Rural Development and Food Security
A "Community Informatics" Based Conceptual Framework

Michael Gurstein
Research Fellow
Technical University of British Columbia
Vancouver BC, CANADA
Gurstein@techbc.ca

Abstract

This paper presents an approach to ensuring the accessibility and utility of Information and Communications Technologies within the real context of specific conditions and limitations in the range of developing world contexts and specifically for those in rural areas.

1. Introduction

As the full dimensions of the transformation initiated by Information and Communications Technologies (ICTs) has become more widely understood, the means by which these might be integrated into and enhance the opportunities in such areas as “rural development” have begun to come to the fore. But in a context where there are severe limits to the accessibility and utility of the technology particularly for those outside of urban areas and in developed world contexts, the question arises as to how these opportunities might be realized not just in the abstract as a sense of possibility, but within the real context of specific conditions and limitations in the range of developing world contexts and specifically for those in rural areas.

The speed with which the new Information and Communications Technologies (ICTs) and particularly the Internet have advanced in their dispersal and capabilities is truly astonishing. From what was in effect a standing start, in some five years the overall numbers of those with access to and use of the Internet has gone from less than 1,000,000 people worldwide to some 250,000,000, with those numbers doubling approximately every 18 months. While these numbers are truly astounding, there is a sad disparity as between the access "haves" and the access "have-nots", with the numbers of those with Internet access and accounts being significantly skewed by income level and by location of residence.

Regrettably, those in developing regions and particularly the African continent overall have the least access, and even within those regions, the access is overwhelmingly among the higher income groups and particularly in certain urban areas.

2. Access

Central to issues of use and usefulness of ICT’s for rural development is the question of “access”. Without “access”, that is the means of making direct use of ICT’s and particularly entering into and using the world wide ocean of information and communications capabilities presented by the Internet, little else is possible. Clement and Shade have developed what they call an “Access Rainbow” which is a systematic rendering of the different “levels” through which access is determined. Their “access” model is freely adapted below.

Defining access

While access is consistently identified as a key principle in policy discussions, it is not an end in itself. Access simply enables further activities that can only partially be specified beforehand.

a) Access for what purposes?

In broad terms, enhancing the Information and Communications Infrastructure (ICI) holds the promise of enabling all citizens to participate more fully in all aspects of economic, social, cultural and democratic life. A central notion is the possibility of participative interaction with others. In contrast with existing electronic media, digital networks allow people to be creators as well as recipients. In many situations, computer based information and communications technologies (ICT’s) offer significant advantages over conventional media for accessing, creating, exchanging and sharing information in the conduct of daily affairs, thus benefiting the social individual in each of his or her major roles as consumer, producer, caregiver and citizen.
b) Access for whom?
To the extent that network services are valuable, no one should be excluded from the opportunity of participating in their advantages. Furthermore, the benefits for everyone expand as more people become reachable through the network. However, not all citizens are alike and we need to recognize the diversity of people and their particular access needs. This involves recognizing the obstacles to access characteristic of various 'populations', most notably age, gender, income, education, disability, language, ethnicity, geographic location (urban vs. rural and remote), and nationality (developed vs. developing countries).

c) Access to what?
Until recently, models of information/communications infrastructure emphasized the purely technical aspects, notably physical connectivity. Undoubtedly, digital networks will displace many activities currently conducted via highly evolved conventional media such as the postal service, document publishing and distribution systems, telephone services, TV and radio broadcasting, but are unlikely to render any of them completely redundant. Rather, digital networks will be increasingly interwoven with these other networks in complex and mutually redefining ways.

d) Carriage Facilities
While technical advances in carriage facilities promise greater capacities, wider availability and reduced unit costs, there are well founded concerns that some people, notably those with low incomes or living in rural or remote areas, will actually be worse off. The most prominent access gap results from the expense of providing terrestrial-link carriage services to those living in rural and remote areas. This raises the question of what constitutes the minimum "essential" bandwidth and hence what should be guaranteed in some way.

e) Devices
Current work stations are costly and become rapidly obsolescent. Again it is those with lower incomes who are at greatest risk. Also, many devices are difficult to use and not readily adaptable to individual differences, especially for people with disabilities.

f) Software Tools
Software is the critical new technical ingredient which expands the capabilities of the ICI. Monopolistic practices in the software industry, contribute obstacles to the smooth interoperability of software packages from competing vendors. These factors make software more expensive to buy and learning to use it effectively a major challenge. … Furthermore, software is largely written with English speakers in mind, thus disadvantaging other language groups. The general lack of encryption and other privacy protection features (e.g. in web browsers) represents another inhibition to the widespread usefulness of software.

g) Content Services
Many of the essential on-line data bases are currently available via the Web without charge to the user. However, commercial influences could undermine some of the diversity and quality of the information. As with software tools, content/service design must accommodate a broad range of users (including people with disabilities), cultures, and languages.

h) Service/Access Providers
Workplaces offer much more than just free access to equipment and connection - they provide a range of supportive services including purchasing, configuring, upgrading, maintaining, troubleshooting, repairing, and documenting systems as well as staffing help desks and training sessions. All of these are skill demanding and expensive but vital to routine, unproblematic ICT use.

i) Literacy/Social Facilitation
New digital media place significant learning burdens on users. Achieving widespread effective use of network technologies must therefore be supported by a variety of formal and informal learning facilities.

j) Governance
Governance is about the ways in which decisions are made concerning the development and operation of the information/communication infrastructure. Current governance and policymaking is centred in the major developed (OECD) countries, with corporate and industry stakeholders playing leading roles. Privatization and the deregulation of global telecommunications markets are seen as the way to foster competition and technological innovation. Important issues, such as public accountability, cultural identity, social inclusiveness and cohesion, and national sovereignty, are being threatened by giving such a priority to market forces.

A general model and a model of access specific to ICT’s for Rural Development would include:
• support for a multiplicity of usage roles involving creation and dissemination as well as retrieval of existing information;
• address the full range of possible users and the diversity of their life situations;
• recognize the interplay of social and technical dimensions in the development of infrastructure;
• encompass both conventional and new media;
• highlight "access gaps", areas of social need likely to be "left out" by market forces acting alone; and
• help identify what services should be considered "essential".

This model is important because it will define the broader context within which ICT’s for Rural Development can be framed and the limitations within each of these elements presents the constraints on making ICT’s useful for Rural Development both at the more general level and also specifically within each community or regional context.

3. What is "Community Informatics"?

Community Informatics (CI) is an approach that begins with the perspective that access to ICT can provide a set of resources and tools that communities, and individuals living in communities can use to pursue their goals in such areas as local economic development, cultural affairs, civic activism, community based health and environmental initiatives. Access of course, is more than simply technical access or even individual access. It includes in the Developing Country context, how to ensure that individuals or communities may make use of the opportunities provided by ICTs both where there is a means for direct use of the technology and also where this is locally absent. This issue is one that is currently being examined in many countries where the cost of individual access is prohibitive. It is also being examined in contexts where there may be reasons for having "community" access in addition to "individual in-home" access. In these instances, how to provide this type of “access” through physical facilities or through the redesign of existing information dissemination systems is a significant starting point.

Having established a facility for providing "community access", it becomes necessary to determine how to manage and sustain the institution or organization through which the access is being provided. It is also necessary to organize the facility so as to optimize the use of the technology and the opportunities which it provides. Finally, there are questions as to how the public or community access opportunities are linked into ongoing non-technical service or other organizational structures, including how access and use of a public access site for example, for rural development purposes might be linked into existing rural and economic development facilities and institutions in a local community.

4. Telecentres

Rural development is concerned with the rural producer looking to advance his economic position while retaining residence in a rural area. Thus, for CI and Rural Development, the objective may be to ensure that the individual, family or community has through the use of ICT, access to information, or to services that might otherwise be denied to them with conventional means but which will enhance their position as rural residents—as both producers and consumers. In this way they will be enabled to play a more active role in the economic life and well-being of their communities.

In this context, ICT and Rural Development could include providing crop, weather or market information (for example concerning current prices, futures, shipping information); information regarding the availability of local production support services (availability of extension services, fertilizers, livestock inspection services); extension education services; on-line production counseling and mutual support networks; weather or crop advisories and so on. In some cases ICTs could provide a means to bypass the local marketing systems as for example in identifying more distant markets, negotiating contracts and supply information and so on.

In Developing Country circumstances the most likely means by which the general population and particularly the rural general population will have access to computer-mediated services will be through some type of public access facilities such as Telecentres. This means that these centres, in addition to being centres of communication and small business support in rural areas, may also become centres for the delivery of rural development support services for their community catchment areas.

The key element of course, in any Rural Development application is information. It is information that is being accessed for use as the Rural Development "service". In order for this information to be retrievable, understandable, and relevant to the Rural Development consumer there may need to be mediating structures linking the "service" available electronically with the end user. For example, a technologically trained Rural Development para-professional (Extension Worker) could translate the
development support needs of a local rural community into the appropriate Internet search criteria; and interpret and translate the returned information putting it in a form that is useable by the local community. One major role that an organized network of Telecentres could play is to create and maintain index web sites and search engines that meet the specific needs of the Rural Development service consumers in the respective regions.

5. A 'Community Informatics' Approach

CI is an approach to ICT, which includes a concern for the accessibility of the hardware, the software, the connectivity and the information; and for the use and user to which the technology is being applied, particularly within the context of the user's physical community. Incorporating the user and his community into the system design process introduces new elements and new "stakeholders" into an extended approach to ICT design, development, and implementation. (See for example Gurstein, 2000. Much of what follows parallels the detailed plan for a locally based “Knowledge System” for rural Uganda, cf. Crowder and Fortier, 2000)

a. Access Facilities

How the user gets access to the technology is of particular interest. For many and particularly in less "connected" regions and countries, this will be through public or community-access facilities, i.e., Telecentres, CAP sites, "cybercafes", etc. These centres, in addition to providing communications and small business support, also may become centres for the delivery of electronically-mediated training, and public information including rural extension services.

b) The Design of the Service

Central to the success of the activity will be the information or service being provided. There are a vast amount of information and services available on the Internet. However, relatively little of it is appropriate or useable in contexts where environmental conditions, resource scarcities, skill deficiencies, and cultural expectations and practices are different from those in the developed countries. For services to be widely useful, information providers must design and provide services of specific interest to the end user, and particularly which takes account of the specific contexts of the various regions and cultural and linguistic groupings. What would be best is if information service providers were widely distributed and close to those using the information so as to localize information from other regions and to develop information of special interest within local contexts.

c) Design of the Telecentre

The telecentre will be central to the capacity of a Rural Development initiative to have a broad impact in local communities. The range, number and distribution of telecentres will determine whether the service is available to the few or the many. The effectiveness and capacity of the centre will be the lynchpin of the effectiveness and success of the service. It will thus be necessary to undertake the planning of the telecentres in the context of their being the node through which Rural Development is delivered. It will also be necessary to design the operations of the telecentre so that the centre is able to act effectively as the intermediary between the information provider and the information user. The physical and organizational design of the telecentre should also reflect its possible use as a Rural Development facility and should include among other critical telecentre elements:

1. An institutional linkage and physical base
2. Connectivity
3. Multiple uses--education, extension, small business support, communications
4. A paraprofessional extension worker with online and information management skills
5. Translation facilities for the key languages served in the region
6. Some means to ensure sustainability

d) The design of the Information or Service

As already noted, there is a vast amount of information and services available on the Internet. However, relatively little of it would appear to be appropriate or useable in the Developing World context where conditions are so different from those in the North and particularly with respect to environmental conditions, resource scarcities, skill availabilities, and cultural expectations and practices.

For Rural Development ICT services to be useful it will be necessary to develop the capacity with the information provider to design and provide service of specific interest and relevance to the Developing Country end user and particularly information which takes account of the specific contextual circumstances found in particular Developing Countries and regions and their various geo-physical, climatic, cultural and linguistic groupings. It would probably be most advantageous if information service provider facilities were to be developed in the Developing Countries themselves, which could both localize information from other parts of the world and develop information of special interest within the particular Developing Country context.
e) The community system

The design of the community system into which the ICT enabled service or information will be transmitted will be particularly important for Rural Development working through public access telecentres. There is a tendency in the developed world to think that the mere presence of electronic resources will meet the requirements of a "community" without the need for further intervention or leadership. In the Developing World context, the on-line information or service will probably for the most part be provided to groups rather than to individuals. In some cases these groups will already have been formed, in other cases they may need to be formed specifically to take advantage of the opportunities presented. Thus, for example, a local farmers group might be developed which meets regularly to obtain advice on crops and marketing related matters by means of the Internet. The group would identify its information needs, the request or search would be undertaken by a paraprofessional trained for such activities and he or she would in turn pass the information back to the group where it would be assimilated/processed/applied.

It will, in this context, be necessary to look at the entire service process as a system, including the information or service provider/designer, the paraprofessional intermediary, the professional, and the group or community information user/recipient. Effective planning and development for all stages of the process will be needed for the service activity to be successful. It may also be desirable to establish a process of information-sharing between groups with similar concerns, as a parallel to the useful and beneficial interactive communication processes which have developed between individuals.

f) On-Line Service Delivery

Among the rural development related services that are currently being provided or could be provided through the Internet are:

- Information
- Education and training
- Mentoring and consultation
- Diagnosis and monitoring
- Transaction processing

Useful and useable information is at the core of ICT-enabled services. For this information to be retrievable, understandable, and relevant to the consumer there needs to be "mediating structures" linking the electronic "service" with the end user as for example, a technologically-trained paraprofessional translating the needs of a community support group into appropriate Internet search criteria and then sifting, interpreting, and translating the returned information into a form that is useable by the "client" community.

A useful model of an online community information resource can be found in the Community Toolbox whose mission is to “promote community health and development by connecting people, ideas and resources.” The site includes online training for developing community leadership, an index of health resources, both physical and virtual, local and national, and online discussion and chat to facilitate users to share information or to organize community health initiatives.

g) On-Line Support

"On-line support" is the mechanism whereby individuals provide information, comfort and mutual assurance to each other through the medium of the Internet. This can be done either by e-mail, newsgroup or web conference (asynchronous) or by chat (synchronous), although in most cases it is done asynchronously. Included in this would be a variety of groups of producers working in similar geo-climatic areas (for example the Sahel), producers working with similar types of crops (sugar cane, sorghum), supports for a variety of exotic conditions and crop or animal diseases, and individual or cooperative support facilities. These groups provide the opportunity to discuss current conditions, or problems with others who have direct experience of the problem or circumstance. These online support groups are also being used in a variety of ways by researchers including crop and climate researchers and veterinarians.

5. Rural Development Applications

a) Rural Development Information

This includes a range of information of local interest such as local listings, directories, a local calendar/schedule of events, and so on. In many cases public extension information is provided. In some cases this is being done through the regional extension office or through NGO’s which, on a voluntary basis, are maintaining rural development data-bases, now generally in the form of a web-site.

b) Service Delivery On-Line

ICT is being used as a means for providing rural development services, including information and registrations, extension information and counseling, and technical information and small business support (including mentoring). This direct provision of services is only in its infancy and particularly in a Developing Country context. However, one can expect that this will grow dramatically in the very
near future as it comes to be realized how cost
effective this approach may be in a number of sectors
and particularly in those areas which are highly
information intensive such as information provision,
training, registration/licensing, and so on.

   c) E-Commerce
   Both commercial and non-commercial agencies
are making efforts to ensure that some of the
opportunities emerging through Electronic Commerce
are being made available to geographic communities
including rural Developing Country communities, as
for example through E-mails, community web-sites,
links between SMEs and on-line commerce and
others.v  A number of initiatives are currently
underway to find ways of linking local commercial
and production activities with the facilities offered by
e-commerce, both directly to retail and trade
purchasers and to suppliers.81

   d) Education/Training/Learning Networks
   A major and rapidly-emerging application area is
in education, training, or life-long learning. Increasing areas of education and training are being
provided on-line, including the on-line distribution of
course material in text, oral, and even video format
along with an asynchronous or synchronous
interactive component through e-lists or forums or
chat facilities. The medium is still in its early stages
and techniques and curricula incorporating some of
the unique opportunities which the technology affords
are just now being developed. Also the methods for
linking on-line facilities with training and life-long
learning needs, and with existing community
organizational and institutional structures, are just
now being developed along with the means to link
this into on-going and emerging opportunities for
extension training in a variety of geographic and
production related contexts.

   e) Community and Regional Planning
   Much more sophisticated community involvement
in local land use and environmental planning is now
possible as a result of the application of Geographic
Information System technology.

   f) Telework
   ICTs may support local economies by allowing
for work to be done remotely from the workplace, or
"telework". Decentralized computing linked to a
communications allows work to be done from any
connected remote location. Skills and training can be
provided remotely. Some have suggested that
technology would allow for certain enterprises or
their employees to be located anywhere so long as
they were tele-connected.

   g) Civic/Community Participation On-Line
   ICTs are being used to enhance civic and civil
society participation through non-partisan electronic
democracy projects, and through public consultation
initiatives. Such "electronic democracy" is providing
to citizens the initial means to obtain and circulate
information of local political/civic interest. Ultimately
the on-line expression of public opinion will be
linked in some manner directly to the formal
discussion of on-going local issues, even to the extent
of formal electronic "voting" on issues and direct
participation in decision-making.

   6. A CI Model for an Integrated Service
   Delivery System
   In the above we have begun to discuss ICT-
enabled services and application delivery systems
within a CI context. A preliminary model of this type
of service delivery system would include:

- a community-based technical capacity to
  receive services and information in a manner which
  can be made accessible and disseminated to a wider
  population, as for example through the network of
  Telecentres that are being established throughout
  many rural areas. These Telecentres will then need
to have a minimum level of connectivity and processing
power and the technical skill for on-going
management and maintenance.

- a social/organizational capacity to receive
  and redistribute services and information. This will
  require that the Telecentres have the local capacity to
  identify service and information needs that can be
  provided electronically. Additionally they will need
to have the skills to access and process the
  information and services as they are made available.
  They will also (and crucially) need the means to
  interpret and translate that information and those
  services from and to the local populations, who in
  turn may be from a variety of linguistic and cultural
groups and with widely-varying levels of literacy and
education. There will also be a need for the capacity
to copy and distribute the information in paper form
and orally through presentation to community
meetings.

This information need not be redesigned
specifically for each sub-population but it must be
presented in a manner such that it can be translated
and redistributed by local Rural Development
paraprofessional intermediaries. There will also be
the need for a capacity to identify what information or
service can and should be provided, given the limited
resources that will be available for this activity. There
is the additional issue of "who owns" the information,
both in terms of copyright/distribution permissions
and of authentication of the information. (In this
context, there is the additional question of the various
political/cultural/religious biases or "agendas" which
may be an underlying element to the information
The application will be designed so as to accommodate a "mediator" between the application or service provider and the end user, programming may present itself sooner rather than later and any program developed should make accommodation for this.

- a human capacity to mobilize resources in this sector, including leadership and vision. Many communities lack the skill to bring together the resources that might be available with the need, in a sector as new and as rapidly-evolving as this one. Traditional leadership in communities may be ill-equipped, feel themselves to be inadequate, or lack the information to move forward with ICT, and those with the skills may only be interested in pursuing individualized efforts. Thus communities need access to appropriate leadership and leadership training to assist in pursuing technology-enabled opportunities as they emerge.

- an overall Rural Development program development and management capability to integrate and expedite the various requirements, to seek out funding as required, and to ensure that the various components of the system work together smoothly. The Rural Development program development capacity will also need to establish service delivery priorities to ensure that efforts are directed towards the areas of highest priority.

- A means to ensure evaluation and feedback from the service and information back to the information source and development group. Assistance in undertaking evaluation and feedback procedures will be desirable.

7. Features of a CI Rural Development Application

The key characteristic of a CI Rural Development application, of course, is that it is meant to support RD objectives and to be useable by rural actors or agents.

a) Training: The application will necessarily include a significant training component, not as an afterthought or as an "add-on" but as an integral part of the system. The training should be directed to allow for the non-professional user to manage and maintain the system being operated.

b) Ease of use: The application will be designed so as to optimize its ease of use, including installation and on-going maintenance, where possible by the community or end user. While the "backend" of the application may be complex (they often seem to be based on UNIX/LINUX architecture which is famously not user-friendly), the "front-end" should be transparently easy to use and to implement.

c) Mediation: The application will likely be designed so as to accommodate a "mediator" between the application or service provider and the end user,

- a social and organizational capacity to utilize and implement the services and information which are being provided through the facility. There will need to be the organized development of groups to work through and with the Telecentres and the extension worker, to receive the information and service and to implement this in their own lives, that of their families and of their communities. These groups will need to be planned for and developed as part of the overall Rural Development program, as without these groups the program will have little resonance or effect in the communities to which the programs are being provided.

- an organizational capacity to localize external information of use to specific services and, where necessary, to compile and develop its own information resources. This capacity would probably be best achieved though a semi-independent Centre linked to, but organizationally distinct from, an institution such as a university or library (ensuring that the services and information are accurate and reliable but not so professionalized that lay people cannot understand them).

- a technical capacity to receive Regional Development services and information in a manner which can be made accessible and disseminated to a wider population. It is anticipated that this capacity to receive information will be found through the network of Telecentres that are being established throughout many rural parts of Developing Countries. This will mean that these Telecentres have to have a certain minimum level of connectivity and processing power and the technical skill to manage and maintain this facility on an on-going basis

- a technical capacity to mount and deliver this information via the various modalities of the Net, including and particularly E-mail, the WWW, and chat. The service provider should be capable of keeping abreast of ongoing technology development and to undertake limited Research and Development activity in support of their work. This will ensure that the activity moves both at a pace appropriate to the expanding capacity of the overall delivery system as well as to its users. Particularly in the context of multimedia, the web is moving towards streaming audio and video as a major delivery vehicle. Similar increases in delivery capacity are likely to continue (satellite service delivery is one reason) and thus the opportunity to integrate audio and video into ongoing
since the end use of the service is meant to be available to the general locally based producer and not just to specialists.

d) **Applied technical system**: The application is for the most part identified by what it does, not how it operates. Its support for community extension, for example, is assessed by its effectiveness in contributing to community extension, not by the elegance of its software design. The particular way in which the contribution is made or its technical features (for example, design elegance) will, from this perspective, be of lesser interest or relevance.

e) **Governance Structures**: The application is managed or "governed" so as to support processes which facilitate community consultation and participation in decision-making.

f) **Sustainability**: Key to the application is the on-going sustainability of the various services. How public access facilities, regional development web sites, or other related applications can be sustained after a transition from volunteer management and/or public sector support is the key to success. Identifying an appropriate "business model" for an ICT-enabled service is thus of crucial importance.

### 8. Issue Areas:

a. **The sustainability of the system**

Many of the Rural Development oriented online initiatives undertaken in the developed world have been done either as volunteer efforts by those with access to supportive resources (through governments, universities or other types of organizational supports) or as specially funded experiments or pilot projects. As yet there is no business or revenue model for Rural Development activities through the sale of associated goods or services. Given the resource limitations of the program context in Developing Country, neither of these approaches is likely to be possible.

A key component of the overall system and a key cost area for the program is the Telecentre. The overall business model for the Telecentre itself has not been worked out, whether for example, it operates solely on a fee for service basis or as a government program delivery point with ongoing subsidies accordingly.

b. **Literacy, language and culture**

A Rural Development program will need to respond to issues of literacy (or rather, illiteracy), the very large numbers of languages (some without written scripts) and the range of cultures and religions that are found within the Developing World. An absence of literacy may in part be handled through the paraprofessional extension worker who acts as a translator between the world of text and the world of speech. However, many of the available resources are in text form and it will require a major and costly effort to provide these in a manner that an individual with a only limited education (such as the paraprofessional extension worker) could make this usefully intelligible to the community user. Similarly with making resources available in the various local languages—in some cases there may be dozens of languages just within the catchment area of the telecentre. Whether the extension worker could be expected to undertake these kinds of translations is a question and certainly as little of this as possible should be required if only to avoid mistranslation and mistakes. Culture and cultural or religious sensitivities will have to be assessed on a local and pragmatic basis. The various telecentres will need to experiment with what information or services will be acceptable (or unacceptable) in particular contexts.

c. **Reliability of information**

There will be the need for on-going monitoring of the reliability and scientific validity of the information being made available through the program. While it is anticipated that the Information Centre will filter and verify much of the information being made available through the Rural Development services, there will also be considerable scope and likelihood for accessing the broader information base of the Internet. The unreliability and even danger of some of the information circulating on the Internet is of concern in Developed countries and may be of even greater concern in a Developing Country context where less experience and critical capacity may be available and where there may be more willingness to accept the authority of the written text in computerized form than would be the case for similar types of information in Developed countries. There also will be the need to maintain ongoing contact with the larger research and scientific community to respond to issues as they may arise and for the local system to make its presence felt to the broader public so as to build up credibility in the public’s eye if and when the need should arise for an intervention. Consideration might also need to be given to some form of on-going certification of information sources for their reliability.

d. **The ICT and the Extension Worker**

An earlier discussion of the model presented above in the context of ICT based Telehealth applications in Developing World contexts indicated that a significant requirement and area of use for the
system is in the support that the system would provide to the Rural based service professional. In many cases these professionals, such as health care or extension workers find themselves to be professionally isolated in their posts, often far from sources of professional support, consultation and continuing education for themselves. The model of ICT use in Developing Countries will for the foreseeable future be one where its most direct application will be in support of existing field based professionals and it thus will be necessary to ensure that information sources are designed so as to provide this kind of service. It will be noted that much of the information on the WWW currently is directed toward the individual end user rather than towards professional or paraprofessional intermediaries as the individual end user is the most common mode of practise in Developed Countries.

8. Conclusions
There is a window of opportunity at this time when policy decisions are being made in regard to both the creation of a network of Telecentres and the creation of on-line Rural Development support services. Integrating the planning and operation of these endeavours could provide considerable cost savings and increase the effectiveness of programs, particularly if the infrastructure required is coordinated and cost-shared with the extension network that is already in place. A number of useful models and practical experiences are available that might be adapted to the needs of Developing Country communities. In particular, a coordinated network of telecentres acting as Rural Development delivery nodes could be a powerful resource in rural Developing Country contexts for supporting rural sustainability by enabling accurate information about local agricultural matters, and by facilitating cooperation and interaction between organizations, institutions and communities distributed throughout the world.

REFERENCES


**Endnotes**


ii <http://ctb.lsi.ukans.edu/>.

iii The provision of public access has in some instances flowed out of these Community Information Centres, as for example in Australia. See <http://www.vicnet.net.au/vicnet/contents.htm>.

iv Gurstein and Dienes, 1999.

v Gurstein, 1999b, Gurstein,1998b.

vi See for example the Government of Canada's Mainstreet program, the World Bank's Virtual Souk, the US-based WebMarket and similar initiatives elsewhere.