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FOR ACTION

Question 10b/2: Development of multi-purpose community telecentres

STUDY GROUP 2

SOURCE: UNIVERSIDAD NACIONAL DEL NORDESTE, GRUPO DE INVESTIGACIÓN EN TELECOMUNICACIONES RURALES (GTR-UNNE) (ARGENTINA) [1]

TITLE: BASIC RURAL COMMUNITY TELECENTRES (TYPE-0 TELECENTRES)[2]

Action required: To take into account the model outlined for Basic Rural Telecentres, as an option design for next MCT pilot projects envisaged within the Integrated Rural Development Program (Valletta Action Plan-Program No. 3). To promote in-depth analysis, further studies, field trials and deployment/testing of sample Type-0 networked facilities worldwide, by mobilizing resources from incumbent organizations, governments and the private sector.

Abstract: Among the difficulties involving the feasibility of rural community telecentres, the initial investment and operating costs impose critical limitations to the chance of achieving self-sustainability. The problem gets worse in the case of small and isolated rural settlements, where the income pattern is inherently limited. This article describes a new expansion concept for community telecentres in rural areas, where the services are selected and provided on the basis of optimal impact rather than optimal revenue. Feasibility goals can be accomplished even for small, low-income communities, as long as the number and location of the centres enable both local and external revenue generation. The investment is strictly limited by using simple and inexpensive infrastructure. Typical applications such as training and e-mail messaging

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[2] This document is an abridged version of a paper presented at the 16th. International Teletraffic Congress (ITC-16). Workshop on Developing Countries. Edinburgh, Scotland. 6/1999.

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can be brought to small communities by combining state-of-the-art technology with a suitable scale for the whole project.

1. Communications through rural community telecentres

In most developing countries, the design of feasible solutions for rural community telecentres is subject to well-known constraints: low income, isolation, illiteracy and lack of basic infrastructure in the selected area (electricity, water supply, roads, etc.). Maintenance & supervision missions are time-consuming and costly, as long as transportation depends either on long trips by boat or on expensive, chartered planes. Power consumption in these facilities is critical, with solar panels becoming the main source on accounting of their unavoidable price per watt.

The placement of just a few telecentres in specific communities of a rural area is not good enough as a communication alternative, because local communities need as well reliable links among themselves, not only with villages and cities. Then, the network design should take into account local (mesh) traffic, in addition to typical inter-urban (star) planning patterns. From a quick survey conducted in Suriname in 1998 among 31 regular customers in the rural areas of Brownsweg and Gujaba, 4 out of 21 respondents (19%) reported that they had not used yet the local facility, because there were no telephone/fax line available at the place they wanted to communicate with (neighbouring towns). This supported the argument favouring a network with a star-mesh traffic pattern, from each rural settlement to the main city but also to/from neighbouring settlements (1).

Regarding the nature of communication in rural areas, demand studies on attitudinal characteristics of the users addressed the inherent constraints of the communication through public locations (6). For example, receiving phone calls in public offices is somewhat difficult, because of the previous synchronization or appointment required between the caller and the recipient of the call. Incoming traffic at MCTs -if any-is typically asynchronous (fax, e-mail & other store-and-forward options). Chat sessions through the Internet should be rather initiated from the MCT, except in the case of scheduled events. In rural telecentres with just phone communication, incoming traffic is usually low and subject to the existence of a call warning system or a messenger in order to notice the local recipient on the incoming call. This comports higher costs and delays, with poor efficiency and less privacy throughout the overall process. Revenues are lost because a number of potential incoming calls to rural customers is delayed or definitely discarded at the origination point.

The income pattern of the community is the upper bound for every realistic business plan. Experience has shown that local MCT users usually rank among the wealthiest inhabitants (6), yet an optimal impact project should address as well the needs of unfavored social groups. This led to the consideration of a "bottom-up" feasibility criterion for rural telecentres, where the maximum expected local revenue generation is constrained by the community income (1.5% to 3%) (2). Of course, some users may be well prepared to spend more, and consequently the tariffs may be theoretically raised beyond the income threshold (13). But in the case of projects funded by development programs, it is doubtful that such a policy enabled the individuals to obtain a net welfare surplus from using the MCT services, nor the community hosting an MCT to improve its overall development level in the long run. For example, a survey in rural Suriname indicated 61% of typical MCT users earning USD. 33.- a month or less (1), then their expected consumption bound in telecommunications should be only USD. 1.- in order to have chances to get a net welfare surplus from using the facility. There are at least 2 implications of these facts: 1) Part of the MCT revenues should come from outside the rural area and from services other than telecommunications (e.g. training courses and educational programs). 2) The investments and operational costs should be lowered as much as possible, by combining state-of-the-art technologies with a scale large enough to achieve economic feasibility in the whole project, rather than on particular locations. 3) In order to get the facilities serving the local traffic (rural-urban) and thus generating profits from it, a number of MCTs should be deployed at the same time.

2. Basic Rural Telecentres

The concept of basic rural telecentres was developed during the study performed by GTR-UNNE in Suriname in 1998, as a part of an evaluation mission of ITU-D (1, 2). After the evaluation, it was evident the need for a mean to provide feasible services to communities with a population of about one third the size of the smallest MCT location (the town of Guyaba in the Sipaliwini district), according to some conditions:

- Business model with social expenditure in ICT services limited by the community income expectancy.
- Suitable to fulfil typical ICT needs in low-income rural areas.
- Low investment and low maintenance costs.
- Mobility and relocation features.
- Low power consumption
- Scaleable, state-of-the-art technology standards.

The resulting approach as described hereto, should be seen just as a limited-scope response to funding problems in projects targeting low-income rural communities. In Suriname, fully-fledged MCTs (or "Type 2" MCTs as labelled in the original plan) were envisaged as large units to support a variety of applications including e.g. FM broadcasting, videoconferencing and telemedicine. Nevertheless, the investment required for such a model was later considered as unaffordable. Type 1 telecentres, as currently operating in this country are standard facilities with telephone booths, fax and a PC workstation with printer and dial-up access to the Internet. In view of the feasibility problems found in their operation, GTR-UNNE focused on another kind of facility suitable to deliver ICT services to very small, low-income rural settlements, designated as Type 0 telecentres. By combining an appropriate choice of services and state-of-the-art infrastructure it is possible to drive the MCT project towards an optimal-impact feasible solution, without discarding unfavoured communities.

Initially, the proposal for Suriname focused on a basic rural MCT model ("Type 0") equipped with a low-power handheld computer connected to a fixed or mobile cellular subscriber terminal, powered by solar panels (2). Notwithstanding, an alternative solution had to be drawn for communities without power, and out of the cellular footprint. Fig. 1 depicts the outline of a basic telecentre fulfilling these conditions, where a LEOS-narrowband VHF data communicator replaces the cellular terminal and the communication is only performed by e-mail. Table 2 summarizes the budget sample for this alternative, with reference to income conditions as found in 1998 in Suriname. Both cases rely on the assumption that text messages will often provide a more affordable and helpful communication service respect to POTS in small and isolated communities. As a further technical alternative, the plans for IMT-2000 and other G3 mobile systems will prompt the use of new transmission resources for connection of Type-0 rural telecentres such as the utilization of High Altitude Platform Stations (HAPS)(10).

The field survey carried out among customers of Type-1 Guyaba MCTs in Suriname (1998) led to the adoption of demand forecast calculations with very conservative patterns. Table 1 shows that individual earning less than USD. 33 a month accounts for 32% of regular customers, and up to 61% if those users not reporting such information are also included. In order to ensure a net welfare surplus in the provision of ICT services to individuals living in low-income rural locations, and thereby to have these services making a real contribution to social development, another assumption was adopted. This aims at limiting the community expenditure in communication services to <3% of the income for individuals in the 6 lowest income ranges (up to USD. 444.- a month), and <1.5% for the upper 2 income ranges (ITU, 1998 and Taylor, 1994) (8,13). This assumption led to a value of SG. 161,325 (USD. 358.50) as the maximum expected revenue generation for that community. When the same (hypotetic) income grid is extrapolated for every location candidate to hold a Type-0 MCT, the size of the community being reduced to one third (340 inhabitants), the maximum expected local revenue generation would arise USD. 119.- a month (USD. 1,432./yr), ceteris-paribus. The budget sample included in Table 2 is even lower for this item (USD. 1,020.-), because the maximum local expenditure will be achieved just when the MCT turnover reaches maturity status (some 2-3 years).

Gross Income Ranges (Per month-in local currency)	**Type-1 MCT Customers**	**Max. Expected Revenue (#)**	**Type-0 MCT Customers**	**Max. Expected Revenue (#)**
Without Income Information ##	29	6,525	10	2,250
Monthly Income < 15,000	32	14,400	11	4,950
15,000 to 30,000 @ 3%	10	9,000	3	2,700
30,000 to 60,000 @ 3 %	3	5,400	1	1,800
60,000 to 100,000 @ 3 %	13	39,000	5	15,000
100,000 to 200,000 @ 3 %	7	42,000	2	12,000
200,000 to 400,000 @ 1.5 %	3	18,000	1	6,000
> 400,000 @ 1.5 % +	3	27,000	1	9,000
Totals (Expected)	*100*	*161,325*	*34*	*53,700*

 # Communication expenditures calculated as 3% of consumers' gross income (below) or 1.5 % (above SG. 200,000/mo)

w/o income data assumed as earning SG. 7,500/ mo.

+ Gross income assumption: SG. 600,000/ mo.

(*) All values estimated according to a survey carried out through MCT providers in Suriname (May, 1998).

Type-0 MCTs customers per range rounded at 1/3 of Type-1 MCTs. Exchange rate adopted: 1 USD= SG. 450.-

(The Central Bank of Suriname, 5/ 1998)

3. Infrastructure of basic community telecentres

The infrastructure of a Type-0 MCT is strictly limited, in order to maintain the initial investment as low as possible. A degree of mobility is allowed in order to bring ubiquitous services to the community, while avoiding housing expenditures. This MCT model does not require to discard smaller or lower income communities (e.g. 50 to 250 inhabitants); for example, a group of 2 to 5 neighbouring settlements can still cluster themselves so as to own a shared, rotary-access facility operating 1-2 days weekly at each location, by taking advantage of the fair mobility of Type-0 MCTs (2). The envisaged equipment should be portable, light and sturdy enough to be transported in vehicles or boats, depending on the distances involved.

The core device of Type-0 telecentres is a handheld personal computer with keyboard. These units use to be small (3"x 6") and supplied with a 75-100 Mhz processor, 8 to 24 Mb RAM, built-in modem of 14.4 Kbps to 33.6 Kbps. and grayscale display of 640x240 pixels. They also feature infrared ports or connectors for a docking station, if a printer or another device is further required. Battery life is about 15-20 hours, so they are expected to perform well in rural MCTs. The external link is performed by a narrowband-LEOS VHF communicator, a simple and inexpensive data terminal operating at 148.000 to 150.050 Mhz, 2.4 Kbps. (upstream) and 137 to 138 Mhz., 4,8 Kbps (downstream). Output RF power is around 5 W, featuring optimized battery consumption (sleep-mode). LEOS narrowband communicators are similar to standard 2-way VHF radios; some of them have built-in GPS units and extra features not strictly necessary for messaging applications at rural MCTs. However, input data ports are suitable for remote self-monitoring , and consequently operating variables such as RF, handheld operation, solar cell and battery status can be transmitted by using SCADA arrangements.

Electric power is provided by 100-150 W solar cell arrays (14 V., 4 A. solar panels), connected to rechargeable-hermetic, maintenance-free batteries and a switched regulator. The equipment at the MCT also includes a VHF directive antenna with coaxial line, accessories, and a kit of basic tools and simple furniture. All the equipment should consist of rugged, sturdy units 100% portable in order to facilitate quick transportation and replacement if necessary. The MCT can be installed in a small free space of public buildings like elementary rural schools, health care posts, police or NGO local offices, as usual. Likewise, operation is performed by local leaders -teachers, nurses, counsellors or local entrepreneurs, earning a small, complimentary profit for their assistance in training and communication services (depending on the MCT revenue generation). The facilities are expected to open 10-12 duty hours a day according to solar light power condition.

4. Services delivered via Type-0 Telecentres: rural messaging applications

Although there are many services that can be arranged to be provided at basic rural telecentres, messaging and training applications rank among the highest priorities in most developing countries. A rural messaging system is regarded as a suitable and affordable way to communicate very small communities and individuals living in isolated areas. For example, in Suriname much of the local traffic transmitted or received at Type-1 telecentres is bursty, consisting of short messages like "I will be there 6 PM. Please wait me in the boat", "I need more oil for the engine; rush me again the same brand" (1, 2). Handling by phone these messages may be difficult and expensive, because public phones use to locate just at few locations and the messages cannot be stored and later retrieved by final recipients, nor forwarded or transmitted to multiple destinations. As in other developing countries, inherent limitations constrained the use of paging services: small coverage radius, high costs and lack of interest in many residents respect to one-way systems, due to their inability to call from the rural location. On the other hand, the use of classical SSB-HF radio devices implies high power requirements, lack of privacy, noise and poor overall reliability. The original MCT project for Suriname early envisaged VSAT infrastructure for "Type-2" rural telecentres, but afterwards, high costs in the provision of GEOS terminals backed them out. Envisaged airtime rates and handset prices in LEOS global phone systems discouraged, by their part, the generalized implementation of voice links for low-income regions.

In view of the need for a cheaper, reliable and ubiquitous, messaging system for Suriname and other developing regions, in 1998 GTR-UNNE proposed the implementation of a nationwide-coverage rural e-mail network, where messages to/from community telecentres would be conveyed through Low Earth Orbit Satellite constellations (LEOS). This approach rather focused on data transmission, specifically on low speed data communications via narrowband VHF terminals. Contemporarily, initiatives such as a satellite e-mail network for developing countries proposed during ITU´s II World Telecommunications Development Conference (WTDC-98) envisaged the provision of cheaper access to Internet LEOS communications for non-profit purposes (9). In that case, a coalition of satellite owners and NGOs with user counterparts in developing nations targeted humanitarian and development needs by providing a no-fee service. Wherever commercial services are required as well, other LEOS providers will be available for rural Type-0 MCTs, though. In both cases, the service can be delivered on a seamless, anytime-anywhere basis by using VHF narrowband data communicators at rural locations.

The rural e-mail service can be price-competitive, since many messages are sent or retrieved in a single data call. This may include multicast applications (government or health care bulletins, people finder or emergency warning). Messages keep stored if the recipient is not available at the destination point, or in the case of power failures. If this service is implemented on a seamless network reaching whole rural areas, even illiterate users or people speaking different languages can benefit from it, through the intervention of MCT and call centers´ staff. Although text communications are limited in terms of the expression of emotions and personal feelings, the use of symbol conventions in e-mail and chat messages became widely accepted as a way to partially overcome such limitations, despite lifestyle differences in the society. A study of 1994 revealed that attitudinal and facial expression through symbol codes triggered the growth of e-mail in Japan and other countries, where face-to-face and spoken communication tradition largely outweighs the importance of text -in both residential and business sectors- (12).

One or more messaging offices or call centers are required to patch e-mail messaging between the rural network and origination-destination users without an e-mail account (Fig. 2). At the call center, traffic from sources other than computers is bundled-unbundled and patched with fax, voice-mail or PSTN numbers. Existing Type 1-2 telecentres, cybercafés or public call offices located next to destination focus points may take the role of a messaging office. The text is normally up to 2,000 characters per message if the relative position of both the rural terminal and the Ground Earth Station allows a single hop link through the nearest satellite. Otherwise, multiple hops are required and the information should be limited to 200 characters.

5. Training and educational services via Basic MCTs

Educational activities are almost mandatory in projects involving rural community telecentres. These services, often requiring institutional agreements with the government and national/international agencies or NGOs are also regarded as an alternative for indirect funding support. Typical forms include:

a) Extension courses and seminars aiming to extend the geographical coverage of the formal educational system and/or to complement its curriculum (e.g. language courses and computer applications).

b) Health care campaigns, farming technologies and specific training programs for rural workers and local entrepreneurs.

c) Multimedia programs using ICT resources in addition to traditional distance learning via FM-radio-TV.

d) Remote advice, examination and consulting service to help rural learners.

In the case of a Type-0 telecentre, training is delivered either by the local MCT staff or as well by teachers, physicians or government institutions hiring the facility. In all cases, the key advantage is the covering depth of the telecentres rather than their basic, limited equipment. With just the standard software endowment of regular, small handheld computers, a variety of useful skills may be developed among learners: word processing, typing, drawing and art design, tax and accounting, farm managing, etc. During the survey carried out in 1998 in Guyaba (Suriname), 25 out of 26 respondents (96%) expressed that they would attend a course about PC operation/ Internet if this were delivered at no cost for them (1). In general, it is assumed that learners can enrol to scheduled MCT courses free, and that the government and other host institutions hiring the facility support the cost of using the available network resources. Though these costs may be quite low and such institutions can benefit from spreading their educational/ training coverage to the widest geographical area; from eliminating or reducing expensive travel-supervisory -control costs, and from increased efficiency in the use of scarce goods (time, vehicles, trainers, etc-). The incorporation of local trainees to the social and economic development process in low income or isolated regions, implies in turn new opportunities in production, consumption, health care and job creation, thereby fostering the community welfare and its social cohesion.

6. A business model for basic (Type-0) community telecentres

Type-0 community telecentres aim at fulfilling first-priority ICT needs of low-income and isolated rural towns. Depending on the network access options available in any specific region (WLL, fixed cellular, etc.) voice and e-mail messaging services, as well as small training programs may be implemented. Ground terminals and solar cells can be deployed for this purpose at convenient locations, connected to small handheld computers with keyboard and modem. Inexpensive portable PCs with basic processing capabilities will work better for enhanced educational applications at selected locations, too. Outdated, recycled or surplus notebook units are also eligible, in order to keep power consumption as low as possible. The business plan sample in Table 2 refers to Type-0 rural telecentres for data communications and training activities equipped with low-cost handheld PCs harnessed to narrowband-LEOS VHF terminals powered by solar panels. Such arrangement may be suitable for low-income settlements of some 300-400 inhabitants (housing costs of the facilities are not included). It was envisaged with reference to an hypotetic community of 340 inhabitants (1/3 of the population of the smallest location with Type-1 MCTs, as existing in Suriname in 1998, with the same income distribution pattern) (Fig. 1). The model´s assumptions are as follows:

- 340-inh. Rural community with a maximum social expenditure in ICT services limited to USD. 1,432.-/yr.
- Purchase & leasing values were estimated in October 1998 for a plan involving 50 to 100 basic MCTs equipped with standard hardware devices (estimated prices are FOB-USA).
- Investment in equipment with preferential annual interest rate of 7.5 % (equivalent to 50 % of the average interest rate for loans in foreign currency, as estimated on May, 1998 by the Suriname Central Bank).
- Facilities to be on duty 12 hours a day (scheduled according to availability of sunlight), 25 days a month in average.

Table 2. Operational Budget Sample for a Narrowband LEOS *Type 0* Rural MCT (*)

Investment			
1. Telecommunications Equipment			
1 - Narrowband LEOS Communicator 4.8/2.4 Kbps			
1 - Kit solar panels/ Batteries/ Regulator & Ancillary equipment.			
1 - Kit VHF Antenna, Coaxial line & Others.			
1 - Furniture basic set & toolkit			
Subtotal...		2,100.-	
2. Computer Equipment			
1 - Low power Hand-held Computer w/ built-in modem		600.-	
Total Investment...		2,700.-	
Annual Costs			
a) Capital consumption & debt service			
Depreciation cost -Telecommunications Equipment - 10 years @ 8%	313.-		
- Computer & Fax Equipment - 5 years @ 8%.............	150.-		
Finance cost (Estimated at a preferential interest rate of 7.5%)	203.-		
Subtotal..			666.-
AO&M Costs:			
Narrowband-LEOS low bit rate data leased connection annual rate: Based on a 24-Month Agreement @ USD. 35.-/mo.	420.-		
Message patching/handling: 10,200 messages @ USD. 0.005/ message		51.-	
Fixed AO&M Costs: 3 AO&M multiple missions/yr. (each mission planned so as to reach 5 rural MCTs in the same area) @ USD. 495/ 5 = 99.-/ea.	297.-		
Other Indirect Costs (supplies, equipment spares, etc.) @ 1% of items 1&2: =	27.-		
Subtotal...			795.-
Total Annual AO&M Costs:..			1,461.-
Pre-Tax profit for MCT providers: 30% of Locally-generated revenues.			306.-
Pre-Tax profit for MCT providers: 20% of ICT & Internet training programs:			288.-
Break-even revenue..		2,055.-	
Annual Revenues			
1) Outgoing E-mail messages: 10,200 messages/yr. @ USD 0.10/ea.	1.020.-		
Subtotal-Revenues generated at the local community.....................			1.020.-
2) Incoming voice messages (10% of 2)- 1,020 tel. calls (3'/ea.)@ USD. 0.078/min.			239.-
3) Training schedule: 4 hours/day/25d/mo. @USD. 1.50.-/hour (efficiency = 80%)			1.440.-
Total- Annual Revenues:..			2,699.-
Pre-tax Envisaged Operational Balance:..			644.-

(*) All values are estimates by GTR-UNNE based on a case study in rural areas of Suriname (1998)(1).

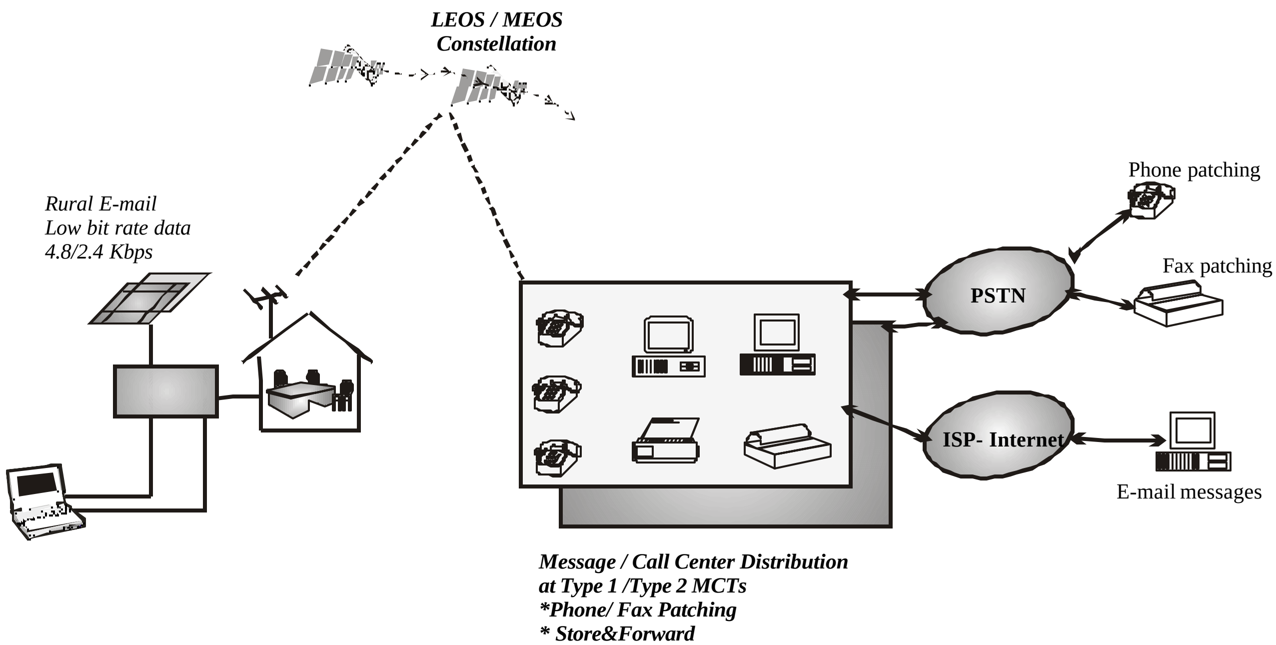

Fig. 2 **GTR-UNNE 1999.-**

- Local staff (1) also supposed to take care of training modules, messaging delivery and basic repairs.
- Rural e-mail used daily by customers equivalent to 10% of local residents, sending 1 message each (34 outgoing messages a day in average, including business, government and visitors´ submissions). Incoming messages are free for recipients.
- Revenues by incoming voice/fax messages reverted from call centers or from larger MCTs are based on 3'-average calls rated as regular phone calls to MCT's fixed cellular numbers (USD. 0.078/minute, fractionating every 1') (1)
- Supervision/maintenance performed in-situ three times a year (centralized extra maintenance, if needed is provided by replacing devices). M&R typical missions cover a boat trip to 5 locations in the same area, plus ground transportation (500 Km.), including travel expenses and overtime bonus salary (1).
- Training services are scheduled 4 hrs. a day before and after messaging service peaktime hours. The cost for host institutions is estimated at USD. 6.-/day and USD. 120.-/month (80% effective training time delivered).

7. Conclusion

The size and the profile of rural telecentres, and the resulting investment and operating costs are ultimately bounded by the community income. However, the per-unit investment in rural locations should cover just the services required by the community, according an *optimal impact* rather than an *optimal operation* criterion. The impact-driven design approach (2) enables the analysis of socio-economic variables to determine which services will likely yield the greatest improvement in terms of development status of the area. In every social project there is a need for capital and a risk involved, but experience has shown that large projects definitely obtained better conditions in price, quality, technical support and interest rates (4). In order to test this approach, a sample of Type-0 networks could be deployed in isolated, low-income regions of developing countries by mobilizing resources of incumbent organizations, governments and the private sector.

The concept of Basic MCT is in line with the theory of "unrestricted rural expansion" (15), where both the risk and the viability threshold are lowered by increasing the scale and the covering depth of rural networks in terms of geographical and socio-economic capilarity. Although the risk has to be managed and the expenditures should be honoured -otherwise no investment will be made on MCTs-, always there are options for improving rural access. Technological solutions as described in this document will become outdated very soon; therefore, basic telecentres should be regarded as a permanent, horizontal expansion strategy based on moving technologies, rather than a single, contingent solution. Further IMT-2000 and G-3 standards will enable technological updates in Type-0 telecentres, so as to follow maturity progress in IP telephony, simplified Web access and other suitable services.

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