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*Community Informatics and Human
Development **

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November 2006

* Published at the International Workshop on Community Informatics
(COMINF'06). Montpellier, France. November 2-3, 2006. NRC 48767.

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Community Informatics and Human Development

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Abstract. A global crisis in human development and prosperity exists. Its constituents include extreme poverty, illiteracy, gender imbalances, and armed conflict. One response has been the creation of the Millennium Development Goals. The recent United Nations World Summit on the Information Society affirmed support for linking the further development of the global information society to these goals. This paper argues that community informatics has a specific role to play in contributing to the realization of the Millennium Development goals and the improvement of human development in general.

Keywords: community informatics, human development, poverty, Millennium Development Goals

1 Our World

Social, scientific, and political developments over this last millennium have brought remarkable progress to the overall human condition. Average life span, literacy, agricultural production, and the ability to manage large social organizations have all improved greatly in the aggregate. However, it is difficult to say that our world is not in crisis, whether viewed from the perspective of sustained and recurring historical processes or as a conjunction current social, material, and environmental conditions.

We are in an epoch where significant inequalities remain and poverty, disease, and military conflict are devastating communities at significant levels. Over 20% of people in the world live in extreme poverty [1]. Over 100 million children are not receiving basic schooling [1]. Child mortality rates in some parts of the world are as high as 29 times that of most developed countries [1]. Over 1 million people die annually because of lack of access to clean water [1, 2, 3]. By the year 2015, HIV/AIDS is expected to have reduced populations in developing countries by 100 million. In many of these countries whole public service sectors have already been devastated by the epidemic, thereby exacerbating existing social problems [1]. Women and girls are at heightened risk in most human development indicators, including health and access to education. More than 20 major wars and other armed conflicts have occurred over the past decade, causing sustained damage to social and political infrastructure. Genocide has been formally recognized in several of these wars (see [6] and [7]). More details are given in an appendix.

Linkages between all of these issues reveal added complexities. For example, women who are less educated are more likely to become infected with HIV, while access to primary education for many children is being reduced significantly as teachers and other professionals die from AIDS.

Responding to the troubling status of human development, member states of the United Nations agreed unanimously to the Millennium Declaration which set goals

for addressing key human development indicators to be achieved by the year 2015 [8]:

- Goal 1.* eradicate extreme poverty and hunger;
- Goal 2.* achieve universal primary education;
- Goal 3.* promote gender equality and empower women;
- Goal 4.* reduce child mortality;
- Goal 5.* improve maternal health;
- Goal 6.* combat HIV/AIDS, malaria, and other diseases;
- Goal 7.* ensure environmental sustainability; and
- Goal 8.* develop a global partnership for development.

These are now widely known as the Millennium Development Goals (MDGs). They have become the primary metrics for measuring human development. They have also become a major component of agreements in international forums, including the recent United Nations World Summit on the Information Society (WSIS). For many people, the MDGs are the current benchmarks against which policy and action in many domains should be judged. Governments and civil society in the WSIS, for example, decided that MDGs should be the basis of its plan of action: “Our challenge is to harness the potential of information and communication technology to promote the development goals of the Millennium Declaration” [9].

It is difficult to dissent from the claim that our world is in crisis if the current status of the MDGs is examined. The United Nations Development Programme reported in its 2005 Human Development Report that at 10 years from the 2015 Millennium Development Goals, “if current trends continue, the MDGs will be missed by a wide margin what was possible” [1].

Technology can make positive contributions in the attempt to meet these goals. Stephen Lewis, former United Nations Ambassador and Special UN Envoy on HIV/AIDS in Africa, when asked about positive applications of ICTs in responding to HIV/AIDS in the developing world cited several examples: applications of basic mobile telephone technology in a number of countries, including Botswana; the use of computers to track medication and patient records in Swaziland; and the implementation of distance learning by the Royal College of Nursing in the UK to carry out remote training of medical staff [10]. Experience has taught the computing professions that if examples such as these are successes, they are as much, if not more, the result of careful social processes as they are the result of the unique characteristics of the particular technologies being used. The traditional field of management information systems and the newer field of community informatics provide different perspectives on the social processes necessary for conducting technology design and implementation processes. This paper attempts to make the case that community informatics has a specific role to play in facilitating technological contributions to the improvement of human development.

Community informatics is an emerging discipline that is developing ICT analysis, design and deployment techniques that are geared toward the unique requirements of communities. This is in contrast to the field of management information systems, which was developed for organizational contexts. The linkages between community informatics and human development can take several trajectories. One trajectory relates the fundamental importance of information in addressing any societal issue to the inherent potentials in information and communication technologies (ICTs) for facilitating the exchange and processing of information. It is held as axiomatic that communication is a fundamental social process and a foundation of all social organization. Thus, ICTs must not be seen only at a technical level for their processing capabilities; they must be seen at a social level as enablers – for good or bad -- of social processes and social organization. In particular, ICTs are potential enablers of effective formation and communication of information that is vital to

addressing human development issues. A second trajectory is a corollary of the first, which is that if ICTs are to be viewed as integral to the search for solutions to problems of human development, then community informatics is among the key disciplinary approaches that are necessary for solution-seeking. Traditional management information systems approaches are designed for organizations and are not necessarily well-suited to addressing the unique requirements of communities.

This paper does not seek to be a comprehensive treatise on community informatics nor to focus on specific MDGs and case studies. It represents the beginning of a process for the author. This paper has two goals: (1) to motivate the development of a more comprehensive vision and a plan for contributing community informatics expertise to the improvement of human development and (2) to propose an initial set of tasks and challenges for accomplishing the first goal. Sections 2 and 3 address the first goal. Section 4 addresses the second goal.

2 Community Informatics as Praxis

What difference can community informatics practitioners make in all of this? The author still encounters arguments from peers and colleagues suggesting that computing and information sciences have no relationships nor obligations to social and political spheres. Perhaps one indication of this type of thinking is the fact that the two major academic computing societies in the world, the Association for Computing Machinery and the IEEE Computer Society, had little or no official representation at the recent United Nations World Summit on the Information Society. In contrast, non-governmental organizations (NGOs) from a wide variety of interests participated vigorously in the policy debates there.

This separation between academic and practical endeavors is understandable on the grounds of disciplinary focus, but the bridging function that science provides between policymaking and implementation – to both positive and negative effect -- is not new. The problem is that research, engineering, and implementation processes produce the ICTs which give constant rise to serious policy issues. The response has usually been to address only the direct and indirect effects on society of ICT production and use, and, to a lesser extent, how the characteristics of certain ICTs might be leveraged to either address human needs or to violate human rights. Thus, the processes and professions that produce ICTs might be said to exist as “black boxes” relative to the social impacts they make. In an abstracted view of this, the computing and engineering professions are arguably the most responsible for generating the technological artifacts and complex systems that yield the transitive social, political, and economic phenomena to which society must later respond. Yet, these professions and their approaches have been subject to only minor scrutiny and calls for accountability.

This call to link community informatics research and praxis more closely to global society's most serious problems is not a call to technological constructionism. Most people within technology and policy sectors -- and society at-large -- now recognize that technology is not infallible and that technology cannot and should not be counted on alone to solve social and political problems. It can be argued, however, that given the phenomenal evolution of technologies for enhancing the production and communication of knowledge, the computing professions have an obligation to examine what contributions they can make to addressing major social issues. What is clear to practitioners who have gravitated to the disciplines of social and community informatics is that ICTs have become inextricably linked with almost all facets of human society and they have the potential to bring both benefit and harm to it.

This calls into question the nature of community informatics. The author has previously defined community informatics as [11]:

... an interdisciplinary field concerned with the development, deployment and management of information systems designed with and by communities to solve their own problems. It is arguably a part of social informatics, which has been defined by Kling [12] as 'the interdisciplinary study of the design, uses and consequences of information technologies that takes into account their interaction with institutional and cultural contexts.'

Community informatics can be seen in the context of social informatics as a disciplinary site focusing specifically on the roles and relationships between ICT and communal environments and their unique requirements.

This definition is not enough, however. Community informatics must be seen clearly to inform and encourage a praxis. That is, teaching and research within the discipline must be directed more vigorously to the practical application of its knowledge. Such a praxis should be focused, in particular, on major societal issues such as those represented by the MDGs. Community informatics is uniquely suited among the computing and information science disciplines in this context given its specific attention to social, economic, cultural and other facets of communities in understanding the ways that ICTs should and should not be used.

It may still be difficult for some people to contemplate actionable linkages between science and engineering and issues such as the MDGs, but this is not a new type of framework for science and engineering. The organization Doctors Without Borders / Médecins Sans Frontières (MSF), founded in 1971, is an important example of a professional community that has resolved the linkages between its general scientific and ethical obligations and specific critical social needs -- in this case the delivery of medical care in emergency situations [13]. Since 2002, there is now also Engineers without Borders -- International, an organization that has explicitly sought to contribute engineering expertise toward meeting the MDGs [14]. Analogous efforts should be contemplated within the computing professions.

Community informatics is itself an acknowledgment of more than the non-value-neutral and fallible nature of ICT. It is a recognition that the idea of purely technical solutions to societal problems is a fallacy and, further, that the seeking of technical solutions must necessarily be a social process. In this context, advanced ICTs such as the Internet must be considered only "candidate solutions," in the parlance of systems analysis, within a community informatics approach. A better phrase might be "candidate contribution." That is, advanced ICTs must not automatically be assumed to provide the best solutions. Instead, ICTs in general must be viewed only as potential components of overall solutions to a given problem, where other non-technical and social components are assumed to play the leading roles. Thus, the process of finding candidate contributions is a holistic one. This process includes, but is not limited to, the following steps: (1) understanding the community context to which ICTs might be applied; (2) developing appropriate and sustainable models for the socio-technical systems into which such ICTs are to be integrated; and (3) selecting and appropriating ICTs based on knowledge gained from parts (1) and (2) of this process. The overriding concern then is to select technologies that are suitable and appropriate to a community given social, cultural, sustainability and economic factors. To achieve this, it is necessary to be open to the full range of communication modalities and technologies, including simpler and older technologies.

The pressing nature of the problems outlined in the first section calls for every tractable and useful strategy to be brought to bear to solve them, including the

application of ICTs. Taken from a traditional management information systems (MIS) perspective, where the materials and expert computing professionals required to develop systems are often assumed to be abundant, the identification of feasible technical contributions to meeting goals such as those in the Millennium Declaration might be seen as relatively straightforward. The realities for developing countries are vastly different. ICT resources and computing professionals are usually both scarce in the developing world. The characteristics of communities in general are highly unique relative to organizations and, therefore, the development of ICTs for communities warrants a special focus [15, 16]. Historically, MIS project failures exceed successes by a significant margin, thus, special care must be taken in systems design processes within community contexts since the economic, political, and social tolerances for failure are usually not as high in communities as they are in large industrial and governmental organizations [17].

3 Our Technology

In contrast with the poverty and inequality that exists today, there is a growing abundance of information technology and services in the developed world. This is a technological epoch where the usage, reach and capabilities of ICTs continue to accelerate at a remarkable rate. It cannot be argued, therefore, that there not sufficient resources to try to use ICTs to contribute solutions to these problems.

Dispersion of ICTs is but one indicator of this progress. According to the International Telecommunication Union [18] the period between 1994 and 2004 saw in the developing world alone increases in the proportion of¹:

- fixed telephone lines per inhabitant, from 4.4 to 12.8 per 100 inhabitants;
- mobile telephone subscribers, from 0.19 to 18.8 per 100 inhabitants; and,
- Internet users, from 0.03 to 6.7 per 100 inhabitants.

Correspondingly, in the developed world between 1994 and 2004 there were, according to the ITU [18], increases in the proportion of:

- fixed telephones lines from 48.8 to 53.5 per 100 inhabitants;
- mobile telephone subscribers from 5.20 to 76.8 per 100 inhabitants; and
- Internet users from 2.18 to 53.8 per 100 inhabitants.

Nielsen/NetRatings reported that the total numbers of online searches increased 55% over the 12 months starting in December 2004 [19].

Innovation is perhaps a more important indicator of the potential of ICT research to address at least some of the major human development problems. Patents are but one indicator of innovation. Phenomenal increases in ICT patent filings have been seen over the past decade. Information and communication technology (ICT) patents filed by the 30 member countries of the Organisation for Economic Co-operation and Development (OECD) with the European Patent Office (EPO) made up 16.4% of their total national patents [20]. By the year 2000, ICT patent filings with the EPO made up over 34% of their total national patents [21]. Between 1990 and 1995, investment in ICT contributed an average of 34% to the growth of GDP across member countries. This increased to 55% between 1995 and 2003 [22].²

Even more phenomenal innovation can be seen outside of the restrictive, and arguably counter-productive, application of patent and copyright regimes. The community of free and open source software (FOSS) has seen phenomenal growth

¹ These ITU data were collected from 206 economic areas with populations greater than 40,000 (ITU May, p.9).

² Only 19 of 30 member countries are accounted for in the data cited here due to a reporting threshold set by the OECD.

over the past decade. FOSS has been responsible for making numerous free (or low total cost of ownership) solutions to individuals and communities, including operating systems, document processing applications, and web-based content management systems. Open specification hardware, in analogue to FOSS, is perhaps less familiar to many, but is hardly new. The seeking of ICT-based solutions has had to include consideration of low cost, public domain or open source solutions. Open technologies will enable communities to be more self-sufficient in replicating, maintaining and enhancing ICT-based development projects. This approach allows a community to have complete access to the internal workings of the technologies they use. Many open technologies have no cost licensing, alleviating developers of much of the costs of acquiring technologies.

The crucial point is that the costs, processing power, portability, energy consumption rates of commodity ICTs are now such that there is little excuse for not vigorously searching for ways that they can contribute to addressing major human development issues.

4 Tasks and Challenges

Disciplines such as computer science and mathematics periodically develop “grand challenge” problems, sets of problems whose solutions are necessary to make major progress in a field and which possibly offer applications that would significantly advance society. One example is supercomputing [23]. The challenge in developing technological contributions to solving human development issues is unique relative to traditional management information systems in that they must be socially and culturally appropriate and operationally, economically, environmentally, and socially sustainable. This is especially true for developing and least developed countries, where resources and training are certainly scarcer than in most communities.

A significant amount of community informatics-related praxis targeting issues in the MDG sphere has already taken place. This can be seen in numerous FOSS projects, the development of telecentres around the world, and numerous ICT training and policy projects. An examination of projects developed by NGOs that participated in the WSIS provides a good sample of this type of work.

Still, there is much to be gained from developing a systematic community informatics approach wherein best practices from “work on the ground” can be shared and taught within established research and pedagogical networks. Two major tasks must be pursued for such a process to commence: systematic stocktaking and the development of a comprehensive community informatics curriculum.

Stocktaking is a necessary part of any institutional programme, in this case the academic discipline of community informatics. An ongoing process is needed to assess its contributions, shortcomings, and strategic directions. Issues in the MDG sphere should be a special focus of this stocktaking.

The development of a community informatics curriculum has been discussed within the Community Informatics Research Network (CIRN), arguably the main body for this discipline. This work must be completed. Such a curriculum is a necessary framework for stocktaking to be performed and for establishing strategic directions for the discipline. An analogous relationship can be seen in the Association of Computing Machinery's computing curricula, which have for over forty years been critical components in the creation of institutional road maps for computer science and related areas of engineering [24].

Several research and development challenges exist for which efforts must be redoubled -- some of these are already well-known: furthering the understanding of

sustainability, development of educational resources for developing and least developed countries, and addressing rural and remote issues.

The development of sustainable ICT contributions to MDG sphere issues must address constraints in several dimensions. These include, but are not limited to: economic sustainability, environmental sustainability, and the development of productive forces within target communities. Economic sustainability of ICT projects is crucial and has been addressed extensively. Greater attention must be given to creating ICT life cycles which are environmentally sustainable. Significant progress has been made over the past two decades in reducing energy consumption, including processors, energy-aware software behaviour, and applications of LED technology. Practical, environmentally-sustainable solutions to power generation, particularly for remote applications are now more widely available. One interesting example is the recent development of an integrated solar powered WiFi solution designed specifically for constraints faced by developing countries [25]. There also exists an emerging telecommunication sector that is focused on developing low cost wireless communications devices, such as VoIP mobile telephones; and systems that permit the implementation of community-based telephone and cable television cooperatives [26, 27].

Work remains, however, on managing the end of the life cycle for hardware. Many developing and least developed countries have themselves become victim to the end of the supply chain of hardware consumption through dumping and the harvesting of parts under dangerous labor conditions. What is required is a commitment to evolving “cradle to cradle” design of hardware and system life cycles, where these activities are no longer environmentally damaging nor hazardous to workers [28].

Sustainability within community informatics must also include development of productive forces within target communities themselves for creating and managing ICT. Participation is a necessary but insufficient condition for ICT design to be effective. Among the greatest threats of new technologies is that they have the potential to perpetuate and expand existing power relations and inequalities, as well as to enable new forms of state repression. To empower communities to respond to and avoid these threats, community informatics must enable a fully democratic and consensual process. That is, it must facilitate more than political democracy embodied in participatory ICT design approaches. Community informatics must go beyond this to enable people to share control of the decision making around the economic, cultural, environmental and other issues regarding ICT-based projects. More fundamentally, community informatics must empower communities that contemplate ICT-based solutions to develop their own productive forces within the information society so that they can control the modes of production that evolve within it and, thereby, have the possibility of preventing and responding to its threats.³ FOSS as a mode of production is a prime example. In this case, it can enable communities to develop their own means of creating software. A current example of these principles being put into practice is the decision by the Extremadura region of Spain to implement ICT solutions that are completely open source, including the use of the Open Document Format (ODF) [29].

The fundamental requirement for creating this type of productive capacity within developing and least developed countries is the creation of educational resources. Text books are too expensive for many students in developed countries; access to such material in developing and least developed countries is all but impossible. The creation of free educational literature is the only practical approach to solving this problem. One new model is the Global Text Project, which plans to write electronic text books across all major academic disciplines using collaborative web technologies

³ The author has long been inspired by various writings of Walter Rodney [31] and Amílcar Cabral [32] in this context. For comprehensive treatment of these issues see Powell [33].

[30]. Community informatics can make significant contributions to such efforts not only in developing content, but in supporting and improving these types of educational models through the development of low cost ICTs that are sustainable in developing countries, including rural and remote regions. Specific research problems, include improving support for natural language translation of texts and optimizing document caching and delivery mechanisms to operate in low bandwidth and low connectivity environments.

5 Conclusions

This paper is the beginning of a process. It is a call for a consensual and democratic process to commence within existing networks, such as CIRN, to more fully develop this vision of linking community informatics more closely to the pursuit of the Millennium Development Goals and the improvement of human development in general. The community informatics community has a unique opportunity following the WSIS and the processes it has set in motion to help shape information societies for human needs. It can, in particular, help to focus ICT research, design, and implementation on addressing the most pressing human development issues. This includes directing parts of its research and pedagogy on developing a more effective praxis for this purpose and on continuing to evolve its networks of practitioners. Finally, the community informatics community must also oppose designs and applications of ICTs that perpetuate social, economic, and political inequality and contribute to armed conflict.

Acknowledgments. The author thanks Aldo de Moor and Michael Gurstein for their in-depth comments on this paper.

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Appendix: An Overview of Human Development Indicators

The United Nations (UN) classifies “extreme poverty” the condition of living on less than \$1 (US) per day. The United Nations Development Programme (UNDP) reported that the global proportion of people living in extreme poverty in 2001 as 20.7%. The proportion in Sub-Saharan Africa in 2001 was 46.4% [1].

The UNDP estimates that over 100 million children of primary school age are not enrolled in school, over 42 million of these are in South Asia [1].

The UNDP reported that from 1980 to the present, the child mortality in Sub-Saharan Africa increased from 13 to 29 times the rate of developed countries [1].

The UNDP estimates that over 1 billion people lacked access to clean water, 55 million of these are in Latin America and the Caribbean [1]. The World Water Council reports that in many regions around the globe increases in population, contamination, agricultural practices, and political conflicts continue in combination to create or heighten water scarcity [2]. The World Health Organization (WHO) reported in 2004 that 1.8 million people die annually because of lack of access to clean water [3].

The United Nations Programme on HIV/AIDS (UNAIDS) estimated that 38.6 million people were living with HIV in 2005, up from 36.2 million in 2003 [4]. An estimated 4.1 million adults and children were newly infected by HIV in 2005, up from 3.9 million in 2003. The global prevalence rate of people living with HIV has leveled off at 1% between 2003 and 2005, but the epidemic continues to expand in Southern Africa [4].

HIV/AIDS must be viewed from the perspective of its current and future impacts, however. So significant are they that UNAIDS has predicted that societal changes brought about by HIV/AIDS and the inability to respond adequately will impede attainment of the MDGs. This prediction is based on expected reductions in population overall; deaths of professionals, such as doctors and teachers in particular; and socio-economic shifts that have resulted, such as reductions in productivity as able-bodied people are forced to care for family members who are sick. Population reductions of over 100 million by 2015 – the year set by the United Nations for its Millennium Development Goal targets -- are predicted for the top 60 countries impacted the most by the epidemic [4]. The UNAIDS “2006 Report on the global AIDS epidemic” shows that Sub-Saharan Africa and Asia are currently experiencing the most significant impacts. In Sub-Saharan Africa, deaths from AIDS are already significantly impacting access to education, medical care, and other facets of a welfare state assumed by most in the developed world, as teachers, doctors and nurses, and professionals are themselves infected.^{4,5}

The UNDP estimates that over 50 million girls of primary school age are not enrolled in school, over 5 million in Arab countries. Women and girls are at greater risk than men for living in extreme poverty and women are at greater risk for becoming infected with HIV.

Armed inter-state and intra-state conflicts have occurred on grounds of ethnicity, religion, and competition over territory and resources. They have been the cause of sustained damage to social and political infrastructure, which amplify social crises such as those surveyed above. Genocide has been formally recognized in several of these wars (see [6] and [7]).

⁴ HIV InSite (<http://hivinsite.ucsf.edu/>) provides a comprehensive set of statistics sources dealing with HIV/AIDS.

⁵ Former United Nations Ambassador and Special UN Envoy on HIV/AIDS, Stephen Lewis paints a vivid picture of these impacts [5].