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## COMMUNITY INFORMATICS: BUILDING LEARNING COMMUNITIES FROM THE INSIDE OUT

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### ABSTRACT

Community Informatics is an emerging area which examines issues related to the education of the community about the use of Internet technologies for social and economic development. As such, community informatics projects are examples of lifelong education. The purpose of this paper is to analyse the emerging literature on community informatics as a basis for our model of community informatics. We start by presenting the major themes in the research to date. The review is intended to highlight the variables that have been outlined by previous research as determinants of successful or unsuccessful diffusion of information technologies in organisations. We conclude this discussion by outlining the variables from the diffusion literature that can be used as the building blocks for a theoretical model of community informatics. We end the paper with an outline of the major directions for future research emanating from our model.

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### INTRODUCTION

The term 'community informatics' (CI) is defined in this paper as a technology strategy or discipline that focuses on the use of Information Technology (IT) by territorial communities. As indicated by Gurstein (1999), CI links economic and social development at the community level with emerging opportunities in such areas as electronic commerce, community and civic networks and tele-centres, electronic democracy, self-help, advocacy, and cultural enhancement. As such, this term brings together IT and information systems with community development.

As an area of research, CI can be regarded as the body of theory underlying one of the most exciting phenomena of the last decade, namely the diffusion and use of Internet technologies within communities. The Smart Communities movement, as it is often referred to in the popular press (Eger, 1997a; Canadian Government, 1998; and Nordicity, 1997), is a social reality not just in North America and Europe, but also in Asia, Australia, and the Middle East. There are also large-scale CI projects in South America and Africa. The Smart Communities movement is a world phenomenon, encompassing communities in both developed and developing countries, though perhaps not to the same extent. Generally speaking, the Smart Communities movement seems to be driven from the top (by public agencies), as opposed to the Community Networking movement, which is similar in most attributes but seems to be driven from the community level (AFCN, 1999).

The purpose of this paper is to analyse the emerging literature on CI as a basis for our model

of CI diffusion. Even though our literature review is not anchored in the literature on lifelong learning, we consider the process of IT diffusion in communities as an example of lifelong learning, as it involves the acquisition of new skills by adults as a means for bettering their individual and collective community capacity. We start with a review of the major themes in the research on CI to date. Because one of the major themes addressed by the literature is diffusion of IT within communities, we proceed to review the literature on diffusion and implementation of information systems in general. Given that much of the literature on diffusion is based on formal work organisations, we conclude this discussion by outlining the variables from the diffusion literature that can be used as the building blocks for a theoretical model of CI. We conclude with an outline of the major directions for future research emanating from our model.

### LITERATURE REVIEW

A review of the literature on CI reveals that it focuses on the following themes:

#### **Why is it important for communities to learn to use IT?**

The answer that is provided by the literature to this question is that communities are now part of the global village and no longer exist in isolation within 'nation states'. The pressures of globalisation mean that communities need to learn to benefit from this new economic and social reality. Otherwise, they will be left behind. It is suggested in the literature that the only way that communities, particularly in regional and rural areas, can survive in this new

world order is for them to use IT for linking with the global village (Ohmae, 1995; Caves and Walshok 1997; Eger, 1997a and 1997 b; Canadian Government, 1998; Lankester, 1998; and Giddens, 1999).

Another reason that has been mentioned in the literature as a driver of CI is the need to combat community fragmentation. Thus, some authors suggest that information systems can counteract the increased sense of disconnectedness (UNDP, 1999; AFCN, 1999).

It is important to note that not all the literature in this area is in agreement that it is important or even beneficial for communities to learn to use IT for communication among their members. As indicated by Kling (1996), in a paper that focuses on the use of Internet technologies by communities in California, the ways that people work and communicate via computer networks could potentially "destabilize conventional social categories".

### **How can IT's support community development?**

It is suggested in the literature that IT's can support community development through helping communities identify and harness local commitment, resources, and skills (Canadian Government, 1997; Eger, 1997b; Dohney-Farina, 1997; Pigg, 1998; AFCN, 1999). The assumption is that once community efforts are put together, the resulting joint effort would lead to stimulation of sustainable local economic activity and improvement of quality of life (Aspen Institute, 1996). This assertion is based on the premise that communities have considerable untapped capacity and that IT's can help them become aware of this capacity and bring it to fruition.

### **What makes CI effective in some communities?**

One of the most important themes in the literature on CI is the search for effective means for diffusing IT within communities. In this context several success stories are frequently quoted. The first of these, the Missouri Express Project, was established in Missouri in 1993. This project aimed to connect 80 communities in Community Information Networks (CIN's) over a three-year period (Pigg, 1998). The emergence of the Smart Communities concepts in San Deigo in 1994, led to the establishment of the World Foundation of Smart Communities in 1997 (Eger, 1997). The approach underlying these projects was based on a wide variety of IT applications intended to create vibrant

sustainable regional economies through targeting business and formal educational processes.

One of the early attempts to identify issues that can help remote communities benefit from CI was initiated by Gurstein (1999). In his discussion of the CI Project at Cape Britton, Nova Scotia, which he initiated and led, Gurstein mentioned the following as potential advantages of CI for remote communities: (1) overcoming distance insensitivity, (2) achieving local ownership and management of local information, (3) making tele-work possible, (4) enabling local nuance in the processing of information, (5) promotion of flexibility for small scale distributed production, and (6) obtaining economies of dis-aggregation.

In the same study, Gurstein identified three strategies for CI as an enabler of community economic development: (1) using it as a 'marketing tool' for small business; (2) using it as an 'enabler' for the mobilization of a wider range of resources for community economic development, and (3) and using it as a 'distributed networker' for the emergence of new networks and economies of 'dis aggregation'.

In a recent review of the Access Indiana project which funded the establishment of twenty eight community networks, Rosenbaum and Gregson (1998), listed the following as factors that contribute to the success of CI projects:

- integration into the routine life of the community,
- local content for local needs,
- linkage to local government, schools, and social services, and
- processes that define long term sustainability.

### **What factors can interfere with the successful diffusion of IT within communities?**

Gurstein's work (1996,1999) also heralded the beginning of the search for factors that may hinder the successful diffusion of IT within communities. Based on his findings, Gurstein indicated that less than successful CI projects were associated with the failure to link the projects with local economic activity and to unite community efforts behind strong leadership. In this context, Gurstein (1999) saw the use of CI as a double edged sword. Whilst it could facilitate community development, it could also be associated with discord within the community resulting from the differential effect on various community stakeholders.

Another study that attempted to identify factors that hinder successful diffusion of IT within communities was undertaken by Scott et al, (1997). This study was based on the first and largest CI project in Australia. It involved the establishment of 450 public access points across three Australian States. The most important shortcoming of this project was that its facilities were under-utilized. The authors saw the fact that the project was based on public rather than private access points as the major reason for its limited success. They recommended that in future, public funded CI projects should strive to encourage private access points (through local ISP's) and invest in raising community awareness of Internet technologies through promotion and training activities.

In summary, even though the identification of issues that help or hinder diffusion of IT within communities is of much concern to practitioners and researchers, not much has been done to conceptualize or study it (Kling, 1999). Our model, presented in the following sections, focuses specifically on diffusion of IT within communities as the key for understanding and promoting CI.

### Toward a model of CI

Given the importance of diffusion issues for our understanding of CI, it is necessary to start the discussion with a review of the literature on diffusion and implementation of IT in general. The following discussion is based on literature reviews by Markus (1994) and Romm et al, 1997. Both papers considered the diffusion and implementation of IT within formal work organizations. As such, the relevance of the discussion to CI is an issue that would need to be carefully considered.

The literature on diffusion of IT discusses it mostly from a **negative** perspective, namely, what factors would lead potential users to **resist** the new technology rather than embrace it. It is in the context of resistance that two sets of theories that explain diffusion have been proposed. The first set of theories looks at diffusion in the context of individual behavior, namely, the reasons that would lead individuals to resist the adoption of a new technology. The second set of theories looks at diffusion from a collective perspective, namely, the reasons that would lead groups (or whole organizations) to resist the adoption of a new technology.

The individual theories of resistance focus on three major variables. The first of these is the traditional **Technological** theme or the un-friendliness of the package (Culnan, 1984). As IT has matured and become easier to use, other issues affecting diffusion have emerged. Non-technological variables at the individual level were grouped under **Motivation** and **Task**. Motivation was used to

describe issues such as conservatism, fear of change, lack of involvement, and incompatible cognitive style. The task variable covered issues of perceived appropriateness of the technology for the task being undertaken. This variable was discussed particularly in relation to "richness theory", namely, the degree to which the technology was able to support the information requirements of the task (Daft and Lengel, 1986). The Technology Acceptance Model (TAM) described by Davis et al, (1989) explains individual technology diffusion in terms of perceived usefulness and ease of use, which basically combines the first two variables in the above conceptualization.

At the collective or system level, Markus (1994) describes how diffusion of IT can be enhanced by recognizing the social aspects of utilization, namely, the degree to which the technology is perceived as appropriate by the community of potential users. The major variables that have been listed under the collective level were **structure**, **environment**, **politics**, and **culture**.

- Structure-oriented theories concern "the match between the structural characteristics of an organization and different system design attributes" (Markus and Robey, 1983, p 209). Thus, a system might be resisted when its implementation is seen as threatening the current structural characteristics of the organization (Rice, 1980; Olson and Lucas, 1982).
- Environment-oriented theories concern "the fit between system design characteristics and the environment of the organization in which it is used" (Markus and Robey, 1983, p 211).
- Politics-oriented theories concern resistance to implementation of an information system "because it causes a redistribution of power unacceptable to those losing power" (Markus and Robey, 1983, p 210). These theories assume that individuals are likely to consider systems more or less appropriate depending on whether they stand to gain or lose power from the system's implementation.
- Culture-oriented theories concern "the fit between the organizational culture presumed in the design of the system and the actual organizational culture in the implementing organization" (Pliskin, et al, 1993, p 2).

## HOW CAN WE APPLY THE ABOVE VARIABLES TO DIFFUSION OF IT WITHIN COMMUNITIES?

When we consider the above variables in the context of communities, it becomes apparent that they are only partially relevant. In the following discussion we will study the relevance of these variables to CI and explain how, if at all, they can be used to enhance our understanding of CI.

- **Technology** – Given that CI focuses on the whole community, including its less computer literate members, it is, indeed, important that technologies that are diffused within communities are perceived as user friendly.
- **Motivation** – When it comes to CI, there is no question that the motivation of individual members within the community can make a difference to the success or failure prospects of a CI project.
- **Task** – There is no doubt that this variable would affect the success or failure prospects of a CI project. If members of the community cannot see how the technologies can be of use to them, they are not likely to adopt them.
- **Structure** – Given that CI focuses on non-formal organisations which, by definition, do not have a formal structure, we cannot expect projects that are introduced to such organizations to change their structure. Hence, this variable is not included in our model of CI.
- **Environment** – This variable would translate as changes to the social and economic environment in which the community as a whole is operating. For example, living in a remote area such as Cape Breton, Nova Scotia (as reported by Gurstein, 1999) would work as an incentive for community members to embrace Internet technologies as a means for marketing their unique products.
- **Politics** – This variable would refer to the degree to which the community as a whole is characterized by harmonious relationships between its members. It would also translate into the degree to which the

members of the community support their leaders in their effort to diffuse the new technologies.

- **Culture** – This variable would suggest that the culture of the community to which the new IT's are being introduced has to be compatible with the goals of the project in order for the project to succeed.

Before we proceed to present our CI model, there is one more important issue that needs to be considered. This issue is the **nature** of the diffusion process itself. While the above variables are independent variables in the sense that they explain issues that **affect** the outcome of the diffusion process, the actual manifestation of the diffusion process, the how, where, and what of it, deserves some consideration too, as it may not be the same in the context of CI.

An important distinction that needs to be made in this context is between the quantitative aspects of diffusion, or its **rate**, as opposed to the qualitative aspects of diffusion, or its **depth**.

The discussion of diffusion within the context of work organizations seems to focus on quantitative measures of diffusion. Thus, the number of users who actually adopt the new technology is seen as the most important criterion for how well diffused the technology is. The emerging literature on CI (see in particular, Gregor and Jones, 1998; Kling, 1996; Kling, 1999; Rosenbaum and Gregson, 1998) seems to suggest that when it comes to diffusion of Internet technologies within communities, qualitative measures which reflect depth of diffusion should be considered too. Thus, issues such as who is using the Internet (adult males, adult females, male children or female children), as well as, for how long and for what purposes, are of utmost importance.

Figure 1 presents the relationship between the independent variables and dependent variables in our CI model.

As indicated in Figure 1, the model differentiates between individual and collective level variables as independent variables affecting the diffusion process. The model assumes that there are complex relationships between the independent variables (indicated by the arrows that connect them) and that there are feedback processes that lead back from the dependent variable to the independent variables (indicated by the arrow at the bottom of the figure).

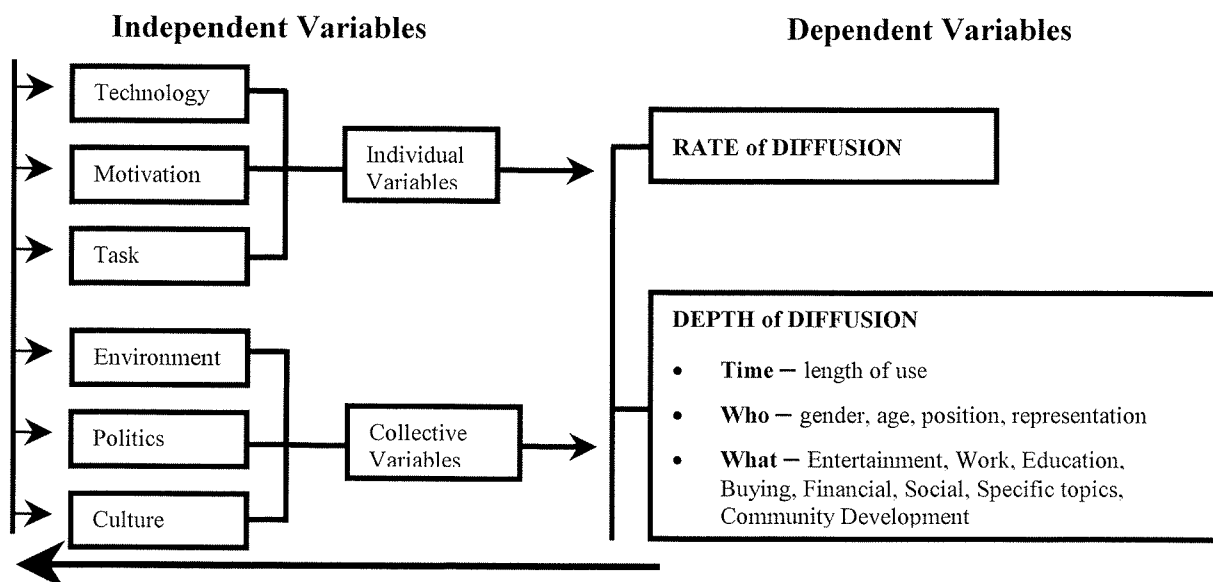


Figure 1. The Community Informatics Model

## DISCUSSION

The CI model presented in the previous sections can inspire debate and empirical investigation into a number of questions that are crucial to CI as an area of research and practice.

The first question relates to the relationship between the independent and dependent variables that contribute to the dynamics of diffusion within communities. The model identifies six independent variables that affect diffusion of technologies within communities, and two dependent variables that act as sub-components of diffusion within communities. Even though the model does not specifically explain the nature of the relationship between the independent and dependent variables, it suggests that changes in the one set of variables would result in changes to the other set.

It is our belief that the link between the independent and dependent variables in the model can shed light on one of the questions that is at the heart of the debate on CI, namely, the causes of the 'digital divide'. As noted by a number of authors (AFCN, 1999; Drucker, 1995; Gurstein, 1999; Kling, 1999; Ohmae, 1995; UNDP, 1999; Steinfield and Klein, 1999) the digital divide, namely the gap between the 'information haves and have nots', is a curious phenomenon because it doesn't seem to follow the

usual distinction between the developed and developing countries. Some communities who can boast success stories in the area of CI are located in developing countries, while many communities with extremely low levels of diffusion of IT's are actually located in developed countries.

Our model suggests that one way to understand the digital divide is to view it as a phenomenon that reflects different values of the independent

variables. Thus, a community whose members perceive Internet technologies as difficult to use (the Technology variable), un-exciting (the Motivation variable), and irrelevant (the Task variable) would be less inclined to adopt these technologies even if it has the financial resources to do so. Conversely, a highly cohesive community (the Politics variable), whose members believe that Internet technologies are compatible with their value system (the Culture Variable) and see these technologies as a means for gaining an important competitive advantage (the Environment variable), would be inclined to embrace these technologies even if their financial and educational resources may be quite limited.

A second question that the model can inspire debate and empirical research into is the **nature** of the change process associated with CI projects. Our model implies that the variables that are outlined in it remain valid over the duration of the change process. An interesting set of empirical questions relevant to this issue would be:

- How do CI projects change over time?
- Do the attitudes of community change over time?
- Does the behavior of community members change over time?
- Are the changes in both attitudes and behavior gradual (evolutionary) or abrupt (revolutionary)?

Finally, our model can inspire debate into managerial and leadership aspects of CI projects. It is not a coincidence that our model emphasizes the tension between the individual and collective aspects of the diffusion process. This tension is at the heart of CI as an area of inquiry and research. It

underlies an interesting paradox on which CI is based. This paradox concerns the fact that CI is about the diffusion of technologies that have the power to either disintegrate or integrate communities. Another way of putting it is to suggest that these technologies have the potential to democratize or centralize communities, thus strengthening either the collective (through decentralization) or a few individuals who rule it (through centralization).

The tension between the individual and collective aspects of CI can inspire quite a few interesting empirical investigations that look at the managerial and collective issues of diffusion projects. Employing a combination of qualitative and quantitative research methodologies, case studies that capture the totality of the diffusion project can be put together. Such case studies can reveal the interplay between who initiates the CI project, who leads it, who contributes the resources, and who sustains it during the duration of the project life. Based on such case study research, preferably within and across cultures, it would be possible to test our model, and, consequently, to determine empirically the factors that lead to success or failure of CI projects.

## REFERENCES

- AFCN. (1999). Association for Community Networking. Retrieved from the World Wide Web: <http://bcn.boulder.co.us/afcn/intro.html>
- Aspen Institute, (1996). Measuring Community Capacity. Washington DC: The Aspen Institute.
- Canadian Government. (1998) Smart Communities Retrieved from the World Wide Web: <http://smartcommunities.ic.gc.ca/smart/indexen.htm>
- Caves, R., & Walshok, M. (1997 Nov-Dec.). Transforming regions through information technology. Developing smart communities in California. California County Magazine 29-31. Retrieved from the World Wide Web: <http://www.smartcommunities.org/pub/transform.htm>.
- Culnan, M. (1984). The dimensions of accessibility of online information: implications for implementing office information systems. ACM Transactions on Office Information Systems 2(2). 141-150
- Daft, R. & Lengel, R. (1986). Organizational information requirements, media richness and structural design. Management Science 32(5), 554-571.
- Davis, F.D., Bagozzi, R.P., & Warshaw, P.R. (1989). User acceptance of computer technology: A comparison of two theoretical models. Management Science 35(8), 982-1003.
- Dohney-Farina, S. (1997). The wired neighborhood. New Haven CT: Yale University Press.
- Drucker, P. (1995). Managing in a time of great change. New York: Truman Talley Books.
- Eger, J. (1997a). How California's communities can thrive in the digital age. International Centre for Communications, San Diego State University.
- Eger, J. (1997b, October 26). Cyberspace and Cyberplace: Building smart communities of tomorrow. San Diego Union-Tribune.
- Giddens, A. (1999). Runaway World. BBC Reith Lectures, 1999. Retrieved from the World Wide Web: [http://news.bbc.co.uk/hi/english/static/events/reith\\_99](http://news.bbc.co.uk/hi/english/static/events/reith_99)
- Gregor, S. & Jones, K. (1998) Beef producers on line: Diffusion theory applied. Information Technology and People, 12(1), 71-85.
- Gurstein, M. (1996). Managing technology for community economic development in a Non-Metropolitan Environment. UNESCO International Conference on Technology Management, Istanbul, Turkey. Retrieved from the World Wide Web: <http://ccen.uccb.ns.ca/articles/nonmet2.html>
- Gurstein, M. (1999). Flexible networking, information and communications technology and Local Economic Development. First Monday 4(2). Retrieved from the World Wide Web: [http://www.firstmonday.dk/issues/issue4\\_2/gurstein/index.html](http://www.firstmonday.dk/issues/issue4_2/gurstein/index.html)
- Kling, R. (1996). Social relationships in electronic forums: hangouts, salons, workplaces and communities. Section IV In R. Kling (Ed.) Compertization and Controversy: Value conflicts and social choices. San Diego: Academic Press.
- Kling, R. (1999). What is social informatics and why does it matter? D-Lib Magazine, 5(1).
- Lanckester, C. (1998). The Internet and developing countries: A new paradigm. Proceedings Networks Conference, Bangalore 3-6 June. Retrieved from the World Wide Web: <http://www.sdnf.undp.org/papaers/wru.htm>
- Markus, M.L. (1994). Electronic mail as a medium for managerial choice. Organization Science 5(4), 502-527.
- Markus, M.L., & Robey, D. (1983). The organisational validity of management systems, Human Relations 36(3), 203-226.
- Nordicity. (1997). Community experiences with information and communications technology-enabled development in Canada. International Development Research Center, Canadian Government. Retrieved from the World Wide Web: <http://www.idrc.ca/acacia/nordicity/title.htm>
- Ohmae, K. (1995). The end of the nation state: the rise of regional economies. New York: Free Press.

Olson, M. M. H., & Lucas, H. C., Jr. (1982) The impact of office Automation on the organization: Some implications for research and practice. Communications of the ACM, 25(11), 838-847.

Pigg, K. (1998). Missouri Express: Program implementation assessment. Missouri: Missouri University. Retrieved from the World Wide Web: <http://outreach.missouri.edu/moexpress/>

Pliskin, N, Romm, T., Lee, A.S., & Weber, Y. (1993). Presumed versus actual organisational culture: managerial implications for implementation of information systems The Computer Journal, 36(2), 1-10.

Rice, R.E. (1980). Impacts of organizational and interpersonal computer-mediated communication. In M. Williams (Ed.). Annual Review of Information Science and Technology, 15, pp 221-249. White Plains, NY: Knowledge Industry Publications.

Romm, C., Pliskin, N., & Clarke, R. (1997). Virtual Communities and Society: Toward and integrative three phase model. International Journal of Information Management, 17 (4) 261-270.

Rosenbaum, H., & Gregson, K. (1998). A study of state funded community networks in Indiana. Indiana Department of Education, Center for School Improvement and Performance. Retrieved from the World Wide Web: <http://memex.lib.indiana.edu/hrosenba/www/research/co-mmnet/exec.html>

Scott, M., Diamond, A., & Smith, B. (1997). Opportunities for communities: Public access to networked IT. Canberra: Department of Social Security.

Steinfeld, C., & Klein, S. (1999). Local versus global issues in electronic commerce. Electronic Markets, 9(1).

UNDP. (1999). The Human Development Report. The United Nations Development Program. Cary, NC: Oxford University Press.