

The Promise of Digital Libraries in Developing Countries

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Many current technology trends are not benefiting developing countries—indeed, some bring serious negative consequences. Just as industrialization and globalization have increased the gulf between haves and have-nots, so information and communications technology is creating a chasm between “knows” and “know-nots.” By and large developing countries are not participating in the information revolution, although knowledge is critical for development. The knowledge gap between rich and poor is widening [1, 2, 3].

1. Digital libraries in human development

We identify five important areas where digital libraries can promote human development.

Dissemination of humanitarian information is a realm where traditional publishing and distribution mechanisms have failed tragically. Whereas a US medical library subscribes to about 5,000 journals, the Nairobi University Medical School Library, long regarded as a flagship center in East Africa, last year received just 20 journals (compared with 300 a decade ago) [4]. In Brazzaville, Congo, the university has only 40 medical books and a dozen journals, all from before 1993, and the library in a large district hospital was a single bookshelf filled mostly with novels.

Digital libraries, by decoupling production and distribution costs from intellectual property charges, offer a desperately-needed lifeline. A wealth of humanitarian material is produced and placed in the public domain by NGOs and international organizations such as the UN. In principle, this information could be made freely available in the form of networked digital libraries. (Distribution in developing countries is discussed later.) More broadly, increasing the level of education through knowledge and technology transfer, particularly for doctors, teachers, and other professionals, is an important economic benefit of digital libraries.

Disaster relief, whether for natural disasters such as earthquakes and hurricanes or man-made ones such as terrorist attacks and nuclear accidents, demands immediate and informed response in an environment where the local infrastructure may be unpredictable or severely damaged. Disaster relief situations are tackled in parallel by numerous players in a variety of organizations,

presenting an overwhelming need for information—information that is tailored for the problem at hand, organized to be accessed effectively, collected and disseminated rapidly, and distributed even if the network infrastructure is crippled.

Digital library technology can very quickly create organized collections of information, graced with comprehensive searching and browsing capabilities. Intelligence specific to the nature of a disaster, the geographical region, and the logistic resources available for the relief effort, can be gathered into a made-to-order digital library collection that combines targeted knowledge with general medical and sanitary information.

For **preservation and propagation of indigenous culture**, the relevant information is readily available locally—in contrast to the preceding scenarios, which disseminate within developing countries information originating in the developed world. Nurturing a capability for creating information collections is a more effective strategy for sustained long-term human development.

Information about indigenous culture takes many guises: oral history in the form of narration and interviews; artifacts in the form of images and descriptions; songs in the form of audio recordings, music transcriptions, and lyrics; dances and ceremonies in the form of video, audio, written synopses and interpretations. Multimedia digital libraries allow such information to be integrated, recorded, browsed, and searched, within a uniform user interface. Because language is the vehicle of thought, communication, and cultural identity, a crucial advantage of digital libraries for culture preservation is the ability to work in local languages, thereby strengthening individual cultures, promoting diversity, and reducing the dominance of English in the global information infrastructure.

Locally-produced collections of information relevant to communities are needed to bridge the information gap between the developing and developed worlds [5]. Teachers prepare educational material that addresses specific community problems, or adapt other material to employ local examples. Indigenous people have medicinal knowledge based on local plants or long-acquired knowledge of the cultivation and protection of local species. Local groups assemble information collections that describe and reflect neighborhood

Title	Language	Year	Organization	Publications and pages	Description
Agricultural Information Modules	English French Spanish	2000	UN Food and Agriculture Organization	260	A digital capacity building project to foster the development of country-based CD-ROMs and to meet local information needs by combining international modules with local information
Biblioteca Virtual de Desastres	Spanish	1999	Pan-American Health Organization/World Health Organization	250 25,000	Publicaciones sobre preparativos, mitigación o respuesta a los desastres, especialmente orientados hacia los países de América Latina y el Caribe, pero de interés y utilidad para todos los países del mundo
Bibliothèque pour le Développement Durable et les Besoins Essentiels	French	1999	Humanity Libraries Project/Payson Center	600 40,000	Agriculture, aquaculture, construction, coopération, eau, économie, éducation, énergie, environnement, femmes, industrie, nutrition, santé, société, science, et technologie
Collection on Critical Global Issues	English	1999	UN University Press	210 32,000	Agriculture and land management, development, environment and sustainability, natural resource development, science and technology
Food and Nutrition Library	English	2000	UN University Press/Humanity Libraries Project	260 28,000	Food and nutrition, food policy, nutrition research (includes the Food and Nutrition Bulletin)
Humanity Development Library	English	1999	Humanity Libraries Project	1,230 160,000	Various areas of human development, from agricultural practice to economic policies, from water and sanitation to society and culture, from education to manufacturing, from disaster mitigation to micro-enterprises
Medical and Health Library	English	1999	Humanity Libraries Project/Payson Center	210 30,000	Clinical treatment, emergencies, essential drugs, family planning, food and nutrition, health education, hiv/aids, medical equipment, prevention, public health, research, sanitation
SAHEL point Doc	French	1999	UNESCO	170 12,000	Contient des ouvrages de divers genres tels que des documents d'information et de vulgarisation, des guides pratiques et techniques, des fiches techniques, des rapports et actes de colloques, etc.
World Environmental Library	English	1999	GTZ/Humanity Libraries Project	400 45,000	Agriculture, biodiversity, climate change, environmental impact assessment, energy, health, natural resources, policy, sustainable development, waste management and water

Table 1 Information collections produced for developing countries

conditions, providing new material for socio-cultural studies, fostering cultural exchange while retaining diversity, and increasing international understanding.

New opportunities to enter the global marketplace. Countries such as India, Romania and the Philippines have long undertaken low-level information-processing tasks like data entry and OCR—indeed, we have had successful experience with local replication of digital library CD-ROMs in Columbia and Pakistan, saving significant transport costs and customs charges.

The varied demands of digital library development, such as manual metadata extraction, collection organization, cataloging, and information presentation, will greatly expand the range of tasks that the developing world can undertake, creating valuable new export markets.

2. The technological infrastructure

Computers are not so rare in developing countries as one might think. Their extremely rapid obsolescence rate, combined with the developed world's voracious appetite

for the latest and greatest, makes low-end machines essentially free: many find their way abroad. A 1998 World Bank survey of developing countries found 3 to 30 PCs per 1000 people, depending on the poverty level [5]. With growth predicted at 20% per year, we estimate that there are now around fifty million PCs in developing countries, serving a population of four billion.

Networks. A more serious obstacle is that network access varies widely across the world. Whereas in 1998 more than a quarter of the US population were surfing the Internet, the figures for Latin America and the Caribbean were 0.8%, Sub-Saharan Africa 0.1%, and South Asia 0.04% [4]. Schools and hospitals in developing countries are poorly connected. Even in relatively well-off South Africa, many hospitals and 75% of schools have no telephone line. Universities are better equipped, but even there 1,000 people can depend on just one terminal. The Internet, as Arunachalam [6] puts it, "is failing the developing world." While global satellite communication networks will eventually bring relief, this takes time and money.

Distribution media for digital libraries should be separated from their structure and organization. Physical distribution of information on recordable devices can provide an attractive alternative to networks. While easily disparaged, the ubiquitous CD-ROM is a very practical format for areas with little Internet access, and can hold a useful volume of information—particularly in text form. A year's supply of those 5000 medical journals mentioned earlier could fit, fully indexed, on a single DVD.

Impoverished computing platforms. Computers in developing countries tend to be low-end, often with poorly-installed software. The computing environment is quite outside the control of system developers, and may lack network access, CD-ROM drives, browser software, adequate disk storage and main memory.

The **Greenstone software** (see sidebar) works standalone on platforms appropriate to developing countries—all varieties of Windows from 3.1 up, and Linux. Supporting primitive platforms poses substantial challenges: for example, Microsoft compilers no longer support Windows 3.1 and it is necessary to use obsolete versions.

Even standalone users interact through a Web browser: Netscape is supplied on each CD-ROM. Greenstone runs locally but incorporates a Web server so that if the system happens to be connected to an intranet—say in a hospital or school—information is available to other machines, which may not possess CD drives. This happens automatically: no special configuration is necessary. Another engineering challenge is checking for the existence of a network. While installed network software is easily detected, it is difficult to determine non-intrusively whether it is operational. Incorrectly installed or configured software is endemic in developing countries, because computers there are often cast-offs whose software is inappropriate to their present environment, yet system support to rectify the problems is unavailable.

3. Example information collections

Greenstone is being used to deliver humanitarian and related information in developing countries. Table 1 summarizes nine information collections, available on the Web (nzdl.org) and CD-ROM, from organizations ranging from UN agencies to small NGOs.

For example, the *Humanity Development Library* is a compendium of practical information aimed at helping reduce poverty, increasing human potential, and giving a practical and useful education. It contains 1,230 publications—books, reports, and magazines; a total of 160,000 pages and 30,000 images. In print it would weigh 340 kg, cost US\$20,000, and occupy a small library bookstack.

The other collections include information on topics ranging from disaster relief, agriculture, the environment, medicine and health, food and nutrition, and regional affairs. Fifty thousand copies of these CD-ROMs are

Date: Tue, 25 Jul 2000
From: Kataayi Multipurpose Coop <kataayi@afsat.com>
To: Dr Michel Loots <mloots@humaninfo.org>
Subject: Request for Humanity Development Library

We are Kataayi Multipurpose Cooperative from Uganda, a community based cooperative which has been in existence for the last 20 years.

At present we are concentrating on introducing ferro-cement rainwater catchment tanks, renewable energy technologies such as solar, wind, and biogas, locally made clay roofing tiles, technical education, and an information and communication center.

We believe that an information and communication center located in our rural community will have a major development impact on our people. Reliable communication from our area requires traveling over rough roads to the district town 20 km away. When reaching the town we can use public phone and fax services at relatively high costs. There are no email communication services in the district town. As well the nearest source of information in the form of books, periodicals, and newspapers is in the district town. Therefore, the distance and difficulty of reaching the town discourages most persons from taking advantage of information and telecommunication.

We have laid the groundwork for this center by acquiring computer training, a computer, solar power equipment, establishing an email connection via a cellular phone, gathering a number of books, and constructing a two-story brick building for housing the center.

We are now looking for more books and periodicals especially those which can give our people information on intermediate technology, fair-trade marketing, agriculture, environmental conservation, spirituality, and social justice issues. We have been introduced to the Humanity Development Library and we think it would be a wonderful source of information for our community. We would like to make it available to our community through the information and communication center. Our computer is capable of operating the CD. How can we get a copy of the Humanity Development Library, and will there be a fee? Do you have other libraries on CD as well?

We are also looking for sources from which we can receive books to expand our library. Can you direct us toward any such sources?

Sincerely,
Emmanuel Kateregga-Ndawula, Chairman

Figure 1 Example request for the Humanity Development Library

distributed annually, of which 60% are provided free. In these quantities, the cost of replication and distribution is around \$5 per disk. The need for this kind of information is eloquently conveyed by the typical request letter of Figure 1.

In an evaluation survey involving 90 responses to a questionnaire circulated to 360 randomly-chosen organizations, the majority (75%) liked the interface, and nearly all (96%) said they wanted more CD-ROMs of this type [7].

4. End-user collection creation

Notwithstanding their variable, often rudimentary, computing environment, users in developing countries should be empowered to produce digital library collections themselves, not just consume information produced elsewhere. Creating new collections typically requires advanced knowledge of file formats, how

documents are structured, what metadata is available, and how to translate it into appropriate searching and browsing indexes. However, making new collections that are modeled on existing ones, with source documents in the same format, metadata provided in the same way, and the same searching and browsing facilities, need be no more difficult than updating current collections.

Greenstone incorporates a collection-building “wizard” that allows non-programming users to create and organize new digital library collections from source documents present on local disks or downloaded from a network. Guiding the user step by step, it requests the collection’s name, stated purpose, email contact address, existing collection to use as a model, file types to include, and source directories and URLs to mirror.

Collections are built on whatever machine is running Greenstone. This may be the user’s stand-alone computer, a server on a local intranet, or an Internet server belonging to an international organization. In all cases access is through a standard Web browser. Greenstone controls access so that only authorized users can build collections on any given server; as an additional safeguard against misuse the server administrator is automatically notified of each new collection.

Through the same simple interface, authorized users can add material to collections, or prepare a directory that contains a complete image of the data and program files necessary to burn a self-installing CD-ROM containing a collection. In developing countries CD-ROM writers are frequently available in local telecenters equipped with high-end computers provided by governments, NGOs, and private initiatives.

Finally, by using Unicode throughout Greenstone, users are able to translate the interface into local languages without having to delve into the detailed operation of the software.

5. Conclusions

It has often been observed, in areas like solar energy and mobile telecommunications, that technological advances in developing countries leapfrog those in developed ones because the necessarily conservative forces of established infrastructure are absent.¹ We think digital libraries will provide another example, compensating for the failure of traditional distribution mechanisms to address local needs and get information where it is needed.

¹ For example, developing countries are now experiencing high levels of mobile phone growth. In Cambodia, 72% of telephones were mobile in 1998 [8].

In the developing world, digital libraries represent a “killer app” for computing technology. Priorities in developing countries include health, food, hygiene, sanitation, and safe drinking water. Though computers are not a priority, simple, reliable access to targeted information meeting these basic needs certainly is. Digital libraries give system developers a golden opportunity to help reverse the negative impact of information technology on developing countries.

Acknowledgments

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