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THE PROMISE
OF DIGITAL LIBRARIES IN DEVELOPING COUNTRIES

Although knowledge is critical for development, few developing countries are participating in the information revolution. Just as industrialization and globalization have increased the gulf between the haves and have-nots, so information and communications technology is creating a chasm between the knows and know-nots [5].

For dissemination of humanitarian information, traditional publishing and distribution mechanisms have failed tragically. Whereas a U.S. medical library subscribes to about 5,000 journals, the Nairobi University Medical School Library, long regarded as a flagship center in East Africa, receives just 20 journals [3]. In Brazzaville, Congo, the university has only 40 medical books and a dozen journals, all published before 1993. Digital libraries, by decoupling production and distribution costs from intellectual property charges, offer a desperately needed lifeline.

Disaster relief, whether for natural disasters such as earthquakes or 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. Digital library technology can 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.

Nurturing a capability for creating local information collections is an effective strategy for sustained long-term human development [4]. 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 conditions, providing new material for socio-cultural studies, fostering cultural exchange while retaining diversity, and increasing international understanding.

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

The Technological Infrastructure

Computers are not so rare in developing countries as one might think. Their extremely rapid obsolescence 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 1,000 people [4].

A more serious obstacle is that network access varies widely across the world. Whereas more than

a quarter of the U.S. population was surfing the Internet in 1998, the figures for Latin America and the Caribbean were 0.8%, Sub-Saharan Africa 0.1%, and South Asia 0.04% [3]. Schools and hospitals are poorly connected. Even in relatively wealthier South Africa, many hospitals and most schools have no telephone line. Universities are better equipped, but even there 1,000 people can depend on just one terminal. The Internet is failing the developing world [2]. 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 practical format for areas with little Internet access, and can hold a useful volume of information, particularly in text form.

Computers in developing countries tend to be low-end, often with poorly installed software. The computing environment is outside the control of system developers, and may lack network access,

browser software, adequate disk storage, and main memory.

The Greenstone software (see the article in this special section) 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. This happens automatically: no special configuration is necessary. Another engineering challenge is checking unobtrusively for the existence of a network, especially in situations where network software is poorly installed.

Information Collections

Greenstone is being used to deliver humanitarian

The NSF National Science, Mathematics, Engineering, and Technology Education Digital Library Program

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The National Science Foundation's (NSF) National Science, Mathematics, Engineering, and Technology Education Digital Library (NSDL) Program aims to establish a national digital library that will constitute an online network of learning environments and resources for science, mathematics, engineering, and technology (SMET) education at all levels. The program builds on work supported under the multiagency Digital Libraries Initiative; its first funding cycle was in FY00.

Proposals are accepted in four tracks: *Core Integration System* focuses on the coordination and management of the library's core collections and services and development of the library's central portal. *Collections* projects aggregate and manage a subset of the library's content within a coherent theme or specialty. *Services* are expected to support users, collection providers, and the *Core Integration System* to enhance the impact, efficiency, and value of the library. Targeted Research explores specific topics that have immediate applicability to one of the other three tracks. (See www.ehr.nsf.gov/ehr/due/programs/nsdl for more information.)

Nearly 90 proposals were received in FY00 requesting approximately $59 million in total

funding. Twenty-nine projects were supported with a cumulative budget of approximately $13.5 million. These included six pilot projects in the Core Integration track, 13 Collections track projects, nine Services track projects, and one in the Targeted Research track. Approximately $25 million will be available for support of new projects in FY01. (A copy of the program solicitation is available at www.nsf.gov/cgi-bin/getpub?nsf0155). **C**

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Title	Language	Year	Organization	Publications and pages	Description
Table 1. Information collections produced for developing countries.					
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.
Bibliotheque pour le Development Durable et les Besoins Essentiels	French	1999	Humanity Libraries Project/Payson Center	600 40,000	Agriculture, aquaculture, construction, coopération, eau, economie, education, energie, 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.
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.

and related information in developing countries. Table 1 summarizes information collections, available on the Web (nzdl.org) and CD-ROM, from organizations ranging from UN agencies to small NGOs. Fifty thousand copies of these CD-ROMs are distributed annually, of which 60% are provided free.

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, which in print would weigh 340 kg, cost $20,000, and occupy a small library book stack. The need for this

kind of information is eloquently conveyed by a typical request letter (see example on next page).

In an evaluation involving 90 responses to a questionnaire circulated to 360 randomly chosen organizations, the majority (75%) liked the interface, and nearly all (96%) wanted more CD-ROMs like this [1].

End-User Collection Creation
Notwithstanding an 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 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 nonprogramming users to create and organize 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.

Through a 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, Unicode is used throughout Greenstone, and users can translate the interface into local languages without having to grapple with the software itself.

Conclusion

It has often been observed that technological advances in developing countries can leapfrog those in developed ones. 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.

In the developing world, digital libraries represent a killer app for computing technology. Priorities there 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 computer professionals a golden opportunity to help reverse the negative impact of information technology on developing countries. **C**

> **Example request for the Humanity Development Library.**
>
> Date: Tue, 25 Jul 2000
> Subject: Request for Humanity Development Library
>
> We are Kataayi Multipurpose Cooperative from Uganda, a community-based cooperative that 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. Also, 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?

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