.4	13.5	41.4	90.4
					Czech Rep.	26.8	17.7	36.0	96.5

Source: ITU Indicators, 2003. (www.itu.int/ITU-D/ict/statistics/).

* 2002. * 2001

ENITEL is presently the only operator licensed to provide main telephone services, but the period of exclusivity is scheduled to end in April 2005. Four companies provide public telephone services. There are only two licensed cellular operators (Enitel and Bell South), albeit many (21) Internet Service Providers. (www.telcor.gob.ni) With competition limited to only a few players, the costs of telecommunication services are very high.

Cybercafes have sprung up throughout the country, mainly in Managua and large towns, providing Internet services and Voice over the Internet telephony (VoIP) to the public. In addition, various agencies, including the SIA, have established publicly sponsored telecenters. The following table lists known telecenter or telecenter-like initiatives in operation, either presently (December 2004) or counted at end 2002.

Table A2. Telecenters in Operation in Nicaragua 2002-04

Technology Kiosks*	24	67 were established by the Instituto Nacional Tecnológico, INATEC, but most have closed. Of those remaining, few are connected to the Internet.
Telcor telecenters*	46	All are located in urban areas.
SIA	7	Established by SIA in 2002-2003
SINIA Centers	4	Established by MARENA to help communities monitor and address environmental issues. Are not open to the public for general telecom services.
Cibercafés*		
Managua	100	Arce and López [2003]
Other large towns	73	

* Data is from (Arce and López [2003] and is valid as of end 2002.