

WHAT LIES BEYOND VIRTUAL COMMUNITY INFORMATICS – EXPANDING A RESEARCH AGENDA

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ABSTRACT

The paper suggests directions for future work by bringing together the perspectives of researchers in community informatics (CI) and community operations research (COR). It begins with the assumption that community informatics has evolved into a broader field which includes also virtual CI. The outlined possibilities for future research in CI result from an analysis of past critiques of community informatics and of the evolution of group support systems and COR. The presented ideas complement and expand an earlier research agenda for virtual community informatics, aiming at the development of a better understanding of the needs for networking of virtual and physical communities.

INTRODUCTION

Keeble and Loader (2001) define community informatics (CI) in a broad way which offers on the one hand, the opportunity to investigate the rich diversity of virtual communities that are forming between individuals influenced by information and communication technologies, and on the other hand, it enables the investigation of how they can support networks of people who already know each other. Historically however, community informatics was associated with

the narrower question how information technology supported the interaction of physical communities (see Gurstein, 2000). This has changed over the years and its meaning today is wider as Keeble and Loader (2001) imply. For example, in 2002 Bieber and Gurstein proposed a new term/field, called (virtual) community informatics, to include community informatics, virtual community informatics, and communities of practice. Bieber and Gurstein (2002) also suggested that all three fields could benefit from the concepts, techniques, practices and suites of tools being

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developed separately for each of them. They espoused that this new field lies in the center of a hub bringing together people concerned with local communities, virtual communities, and communities of practice, and facilitates structuring collaborations between researchers and practitioners, including industry, in these three domains.

Gurstein (2004:3) went further by dropping (virtual) from the above notion and uses instead just the term community informatics in a way that is similar to the views of Keeble and Loader (2001). He notes: "...it is my personal belief that there is a necessary convergence between enabling physical and virtual communities through information and communications technologies (ICTs) and that the ultimate power of the technology for communities arises when the use of the technology as between the physical and the virtual becomes seamless and invisible..." (Gurstein, 2004:3). This integrative understanding of the notion of "community informatics" expressed by Gurstein (2004) requires a new vision for possible research efforts in this evolving field and that was one of the motivations for the work, reported here.

We were also inspired by an insightful publication by Lee, Vogel and Limayem (2003). They categorize virtual community research into five stages of growth, based on an earlier paper by Lai and Mahapatra (1997). Lee, Vogel and Limayem (2003) suggested a research agenda in virtual community informatics (VCI) that is summarized in Table 1.

According to Lee, Vogel and Limayem (2003), a virtual community is "a cyberspace community supported by computer-based information technology, centered around communication and interaction among participants to generate member driven contents, resulting in the development of relationships". This definition seems to imply that relationships will be built up as a result of technology influence. A potential remark could be that this is an optimistic assumption and it does not hint any possibility that the relationship might be also physical. The notion of virtual community informatics is quite narrow as sooner or later the boundary

CONTRIBUTION

This paper makes three contributions:

- it provides a comparative analysis of research issues in community informatics and community operations research and derives potential lessons for CI researchers;
- it establishes a link between the evolution of past work in group support systems and previous critiques of community informatics research. It informs further the need to promote the support of community building through cooperation between community informatics and community operations research;
- it expands Lee, Vogel and Limayem's (2003) CI research agenda, aiming to supplement their ideas in several ways, leading to a more comprehensive research agenda in community informatics, providing better understanding of the needs for computerized support for virtual and physical communities.

between the virtual and the physical relationship becomes blurred. Sticking to the assumptions of such a definition appears to leave open the question of what to do with respect to the need for computerized networking support in existing physical communities, or in communities characterized by both physical and virtual interaction.

The agenda for virtual community research by Lee, Vogel and Limayem (2003) is well justified given its purpose. The stages of growth of the CI field present a convenient framework for structuring research. The suggested research methods are widely used and appropriate for virtual communities. Since there is no assumption for direct human interaction within such communities and between the communities and the researcher, their inclusion of positivist research methods is appropriate. However, following the ideas of Bieber and Gurstein (2002) and Gurstein (2004), we believe that information systems scholars and practitioners will have a stronger impact on society by considering the broader

Table 1. The five stages of growth of virtual community (VC) research and the research agenda issues in virtual community informatics, based on Lee, Vogel and Limayem (2003)

Stages of growth of virtual community research	Suggested issues for VCI research
Getting a fundamental understanding about the virtual community	Studies to provide better definitions for tools supporting virtual communities, conceptual papers with theoretical frameworks.
Technology development to support communities	Understand the needs of virtual communities using surveys, develop a wider variety of tools and better user interfaces.
Understanding the functions derived from VC Informatics and proposed adoptions for them	Study knowledge transfer in a VC, apply active learning, apply case study method for how knowledge is exchanged in a virtual community
Implementation and outcomes assessment	Study the impact of VC tools on process and outcome variables such as participation, satisfaction, information exchange and emotional support.
Institutionalization of virtual communities, including studies on the impact of virtual communities on electronic commerce	Develop ways to integrate the virtual community with profit making electronic commerce and customer relationship management applications.

notion of community informatics which would include both virtual and physical communities, the involvement of the human element and the interaction between researchers and the communities. As we suggest later on, additional methods would be needed to meet this goal.

Links between community development and information technology (IT) have been explored over the last three decades by sociology, planning and other fields. Among these is also community operations research (COR), a well established branch of operations research (OR), a discipline that has historically influenced the field of information systems. Previous research in COR and complex problem solving (see Petkov, Petkova, Andrew and Nepal, 2006) hinted the search for possible links to CI. Further motivations for this paper were a thoughtful review of the state of community informatics (see Pitkin, 2001) and a thought provoking investigation of two strands in group support systems by Morton, Ackerman and Belton (2003). That led to the generation of ideas for expanding the work by Lee, Vogel and Limayem (2003) to make it applicable to the broader field of community informatics.

The aim of this paper is to propose additional research directions leading to the development of a deeper understanding of the needs for networking of virtual and physical communities by bringing together the perspectives of researchers working in community informatics and community operations research.

We proceed with an overview of some aspects of community informatics and community operations research. We draw conclusions from the evolution of two strands of group support systems as described by Morton, Ackermann and Belton (2003). As a result, we derive some lessons for community informatics and community operations research, followed by an outline of possible steps for further community informatics research initiatives.

SOME RESEARCH ASPECTS OF COMMUNITY INFORMATICS

Community Informatics as an emerging field

For the purpose of this paper, we consider community informatics to be

evolving from the notion of (virtual) community informatics as a collection of many sub-areas within established disciplines, which slowly converge towards the formation of a new field concerning both local and virtual communities. Since virtual community informatics is well researched by Lee, Vogel and Limayem (2003) and others, it will not be discussed here. Communities of practice are investigated in detail by Bieber, Engelbart, Furuta, Hiltz, Noll, Preece, Stohr, Turoff and Van de Walle (2002) and Horan, Arguelles and Worthington (2004) among others; therefore, we will concentrate mainly on community informatics, the third field mentioned by Bieber and Gurstein (2002), having in mind the convergence between the work on supporting both physical and virtual communities with IT, noted by Gurstein (2004).

Community informatics emerged as a field only recently. Previously, related topics were promoted most notably by *The Information Society*, a journal dedicated to social informatics. *The Information Society* published a special issue in 1998 on the prospects of virtual communities. This was followed by two special issues in 2003: on the digital divide and on community networking globalization of electronic commerce (see Kling, Kraemer and Dedrick, 2003 and Special Issues TIS). A focused group of papers on community informatics was published in the 2003 special issue of the *Informing Science* journal (see Pavkov and Winter, 2003 and other articles within this issue). Another journal, dedicated both to social informatics and community informatics, is *Information, Communication and Society*, sponsored by the community informatics research unit at the University of Teeside, United Kingdom (CIRA).

The signs of formation of a new discipline became more evident with the paper collections edited by Gurstein (2000) and Keeble and Loader (2001), followed by the papers in the electronic proceedings of (virtual) community informatics conferences (see Bieber and Gurstein, 2002). Subsequently, the conferences of the recently formed community informatics research network led to the publication of the first several issues of

the *Journal on community informatics* in late 2004 and 2005 (see Gurstein, 2004).

The trend towards the convergence of virtual communities and physical communities noted in the writings of Bieber and Gurstein (2002) and Gurstein (2004) may be observed also in the papers of other leading representatives of the CI scholarly community. Keeble and Loader's (2001) ideas of CI is in concert with Bieber and Gurstein's (2002) thinking, as they consider CI to involve the rich diversity of virtual communities which are forming between normally disparate individuals influenced by communication technologies, and community networks of people who already know and care about each other.

Gurstein (2004:2) provides the most comprehensive multifaceted characterization of the emerging field of community informatics:

“CI is concerned with the processes of communities adapting and transforming, networking and binding, responding to and becoming the authors in the unending and increasingly rapid flow of information within and among communities and between communities and the larger society. CI addresses this process of adaptation and transformation through a systematic concern with the *how* - the infrastructure, the devices, the connectivity of enabling and empowering; the *how to* - the training, the community and organizational development; the necessary conditions - the funding, regulatory environment, the policy frameworks; and finally and perhaps most importantly the *why* - the goals and objectives of enabling and empowering communities.”

The following subsections deal with several aspects of published work in CI.

Past research reviews in CI

There have been several serious attempts to review research in community informatics. Romm and Taylor (2001) identify four main themes in CI: Why is CI important for communities to learn to use? How can CI support community economic and social development? What makes CI effective in some communities? What factors can interfere

in the successful diffusion of CI within communities?

Taylor, Day and Marshal (2002) suggest a framework for research in CI which aims to redefine community engagement with commerce, public agency service provision and governance. A broad agenda for CI research in Canada, based on seven large projects, is presented in Clement, Gurstein, Longford, Luke, Moll and Shade (2004). Further ideas on CI applications in developing countries are formulated by Erwin and Taylor (2004). Finquelievich (2002) raises a set of questions emerging when working on the subject of community informatics in Latin America which seem to be valid for most developing countries.

Loader and Keeble (2004) provide a comprehensive review of past work in community informatics, and suggest the following topics in their research agenda: communities fit for the “information poor”; connecting community places to community spaces; shaping the technology; defining the digital divide and sustainability. Each of those reviews provides complementary valuable insights into various aspects of community informatics research. Our suggestions for extensions of the agenda by Lee, Vogel and Limayem (2003) are drawn partly from this previous research without duplicating it.

Community Informatics as a factor for social transformation

A common issue in the various definitions of CI is the recognition of the role that CI plays *as an enabler of economic development* (see Gurstein, 1999; Gurstein, 2004; Rathwohl, 2003, Keeble and Loader, 2001). Practical work in the field has been the subject of case studies (see Clement, Gurstein, Longford, Luke, Moll and Shade, 2004) or evaluation reviews like the one on community networking and community technological centers, presented by O’Neil (2002). Sustainability of CI initiatives is an issue that is closely related to socio-economic development. This was the focus of the inaugural conference of the community informatics research network in Plato, Italy in 2004 (see Simpson, 2005).

Of particular importance is the notion of community. According to Gurstein (2004:2) “Communities are the bedrock of human development. They ensure the transmission of language and culture. They provide for human security through knowing one’s neighbors. They are the crucible for effective democracy through inculcating values of civic responsibility and active and effective citizenship.” A related notion is community involvement. White (2003:135-136) provides an analysis of various views on community involvement in community operations research projects which is applicable also to CI. He also states that community involvement concerns “simply the active involvement of people sharing in issues which affect their lives” (White, 2003:135). We found little evidence that CI researchers have engaged in measuring the impact of CI upon social improvement. We see a rich opportunity for future work on the social transformation potential of CI. The framework by Lee, Vogel and Limayem (2003) does not include suggestions related to this issue.

On the scope of Community Informatics

A practical difficulty for CI work is the lack of a uniform opinion on the scope of community informatics. Clement, Gurstein, Longford, Luke, Moll and Shade (2004:13) list six areas within CI that encompass a community informatics approach: “access facilities, service design, tele-centre or community access centre design, design of the community system, online service delivery, and online support.” A slightly different set of areas of CI is presented by Gurstein (2000:1): “electronic commerce, community and civic networks and telecenters, electronic democracy and on-line participation, self-help and virtual health communities, advocacy, cultural enhancement, and others.” Keeble and Loader (2001) group the papers in their edited book in four categories: community informatics as place and space; the experience of community informatics; electronic empowerment and surveillance; and policy implications of community informatics. Romm and Taylor’s (2001) view of the scope of CI is more useful to those interested in better implementations of CI projects. On the other hand, Keeble and Loader’s (2001) views reflect the position of a CI user. Further

research on the current views of the scope of CI is needed to reject or confirm the broader integrative view advocated by Gurstein (2004) and supported in this paper.

Design issues in CI

Community informatics projects designs have been discussed more in recent work. Previously the focus of researchers was mostly on application aspects and on socio-technical analysis of CI initiatives, but that is changing. A comprehensive multilevel approach to the design of human services information systems is presented by Pavkov and Winer (2003). Their paper shows how to implement scalable systems that address issues of community involvement, the digital divide and other aspects of providing a new technological solution to the human services system of a county.

Cunliffe and Roberts-Young (2005) analyze 19 Welsh community oriented web sites regarding how they promote community support through a bilingual design involving the Welsh language and English. They found that the analyzed web sites were used fairly passively, largely for presenting information, and that the notion of a participatory online civil society that revitalizes political debate and engages people in political processes still seems to be a distant goal. This is an important issue that requires the attention of the CI researchers and practitioners.

The application of existing design theories in information systems and related disciplines is a potential avenue for building CI applications. Thus Petkov, Petkova, D'Onofrio and Fry (2003) employed the concept of critical success factors to the design of a system for gathering evidence on personnel, technical and environmental factors affecting software development by small IT companies in a regional context. Blythe and Monk (2005) adapt methods from human computer interaction and iterative participative design for the design of Net Neighbours, an online shopping scheme that widens Internet access to older people via volunteer telephone intermediaries (Blythe and Monk, 2005).

Research methods suitable for CI

The theory and practice of community informatics is evolving. In the early years it

was not usual for CI researchers to discuss the applicable theoretical justification of their work. This is changing gradually, but the need for theory development continues to be an issue. Romm and Taylor (2001) stress the importance of longitudinal empirical research of CI applications. Clement, Gurstein, Longford, Luke, Moll and Shade (2004) apply both quantitative and qualitative methods, including action research to seven case studies of CI applications in Canada. A more radical, emancipatory approach is advocated by Graham (2005). Moggridge (2001) provides other theoretical insights according to which community information systems can be explored through human enquiry, a term embracing approaches to development, learning and research which have at their heart a commitment to learning that is with and for the people.

Building cumulative research results in CI will take a significant amount of time. Hence, we consider that it will be of benefit for CI to explore the development in an older field such as community operations research. The latter has a longer history of reflective analysis of success and failure stories in working with communities, as will be shown in the next section.

COMMUNITY OPERATIONS RESEARCH AND COMMUNITY INFORMATICS

Community operations research was initiated about twenty five years ago in the USA and the United Kingdom, when it became clear that the needs of small community groups were different from those of the traditional clients (the corporate sector and government) for operations research. A representative collection of papers in that field is the volume edited by Midgley and Ochoa-Arias (2004). According to Ritchie, Taked and Bryant (1994), community OR can be applied to a diversity of sectors like health, education, housing, employment; it has diverse origins and organisational contexts and is characterized by a diversity of working methods and outcomes as well as research techniques and approaches.

The published literature on COR (see Taked and White, 2000; White, 2003; Midgley and Ochoa-Arias, 2004 and others)

demonstrates close attention to the methodological side of the intervention. A number of relevant methods for community OR were discussed in Jackson (2003). Another valuable collection of methodological papers has been compiled by Rosenhead and Mingers (2001). With the exception of some of the articles in Ritchie, Taket and Bryant (1994), most other publications on COR explicitly declare their methodology which is not often done in CI.

Wong and Mingers (1994) provide an extensive evaluation of the field of community OR in its early years. Rosenhead and Mingers (2001) present a classification of the problems and types of methods appropriate for community operations research (see Table 2).

Problem solving methods are associated with classical operations research. According to Rosenhead and Mingers (2001:350), they are suitable for managing the internal workings of an organization, or when it needs to persuade outside bodies about the quality of its business plan. The same authors conclude that problem structuring methods, with their participative nature, can facilitate the process of attitudinal shift and mutual accommodation through which community organizations move forward (Rosenhead and Mingers, 2001:351).

The existing literature on COR shows that problem structuring methods are used much more commonly than problem solving methods. Rosenhead and Mingers (2001) included in the second edition of their seminal collection papers pertaining to strategic options development and analysis (SODA), soft systems methodology (SSM), strategic choice, robustness analysis and drama theory – probably the best known problem structuring methods. Such approaches are suitable for “messy”, complex, “wicked” problems (see for details Rosenhead and Mingers, 2001:4-6).

Their features can be characterized as the opposite of the traditional operational research; i.e., non-optimizing, providing integration of hard and soft data with social judgements, promoting simplicity and transparency, involving people as active subjects, facilitating planning from the bottom-up, accepting uncertainty and aiming to keep options open (Rosenhead and Mingers, 2001:11). Problem structuring methods are not uniform in their philosophical assumptions. Some of them, like soft systems methodology (Checkland, 1999), belong to the systems thinking field (see Churchman, 1971, Jackson, 2003), whose importance for IS has been rediscovered recently (Ivanov, 2001; Alter, 2004). Ivanov (2001:15) states that researchers in information systems (and in our opinion also in community informatics) “need to employ a systems approach and concentrate on problems that are real ethical dilemmas...” One potential avenue for theoretical and practical exploration is to investigate which combinations of research methods are the most effective and fruitful in CI, and how these methods might be best split up and then linked together in a community based intervention (for a similar idea related to operation research see Rosenhead and Mingers, 2001:351).

If the information needs of a community are considered, one can derive a classification of focus and sub-fields in community informatics similar to the one for COR as shown in Table 2. An examination of published accounts of CI applications shows that most of them are about implementation of problem solving methods. On the other hand, there is very little work done on applying problem structuring methods or systems thinking to issues related to larger groups communicating via information and communication technologies (ICT).

Table 2. Problem/method classification for community operations research (after Rosenhead and Mingers, 2001)

Focus	Field	Indicated Methods
Internal	Physiological	Problem solving
	Resolution of differences	Problem structuring
External	Strategy	Problem structuring
	Persuasion	Problem solving

The CI literature shows that community informatics applications usually involve larger groups, spreading over regions and cities, and rarely, a larger portion of the society like national or international groups. The CI field is influenced strongly by the integration of telecommunications and information technology, and the hopes for economic development associated with that. CI deals with the implications of the new technology for the individual citizen alone and in relation to her role in society or in a regional setting. Rosenhead and Mingers (2001) point out, on the other hand, that traditionally problem structuring methods for COR have been developed on the premise that the group is small, and that the interactions will be face to face. They recognize, however, the increasing importance of virtual groups with the growth of the Internet and conclude that further work is needed on the effect of virtual communication on the quality and depth of the conversation that it can support, and on the role of multimedia on the quality of interaction within groups (Rosenhead and Mingers, 2001). These issues have implications also for CI research.

It would be useful for CI researchers to investigate the lessons learned by tracing the evolution of various applications of community OR since it has more documented success stories. One example could be the findings of White (2003:144) regarding an interesting COR intervention with multicultural groups: “the use of participatory approaches...created a learning environment...coupled with facilitation, this encouraged a diversity of views, the domination of one position was prevented, and individual expertise was drawn upon. This helped the group to unlearn inappropriate experience and to develop a shared understanding of the options opened to the group.” To the best of our knowledge there is no published reference in the field of community informatics that claims to have achieved similar practical results from a CI application.

The next section deals with some critiques of CI and potential implications for CI from the evolution of the field of group support systems. These lessons seem relevant

due to the increasing number of former group support systems researchers working now in virtual community informatics (e.g. see the list of authors in Bieber, Engelbart, Furuta, Hiltz, Noll, Preece, Stohr, Turoff and Van de Walle (2002), Turoff, Hiltz, Bieber, Fjernerstad and Rana (1999) and Lee, Vogel and Limayem (2003)).

SOME REFLECTIONS ON A CRITIQUE OF THE STATE OF COMMUNITY INFORMATICS AND LESSONS FROM THE FIELD OF GROUP SUPPORT SYSTEMS

Our findings showed that there is little research reflecting on the state of the CI field. A notable exception is the paper by Pitkin (2001). A brief summary of Pitkin's (2001) critiques of CI is presented below. These critiques justify some of the directions for future research in CI proposed here.

Discussion of Pitkin's critiques of community informatics

Pitkin's (2001) *methodological critique* of CI is based on the fact that the lack of historical understanding of past technological innovations leads to the myth of the information highway that encourages people to forget that technological development is always part of a social and political context. Important questions raised by Pitkin (2001) include the potential danger of undermining the public, civic sense of cities by promoting virtual community networks, and issues of privacy. Similar concerns are expressed by Rosenhead and Mingers (2001:352).

Pitkin (2001) *questions the philosophical assumptions* of community informatics that place hope in the power of technology to be a catalyst for positive social change, or for improved decision making. An example of such uncritical positive expectation about CI benefits is the statement by Rathswohl (2003:1) that “much effort today in community informatics is finding ways of making the enormous opportunities of Internet connectivity of real value to communities of all types”.

According to Pitkin (2001) *the ideological critiques of CI* can be grouped

with the philosophical one. He suggests that community informatics project leaders should recognize their own privileged position as experts, and understand how this role is challenged in the twenty first century in order not to limit the political viability of their work (see Pitkin, 2001). The issue of the changing role of the facilitator in a community intervention, and the elimination of the role of the “expert” was something that was raised also in the COR field by Taket and White through their participatory action research framework (Taket and White, 2000).

The methodological and philosophical critiques by Pitkin (2001) are further justified when one examines the directions for future research in virtual community informatics in Lee, Vogel and Limayem (2003:57). Their work implies that the potential impact of the promoted technologies can't be anything but positive. Their research framework is focused on investigating the aspects of virtual community informatics related to technology and processes but not the actual quality of human interaction in a given context.

A question that designers of CI need to ask themselves is whether a given project increases the division between the users of the systems and the non-users (Pitkin, 2001). The latter methodological issue is addressed, for example, in Pavkov and Winer (2003) but most CI publications ignore it including the work by Lee, Vogel and Limayem (2003).

The discussion of the critiques of CI in Pitkin (2001) invokes a reference to the deep analysis of technology-driven and model-driven types of group support systems (GSS) provided by Morton, Ackermann and Belton (2003), which is the scope of the next subsection.

Lessons for CI and COR from the evolution of technology-driven and model-driven group support systems

The field of group support systems has evolved over the past 30 years into two quite different strands (see Morton, Ackermann and Belton (2003)). According to those authors, model-driven GSS originated in the operations research/systems field. Their proponents tend to associate them with problem structuring methods, which provide a repertoire of

methods for making progress with ill-structured problem situations (see Rosenhead and Mingers, 2001:9). These are the same methods applicable to COR as discussed in the previous section.

On the other hand, the technology-driven group support systems originated within the IS field. The term provided by Morton, Ackermann and Belton (2003:113) refers to the traditional group support systems field. GSS was one of the dominant areas of IS research in the 1980s and 1990s (see Jessup and Valacich, 1993). More details on the history of the two strands in group support systems and on their comparisons can be found in Morton, Ackermann and Belton (2003). Table 3 illustrates the differences between them.

Morton, Ackermann and Belton (2003) provide interesting conclusions from the comparisons between the explanatory elements, outcomes and process in both traditions of GSS work. They note that neither tradition has been very successful in changing the practice of group decision making. According to Morton, Ackermann and Belton (2003:120) “differences may owe more to the philosophical and methodological differences between the two traditions. The interpretative assumptions of the model-driven tradition may make for a more coherent picture of social process than in the more positivist technology-driven tradition.”

Recognizing on one hand that the two traditions are representing two paradigms, and on the other, the fact that they have to address similar practical and research challenges, Morton, Ackermann and Belton (2003:120-122) suggest that there is a potential for synergy between them at the level of practice and at the level of research.

As noted previously, the methods of model driven GSS research are similar to those of COR. Therefore, it is possible to extrapolate the conclusions by Morton, Ackermann and Belton (2003) regarding the potential synergy between model driven GSS and technology driven GSS, and strive for synergy between CI and COR. A step towards that would be to learn from the history of the development in these two strands of GSS, and to try to avoid a

Table 3. A summary of the differences between the technology-driven and model-driven group support systems (following Morton, Ackermann and Belton (2003)).

Category for Comparison	Type of GSS	Main concepts
Philosophy	Technology-driven	Positivist
	Model-driven	Interpretative
Methodology	Technology-driven	Predominantly experimentation
	Model-driven	Action research
Explanatory Elements	Technology driven	Group/technology/test/context/intervening factors
	Model-driven	Decision models/facilitation/clients/stage
Process	Technology-driven	Process gain models/Adaptive structuration theory
	Model-driven	Interpretative negotiation/problem perception
Outcomes	Technology-driven	Task-related (effectiveness, efficiency) versus social outcomes (satisfaction, consensus, useability)
	Model-driven	Action, Learning

similar divergence between CI and COR as is suggested by some of the proposals in the next section.

EXPANDING THE RESEARCH AGENDA IN COMMUNITY INFORMATICS

Possible areas for further research in virtual CI were identified by Lee, Vogel and Limayem (2003). Their suggestions are applicable also to community informatics as defined by Gurstein (2004) but they are not enough. Since CI is a broader field, we believe that those ideas can be expanded further through greater attention to community needs (both virtual and physical). The analysis of the potential links between community informatics and COR implies that CI practitioners may learn from the experience accumulated in COR and systems applications over the last thirty years.

As noted earlier, our suggestions do not aim to replace the research directions by Lee, Vogel and Limayem (2003) but only to supplement them for the broader CI field. The additional research issues in CI, identified here, are shown in italics for greater clarity. They are listed under the same sub-headings used by Lee, Vogel and Limayem (2003) in

line with their model of research growth in a particular field and to stress the continuity between their work and the one presented here.

Fundamental understanding of CI

The vested interests of members of different types of communities, their cohesion and their access to technology are quite diverse. There is a need for their deeper investigation using specific context situations. The success of CI projects might be positively affected by applying problem structuring methods for analysis of stakeholder interests. Another challenge is the identification of true ethical problems in CI, following Ivanov(2001). This includes finding better ways to understand how to promote community belonging, integrating Internet technology in the everyday lives of people, blending virtual community interaction with face to face communication. This is an open question for all those working in (virtual) CI, COR, sociology and other related fields.

A possible implication for CI from the analysis of methods applied in CI and COR is that it is necessary to consider a greater variety of methods applicable to it and explore how they can be mixed together (see Rosenhead and Mingers, 2001) and whether that may lead

to better results from CI initiatives. A greater diversity of approaches might enable CI researchers and practitioners to be more successful in addressing community informatics problems associated with differences of opinion and strategy formulation in a multicultural environment.

Technology development for CI

In addition to the directions suggested in Lee, Vogel and Limayem (2003) for development of better tools supporting virtual communities, *we would suggest efforts towards development of tools supporting group collaboration based on problem structuring methods*, as they have proven themselves in model based GSS and community operations research (see the earlier discussion based on Morton, Ackermann and Belton (2003) and Rosenhead and Mingers (2001)).

Our analysis of design issues in CI shows that further research is possible on adapting the existing methods in the various IT related disciplines like HCI to the field of community informatics.

Functions derived and adoption

Along with Pitkin (2001), we feel that research in community informatics should not uncritically assume that applications of CI will lead to improvement of the affected communities' condition. The methodological question then arises whether this can be investigated in laboratory or field conditions. The uniqueness and complexities of CI problem contexts imply that *field work may be more suitable*, which is different from the past studies of technology driven GSS applying predominantly laboratory methods. Besides traditional empirical research methods, we consider that there is a need for more *action research*, a trend advocated more recently (see Truex (2001) and others).

The Internet's impact on society has been debated theoretically in the past (see Mosco and Wasko (1988)). Meanwhile governments in different countries have adopted various strategies supporting the diffusion of the Internet. In some cases such as South Korea, they are subsidizing such developments heavily, which leads to 99% of households using the Internet (Lee, 2003). A

possible topic for investigation is how such a very high level of Internet access impacts upon the existing physical communities and the formation of new virtual communities, and what are the implications for countries with lower levels of Internet penetration in North America and Europe or very low levels in poor Third World countries.

Implementation and outcomes assessment of CI initiatives

Lee, Vogel and Limayem (2003) suggested relevant research on variables such as level of participation, satisfaction, information exchange, and emotional support. It could be added that further work in CI is needed on implementation and outcomes assessment within specific problem contexts using qualitative research methods. Better evaluation of CI initiatives is needed involving the methods for economic feasibility analysis. *The present needs are not only about more funding for CI, but also about evaluation of the effectiveness of previous investment in CI projects and their usage.*

It seems that *the narrowing of the digital divide*, a global political and economic issue, is beyond the capabilities of an emerging discipline like community informatics. *A closer interaction of CI with other fields including politics, sociology, political economy, community operations research and development is needed in multidisciplinary research efforts.*

Pitkin (2001) cautions against the dangers from the hype of community informatics when seen as a development factor for low-income communities. In line with his *call for applying honesty and ethical principles*, we suggest that *further research is needed on ethical issues in CI.*

Institutionalization of CI

Lee, Vogel and Limayem (2003) consider institutionalization of virtual communities to be another direction for research work in virtual CI. However they mention only the integration of virtual communities with other profit making electronic commerce and customer relationship management initiatives as a way forward to institutionalize virtual communities. In our opinion, that may be just

one of the ways to achieve such a goal. Additional possibilities to institutionalize the processes supporting both virtual and physical communities according to them are related to *transforming local government and the activities of non-profit organizations through information technology, blending the traditional ways of community interaction with those provided by the Internet*. The challenge for CI researchers is not to create new virtual formations, but to improve the effectiveness of non-profit and government structures to serve the needs of the communities through information technology.

CONCLUDING REMARKS

This paper has explored research issues in community informatics and community operations research. It drew on the independent evolution of two parallel strands of group support systems research (see Morton, Ackermann and Belton, 2003), the thoughtful critique of the state of community informatics by Pitkin (2001) and the previously suggested research agenda in virtual community informatics (see Lee, Vogel and Limayem (2003)).

The analysis led to conclusions about the possibilities of bringing together research in community informatics and community

operations research. Community operations research may benefit from the efforts to broaden the interaction between larger groups facilitated by the tools of community informatics. CI scholars may learn from the cumulative experience in COR action research interventions and they may apply also the diverse problem structuring methods of COR.

Further directions for expanding the research agenda by Lee, Vogel and Limayem (2003) were proposed that follow their framework, but serve the purposes of the broader converging field of community informatics (see Gurstein, 2004). There is no doubt that these may not be the only ways to widen the research efforts in CI. Yet we believe that our suggestions contribute in a humble way towards the development of a better, holistic understanding of the needs of communities emerging from (virtual) communities (having both physical and virtual aspects). These proposals may be implemented through multidisciplinary work, complementing many other existing ideas for CI research using the experience accumulated in the field of community operations research.

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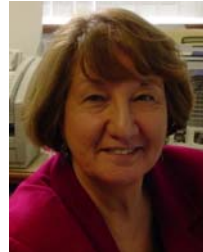
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