

## Enhancing E-government in Developing Countries: Managing Knowledge through Virtual Communities

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### ABSTRACT

The article reviews the role of virtual communities as a knowledge management mechanism to support e-government in developing countries. It explores the need for knowledge management in e-government, identifies knowledge management technologies, and highlights the challenges for developing countries in the implementation of e-government and especially knowledge management solutions. It further assesses the feasibility of this and other knowledge management mechanisms in light of the financial and technological limitations of developing countries. The article suggests that knowledge management is needed to facilitate information exchange and transaction processing with citizens, as well as to enable inter-government knowledge sharing and integration. It concludes that simple knowledge management solutions, and especially virtual communities, will be the most appropriate for developing countries, while enterprise solutions are not suitable.

Keywords: Knowledge management, e-government, developing country, enterprise solution, virtual community

### 1. INTRODUCTION

A 2001 study of the development of e-Government identified the level of e-government in 190 nations (UN/ASPA, 2001). The study outlined five stages of e-government, spanning from emergence to integration. At the time of the survey, none of the surveyed nations had achieved integration, and only 17 had achieved the transaction stage. Most developing nations were either at the emergence or the broadcast stage, thus providing very few interactive services to their citizens. Nations with extensive interactive, knowledge supported services typically also maintained a considerable IT and government infrastructure to offer these, and were generally well funded. This raises the question whether e-Government is largely a question of resources, and specifically whether knowledge management requires the provision of considerable financial and IT resources.

To answer this question, we will first explore the development of e-Government. This will be followed by a discussion of the role and need for knowledge management. We will then explore approaches to knowledge management, which we differentiate into enterprise solutions and alternative solutions and will consider their benefits and feasibilities. Thereafter we will focus on one particular solution, namely the use of virtual communities. Then we will assess the suitability of virtual communities to enable knowledge management and e-Government, based on structural characteristics and several successful case studies. Finally we will summarize our findings and draw conclusions.

## 2. DEVELOPMENT OF E-GOVERNMENT

### 2.1 Stages

For many companies, the development of e-commerce capability has been an evolutionary process. Tapscott (1998) identified an evolution sequence, where organizations matured from initially having a web presence only, to offering transaction services and business front-end and back-end integration (as well as several more sophisticated development levels). Evidence suggests that e-government matures along a similar development path that first witnesses broadcasting, then interaction, then transaction, and finally integration (UN/ASPA, 2001). In *broadcasting* mode, the government's presence is simply a presence, with static web pages and one-way communication. In *interaction* mode, websites are able to exchange information or services with citizens, where citizens can inquire, and obtain some resources from database backed websites located behind a portal. At the *transaction* stage, the public can carry out (financial) transactions with the government. This requires higher levels of processing capability, as well as payment gateways and security implementation. Finally, e-Governments reach *integration* when departments collaborate in significant ways to avoid duplication of efforts, and when a one-stop contact point, which is knowledgeable about the procedures of all involved departments, has been created.

### 2.2 Role and Need for Knowledge Management (KM)

Knowledge management frequently refers to the managerial practices associated with knowledge. It can be defined as "the organizational process for acquiring, organizing, and communicating both tacit and explicit knowledge so that others may use the knowledge to be more effective and productive" (Gray, 2000).

In general, needs for KM arise in three areas: in relationship to the public, within government departments, and in the coordination between government departments. In relationship to the *public*, KM needs arise from the interaction with members of the public and the need to respond to citizens' inquiries. In broadcast mode, the most basic form of e-government, there is little need for knowledge management. However, as soon as the government invites interaction, or transactions, citizens and businesses will begin to ask questions and will hope to have their problems solved. For example, government agencies might enable citizens to purchase business licenses on-line, or to pay taxes on-line. This would (or should) quickly trigger questions about such licenses (e.g., who has to apply, what are the requirements), or about tax regulations (e.g., "can I claim personal exemption"). Such inquiries then need to be handled by knowledgeable people, or by a "knowledgeable information system", a knowledge management system.

*Within departments*, knowledge management can potentially improve the efficiency of operations that might otherwise require considerable knowledge. For example, in Hong Kong's Civil Service, staff applications for "leave" (e.g., for vacation) are guided by more than 200 rules. These rules regulate the type of leave that applies (e.g., annual, staff development), length of leave, timing of the leave, and so on. In light of all these rules, a knowledge management system can significantly lighten the leave administrator's burden, and increase speed and accuracy of applications.

Knowledge uses *between departments* are generally aimed at the reuse of knowledge, the creation of one best solution, and the avoidance of duplication of effort. For example, in the Government of Victoria (Australia), a knowledge management effort was started when seven individuals in different departments realized they were working on the same problem. They decided to build a virtual community to share experiences. The same sharing principle also underlies the Canadian government's new "Leadership Network" (<http://leadership.gc.ca>).

### 3. MANAGING KNOWLEDGE IN E-GOVERNMENT

#### 3.1 Overview

Research and practice have suggested a variety of knowledge management technologies and practices. This section highlights the most commonly used technologies and practices. We divide them into “enterprise” solutions, which rely on large enterprise software to achieve the benefits, and alternative solutions with a much smaller technology component.

#### 3.2 “Enterprise” Knowledge Management Solutions

Over the past several years, numerous information systems solutions for information and knowledge management have been developed (e.g., McKellar, 2003). Many of these have been targeted at large enterprises and therefore are designed to manage large amounts of knowledge and information, accessed by many concurrent users at multiple organization units and locations, and hosted on large, multi-tiered hardware platforms. Correspondingly, their implementation effort is considerable, and the associated costs are high, seldom less than hundreds of thousands of US Dollars for any solution. For example, implementation of a portal using commercial software requires about US\$150,000 to 1 Million for the software license, and several times as much for total cost of ownership. Cost “per seat” (registered user) typically ranges between US\$100 and US\$500 (Roth, 2002a). Other enterprise solutions have similar costs attached to them. Furthermore, many such solutions rely on an existing organizational infrastructure of database, network, ERP systems, and possibly organizational legacy systems. An organization without such an infrastructure will require further investments of similar magnitude.

##### 3.2.1 Portals and KM Portals

Portals do not create any information (and knowledge), but they can collect, organize, and distribute it; thus they are focal points for information (and knowledge) exchange. Apart from providing functions specifically contributing to knowledge management, portals can provide their users many features, such as, email, chat rooms, personalized news, and a search engine, many of which benefit information and knowledge exchange. Presently, the leading portal solutions are offered by the major ERP software companies, as well as some “pure play” portal software companies (see Barlas, 2002a and 2002b; Roth, 2002b).

Many governmental portals have already been set up either for internal, inter-departmental, or government-to-citizen communication. For example, Hong Kong’s government has individual portal solutions for almost every government department, as well as a portal for electronic service delivery to citizens (<http://ESDlife.com.hk>), as do most of the other e-government leaders. Even governments with few resources engage in (limited) portal development, for example Russia and Thailand. Governments that engage in portal development learn that development costs and effort are considerable, but further that on-going maintenance is even more resource intensive. Without frequent updates, the portal quickly becomes outdated and loses its visitors. According to a survey by the National Electronics and Computer Technology Center in Thailand, almost 70% of Thai Internet users are not satisfied with their governmental web sites (Karnjanatawe, 2003). The main causes of dissatisfaction are out-of-date information, difficult-to-locate web sites, difficult-to-find information, lack of needs orientation, and dead links.

Knowledge management portals are an extension of the portal concept, with the purpose of adding superior knowledge representation, search capabilities, and supporting knowledge workers in their activities. Knowledge management portals provide tools to extract, analyze and categorize both structured and unstructured information, and reveals the relationship between content, people, topics and user activities in the organization. As a

result, users ideally receive information and knowledge that best suits their needs (based on their past profile).

In order to build portals cost-effectively, some governments use their portals as e-Commerce sites, or invite industry partners to manage them. For instance, Hong Kong's ESDLife is run as a for-profit venture by a subsidiary of Hutchison Whampoa, which supports itself through advertising revenues and a pay-per-use revenue generation model. Knowledge management portals are still at an early development stage, with no single leading technology. Technologies incorporate for instance context awareness (Pohs & McCarrick, 2002), ontologies (Staab and Maedche, 2001), or intelligent search engines (Pohs & McCarrick, 2002). Apart from development, they require considerable continuous technical support. The cost of KM portals is also still high, e.g. US\$100,000 per CPU (IBM Lotus Discovery) for the server software alone.

### *3.2.2 Customer Relationship Management Software*

Customer Relationship Management (CRM) aims at managing the interactions between an organization and its existing and potential customers as a relationship, instead of individual unrelated transactions. CRM software enables the organization and its employees to "know" its customers via their profile (pattern of past transactions), and to provide them with the most fitting services. Leading CRM systems embed analytical solutions (Barlas, 2003; Maoz et al., 2001), that facilitate performance tracking of customer-facing processes across the enterprise. CRM software can help e-government better recognize citizen demands, create citizen profiles, and in turn serve citizens accordingly. For example, Singapore's eGovernment offers separate eCitizen services to different user groups, and provides special offerings "just for kids". However, the cost of implementing CRM systems is considerable, which limits its use even in the governments of developed countries.

### *3.2.3 Data Mining and Text Mining*

According to Fayyad and Uthuramy (1996), data mining is a subset of knowledge discovery in databases (KDD), a process of discovering useful knowledge from data (Chung and Gray, 1999). The objective of data mining is to identify hidden useful relationships and patterns in existing large datasets, which makes it an important knowledge management technology. The result is typically the extraction of a relationship, formula, or rule that can be applied as a heuristic to complete future activities.

Data mining has been successfully deployed in numerous application areas (Brachman et al., 1996). For example, Amazon uses it for suggesting additional books, based on a customer's current choices. Law enforcement agencies use the technology to create profiles of criminals. Banks employ data mining to leverage their vast customer transaction data warehouses so to identify which types of customers favour to which types of credit products.

Within e-government, the focus of data mining is predominantly on the management of interactions between the government and citizens or business. In these applications, data mining can extract knowledge from transaction data, can lower the burden of dealing with large volumes of transactions, and can improve decision making ability.

Text mining is defined as the process of analyzing text to extract information for particular purposes (Liddy, 2000). It applies data mining techniques to look for patterns in natural language text. Examples of text mining applications include screening email messages from customers in an organization, shortlisting resumes of job applicants, and exploring newspaper about competitors. The text-mined information might be the author, title and date of the articles/publications, the acronyms defined in a text, typical text categorization, and the determination of relationships within a text block or between different text blocks.

We expect text mining to be one of the important technologies in the future when large organizations, including government need to reply to their “customer” e-mail in fast, efficient, and meaningful manner. Already today, some organizations are using this technology as part of their e-mail response systems, but there is still great potential for the breadth of use and the quality of the technology’s responses.

#### *3.2.4 Content Management*

Content management (and workflow) systems are designed to make users more knowledgeable (or at least more informed) by offering on-line access to many of the organizations’ documents. Intelligent content management systems are developed to overcome the difficulty of finding the right information, by supporting document categorization, by tracking document use, and by considering context. Many governments (e.g., United States Federal Government) consider content management as an essential application, and one of the core technologies of knowledge management solution, to overcome problems of information accessibility by knowledge workers. Aside from this internal application, content management systems enable users to publish web content (including tags, hyperlinks, and other search-friendly features).

### **3.3 Alternative Solutions**

Organizations (including governments) unable or unwilling to acquire large and costly enterprise solutions can make use of alternative means to promote knowledge sharing and knowledge management. These alternative solutions offer some knowledge management capabilities, while avoiding the high cost of ownership associated with enterprise systems. We introduce here three widely used solutions, expert directory, virtual community, and basic websites.

#### *3.3.1 Expert Directory*

An expert directory is a simple method for knowledge management in which the organization identifies each staff member’s area of expertise and then publishes a directory which catalogs these expertise areas, as well as contact points (e.g., e-mail). Many organizations that use several other means of knowledge management nevertheless keep an expert directory, as it is both simple and useful. The required technology can be as basic as a web page or (better) a database backed website that contains the list of experts and specializations. A clear drawback of this solution is that it always requires the experts’ attention and does not amplify or duplicate their knowledge. Also, the experts have to be willing to share (repeatedly), and, once an expert leaves the organization, his or her knowledge also disappears.

#### *3.3.2 Virtual Communities*

On-line or virtual communities are communities that exist in a computer mediated space, with relationships between community members, and whose activities are supported by information and communication technology, see for instance Rheingold (1993), Hagel and Armstrong (1997), Carver (1999), Jones and Rafaeli (2000) and Ho et al. (2000). Carver (1999) states that virtual communities are “about aggregating people”. People are drawn to virtual communities because they provide an engaging environment in which to connect with other people – sometimes only once, but more often in an ongoing series of interactions that create an atmosphere of trust and real insight”.

There are several technologies upon which virtual communities can be built, such as chat rooms (see for instance [emediaplan.com](http://emediaplan.com)), e-mail (White, 2001), discussion boards (Carnales, 2000), or GSS (Fjermestad and Hiltz, 1998). Important is in any case that the technology can create a dialog among its participants, that there is some form of threading (an

identification of relationship between messages), and that a record of the dialog can be kept, so as to allow subsequent learning by others.

Among the simplest solutions are those that are entirely e-mail based, where participants send their messages to a central list which then relays every message as e-mail to all list members (listserv). Alternatively, members can send e-mail (or similarly formatted messages) to a central site (discussion board) which then stores the messages and displays them (i.e., on a web page), without re-broadcasting. Community members then have to visit that site to check for new messages. While the first format pushes all messages to all users, the second one enables users to conveniently select which content to receive. Either way, the required technology solution is light-weight and can take advantage of any existing basic e-government technology infrastructure, such as e-mail or interactive web pages.

### *3.3.3 Basic Websites: Web Pages and Database Backed Websites*

Another relatively simple knowledge management solution is the creation of “hard coded” (HTML) web pages, and database backed websites. Web pages written in HTML can be easily produced and hosted with little technology demand. It is then up to the authors to write the pages, so as to allow the communication of knowledge. Database backed websites offer an improvement in this regard, as web pages are dynamically created, drawing data from a database to put content into a largely empty web page “template”. Content creators can update the database and will find the updates reflected in any web page that draws its content from that database. Unlike web pages, database backed websites is technologically more demanding, adding one tier to the server infrastructure.

## **3.4. Knowledge Management Solutions and E-Government Budgetary Constraints**

So far, we have introduced several knowledge management applications, all of which are widely used, either in the government or private sector. Clearly, the feasibility of an e-government knowledge management solution largely depends on the governments’ overall ability and readiness to spend on the necessary information technology and related costs.

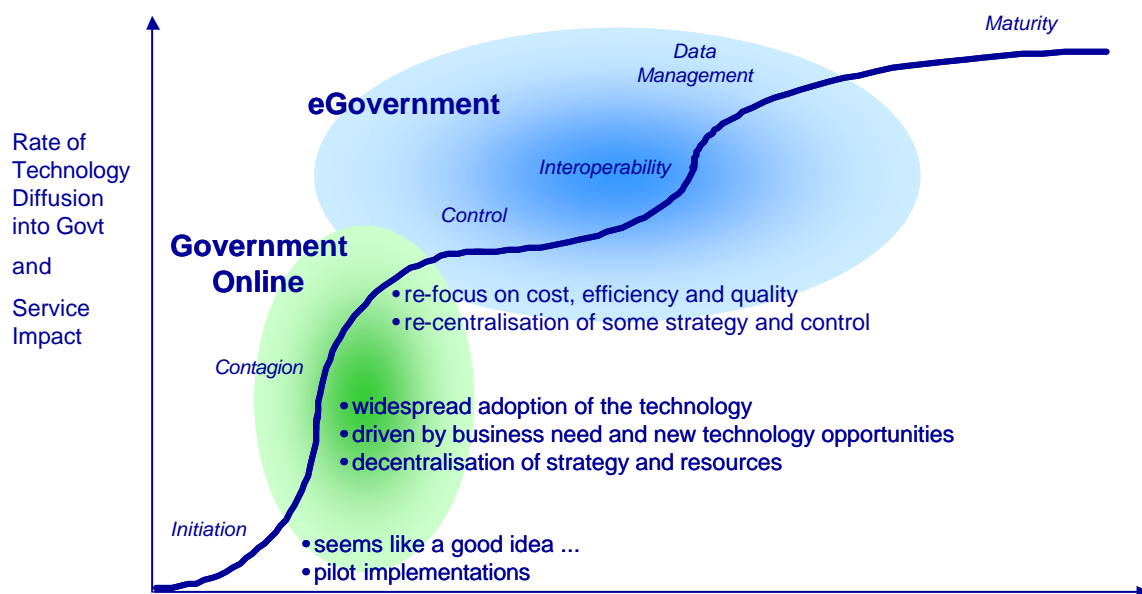
To provide a better understanding of the affordability of various KM solutions, Table 1 illustrates Government IT budgets for some leading and trailing economies. Where known, the table also separates targeted e-government funding from overall IT expenditures by the government. Many governments choose not to separate these two and now consider all government IT spending to be e-government spending.

The table indicates the vast spending differences between developed and less developed economies. Less developed economies spend a smaller percentage of their budgets on IT, while their absolute budget levels are comparatively small as well. In fact, most developing country budgets are not even sufficient to pay for the KM enabling IT architecture. For example, in 2003 the Philippines government intends to raise the IT spending ratio to between 1% and 2% of budget, up from a previously targeted 0.8% (Ho, 2003). With a proposed total budget of 804 billion Pesos (about 14.6 Billion US\$), IT spending amounts to between US\$ 146 and 292. Even this level of funding (comparable to Hong Kong’s IT budget, yet for an 11 times larger population) barely enables the purchase of basic computer equipment and inter-departmental networking technology, let alone afford any substantial enterprise software solutions.

**Table 1: Government Spending on IT (\*2002 budget, \*\*2003 budget)**

Government	IT spending, in Million US\$ approx.	IT spending as % of Budget	E-Government spending as part of IT budget.
Hong Kong SAR*	250	1.2	unavailable
United States (Federal)** <a href="http://www.fcw.com/fcw/articles/2002/0218/cov-budget1-02-18-02.asp">http://www.fcw.com/fcw/articles/2002/0218/cov-budget1-02-18-02.asp</a>	52,000	13	0.08% (i.e. USD 45 million)
UK* <a href="http://www.vnUNET.com/news/1137143">www.vnUNET.com/news/1137143</a> <a href="http://www.hm-treasury.gov.uk">www.hm-treasury.gov.uk</a>	10,000	2.4	5.2% (i.e. USD 522 million)
Pakistan* <a href="http://Paknews.com">http://Paknews.com</a>	unavailable	unavailable	USD 0.06 million
Philippines** <a href="http://www.abs-cbnnews.com">www.abs-cbnnews.com</a> <a href="http://www.neda.gov.ph/GISP/Default.htm">www.neda.gov.ph/GISP/Default.htm</a>	120	0.8	2% of national budget; 75% of IT budget (i.e. USD 89 million)

Given the different economies' ability to pay and the cost of IT, it is apparent that developing countries need to find appropriate ways to drive their e-government efforts. Furthermore, being at early stages of IT diffusion, they first need to develop necessary infrastructure, before any investment in expensive enterprise software solutions becomes meaningful and beneficial (see Figure 1). This limits their choices with respect to e-government solutions in general, and knowledge management solutions in particular.

**Figure 1: IT in Government Maturity Curve (Hodgkinson, 2002)**

## 4. VIRTUAL COMMUNITY

### 4.1 Opportunities

Governments of less affluent countries have few options but to adopt alternative KM solutions, which can offer interaction and knowledge exchange via simple and affordable technology platforms. In fact, developing countries may use this limitation as an opportunity to offer more open and self-help-oriented solutions than their counterparts in developed countries, which have a significant bricks-and-mortar infrastructure that would need to be re-engineered.

Among the alternative solutions, virtual communities can effectively capture and archive the knowledge of multiple experts and can quickly generate new knowledge in response to the needs of the community. Hence, the development of virtual communities has become a priority for governments of developed economies, such as Canada, Australia, or the United States. However, virtual community characteristics, technology demands, and modest financial resource needs suggest their suitability for developing economies as well. The next sub-sections explore suitable community characteristics, illustrate success examples, and assess financial and technology needs.

### 4.2 Virtual Community Characteristics

Virtual communities can be categorized along four key characteristics, as described by Chaudhury and Kuilboer (2001): motive, cardinality of interaction, source of content, and autonomy. These characteristics shape the operation and communication of virtual communities, as well as their suitability for knowledge management. *Motive* differentiates between relationship oriented, information/knowledge interest oriented, or transaction oriented. *Cardinalities* can be one-to-one, one-to-many, or many-to-many. *Content* can be member generated (authored), discussion group generated (as a result of interaction, such as Q&A), or host generated (where a community member with higher authority controls the content generation for the entire community). Finally, *autonomy* can differ from highly independent to highly engaged, indicating different levels of social capital.

#### 4.2.1 Motive

Based on motive, we can differentiate three types of communities. First, there are communities whose primary concern is relationship building and mutual emotional support. This includes for instance communities for those who suffer from chronic illness, and who use the medium to comfort each other. While they may also engage in information exchange and enable the purchase of items via their network, the primary motive should be emotional. Second, communities-of-interest target the mutual information and knowledge exchange. Such communities include professional groups, or groups that exist to foster joint knowledge on a hobby. Third, communities may exist to foster transactional and specifically economic interests. Communities in developing countries will be mainly targeted towards interest and professional exchange, as well as economic transaction. From an e-government perspective, the major purpose will be exchange of best practices between government units, and exchange between government and public (or public-to-public, with enablement from the government).

#### 4.2.2 Cardinality of Interaction

Communications can take place one-to-one, one-to-many, or many-to-many. Cardinality defines who has control over the information exchange, but not necessarily who creates the content. One-to-one cardinality underlies for instance the concept of a private chat room. For most communities this is of rather limited use, other than for the personal exchange of

sensitive information or sensitive transactions (e.g., in communities based on relationship or personal consultations replacing for instance the phone). One-to-many relationships indicate communication hubs, where the hub has control over the information passing to the “spokes”. Hubs can be relationship, informational, or transactional. The transactional hub model is prevalent in one-seller-many-buyer arrangements, such as a large company with numerous customers, as well as in traditional government-to-public (G2P) interactions. In many-to-many communities every community member can directly communicate with everyone else. These communities open a much larger knowledge base, but also shift the locus of control away from any individual communication center.

When community members are limited to e-mail only communication, they will require an e-mail hub (the “list”) to enable mail forwarding to all group members without the need for any individual member to send mail to everyone in the group. This requires less bandwidth at every user side, which is a welcome feature in developing countries where bandwidth is often limited.

#### *4.2.3 Content Source*

In communities content can be individually provided, generated through the group interaction, or host generated. The individual model is seen for instance in “communities” such as the former Geocities (now a Yahoo property). Geocities originally was a “community” of relatively independent web sites, hosted without cost, and arranged by topical interests. Geocities members offered their information “take it or leave it” to others, but also engaged in communal activities, such as linking their websites (e.g., as webrings). Furthermore, sites with similar content were collocated on the same virtual “streets”. We might consider this also as a “federated” model, where each participant is a “knowledge czar” but also willing to share that knowledge. We expect this model to appear in e-government efforts focused on e-learning. Individual “providers” will place their resources on-line, for participants to use or not to use. The model can also be observed in e-governments where each government department creates its own information portal, without integration with other government sources.

Interaction generated content, by comparison, is largely shaped by the communication between community members. It is revealed through questions and answers, or shared as part of general conversation, or provided by aggregation of existing discussions by other community members. This is the typical format of a virtual community and designed to foster just-in-time learning, problem based knowledge exchange, and interactivity. It also enhances the community members’ sense of belonging. The format is well suited for an on-going dialog between government and population and the corresponding knowledge exchange.

Host generated information is the traditional information broadcast model, which was prevalent in the media, the government, and in industry before the Internet. One might expect this to be the model of choice for e-governments, as all the content is prepared by government providers and then broadcast to the citizens, thus allowing the highest level of control and consistency of information. Yet this model requires the provider to create a very significant amount of content (which small e-governments may not be able to offer). The model does not benefit from knowledge that exists distributed throughout the nation, but assumes that all the best answers would have to come from the e-government. As described in the cluetrain manifesto ([www.cluetrain.com](http://www.cluetrain.com)) this form of communication is already perceived by visionaries as behind-the-times. As stated in the manifesto, “markets are communications between people”. Similarly, we might assume that “states (nations) are communications between people” and therefore require the dialog to be truly functional.

#### *4.2.4 Autonomy*

Autonomy, in our framework, describes different levels of social capital and the coordination between community members. Autonomy can range from very independent, such as with the independent properties in Geocities, to highly integrated communities with well-defined rules of collaboration and a strong sense of community. Interim levels may indicate some levels of collaboration, but also within-community fights, and violation of community rules. The Icered.com community demonstrates a low level of social capital, as communication beyond information exchange mostly consists of put-downs and verbal aggression.

#### *4.2.5 Implications for Usefulness*

The “right” combination of characteristics may enable the creation of virtual communities that are effective KM mechanisms. Specifically, planners in developing countries are likely to seek the following characteristics: communities with the motive of information and knowledge exchange, one-to-many (hub-like) infrastructure, multiple content sources, and high level of autonomy.

Bringing information and knowledge to citizens will be of foremost importance to the planners. Hence, the motive will be information and knowledge based. Transaction processing is important as well, but without a developed on-line payments system, transaction processing is difficult to realize. Communities for emotional support are not feasible for developing countries.

Infrastructures need to be least expensive at the end-user level. This favors a hub-and-spoke arrangement, instead of peer-to-peer (many-to-many) arrangements. Planners will be able to build an effective infrastructure, in which participants might only be responsible for the sending of few individual messages, and the receipt of multiple replies.

Multiple content sources are the “killer characteristic” of virtual communities in general, and the most suitable mode of operation in developing countries. Planners can use the combined knowledge of many parties to distribute knowledge in the community, instead of relying on a single party, such as the government to do so. Autonomous or independent information sources will also be important to enable a free flow of information. This is a controversial issue for many planners, as control is taken away from a central source. Planners will have to seek a trade-off between control and information richness that is suitable for their environment.

The following examples of successful virtual communities exemplify the characteristics and demonstrate the choices made by their planners.

### **4.3 Examples of Successful Virtual Communities in Developing Countries**

Developing countries that have taken on e-government initiatives with knowledge management have achieved positive results, even when restricted to a basic infrastructure. We describe five successful examples of applications in different developing countries and draw conclusions from their experiences.

#### *4.3.1 Gyandoot Project*

The Gyandoot project (Sharma and Yurcik, 2001) is supported by Global Knowledge Partnership (GKP). The GPC is a consultation organization committed to the sharing of information, experiences and resources through information and communication technology (ICT) and to promote the effective use of knowledge and information especially in the developing countries. The Gyandoot project was launched on January 1, 2000. Gyandoot (“messenger of knowledge”) is a digital library in the Dhar district of the state of Madhya Pradesh in India. An official website gives citizens global access via a portal.

Gyandoot provides farmers with access to the latest market quotes, product exchanges, and other information crucial to farming. With all these facilities, farmers can find the highest prices for their products without relying on traders or wholesale market. Furthermore, the villagers use Gyandoot to keep track of the cost of their products in the wholesale market. They can now make informed buying and selling decisions concerning raw materials and products. The system's functions primarily support information management, but also enable users to apply this information to create decision rules which lead to improved transaction processing efficiency, and decision making effectiveness.

Gyandoot is a community-owned and financially self-reliant project. The technology used to accomplish it includes an intranet covering 20 village information kiosks and connecting to rural public cyber cafes. In addition, a portal is used to support all online activities. The setup cost of Gyandoot amounted to no more than US\$57,000. The project has been considered so successful that the Legislature decided to replicate information kiosks similar to those of the Gyandoot project throughout the entire state. It provides an example of an on-line economic community which helps an entire group of merchants with similar interests.

#### *4.3.2. Foundation of Occupational Development (FOOD) Project*

The FOOD project is based in Chennai, South India. It was initiated by the PANAsia Telecentre Learning and Evaluation Group (PANTLEG), as a telecenter to facilitate on-line communication, information, and knowledge exchange (PANTLEG, 1999). Specifically, its purpose is to:

- increase the capability of NGOs and Community Based Organizations (CBOs) as a knowledge-broker;
- encourage collaboration in research and development through information access;
- facilitate the use and exchange of information via electronic communications and access to databanks;
- offer e-mail, bulletin board and conferencing services;
- establish internet services and act as an Internet Service Provider; and to
- promote original and innovative networking solutions to specific development problems in the region.

FOOD operates via a modest 64kbps host connection to India's primary ISP. One of the innovative project features is its remote area electronic networking capability through packet radio modems in 10 remote sites. The packet radio network is used to access external databases, data, electronic mail, bulletin board services, and newsgroups. The wireless radio modem technologies results in cost-effective communication and Internet access. Fourteen sub-hosts are connected to the FOOD host, each with 100 to 300 users, the majority being NGOs.

#### *4.3.3 Beijing City Government Website*

The Beijing City Government Website provides citizens with facilities such as government services, information on laws and regulations, a news center, links to other government departments and e-mail. The email section invites citizens to make suggestions about the government development, to complain about government services, or to report unsatisfactory government work. The e-mail section enables knowledge sharing and knowledge management, as citizens are able to offer their "know how" on areas to improve. The website further provides an electronic forum to obtain answers to questions such as how to move one's official residence to Beijing, and the forum would respond by listing specific regulations and procedure, thus enabling additional knowledge sharing. While it is simply a

website with email communication and electronic forum functions, it facilitates two-way communication between the government and the public, which in turn opens up the possibility for knowledge exchange and management.

#### 4.3.4 InfoDes

The InfoDes ([http://www.itdg.org/html/icts/information\\_systems](http://www.itdg.org/html/icts/information_systems)) project is based in Cajamarca, Peru. It was launched by the Intermedia Technology Development Group (ITDG) of the World Bank. ITDG is seeking practical answers to poverty by testing out how new information and communication technologies (ICTs) can be used by small scale producers to improve their livelihoods. The InfoDes project designed and installed an information system that integrates local libraries, research on local knowledge, and information technologies. Its objectives are to:

- provide information to rural citizens and local government (municipalities);
- provide information and communication tools to increase the production of farmers and the management skills of local governments;
- promote local development by improving the access of peasant producers and manufacturers and municipal authorities to information for their respective activities.

The basic infrastructure to enable this project is a telecenter, a room with several desktop computers and basic desks and chairs. The main service offered to the public is access to the Internet (chatting, e-mail and Web browsing) and often also to elementary software (word processing, spreadsheet). The cost of a basic center with 14 stations amounts to about \$15,000 to \$25,000 (Proenza et al., 2001).

Prior to the InfoDes project, the people of Cajamarca province had few formal information systems and one small library for 8,000 citizens. The InfoDes project installed a central coordinating unit in Cajamarca to host a customized database containing a range of locally appropriate technologies and on trade and business issues. Remote rural access points have been linked to the InfoDes centre, and a mobile information unit with video links and internet access has been set up to introduce the service to remote Cajamarcans. Local entrepreneurs and people coming to market can search the project's databases for information with help from trained staff. The Internet gives Cajamarcans access to knowledge on better production and processing methods for potatoes, barley and oca, and facilitates the search for information on markets and potential customers. The InfoDes project demonstrates how to successfully use basic ICTs (Internet) to strengthen the existing information system, to facilitate networking among local rural areas, and to expand information and knowledge services in order to assist the small-scale farmers and enterprises to improve their livelihoods.

#### 4.3.5 Online Forum Armenia

A very basic implementation of the virtual community idea can be found in an online forum set up by the Armenian Academy of Sciences ([www.forum.am](http://www.forum.am)). That site's main purpose is to foster public awareness and to create dialog on public policy issues. The site contains an open, threaded discussion board, a page with human rights contact addresses, as well as several member-only services.

#### 4.3.6 AgriNet Bangladesh

AgriNet Bangladesh (<http://members.tripod.com/~UTTAMDEB/>) is an online guide to Bangladesh Agriculture. It aims at improving the understanding and promoting knowledge about Bangladesh's agricultural and rural development process. It tries to collect news, ideas, views, and thoughts related to the agricultural and rural development in Bangladesh.

In this web site, it includes introduction to Bangladesh's agriculture, information of educational institutes, research institutes, journals, experts' directory, Agri. News, South Asia

Agriculture, special features about agriculture, and an open forum, etc. In the open forum, it would have a debate topic and invite readers to raise their comments through e-mail. AgriNet Bangladesh creates an online database of agricultural experts of Bangladesh in its experts' directory. It also provides readers and citizens with information about fellowships, jobs, grants and conferences for agriculturists.

By using AgriNet Bangladesh, citizens of Bangladesh can exchange their ideas about agriculture. They can also increase their knowledge by referring the experts' knowledge and the latest news posted in this web site.

#### 4.3.7 *AfriKTownCrier – Africans Information Network*

The AfriKTownCrier (<http://groups.yahoo.com/group/AfriKTownCrier>) is a wire service developed to forward information to African communities all around the world. To enrich the contents of the disseminated information, AfriKTownCrier is eager to receive contributed knowledge/information from its members. After studying the suitability of the information, it will disseminate the filtered information to its members all around the world as quickly as possible. The purpose of filtering the incoming information is that AfriKTownCrier wants to provide quality information to its members, thus not only adds value to the Africans' daily lives but also be beneficial to the community. The required information covers a wide variety of issues, such as economics, governmental, and leisure, etc.

AfriKTownCrier actually is acting as a many-to-many information hub to all online Africans by receiving from and disseminating information to them. The number of messages posted in 2002 was 1072, while there are around 500 messages in the first half of 2003.

AfriKTownCrier is a division of AfriK Network Groups. The technical support of AfriKTownCrier is performed by Yahoo!, thus, AfriKTownCrier can concentrate on the administrative side of maintaining the online community.

#### 4.3.8 *Lessons Learnt*

Creating and maintaining e-government capability is not a simple task, particularly for a developing country, it requires considerable resources. Most developing countries are still at the initial stages of e-government (see UN/ASPA 2001 study). Even in the developed world, many government departments are still operating at moderate levels of e-government, and online services are being used by only a fraction of the population or offer for basic services only, resulting in only about 20% of potential services being available on-line in 2000 (Bhatnagar, 2000). In light of this, the above examples illustrate an interesting opportunity for developing countries with limited technology to support advanced forms of e-government with interaction and knowledge exchange.

Table 2 below further illustrates the characteristics of the several initiatives we reviewed. All of the examples were created for the purpose of information and knowledge sharing. Being community sites in some sense, they all make use of many-to-many communication. There are differences with respect to the content source, and the autonomy (including social capital). Together they demonstrate that virtual communities are a viable form of e-government knowledge sharing, even for countries with low GDP and considerable resource limitations, such as India, China, or Peru.

An interesting observation in AfriKTownCrier is that on the surface, the community provides many-to-many interaction; however, implicitly it tried to control idea sharing by filtering and centralizing all the incoming information from its members. As a result, the general public tends to get less freedom of information and knowledge sharing. This phenomenon needs to be evaluated formally in the future.

We should also point out that our attempts to find illustrations of enterprise solutions for knowledge management in developing country e-governments were unsuccessful. In fact,

at present only few well-resourced governments have embraced sophisticated e-government solutions, but instead are struggling to enable presence, interaction, and transaction processing capabilities.

**Table 2. Comparison of Virtual Community Sites**

Projects Virtual Community Characteristics	Gyandoot	FOOD	Beijing City Government	InfoDes	Forum Armenia	AgriNet Bangladesh	AfriKTown Crier
Motive	Information & knowledge sharing Economic Interest	Information & knowledge sharing Economic Interest	Information & knowledge sharing Societal Interest	Information & knowledge sharing Economic Interest	Information & knowledge sharing Political Interest	Information & knowledge sharing Economic Interest	Information & knowledge sharing Societal Interest
Cardinality	Many-to-many	Many-to-many	Many-to-many	Many-to-many	Many-to-many	Many-to-many One-to-many (Discussion Forum)	Many-to-many
Content Source	Individual	Interaction	Host	Interaction	Interaction	Host	Host
Autonomy	Independent	Independent	Integrated	Independent	Independent	Independent	Independent

#### 4.4. Feasibility of KM Solutions

##### 4.4.1 Overview

The previous examples of knowledge management in e-government for developing countries raise some hopes and demonstrate opportunities. Nevertheless, one might wonder whether they are exceptional cases, and possibly only created as showcases. Consequently, in the next sections we will demonstrate that despite the challenges, basic forms of e-government (including virtual communities) are in the reach of developing economies.

##### 4.4.2 Telecommunications Infrastructure and ICT Resources

To be successful, e-governments need to have an IT infrastructure that is capable to support and enable the execution of e-government. An e-government infrastructure in general comprises network infrastructure, security infrastructure, application server environment, data and content management tools, application development tools, hardware and operating systems, and systems management platform. However, many developing countries do not have the infrastructure necessary to deploy e-government services throughout their territory. A recent study by Harris (2003) compared the ICT situations in six selected developing countries, based on World Bank data for 2000. Table 3 illustrates the availability of two important technologies, telephone lines, and personal computer penetration, for several developing countries, as well as the number of Internet users. Interesting finding is that the developing countries are very inhomogeneous with respect to technology availability and use, differing by two orders of magnitude. The number of telephones ranges from 5 to 412 per 1,000 people, and the number of personal computers from 1.5 to 103 per 1,000 people, and in the number of Internet users from 100,000 to 22.5 million.

Clearly then, while countries at the low end of the spectrum, such as Bangladesh, will have immense difficulty with e-government penetration, countries such as China, Thailand, or Malaysia will be in a much better position.

**Table 3. ICT situations in six developing countries**

	India	Bangladesh	Thailand	Malaysia	China	Philippines
Fixed lines and mobile telephones (per 1,000 people)	35.5	5.0	142.6	412.3	177.6	124.4
Personal computers (per 1,000 people)	4.5	1.5	24.3	103.1	15.9	19.3
Internet Users	5.0 million	100,000	2.3 million	3.7 million	22.5 million	2.0 million

#### 4.4.3 Costs of Implementing and Maintaining ICTs

The cost of implementing and maintaining ICT systems is definitely high for a developing country. Table 4, an excerpt from the study of Accascina (2001), summarizes the costs for basic computer connectivity in secondary and rural areas.

**Table 4. The costs for basic computer connectivity in secondary and rural areas**

Item	Capital (approx. USD)	Ongoing Cost (approx. USD)
Computers	From \$400 for a thin client terminal to \$2,000 for a stand alone medium equipped PC	Minimal for the first 2-3 years
Peripherals	From \$200 for printer-scanned-copier multipurpose.  \$200 for UPS power back up, more if electricity production is needed.  \$50 for a Modem.	Minimal for the first 2-3 years, unless functionality is added.
Software	From \$30 for Linux distribution – open source productivity application to \$400 for Microsoft OS+Office-type software	Minimal for the first 2-3 years, unless functionality is added.
“Last mile” connectivity between national infrastructure and user	Two alternatives: Telephone infrastructure: min of \$200 per km from switching center 2) Satellite earth station: approx. \$1,000 including electronics for KU band, delivered.	User ongoing costs: Dial-up: cost of phone call +ISP; Leased line min. \$500 depending on distance to switch center + ISP. Satellite circuit channel. From \$31 for a shared port – requires a pool of users – to a min. of \$2,500 for a dedicated leased circuit.
Rural connectivity to Telecom and Internet backbone	Fiber-optic, copper, satellite-based networks. (In millions of dollars)	Network maintenance and upgrades, depending on the size and type of system
Technical skills training user	Approx. \$20 for basic courses	Nil
Technical skills training technician	From \$100	Nil
Content generation	Informative sites (from \$0) ; E-commerce sites without transaction (from \$500)	Depending on content

In other words, if the cost of maintaining a community computing center is about US\$1,000 to 1,500 per computer, it can very well be the equivalent of several year's wages for a local worker, and therefore the reach has to extend to considerable numbers of people (e.g., thousands), resulting in positive economic or other tangible value. This clearly creates feasibility concerns and requires solutions that rely on sharing of equipment among relatively large numbers of people (e.g., telecenters).

#### *4.4.4 Digital Divide*

In a developing country, the gap between educated and under-educated people can be large. The educated population will already have good opportunities to use information and communication technologies. For example, professionals in large cities in China or India may find it about as easy to access computers as their counterparts in the UK or Canada; the same will clearly not be true for those living in rural areas.

This "digital divide" between those that already have access and those that will not gain access for a long time may result in long-lasting and widening economic gaps between the ITC haves and have-nots. As a result, the provision of e-government services would be biased, favoring educated, urban residents.

The potential digital divide is clearly a concern, and yet it applies to many types of public infrastructure, be it roads, airports, or schools. In fact, ICT may offer more hope in this respect than other infrastructures, as technology and communication costs are continuously dropping, and energy for computers can be provided through small power generators or solar cells. As such, a local village may not have roads, a school house, or telephone landlines, but with satellite dish and a telecenter, it may still be connected to the world.

### **4.5. Virtual Community – Best Fit**

Despite the strong arguments in favor of virtual communities, virtual communities are not automatically the best fit for all e-government knowledge management needs. Any organization or government will face numerous problems, decisions, or inquiries that demand the use of knowledge. These challenges will have different characteristics and therefore different knowledge demands. If we differentiate them by difficulty, repetitiveness, and knowledge source, we can identify different knowledge applications that call for different types of knowledge management solutions (see Figure 2). As demonstrated by our case examples, virtual communities are particularly useful in task environments where knowledge has to be created quickly and is drawn from widely dispersed sources. In contrast, repetitive tasks that draw on in-depth knowledge from the central source (i.e., the central civil service agencies) will be likely better accommodated by enterprise knowledge management solutions.

What makes virtual communities a preferred alternative in the portfolio of knowledge management solutions is their general affordability and effectiveness. Hence, their overall efficiency can enable governments of developing economies to quickly address challenges in a number of knowledge demanding areas, as depicted in Figure 2. Other areas may simply remain unsupported by knowledge management solutions until the necessary resources become available.

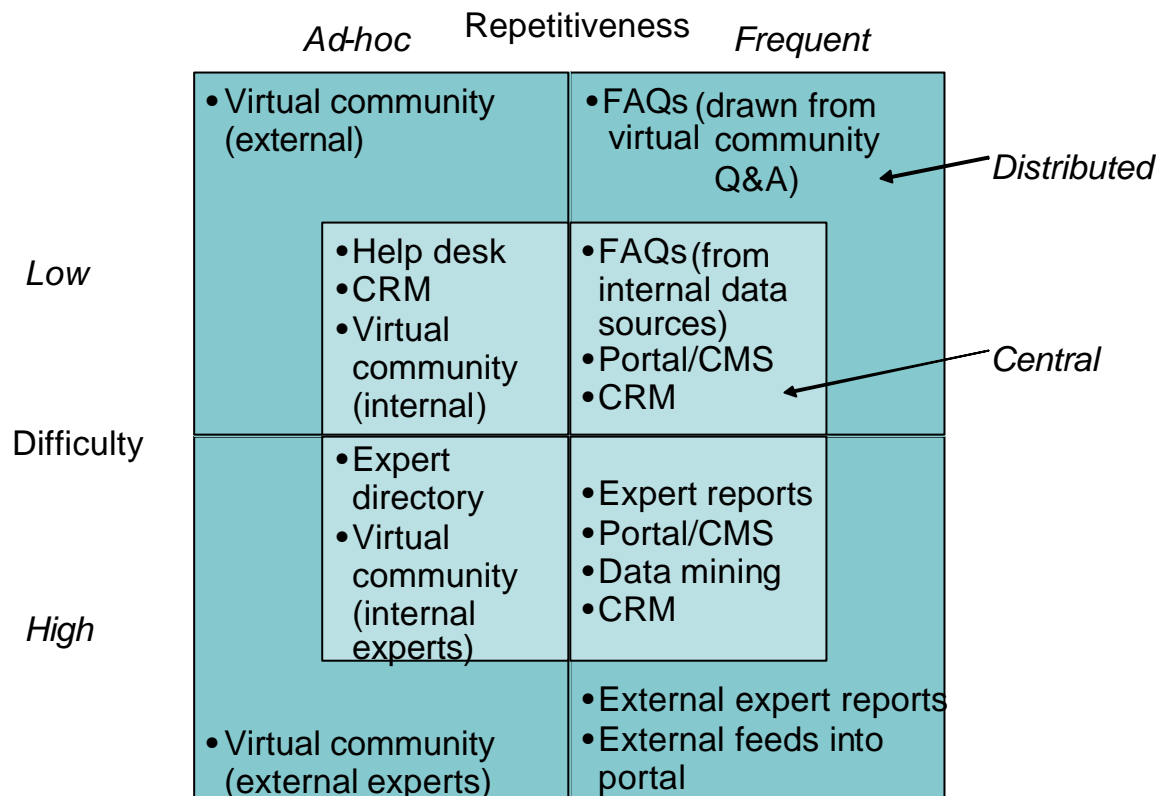
## **5. CONCLUSIONS**

The availability of knowledge and information through the Internet offers significant potential for developing countries, enabling citizens to strengthen their economic base, obtain educational resources, and government services that were previously unavailable. Economic limitations require governments in developing countries to find inexpensive solutions for

knowledge and information delivery. One such solution is virtual communities which rely on the combined knowledge of their participants.

Our findings demonstrate that the creation of virtual communities is inexpensive and technically simple. The required technology platforms can be obtained with the most basic information and communication technologies. The demands for hardware, software or bandwidth are relatively modest.

Virtual communities enable knowledge exchange and have been demonstrated to facilitate the exchange of know how, both in the public and private sector throughout the world. Several success stories point to their effectiveness. Success stories of enterprise solutions for knowledge management in developing countries cannot presently be found.



**Figure 2: Task Characteristics and Knowledge Management Solution Fit**

Successful implementation of virtual communities will require that they are set up appropriately, addressing the important needs of the community and fostering the exchange of knowledge. As a result, virtual communities can also promote e-democracy, as is for instance the goal with the Armenian on-line forum. Governments may then have to be willing to give up some of their “ownership” of the communication channel and allowing free discussion and idea sharing. One might argue that governments will have to adopt similar lessons as put forward for e-Commerce in the 95 Theses of the Cluetrain Manifesto (Locke et al., 1999). The Manifesto postulates for instance “markets are communications”. In analogy, also government-to-citizen interactions may often be conversations, and therefore be particularly suited to support via virtual community technologies. However, not all government or civil service members might agree with this view and its implications.

There are other challenges to the implementation of e-government, especially the cost and availability of the technology and services. Nevertheless, the virtual community solutions

suggested here are among the least demanding in terms of financial and technology requirements and thus will be available even on the most modest technology infrastructures.

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