

Running Head: COMMUNITY KNOWLEDGE MANAGEMENT FOR DEVELOPMENT

Community Knowledge Management for Development: The creation of community learning environments for reducing the knowledge divide.

Peter Rawsthorne (peter@rawsthorne.org)

Memorial University of Newfoundland

Partial fulfillment of the requirements for ED6426

Allister Dyke

November, 2006

Abstract

This paper describes the resources and approach required to build a Community Knowledge Management System (CKMS) in rural developing communities. The increased availability of Information and Communication Technology (ICT) through telecentres, cellular telephones, rural wireless networks and community schools have increased the likelihood of partnerships successfully creating community repositories of indigenous knowledge. Through the use of free open source software (FOSS), access to the multimedia of video recorders, audio recorders and digital photography combined with the increasing knowledge of how to use these technologies with sound pedagogical approaches makes a CKMS within reach for many developing communities. Having the methods to gather, store, retrieve and distribute community knowledge through local partnerships and emerging ICT further reduces the knowledge divide.

Community Focus

Over the last half century much effort has been made to reduce the inequities between the 'haves' and 'have-nots' in the world. The current vocabulary being used to describe this gap includes what has been termed as the 'digital divide'. The 'digital divide' is the gap between those who are able to use information and communication technology (ICT) for their benefit and those who are not. Many see this divide as more than just digital, the divide also includes knowledge, education, a two-way exchange of information between the 'haves' and 'have-nots', and others (Daniel & West, 2006; Eglash, 2002; Gurstein, 2003; Macleod, 2005; Miller, 2001). The amount of work to close this divide through the use of ICT and other global initiatives is over 40 billion dollars annually (World Bank, n.d.).

Much of this work is being initiated, developed and implemented by national and international organizations. For these efforts to have greater impact and to have long-term sustainability they require a greater community focus to deepen their success (Daniel & West, 2006; Gurnstien, 2003; Keniston, 2002; Tripathi & Bhattarya, 2004). The use of ICT combined with free and open source software (FOSS), educational strategies, indigenous knowledge, community innovation, and digital media can create community based knowledge management systems which encourage this deeper success.

The success of the Community Knowledge Management System (CKMS) will primarily come from its focus upon capturing indigenous knowledge. The sustainability of the CKMS will come from having the community build the skills and knowledge by creating and maintaining the system themselves. The CKMS can be easily replicated for the technical infrastructure is based upon FOSS and commodity computer and networking hardware. The

strength of this CKMS strategy is threefold; First, the infrastructure is standardized across all communities, allowing information exchange among participant communities. Second, each community has ownership of their indigenous content, therefore keeping control of their intellectual property and community knowledge (Gupta, 2003). Third, the standardized infrastructure allows community knowledge to be consolidated at the national and international levels.

Issues: bottom-up vs. top-down

Over the last decade much attention has been given to using ICT for development and for poverty alleviation. Many solutions have been proposed and implemented with varying degrees of success (Gurstein, 2003; Keniston, 2002; Macleod, 2005; Miller, 2001; Wiley, 2006). The CKMS addresses many unresolved issues present within ICT for development and poverty alleviation. As stated by CIDA (n.d.), 70 percent of the world's poor live in rural and remote areas, where access to information and communications technologies, even to a telephone, is often scarce—over one-third of the world population has never made a telephone call. It is within these communities that the CKMS is targeted. The issues the CKMS will address include;

- access and effective use
- community education and literacy levels
- infrastructure, bandwidth and connectivity
- knowledge capture and management
- community and participant inclusion

- localized ownership
- software licensing and costs

The CKMS is built from the rural community outward, where primary focus is upon building the knowledge management system for the community. The approach will be from the 'bottom-up', where the 'bottom' is the rural community and the national and international organizations are the 'top'. The bottom-up approach is preferred for it reduces the potential negative impact of a top down approach. This is described by Macleod (2005):

a 'one-size-fits-all', deterministic and top down approach whereby money and agricultural equipment was delivered to developing countries in the hope of reducing poverty only to find that equipment was abandoned due to the lack of skills in how to use it and the expected trickle down effect did not eventuate as little attention was paid to other social, political and cultural factors that impacted on their adoption. Subsequent interventions, which focused on broader development goals and a community driven, bottom-up approach, were far more successful. (p. 45)

A grassroots ('bottom-up') and consultative approach is considered more effective (Gurstein, 2003; Keniston, 2002) as it informs and provides a community ownership (Bhatnagar 2000).

Effective community access

Most of the dialogue regarding the digital divide is focused upon providing access. Access refers to the ability to be connected to the global community, the Information Technology Group (2005) states that, without access to global communications networks, no community can participate in the networked world. This definition of access, though very popular, is not shared by everyone. Many believe that access is more about 'effective use' (Gurstein, 2003). And as Clement and Shade (1998) wisely point out:

Defining access to ICTs is difficult for several reasons. While access is consistently identified as a key principle in policy discussions, it is not an end in itself. Access only enables further activities that can only partially be specified beforehand. There are three main questions to address: 1) Access for what purposes?; 2.) Access for whom?; and 3) Access to what? (p. 2)

It is what happens within the community that is most important. It is the activity, not the access, which makes a community successful. Therefore, one has to wonder if global access is really that important. Does a community require global access for its development efforts or use of ICT? The Information Technology Group (2005) believes that it is the internet backbone that determines the number of users and their online activities. The beliefs and efforts of the Limehouse (2006) Group disagree:

But even without access to the Internet, wireless community networks have tremendous value. They allow people to collaborate on projects across wide

distances. Voice communications, email, and other data can be exchanged for very little cost. By involving local people in the construction of the network, knowledge and trust are spread throughout the community, and people begin to understand the importance of having a share in their communications infrastructure. Ultimately, they realize that communication networks are built to allow people to connect with each other. (p. 1)

The efforts and activities of the community toward development and poverty alleviation are far more important than having global access. It is access to skills, knowledge, learning and each other that will provide the greatest progress toward the community meeting their development goals. The creation, capturing and access to community knowledge and how it applies within their language, culture and geography is paramount for success. Access is therefore a tertiary issue; effective community building strategies and activities are primary.

Importance of indigenous knowledge

Indigenous knowledge provides a community resource that is proven and timeless. It brings the community together and provides strength to the communities' culture. Tripathi & Bhattarya (2004) describe 'indigenous knowledge' as the type of knowledge that has evolved within the community and has been passed on from one generation to another.

Indigenous knowledge is becoming increasingly recognized as one of the keys for successful and sustainable development efforts. Recognizing, utilizing and managing this knowledge has a big impact in achieving development objectives. (Bhatnagar, 2000; Gupta, 2003; Macleod, 2005; Tripathi & Bhattarya, 2004).

When indigenous knowledge becomes a part of the development effort it provides insight into what is unique about the local culture and society. It is a valuable resource for; decision making, policy planning, agriculture, health care, food preparation, education, and a host of other activities in communities (Tripathi & Bhattarya, 2004). Empirical evidence shows that social purpose, social context and social organization is critical to understanding (Macleod, 2005). Social understanding and indigenous knowledge needs to be retained for current and future development efforts. The use of ICT can provide a foundation for gathering indigenous knowledge and as Bhatnagar (2000) states;

Much indigenous knowledge passed down from generation is also becoming extinct because of lack of presentation efforts. ICT and Web technologies could make such information / knowledge visible to large cross sections of rural communities. (p. 4)

This gathering of indigenous knowledge would assist many development efforts. It would provide a long term repository of knowledge that communities, NGO's and organizations could access and gain benefit.

Decentralized and culturally sensitive education

Having an education system that is autonomous and culturally sensitive better meets the needs of the community. This is due to each community being different and having unique learning and administrative needs. Decentralizing (and therefore empowering) the local communities to determine and administer their own educational outcomes are becoming a reality in many developing countries. The International Institute for Educational Planning

(2004) recently dedicated an issue of its newsletter to this topic; the following quote exemplifies this movement;

In recent times there has been a broad movement internationally towards decentralization – transferring authority to local decision-makers. Among the arguments in favour is that national policies are one-size that do not fit all. General policies must be adapted to be relevant. Each community is different; each school has its character. Too much centralization stifles inventiveness, too much inspection suppresses initiative. (p. 2)

Once communities have greater control over their education initiatives they are better able to administer, design and harness local knowledge. As Bhatnagar (2000) points out it is a sense of ownership that matters;

The administration has to be energized to face up to the challenge and implement development programmes with honesty and vigour. The rural poor need to be educated and organized to make demands on the administrative system. In all these areas information technology can play only a supportive role. In design and implementation of applications, field officials must get a sense of involvement and sense of ownership. (p. 7)

Having localized (‘culturally sensitive’) education creates a learning environment better aligned with the pedagogical sensitivities of the community (Macleod, 2005; Pagram,

2006). Once freed to develop their own learning modules, communities can harness the indigenous skills and knowledge in ways better suited for their communities learning style. Community mentors can be identified who can draw upon their deep knowledge to create localized learning. As Swap, Leonard, Shields, Abrams (2001) state; the recognition of mentoring as an important transfer mechanism for knowledge... has grown significantly in the past couple of decades. Once the community has the autonomy to develop their own culturally sensitive education system they are better suited to build localized education.

Inconsistent ICT infrastructure

The ability for developing countries to take advantage of ICT infrastructure is often limited by the basic issues of; electricity, connectivity, cost and skills (Bhatnagar 2000; Gurstein, 2003; Keniston, 2002; Limehouse, 2006; Miller, 2001; Wiley, 2006). To have ICT you need basic infrastructure to keep it running. The following three sections; electrical power and connectivity, capital and ongoing costs, and technical skills look at the issues within these structures and offer suggestions to their alleviation.

Electrical power and connectivity

The most important infrastructure issues is having a consistent source of electrical power (De La Porte, 2005), for without electricity most ICT will not work. The UNDP is doing considerable work in meeting the energy needs for achieving the Millennium Development Goals (MDG). Once electricity is available a community can have the ability to use ICT to capture indigenous knowledge. It is a commonly held belief that internet connectivity and wide area networking are required for ICT to be useful within development (Bhatnagar, 2000; Gurstein, 2003; Keniston, 2002). Internet connectivity should no longer be a limiting

factor in creating a community network. A quote from the book 'Wireless Networking for the Developing World' by the Limehouse (2006) Book Sprint Team provides insight to what is possible;

The overall goal of this book is to help you build affordable communication technology in your local community by making best use of whatever resources are available. Using inexpensive off-the-shelf equipment, you can build high speed data networks that connect remote areas together, provide broadband network access in areas that even dialup does not exist, and ultimately connect you and your neighbors to the global Internet. By using local sources for materials and fabricating parts yourself, you can build reliable network links with very little budget. And by working with your local community, you can build a telecommunications infrastructure that benefits everyone who participates in it. (p. 2)

Given access to electricity; it is possible to start building a community network. Once the network can be built a grassroots CKMS can begin.

Capital and ongoing costs

In most situations, having ICT resources costs money. Managing the costs of ICT equipment in a developing community is a complicated issue. One solution to having access to computers comes from an organization called Computer Aid International (2006) who has shipped a total of 70,000 PCs to 104 countries. Another solution is where commercial cooperatives in developing countries have successfully covered the costs of ICT with financial benefits to the participants (Bhatnagar, 2000; Keniston, 2002). The

subject of covering the costs for ICT is too large a subject for this paper. What is important to know is that it is complicated; and there are many organizations working towards solutions.

Technical skills

For ICT to function and be sustainable it requires technical skills to be available. It is trained ICT professionals who provide the resources to keep technical infrastructure functioning and available (Bollou, 2006). Technical skills have benefit for rural administrators and public officers, for they better see how the technology can be an invaluable tool. Since one purpose of ICT is to improve overall management (Bhatnagar, 2000) having well trained administrators could increase success by having advocacy within the community administrative roles. ICT skills are more often found in the urban areas than the rural areas where the introduction of ICT could have greater development impact. This disparity needs to be remedied for it could further exacerbate the digital divide between rural and urban (CIDA, n.d.; Macleod, 2005). This is where the CKMS would be beneficial. It would provide the ICT infrastructure required to facilitate the skills and knowledge building. Multimedia available within the CKMS would make the required technical training available. As skills developed further training would be created with local assistance (CIDA, n.d.). As the regional network of CKMS increased the available skills and knowledge would also build, allowing a knowledge exchange between communities. Having this network of CKMS would facilitate further learning opportunities for all the communities involved, and would therefore create 'homegrown' sustainability for the ICT.

Knowledge Management: capturing the story

Knowledge management in the rural development context is a community based activity where members of the community share tacit knowledge ‘through processes of socialization and internalization’ (Swap, Leonard, Shields, Abrams; 2001). This community can be either the traditional form of a community within a geographic location or a ‘community of practice’. The members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems, namely a shared practice. (Cummings and van Zee, 2005) The indigenous knowledge ‘stored’ within a geographic community is more tacit and practice-based and traditionally transferred through storytelling. The ability to capture the knowledge within these stories is essential within development efforts for it provides a sense of ownership (Gupta, 2003) and empowers administrators (Bhatnagar, 2000) and assists community members to get things done (McDowell, Nagel, Williams, Canepa, 2005; Swap, Leonard, Shields, Abrams; 2001). The CKMS becomes the shared repository of this community knowledge.

Pedagogy: learning the story

Pedagogy is described as the art or method employed by teachers to facilitate learning. Constructivism is a learning theory which concludes that all knowledge is constructed upon previous learning experiences, observations, interpretations and already held personal or community knowledge. Social Constructivism brings the social and cultural (Vygotsky, 1978) context into constructing knowledge. When an individual is involved in learning indigenous knowledge through their experience, an elder’s story telling, or community

projects they are being active learners within a socio-constructivist method. They are considered active for they are engaged through the experience of doing. This kind of community learning is powerful for as Petrides & Guiney (2002) state; it is where enculturation, immersion and real learning take place. Macleod (2005) further emphasizes;

These cultures have a strong emphasis on oral communication, audiovisual preferences and collaborative learning... Empowering communities to engage in their own authoring... not only supports constructivist educational principles; it also contributes to the diversity of knowledge and languages... and has the potential to preserve cultural histories based on oral traditions. (p. 49)

Bringing computers into the learning process opens possibilities that did not previously exist. Knowledge can be stored in ways not previously encountered. The use of digital cameras, digital audio and digital video can be used to store knowledge and learn new things. Stager (2005) references Seymour Papert (1990) in saying;

That computers and computing offer profound opportunities to learn new things, old things in new ways and construct knowledge in ways that would be inaccessible without access to technology. Constructionism particularly applies to learning with digital technology. If you can use technology to make things, you can make a lot more interesting things. And you can learn a lot more by making them. (p. 5)

The use of digital technologies is being encouraged by UNESCO where youth use these technologies to engage in a critical discourse. They have drawn upon twelve initiatives where it is in practice that learning is being anchored. The theories they draw upon are the critical pedagogy of Paulo Friere and the pragmatism of John Dewey. These initiatives include the use of ICT and rich media to create; newspaper and magazine articles, radio broadcasts, television and video programmes, and internet-based materials. To provide further detail to the significance of this project UNESCO (2006) provides a useful quote;

This involvement is not a singular act: rather an active and collective process of learning. Within these social settings, young people create and develop their own perspectives and knowledge. Participation provided young people a context and community to explore imaginations and ideas. This process of learning, situating educational activity in the lived experience of young people, is dialogical and open-ended. The various media become more than facilitators and instruments; they enable and mediate learning and literacy. They become “social networks” of learning. (p. 8)

It is this reference to “social networks” that has significance. For this social activity is within the learning domain of social constructivism. It is the communities learning, and what better way to capture and perpetuate indigenous knowledge than to have the youth of the community capture, produce and construct the communities’ record. The building of this community record should be considered the communities knowledge management.

Learning environments

Learning environments are an essential piece in creation of the CKMS. They provide the repository of knowledge and learning, and more importantly; they encourage the construction of further knowledge. The learning environment, to paraphrase Dillenbourg (2000), consists of;

A designed information space, where the space is a place for education, and the education is explicit and represented from text to 3D virtual worlds, the students are actors who co-construct the space both locally and at a distance, the space integrates technologies using multiple pedagogical approaches and the space overlaps with the physical world. (p. 2)

The learning environment provides the learning infrastructure which supports the 'community of practice'. This learning community will be drawn together along three dimensions as specified by Wenger (1998);

- **What it is about** – its joint enterprise as understood and continually renegotiated by its [community] members
- **How it functions** - mutual engagement that bind [community] members together into a social entity
- **What capability it has produced** – the shared repertoire of communal resources (routines, sensibilities, artifacts, vocabulary, styles, etc.) that members have developed over time. (p. 1)

The community learning environment is a framework for gathering knowledge about a shared interest, where a community of members can support building knowledge and enhance learning. The strength of the learning environment is its ability to adapt to the local language and culture and in dealing with the different forms of indigenous knowledge. The knowledge can be captured to multimedia (audio, video and photography) through storytelling, observation and participation. As indigenous knowledge is transferred from generation to generation the idea of the student and master or apprentice analogy works well, as Cummings and van Zee (2005) point out; the term community of practice was coined to refer to the community that acts as a living curriculum for the apprentice. Cognitive science research tells us that memorable information is more likely to be acted upon... Therefore, anything that tends to make information more memorable will have a greater likelihood of assuming significance (Swap, Leonard, Shields, Abrams; 2001). It is the combination of using multimedia within a learning environment which makes the information within the CKMS more memorable.

Video and multimedia

Over the last few decades multimedia (video, audio, photography and animations) has become available in a digital format. This digital format allows for storage on computers and easy sharing across networks. Having these resources available in digital form online, makes for a rich mixture of learning objects for e-learning (Boulos, Maramba, Wheeler, 2006; Ractham & Zhang; 2006). The use of multimedia within developing communities has a great impact if you prescribe to the community informatics perspective where educational multimedia has a role to play in narrowing the digital divide, promoting social inclusion

and honoring the cultural context (Gurstein, 2003; Macleod, 2005; Tripathi, Bhattacharya, 2004). The ability to for the user to create multimedia has great benefit for it is a constructivist learning activity. Macleod (2005) speaks extensively about using multimedia in development;

This reflects the argument that access to physical hardware is of little use if you don't have the means to use it effectively and meaningfully... it is important that projects in developing countries incorporate proposals to assist the development of electronic literacies in the broadest sense; encompassing not only the operational aspects of using a computer such as opening and saving files, navigating, word processing and Internet searching but also the development of higher order skills situated within a cultural context... Not only does educational multimedia reflect preferred learning styles based on audiovisual preferences but multimedia literacy enables users to become producers of information. (p. 47)

It is this act of being a multimedia producer where the greatest learning can take place. If the user is creating, editing and publishing the multimedia content they are learning the technical skills and the subject of the content. Through the process of context, accumulation of data, sense making, synthesis and reflection, this information is transformed and converted to knowledge (Petrides, Guiney; 2002).

As previously mentioned, UNESCO has a number of initiatives underway that include the use of multimedia. The strength of these initiatives is the youth involvement in creating

“media mixes” and having them engaged in media production. It is the media production that applies many of the constructivist learning principles. Through the audio production, video production, script writing, story boarding, lighting, site visits, set designing, digital photography, web page design, layout, digital graphics, and use of computers that the participants build skills and knowledge through their lived experience.

Open Source: sharing the story

The paradigm of open source is having a significant impact on development initiatives (Boswell, 2006; Daniel & West, 2006; UNESCO, 2005; Wiley, 2006). In the context of a CKMS open source fulfills two needs; it provides Free and Open Source Software (FOSS) and it provides a source of free Open Course Ware (OCW) or Open Educational Resources (OER). These two are important; as the CKMS requires a technical infrastructure able to host the features for capturing, managing and distributing indigenous knowledge. This infrastructure can be built upon FOSS at great cost savings (Hepburn & Buley, 2006). Also important is the ability to organize the indigenous knowledge as learning or educational material. This material can follow the OER model where the community becomes both the producer and consumer. Daniel and West (2006) bring these two open source focuses together in their statement;

The most promising innovation in ... education is the concept—and the developing reality—of open educational resources (OERs). The term refers to open course content as well as open source software and tools. Essentially OERs apply to teaching and learning the basic principle that underpins academic research: sharing.

(p. 2)

By using FOSS the CKMS will be built upon hardware configurations able to host open source software. The strategy advocated here is one where the hardware and software infrastructure is standardized and therefore only the content is community specific. The standardization of infrastructure has the advantage that it can easily connect and interoperate with other CKMS's. As the CKMS network grows content synchronization can occur and communities can leverage the content found in other CKMS's. Disparate communities can build upon the learning objects developed by other communities and their predecessors for reuse in new learning contexts. (Daniel and West, 2006)

One of the strongest benefits of open source is its democratizing effect (Gurstien, 2003; Hepburn, Buley, 2006; Macleod, 2005). It is democratizing through providing the ability for indigenous (non-western) cultures to develop their own content, in their own language(s), within their own culturally sensitive pedagogy.

Configuration: binding the story

The hardware and software configuration for the CKMS will be built from the server outward. The server will be hosted in a telecentre, a community learning centre or a community space with a consistent electrical source. The server and its knowledge management infrastructure will be built using FOSS. The community network will be wireless and be put together following the wireless networking guide created by the limehouse (2006) group. Remote access to the CKMS server will come over this wireless network from computer nodes throughout the community. It should be noted that the CKMS can simply be a single server hosting all the community knowledge, therefore not

needing to be connected to a network. The server will come preconfigured with all the required software to get the community up and running as quickly as possible. The community will therefore focus on content creation rather than server setup and maintenance. The server will also come with all the OER to assist the community to learn about the ‘care and feeding’ of their CKMS.

Once the technical skills further develop within the community the network can become peer-to-peer where each node (or computer) is a repository of its own indigenous knowledge. This is where CKMS can begin to share knowledge and grow into an effective grassroots repository of shared indigenous knowledge. One of the considerable benefits of this single server outward strategy is that it is not dependent upon internet access (Limehouse, 2006) and it can grow organically as skills, knowledge and resources (computers and networking hardware) come available.

Free and Open Source Software

The main FOSS components of the CKMS server include; the application server, the application development environment, the knowledge management tools, the office productivity tools, and the information indexing and searching tools.

LAMP Servers

The CKMS will be built upon the LAMP server and will be considered the community application server. LAMP servers became popular as FOSS in the late 1990’s for they provide a proven server environment at no cost beyond the hardware and network connection. LAMP servers consist of a ‘stack’ of software applications that can provide all

the software services required for dynamic websites. The LAMP acronym stands for (LAMP, 2006);

L – Linux; the computer operating system

A – Apache; the web server (or content hosting)

M – MySQL; the database

P – Perl, PhP, Python; the programming language

Wiki's, Blog's & Podcasting

The method of collecting indigenous knowledge will be through multimedia. Multimedia allows for knowledge to be captured on video, in photographs and with audio recording. All these media types can be easily stored and published on the LAMP server using an assortment of FOSS applications and approaches. The three used are;

Wikis - is a type of website that allows the visitors themselves to easily add, remove and otherwise edit and change some available content. (Wiki, 2006)

Blogs - is a website where entries are made in journal style and displayed in a reverse chronological order. (Blog, 2006)

Podcasting - is a multimedia file distributed over the Internet using syndication feeds, for playback on mobile devices and personal computers. (Podcast, 2006)

According to Boulos, Maramba and Wheeler (2006); the potential impact of wiki, blog and podcast technologies ... is immense, it is perhaps the combined use of these three applications as 'mind tools' that may yield the most powerful learning experiences.

According to Jonassen et al. 'mindtools' act as cognitive reflection and amplification tools, aiding the construction of meaning, through the act of self-design of knowledge databases.

Productivity

When working with ICT it is also important to record, edit and read the efforts of all those involved in community development projects. Creating documents, spreadsheets, drawings, presentations and accessing data are also tasks performed while completing projects and gathering indigenous and other knowledge. The suite of software tools which provide these abilities are known as office productivity tools. There are a number of FOSS productivity suites available for download; however, according to the UNDP (2004) the FOSS productivity suite, OpenOffice (www.openoffice.org), is gaining popularity as its features are becoming comparable to the proprietary Office suite.

Search & Indexing

The ability to find information after it has been created is an important part of creating a knowledge repository. The tools that allow this information retrieval are known as search engines and there are a number available as FOSS. In particular, Nutch (www.nutch.org) is an open source search engine founded to provide an alternative to the proprietary search engines. The purpose of the search engine on the CKMS server is to continuously index the content available and to provide an easy method to search and access the knowledge stored.

FOSS will be used in creating the CKMS. It will provide the base operating system and file management for the server computer. As more content is added, FOSS will provide productivity tools for content creation, and 'mindtools' to enhance learning. On an ongoing basis all the knowledge stored in the CKMS will be indexed by a FOSS search engine for easy retrieval.

One of the strengths of using open source from ‘bottom-to-top’ is that software infrastructure is separated from the content. This provides the ability to standardize the infrastructure. A standard infrastructure makes for easy interconnectivity and content exchange. So while the CKMS can grow as a grassroots stand-alone community system, it can also connect with other CKMS’s and exchange and / or synchronize content. Having a CKMS with the ability to synchronize with other CKMS (in both directions) would provide many benefits;

- New techniques / lessons would be made available to communities with similar development goals.
- A global or international CKMS would grow providing indigenous knowledge.
- Localized CKMS data could be aggregated for regional, national and global analysis.

Community Knowledge Management: telling the story

The idea of the Community Knowledge Management System (CKMS) was born out wanting a technology infrastructure that would empower the rural poor to innovate, learn and take pride (Gupta, 2003) in their indigenous knowledge. The CKMS was also born out of a disdain for top-down and centralized development initiatives and the belief that rural developing communities are better suited to solve their own problems rather than by ‘outsiders’. The CKMS was also born out of the idea that ICT can have a positive impact upon developing communities without having access to the internet (Limehouse, 2006). Closing the ‘knowledge divide’ is an endeavour that includes both sides of the haves and have-nots (Eglash, 2002). It is equally about the ‘haves’ thinking about what they have and also thinking about what the ‘have-nots’ are without. This thinking includes the

encouragement of knowledge management systems that supports the gathering of indigenous knowledge within the language, culture and context of their community. Providing developing communities with 'off the grid' CKMS's provides the 'have-nots' the resources to close the divide from their end, with their communities objectives in mind, in ways that recognizes their local expertise and allows them to utilize their indigenous knowledge and build pride (Gupta, 2003) in what they know.

Traditionally, development efforts have taken a 'one-size-fits-all' or top-down approach (Cummings and van Zee, 2005; Macleod, 2005). Recently, there has been a growth in a bottom-up approach and the wisdom that is finding its way into development is indigenous. It is becoming increasingly recognized that bottom-up initiatives are effective in meeting community development goals. This success is occurring for the projects are working within the local languages, cultures and ways of knowing. The CKMS provides the technology infrastructure to gather and 'publish' this indigenous knowledge.

Effective use

The first section of this paper addressed the issue of access and effective use. It was discussed that access is only a small part (or even an unnecessary part) of bringing ICT to a developing community. What is more important than access is effective use (Gurstein, 2003). Effective use is ensuring the developing community is able to optimize its use of ICT, not just access the technology and communicate with the globe. Effective use would address the issues of having the content localized so it would be meaningful and useful to the local community (Keniston, 2002). The idea of localized content was supported by the move toward decentralization where the regions and communities have greater autonomy

over their education than national and international organizations. The administration of these localized institutions would come through local representatives and community organizations.

Within the paper attention was given to identifying and providing suggestions to dealing with the ICT infrastructure issues. For a CKMS to work 'off the grid' and be sustainable, it needs to have consistent power and a localized network. The community using the CKMS needs to find ways to deal with the capital and ongoing costs and to have available technical support. Once electricity becomes consistent *and* the ICT resources have been made available the building of a CKMS can begin. One of the primary strengths of the CKMS is it has been built to be self-reliant. This is important for as Cummings and van Zee (2005) state, it guarantees continuity, independent of whether funding in a later stage is needed. The benefits of self-reliance are well described by Gurstein (2003);

In this way, an application would not only be potentially useful at the local level, but also would be directly linked into local needs and create local "ownership" and local "champions" who could provide feedback on its development and evolution. Introducing this approach within a participatory action research methodology would give an application the capacity to evolve and respond to local circumstances — constraints and opportunities — as they present themselves. (p. 11)

Beyond the CKMS being self-reliant at the community level, it is also at the technical level. The CKMS is built to store knowledge and encourage local learning. The training for the

'care and feeding' of the CKMS would come built into the system through comprehensive multimedia learning and supporting documentation. This built-in learning combined with empowered community members to create their own technical learning materials to address local issues would provide a high level of self-reliance and sustainability. Further to this, is having access to OER where materials can be adapted for localized learning (Daniel and West, 2006). These locally created materials could also be shared throughout the geographic region if they solve a common development goal. Therefore, building localized technical expertise and knowledge from the "bottom" up.

A community of learners

The primary method to capture knowledge within the CKMS will be through social constructivist pedagogy and the use of multimedia. Knowledge will be gathered and kept within the language, culture and context of the community. Using multimedia puts the gathering of knowledge into a method best suited for communities which use oral traditions and have audio visual preferences for learning (Macleod, 2005). The use of digital video, digital audio and photography (multimedia) provides tools for the communities to preserve their cultural and oral histories. This paper further explores the theory and practice of constructivism through the use of multimedia. By having community members use multimedia to create and capture local knowledge they are building a community record while embracing the socio-constructivist methods espoused by Vygotsky. An example of building a CKMS is described by Bhatnagar (2000);

An organized effort at diffusing such [indigenous] knowledge through ICT – the Honey Bee Network – was presented at the IIMA workshop. The Honey Bee

network creates a multimedia presentation on many rural innovations with photographs of innovators and the innovation and an audio presentation in the voice of the innovator. There is also a textual description disseminated through a multi-language newsletter. A multimedia database is being compiled to which access could be provided through far flung nodes. Such dissemination diffuses the innovations to wider areas and helps other innovators to come forward to make their innovations public... The project demonstrated how ICT can help empower knowledge rich but economically poor people by enabling grassroots innovators to overcome language, literacy and localism barriers. (p. 4)

This quote reaffirms the importance and ability of a knowledge database (CKMS) to be shared among communities, particularly when a communication network is available.

Bhatnagar also recognizes the importance of using the traditional methods of information exchange through the use of a multi-language newsletter. Having individuals and communities create their own knowledge they are learning by using proven pedagogical methods.

Open Source

The use of free open source software and learning materials is strongly supported for building the CKMS. Open source use has grown considerably for both software and courseware. Wiley (2006) makes note that; average users are making increasing use of open source applications for everyday online activities like instant messaging, journaling or blogging, and sharing pictures. The increased use of OER has large benefits for developing

communities, for as Daniel and West (2006) state; it allows learning materials to be made appropriate by local adaptation. Boulos, Maramba, and Wheeler (2006) speak strongly that;

The uses of such technologies to encourage learners' deeper engagement with learning materials, and the affordance of shared working spaces to improve collaboration between learners are desirable outcomes. It is generally held by many educators that students of all ages learn best when immersed within a culturally and socially rich environment in which scaffolding of learning can be achieved... The combination of wikis, blogs and podcasting technologies, then, has the potential to both liberate and tie learners together, creating dynamic learning communities. (p. 4)

This paper then offers an open source software configuration best suited for the CKMS. The solution includes a 'bottom-to-top' implementation using open source; the operating system and content hosting environment is based upon LAMP, the collaboration software is based upon wikis and blogs, the productivity software is based upon OpenOffice and the indexing and search abilities are based upon nutch. All the software solutions are well supported and mature within their development lifecycle.

Conclusion: unplugged

The Community Knowledge Management System is built to empower the community to gather and take ownership over their learning and indigenous knowledge without dependency on the global technology infrastructure. This ownership with support from a strong ICT strategy and proven learning techniques allows the developing community to

narrow the knowledge divide from their side, on their terms, with their self-determined development goals in mind. The skills and knowledge they develop upon the way will better prepare them to join the global networked community when the community decides is best.

References

- Bhatnagar, S. (2000). Social Implications of Information and Communication Technology in Developing Countries: Lessons from Asian Success Stories. *The Electronic Journal of Information Systems in Developing Countries* 1(1) 1-9. Retrieved on Sept 28, 2006 from <http://www.ejisdc.org/ojs/include/getdoc.php?id=4&article=4&mode=pdf>
- Blog. (2006, November 4). In Wikipedia, The Free Encyclopedia. Retrieved November 4, 2006 from <http://en.wikipedia.org/wiki/Blog>
- Bollou, F. (2006). ICT Infrastructure Expansion in Sub-Sahara Africa: An Analysis of Six West African Countries from 1995 to 2002. *The Electronic Journal of Information Systems in Developing Countries* 26(5). Retrieved on October 21, 2006 from <http://www.ejisdc.org/ojs2/index.php/ejisdc/article/view/275>
- Boswell, D. (2006). Free and open Source Software at the United Nations. Retrieved on November 1, 2006 from http://www.onlamp.com/pub/a/onlamp/2006/07/20/un_and_foss.html
- Boulos, M., Maramba, I., & Wheeler, S. (2006). Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education. Retrieved on October 3, 2006 from <http://www.biomedcentral.com/1472-6920/6/41>
- CIDA. (n.d.). CIDA's Strategy on Knowledge for Development through Information and Communication Technologies (ICT). Retrieved on October 24, 2006 from <http://www.acdi-cida.gc.ca/ict>
- Clement, A. and Shade, L. (1998). The Access Rainbow: Conceptualizing Universal Access to the Information/Communications Infrastructure. Retrieved on October 2, 2006 from <http://www3.fis.utoronto.ca/research/iprp/publications/wp/wp10.html>
- Computer Aid International. (2006). Computer Aid has provided over 70,000 PCs. Retrieved on October 22, 2006 from <http://www.computer-aid.org/home.htm>
- Cummings, S. & A. van Zee. (2005). Communities of practice and networks: reviewing two perspectives on social learning. *KM4D Journal* 1(1) 8-22. Retrieved on October 5, 2006 from <http://www.km4dev.org/journal/index.php/km4dj/article/viewFile/9/29>
- Daniel, J., & P, West. (2006). From Digital Divide to Digital Dividend: What will it take?. *Innovate* 2(5). Retrieved on October 17, 2006 from <http://www.innovateonline.info/index.php?view=article&id=252>
- De La Porte, P. (2005). UNDP: Electricity and Development Workshop. Retrieved on October 28, 2006 from <http://www.energyandenvironment.undp.org/undp/index.cfm?module=Library&page=Document&DocumentID=5734>

- Dillenbourg, P. (2000). Virtual Learning Environments. Retrieved on October 28, 2006 from <http://tecfa.unige.ch/tecfa/publicat/dil-papers-2/Dil.7.5.18.pdf>
- Eglash, R. (2002). A two way bridge across the digital divide. *The Chronicle of Higher Education*. Retrieved on October 15, 2006 from <http://chronicle.com/free/v48/i41/41b01201.htm>
- Gurstein, M. (2003). Effective use: a community informatics strategy beyond the digital divide. *First Monday* 8(12). Retrieved on October 19, 2006 from http://firstmonday.org/issues/issue8_12/gurstein/index.html
- Gupta, A. (2003). Learning from green grassroots innovators: How does a tail wag the dog? Ash Institute for Democratic Governance and Innovation, John F. Kennedy School of Government, Harvard University. Retrieved on September 29, 2006 from http://www.ashinstitute.harvard.edu/Ash/Gupta_ITG_Paper.pdf
- Hepburn, G. and Buley, J. (2006). Getting Open Source Software into Schools: Strategies and Challenges. *Innovate: Journal of online Education* 3(1). Retrieved October 18, 2006 from <http://www.innovateonline.info/index.php?view=article&id=323>
- IIEP. (2004). Decentralization - can it improve schools. *International Institute Educational Planning XXII*(4). Retrieved on October 22, 2006 from <http://www.unesco.org/iiep/eng/newsletter/2004/octe04.pdf>
- Information Technologies Group. (n.d.). Readiness for the Networked World: A Guide for Developing Countries. Retrieved on October 24, 2006 from <http://cyber.law.harvard.edu/readinessguide/>
- Keniston, K., (2002). Grassroots ICT Projects in India: Some Preliminary Hypothesis. *Asci Journal of Management* 31(1&2). Retrieved on October 2, 2006 from http://web.mit.edu/~kken/Public/PDF/ASCI_Journal_Intro_ASCI_version_.pdf
- LAMP. (2006, November 2). In Wikipedia, The Free Encyclopedia. Retrieved November 3, 2006 from http://en.wikipedia.org/wiki/LAMP_%28software_bundle%29
- Limehouse. (2006). Wireless Networking in the Developing World. Retrieved on September 10, 2006 from <http://wndw.net/>
- Macleod, H., (2005). What role can educational multimedia play in narrowing the digital divide?. *International Journal of Education and Development using Information and communication Technology* 1(4) 42-53. Retrieved on October 2, 2006 from <http://eprints.qut.edu.au/archive/00003261/01/3261.pdf>

McDowell, C.L., Nagel, A., Williams, S.M., and Canepa, C. (2005). Building knowledge from the practice of local communities. *KM4D Journal* 1(3) 30-40. Retrieved on September 28, 2006 from <http://www.km4dev.org/journal/index.php/km4dj/article/viewFile/44/115>

Miller, A. (2001). Reaching across the divide: the challenges of using the Internet to bridge disparities in access to information. *First Monday* 6(10). Retrieved on October 16, 2006 from http://firstmonday.org/issues/issue6_10/miller/index.html

Pagram, P. & Pagram, J. (2006). Issues In E-learning: A Thai Case Study. *The Electronic Journal of Information Systems in Developing Countries* 26(4). Retrieved on October 4, 2006 from <http://www.ejisd.org/ojs/viewarticle.php?id=304&layout=abstract>

Papert, S. (1990). A Critique of Technocentrism in Thinking About the School of the Future. MIT Epistemology and Learning Memo No. 2. Cambridge, Massachusetts: Massachusetts Institute of Technology Media Laboratory. Retrieved on October 17, 2006 from <http://www.papert.org/articles/ACritiqueofTechnocentrism.html>

Petrides, L. & Guiney, S.Z. (2002). Knowledge Management for School Leaders: An Ecological Framework for Thinking Schools. *Teachers College Record* 104(8) 1702-1717.

Podcast. (2006, November 4). In Wikipedia, The Free Encyclopedia. Retrieved November 4, 2006 from <http://en.wikipedia.org/wiki/Podcast>

Racham, P. and Zhang, X. (2006). Podcasting in academia: a new knowledge management paradigm within academic settings. Retrieved on October 2, 2006 from <http://portal.acm.org/citation.cfm?doid=1125170.1125241>

Stager, G. (2005). Towards a pedagogy of online constructionist learning. Retrieved on September 27, 2006 from <http://www.stager.org/articles/onlineconstructionism.pdf>

Swap, W., Leonard, D., Shields, M., & Abrams, L. (2001). Using Mentoring and Storytelling to Transfer Knowledge in the Workplace. *Journal of Management Information Systems* 18(1) 95-114.

Tripathi, N. & Bhattarya, S. (2004). Integrating Indigenous Knowledge and GIS for Participatory Natural Resource Management: State-of-the-Practice. *The Electronic Journal of Information Systems in Developing Countries* 17(3). Retrieved on October 2, 2006 from <http://www.ejisd.org/ojs2/index.php/ejisd/article/view/105>

UNDP. (2004). Free/Open Source Software: Education. Retrieved on October 28, 2006 from <http://www.iosn.net/education/foss-education-primer/fossPrimer-Education.pdf>

UNESCO. (2005). Multistakeholder Partnership Holds E-discussion on FOSS. Retrieved on November 1, 2006 from http://portal.unesco.org/ci/en/ev.php-URL_ID=18238&URL_DO=DO_TOPIC&URL_SECTION=201.html

UNESCO. (2006). Innovative Practices of Youth Participation in Media: A research study on twelve initiatives from around the developing and underdeveloped regions of the world. Retrieved on October 16, 2006 from http://portal.unesco.org/ci/en/files/22831/11593413569UNESCO_Innovative_practices.pdf/UNESCO+Innovative+practices.pdf

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.

Wiki. (2006, November 4). In Wikipedia, The Free Encyclopedia. Retrieved November 4, 2006 from <http://en.wikipedia.org/wiki/Wiki>

Wenger, E. (1998). Communities of Practice: Learning As A Social System. Retrieved on November 1, 2006 from <http://www.co-i-l.com/coil/knowledge-garden/cop/lss.shtml>

Wiley, D. (2006). Open Source, Openness, and Higher Education. Innovate: Journal of online Education 3(1). Retrieved October 18, 2006 from <http://www.innovateonline.info/index.php?view=article&id=354>

World Bank (n.d.). The Costs of Attaining the Millennium Development Goals. Retrieved on October 23, 2006 from <http://www.worldbank.org/html/extdr/mdgassessment.pdf>