Learning from Social Informatics:

Information and Communication Technologies in Human Contexts

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Report Organization

This report serves as a broad introduction to social informatics, not as a textbook. It was stimulated by a workshop that was held at Indiana University (Appendices B and C). Although many of the key ideas in this report were articulated at the workshop, they required substantial additional work by us to refine and develop them into a coherent analysis.

The report contains six chapters which need not be read sequentially, a list of references, and five appendices. The chapters are summarized below.

Chapter I - Introduction to Social Informatics:

This chapter emphasizes how social informatics research can add value to institutions and organizations. It begins with a definition and short illustration of social informatics. We also demonstrate how this research can help to illuminate social and organizational issues with the developments in networked digital technologies.

Chapter II - The Field of Social Informatics

Section 1: Fundamental Ideas of Social Informatics

This section illustrates some the fundamental ideas, approaches, and conceptual underpinnings of social informatics. In this chapter we contrast the direct effects theories with theories of ICT uses and effects anchored in empirical evidence. Further, in this section we explore the socio-technical character of ICTs.

Section 2: Designing and Configuring Systems

Building on the concepts of socio-technical networks, this section provides a series of vivid examples in order to give the reader a better conceptualization of ICTs (such as complex systems). We discuss the complex and contextually embedded nature of ICT design and configuration. Further, this section examines how to characterize the interaction between existing ICTs and the social structures that shape how people use them.

Section 3: The Consequences of ICTs for Organizations and Social Life

Report Organization

This section provides the best entry point into the broad range of empirically-anchored research literature in social informatics. In this section we summarize some of the key findings from the cumulative body of knowledge. Further, we discuss some of the implications of these findings regarding current debates about the roles and values of ICTs.

Chapter III - Policy Aspects of Social Informatics:

This chapter is specifically written for analysts who are researching and framing policies about the ways in which people might, do or should utilize ICTs. Scholars who are not involved in such policy analyses may also find this chapter of interest, as this chapter uses several contemporary examples of ICT policy debates to illustrate the value of a socially and organizationally informed research.

Chapter IV - Teaching Key Ideas of Social Informatics

This chapter is written for educators, curricular committee members and academic administrators, and begins by putting computer science education into the context of the broader discussion about concerns with science, math, engineering and technology (SME&T). The rest of the chapter focuses on the difficulty with creating space in curricula to teach students the analytic framework and techniques for conducting social informatics analyses. Also discussed are the key elements to include and means for inclusion, and a summary of the current status of social informatics teaching. In particular, we highlight the value placed on both ethics and social informatics by the major professional computing societies such as ACM, Association for Information Systems and the Computer Science Accreditation Commission.

Chapter V – Communicating Social Informatics Research to Other Professional and Research Communities

This chapter is for those academics and scholars who incorporate social informatics approaches into their research and teaching, but who do so without the benefit of local collegial interaction or institutional support. Here we offer suggestions for disseminating research not only locally but also inter-institutionally. The suggestions, for the most part, do not require financial investment, but merely a commitment on the part of the scholar to be more pro-active about sharing his or her ideas with colleagues, advocating for the inclusion of these ideas into the curriculum, and being willing to act as a mentor to junior colleagues so that ideas about social

informatics can be passed from one generation of scholars to the next.

This chapter argues for the need for continued research in the areas of social informatics. Specifically, we argue that in order to understand ICTs and their relationship with social and organizational change, systematic and rigorous research must be constant. Furthermore, current researchers must nurture future researchers and, in order to do so, there must support not only from local institutions, but from national funding agencies. We also outline fifteen different strategies for communicating that range from exchange programs for scholars to programmatic support for social informatics research.

Chapter VI – Conclusions (Provisional and for comment)

In this chapter, we present a set of conclusions regarding the state of social informatics. We begin by summarizing what we have learned from the 30 years of systematic and rigorous empirical investigation into the uses, values and roles of ICTs in organizational and societal contexts. We also highlight some of the unresolved issues to be decided, with the intent that the debate should be framed by the body of knowledge represented by research on social informatics.

References, Glossary and Appendices

This collection of supporting material begins with the references cited in the main text and a summary of anthologies and texts that represent social informatics research. Given the multiple fields and the multiple meanings ascribed to many terms in computing, the glossary provides definitions of the terms and phrases we use in this report. The appendices contain the description of the workshop from which this report arose, a summary of that workshop, and the list of reviewers who provided comments and insights on earlier versions of this report.

Guidance for Readers

This report is designed for multiple audiences. We expect that many people will read only the introductory chapters and then other chapters that were most pertinent to their immediate interests. We wrote the later chapters to provide multiple entry points, and sometimes repeat key definitions and key issues in a chapter.

Report Organization

We recommend that all readers read Chapters I and II as these provide the definition, motivation, and conceptual basis for organizational and social research. Further, Chapter VI provides a set of summary points and open issues that also help to frame the ideas in this report.

We also encourage academics and scholars who are interested in and/or conducting research about social informatics themes to read Chapters III and IV (in addition to Chapters I, II and VI). In Chapter II Section 3 we illustrate the discussion of ICT design and use from a social informatics perspective. In Chapter III we summarize the findings and implications. Chapters IV and V, which discuss professional communication and funding, may also be of interest.

Academic administrators (such as deans and department heads), members of curriculum committees, and academics teaching topics related to social informatics should value the discussion of teaching and curricular issues in Chapter IV. Of course, readers of Chapter IV are also encouraged to read Chapters I, II and VI. Chapter V may also be relevant because of its focus on communicating and funding issues regarding social informatics research.

Policy analysts are encouraged to read Chapter III in addition to Chapters I, II and VI. Readers of this chapter may also find the discussions of communicating and funding this work (in Chapter V) of value.

Research funding program directors will find Chapter V, which focuses on aspects of communicating and funding social informatics research, to be most valuable. Further, because of the relation between policy and funding, the material in Chapter III, which focuses on policy, may also be quite relevant.

Chapter I: Introduction to Social Informatics

SECTION 1: THE DISCONNECTION BETWEEN POPULAR AND SCHOLARLY DISCUSSION

What are the effects of computerization on our society? For instance, what does it mean when people say that the Internet will re-shape society? How much will people telecommute and how will telecommuting practices change the way we work? Will the increased use of computers and the presence of the Internet radically reduce the enrollments in colleges and universities whose programs are "place-based?" How will the Web change the ways that people search for and use medical information? These questions are a sample of the ongoing and ever-increasing discussion about the ways in which computer-based systems – more broadly "information and communication technologies (ICTs)[1]" – are playing powerful roles in reshaping organizations and social relations. These discussions take place in a variety of arenas, including personal conversations, newspaper articles, writings by pundits, textbooks about designing and/or managing ICTs, policy analyses, careful professional accounts in professional magazines, and systematic academic research.

Social informatics refers to the body of systematic research about the social aspects of ICTs. Unfortunately, the findings and theories from most of the systematic research rarely appear (in popularized form) in the popular media or even in many of the textbooks and policy analyses. Rather, the research can usually only be found in books and journals which are primarily available by direct purchase from specialty publishers or certain scientific societies, or are located in specialized research libraries. The interested layperson or professional who goes to a large chain bookstore would have trouble finding these materials. Instead, they will more readily find materials written by pundits and journalists who don't seem to read the research.

[1] The acronym "ICT" refers to information and communication technology -- artifacts and practices for recording, organizing, storing, manipulating, and communicating information. Today, many people's attention is focused on new ICTs, such as those developed with computer and telecommunication equipment. But ICTs include a wider array of artifacts, such as telephones, faxes, photocopiers, movies, books and journal articles. They also include practices such as software testing methods, and approaches to cataloging and indexing documents in a library.

Examples of the influence of ICTs on social life are hard to escape. The World Wide Web has become ubiquitous in ads and newspapers, and computing systems are now integral to our banking, transportation, medical, educational, and, increasingly, retail systems in North America. Further, many employers are seeking "computer-literate" workers in a wide variety of occupations, from manufacturing to marketing.

With this report we introduce you to the systematic, rigorous and empirically-based research that has focused on these and other computerization issues. Further, we provide you with a means to both draw on the large and growing body of research that has addressed these questions and to conceptually organize the collected findings.

The broad public discourse on changes to both organizational and societal life due to the increased presence and use of ICTs is being shaped in part by personal experiences, journalists' reporting, pundits' predictions, technologically utopian and dystopian accounts in a range of literatures, and high-level policy discussions. This discourse on ICTs and social change pervades our lives, even though many discussions of the roles of ICTs focus primarily on technical features. Moreover, many of the popular discussions about the roles and socio-economic effects of ICTs are often based on vivid, compelling and well-articulated, but essentially armchair or anecdotal, speculation.

There is also a middle zone, between the less systematic and a-theoretical popular accounts and the more systematic, empirically grounded and theoretically informed research studies. These are the systematic professional accounts of ICTs and social change that are written by sophisticated and careful journalists (e.g., Garfinkel, 2000) or are the products of careful empirical research by the staffs of public agencies (ie., National Telecommunications and Information Administration, 1998, 1999).

By "disconnected discussions" we refer to the way that the public discourse on the roles of ICTs in society takes place almost independent of the accumulated body of knowledge that has arisen from careful empirical research. Beyond the popular discourses there is reliable, evidence-based

knowledge about the roles and effects of ICTs in both organizations and, more broadly, in social life. This body of knowledge comes from more than 30 years of systematic, empirically-anchored investigation, extensive analysis, and careful theorizing. However, this research is difficult for many researchers and professionals to access. It spans many topics, is published in the journals and reports of several disciplines, and draws on a variety of theories and research methods. This collected knowledge provides a rigorous, but also a rich and vivid basis, for understanding the multiple roles that ICTs play in our lives.

Social informatics is a new name for this body of knowledge. A serviceable working definition of social informatics is the systematic study of the social aspects of computerization (a more formal definition is found in Section Two of this chapter). In the rest of this chapter we outline and provide examples of the insights, literatures, and value of a perspective that is grounded in social informatics research. However, this is not a textbook or an anthology of social informatics: it is a pointer to the practical value of the scholarship on organizational and societal effects of computerization. It is also an argument for and demonstration of the practical value of this scholarship.

The primary goal of this report is to introduce you to social informatics research. In doing this, we explain why this body of knowledge is important for all who participate in the design and use of, and education and policy decisions about ICTs in organizations and society. The report is organized for several audiences involved with ICTs:

- Academics or administrators who are developing and/or reviewing curricular proposals for courses that examine ICTs and social change;
- Academics whose teaching and/or research relates to ICTs and social change;
- Academics involved in debates regarding ICT policies (in campus, local, national and international venues); and
- Program funders who support research about ICTs and social behavior.

This report is, in part, a primer on social informatics research for the academics and scholars who teach courses about or are engaged in research on ICTs, but who are not aware of or well grounded in the theories, concepts, or insights of social informatics research. Such academics

and scholars come from a broad set of fields, including computer science, information systems, sociology, communications, information science and management**.**

SECTION 2: DEFINING SOCIAL INFORMATICS

Since the deployment of the first commercial digital computers in the 1950s, their potential power to extend human and organizational capabilities has excited the imaginations of many people. They also evoked fears that their uses would lead to massive social problems, such as widespread unemployment. In the 1950s and 1960s digital computers were relatively expensive (often costing hundreds of thousands of dollars) and relatively few were in use. Consequently, it was difficult to observe their effects, and the writing about computerization was primarily speculative. For example, the concerns about computerized systems becoming efficient substitutes for human labor led to speculation about mass unemployment, radically reduced work weeks, and the "problem" of how millions of people would be able to manage huge amounts of leisure time. From today's perspective, in which computer systems have become ubiquitous and professional workweeks seem to have expanded, these speculations may seem quaint.

In the late 1960s and early 1970s some social scientists began empirical observational studies of the consequences of computerization inside organizations. During the 1970s and 1980s this body of research expanded to cover topics such as the relationship between computerization and changes in the ways in which work was organized, organizations were structured, distributions of power were altered, and so on. Most of the empirical social research was conducted within organizations because they were where the computers and the people who used them most intensively were located. We will discuss the findings of some of these studies in other chapters of this report. Even though these studies may seem to be dated and of limited relevance in the era of the Internet, they can help us to understand some key aspects of contemporary issues, such as "the Digital Divide" (ie, Kling, 1999b). Here, it is sufficient to say that some important studies contradicted the prevailing expectations about the effects of computerization that were seen in the books and articles written for ICT specialists, managers, and the lay public.

By the 1980s, research about the social aspects of ICTs was conducted by academics in a number of different fields, including information systems, information science, computer science, sociology, political science, and communications. These researchers used a number of different labels for their specialty area, including "social analysis of computing," "social impacts of computing," "information systems research," and "behavioral information systems research."

For over 30 years, these research studies were published in the journals of the diverse disciplines, and were written in the researchers' distinctive disciplinary languages. As a consequence, it was hard for many researchers, let alone non-specialists, ICT professionals, and ICT policy-analysts, to easily track relevant research.

In 1996, some participants in this research community agreed that the scattering of related research in a wide array of journals and the use of different nomenclatures was impeding both the research and the abilities of "research consumers" to find important work. They decided that a common name for the field would be helpful. After significant deliberation, they selected "social informatics." (In Europe, the name informatics is widely used to refer to the disciplines that study ICTs, especially those of computer science, information systems and information science.) Some members of this group held a workshop at Indiana University in 1997, and agreed upon a working definition for social informatics:

> *Social informatics refers to the interdisciplinary study of the design, uses and consequences of ICTs that takes into account their interaction with institutional and cultural contexts.*

Organizational informatics refers to those social informatics analyses bounded within organizations, where the primary participants are located within a few identifiable organizations. Many studies of the roles of computerization in shaping work and organizational structures fit within organizational informatics.

The definition of social informatics helps to emphasize a key idea: ICTs do not exist in social or technological isolation. Their "cultural and institutional contexts" influence the ways in which they are developed, the kinds of workable configurations that are proposed, how they are implemented and used, and the range of consequences that occur for organizations and other social groupings.

Social informatics is characterized by the problems being examined rather than by the theories or methods used in a research study. In this way, social informatics is similar to other fields that are defined by a problem area such as human computer interaction, software engineering, urban

studies and gerontology. Social informatics differs from fields such as operations research, where methodologies define their foci and boundaries. Social informatics research is empirically focused and helps interpret the vexing issues people face when they work and live with systems in which advanced ICTs are important and increasingly pervasive components.

Social informatics research comprises *normative, analytical, and critical orientations*, although these approaches may be combined in any specific study.

• The *normative orientation* refers to research whose aim is to recommend alternatives for professionals who design, implement, use, or make policy about ICTs.

> Normative research has an explicit goal of influencing practice by providing empirical evidence illustrating the varied outcomes that occur as people work with ICTs in a wide range of organizational and social contexts. For example, some early research (e.g., Lucas, 1973) showed that information systems were much more effectively utilized when the people who worked with them routinely had some voice in their design. One approach, called particpatory design, built on this insight, and researchers tried to find different ways that users could more effectively influence the designs of systems that they use. Further, some of these studies found that it was important to change work practices and system designs together, rather than to adapt work practices to ICTs that were imposed in workplaces. The recommendations from this body of research are rather direct: ICT specialists and managers should not impose ICTs on workers without involving them in shaping the new ICTs and the redesign of their work practices. These recommendations differ substantially from the strategies of some business reforms of the early 1990s, such as Business Process Reengineering (BPR), whose advocates preferred that ICTs and work be designed by people who were not invested in the workplaces that were being changed. Social informatics researchers blame some of the failures of BPR on an ideology that undervalues workers' knowledge about their work.

•The *analytical orientation* refers to studies that develop theories about ICTs in institutional and

cultural contexts, or to empirical studies that are organized to contribute to such theorizing.

> Analytical research develops concepts and theories to help generalize from an understanding of ICT use in a few particular settings to other ICTs and their uses in other settings. For example, one line of analysis examines specific ICTs as embedded in a larger web of social and technical relationships that extend outside the immediate workplace (or social setting) where the ICTs are used (Kling & Scacchi, 1982; Kling, 1992). For example, complex ICTs may be workable where technical support is available "in the environment." Thus, public schools in university towns may be able to use more complex ICTs when technically skilled undergraduates provide technical support through part-time jobs or independent study courses. The same ICTs may prove unworkable for public schools in cities where inexpensive technical talent is unavailable. The analytical approach, in this case, examines the way that the social milieu is organized to provide resources for training, consulting, and maintaining ICTs, rather than simply the technical simplicity/complexity of the ICT in social isolation.

• The *critical orientation* refers to examining ICTs from perspectives that do not automatically and uncritically accept the goals and beliefs of the groups that commission, design, or implement specific ICTs.

> The critical orientation is possibly the most novel (Agre and Schuler, 1997). It encourages information professionals and researchers to examine ICTs from multiple perspectives (such as those of the various people who use them in different contexts, as well as those of the people who pay for, design, implement or maintain them), and to examine possible failure modes and service losses, as well as ideal or routine ICT operations.
>
> One example is illustrated by the case of some lawyers who wanted to develop expert systems that would completely automate the task of coding documents used as evidence in civil litigation. Social Informatician Lucy Suchman (1996) examined the work of clerks who carried out this coding work and learned that it

often required much more complex judgements than could be made by rule-based expert systems. She recommended that information systems be designed to help the clerks with their work rather than to replace them.

Ina Wagner (1993) examined the design of a surgical room scheduling system and found that major stakeholders (surgeons, nurses, and patients) had somewhat conflicting preferences. If a system were to be designed, the designer would have to take sides in a set of workplace disputes. Ann Rudinow Saetnan (1991) found that an automated surgical room scheduling system was being used only as a record keeping system because of conflicts between surgeons and nurses about when to make exceptions to the automated schedule. These studies indicate that a systems designer who tries to develop "a better automated scheduling system" may have trouble in designing for only one group such as surgeons.

An important set of instances arises in the analysis of the safety and effectiveness of systems for people and the operations of organizations. It is common for analysts who conduct post-mortems on ICTs that have failed to find that the designs or implementations of these systems were not critically examined for the variety of conditions under which people might use them or the ways that they could interact with other limitations in the technical or social systems in which they were embedded (Kling, 1996, Neumann, 1995; see also Chapter II, Section 2.1 for further discussion and examples). The findings of social informatics research would lead an informed analyst to frame the discussion of a new or changing ICT within the varied organizational and social conditions of likely uses.

2.1 The Value of Social Informatics

The empirical base of social informatics research provides valuable insights into the contemporary issues with computerization. Some examples that we will discuss later in this report include:

- How can we best understand the meaning of "access to the Internet" in ways that

help to foster policies to reduce the "Digital Divide"?

- When does the reliance on weapons systems that use advanced ICTs risk escalating a war rather than reducing conflict?
- How can organizations effectively use computer networks to help their professionals share important information about expensive projects?
- To what extent and when have ICT developments fostered "paperless offices"?
- When can ICTs in K-12 classrooms replace traditional media, such as textbooks, and when are such substitutions likely to be costly and pedagogically troublesome?

One reason that many predictions about the social effects of specific ICT consequences have proven inaccurate is that they are based on oversimplified conceptual models of specific kinds of ICTs or of the nature of the relationship between technology and social change. For example, a simple and common way to view the role of ICTs is as a set of discrete tools. In this view the computer is a machine that can help rapidly produce a thick report in a few minutes or rapidly solve a complex differential equation. ICT applications like these, wondrous as they are, take on an added transformative dimension when they are networked with other information technologies, such as those that enable people to use the World Wide Web to get up-to-date weather reports or make it easier for a team of scientists to work together even when they are located in different time zones. Further, assumptions about these relationships and models are often tacit, making them even more powerful because they are taken for granted. For example, many analyses of computerization assume that:

- ICTs have direct effects upon organizations and social life;
- these effects depend primarily upon the ICT's information processing features; and
- the information processing features of new ICTs are so powerful relative to preexisting technologies that they effectively determine how people will use them and with what consequences.

For example, the U.S. national effort to "wire" K-12 public schools to connect to the Internet reflects a belief that students' access to the Internet will improve their educations. The motivation behind this reasoning is laudable. An analysis that pushes beyond the face value of

this belief leads to questions about how this wiring will actually be done and what changes in the educational process will lead to improved learning. For example, most primary and secondary teachers do not know how to use Internet resources to extend their class activities (and will require both training to get prepared and ongoing support to maintain competence). Further, most schools' computers are in special labs, so that the computing is not integrated into routine classroom practices. Instead, and by design, the computing is often isolated from the curriculum. Thus, the potential value arising from the technical triumph of wiring the school is overshadowed by the need for changes in teacher training and support and to the large scale curricular (and floorplan) design in order to incorporate computing. And, even after these changes, the issue of exactly how Internet use improves learning has not been addressed. (We will examine this topic in more detail in Chapter III).

The body of empirical research in social informatics does not make these tacit assumptions about the roles and uses of ICTs. In fact this research has shown that many forms of ICTs, such as groupware, instructional computing, and manufacturing control systems, are often abandoned or reshaped to be used in new ways. In addition, many ICTs create problems that their designers and advocates did not effectively anticipate.

Further, the social informatics research literature shows that the consequences of ICT use can appear "contradictory" because they can differ across the various situations in which the ICTs are deployed. Some "distance education" courses taught over the Internet are found to be distressing to their student participants, while others develop more positive learning environments (Hara and Kling, in press). Sometimes computerization leads to organizational decentralization and at other times to centralization of control. Sometimes computerization enhances the quality of jobs and other times jobs are degraded through tightened controls and work speedup.

In this report we identify some of the ideas that have come from over 30 years of social informatics research - systematic and empirically-grounded research about the design, development, uses, and effects of ICTs in social life. Because these findings draw from multiple disciplines and are couched in the specific and particular scientific languages of these disciplines,

relatively few of these ideas have been disseminated effectively and, consequently, have not shaped the working practice of most information professionals. Further, much of the body of social informatics knowledge has not yet been integrated into many curricula to help better educate young ICT-oriented professionals, and has yet to influence research in related areas, such as digital libraries and new forms of organizing.

In this report, we present an introduction to social informatics research, one that we hope will provide the reader with a point of entry into this research world. In the chapters to follow, we discuss the meaning of the concept of social informatics and the theories, methods, and findings that characterize this field. We also explain how social informatics can be integrated into the curricula of programs and courses focusing on ICTs and social and organizational change.

Chapter II: The Field of Social Informatics

SECTION 1: FUNDAMENTAL IDEAS OF SOCIAL INFORMATICS

1.1 Theoretical Approaches

Any systematic account of the ways in which people or organizations will use specific information and communication technologies (ICTs), or about the effects of such uses upon changes in organizational and social life, rests on a specific conceptualization of ICTs and of the relationship between ICTs and social change. It is common for people to speculate about the consequences of new ICTs by focusing on their distinctive information processing features and imagining their direct effects. In this view, for example, linking a school to the Internet will enable its students to communicate with a wide variety of experts elsewhere in the country. Thus, a school system can use the Internet to have its high school physics students talk with NASA scientists without having to actually hire ex-NASA scientists to teach in its schools. Similarly, this line of reasoning holds that e-mail adds new lines of direct communication between its employees and upper-level managers, meaning that e-mail will "flatten" organizational hierarchies. Sometimes these practices do actually take place. Some NASA scientists have volunteered time to act as outside experts with specific high school classes. However, NASA and other similar scientific organizations are not staffed so as to routinely provide ongoing expert advice to the hundreds of thousands of students who study high school physics every years. There are examples of upper executives who do have an "open e-mail" policy with their subordinates. However, in large organizations these channels would overwhelm upper managers if thousands of their subordinates used e-mail to communicate with them every week. Thus, although the direct effects of such ICTs have been claimed by some to substantially flatten organizational hierarchies or to improve the quality of high school science education, in practice researchers find that these direct effects of ICTs rarely occur on a large scale. Since "direct effects" reasoning about the consequences of ICTs is so common, we will examine it first.

Direct Effects Theories

To identify the social consequences of computerizing some activity, one must have, at least implicitly, a theory of the causal powers that computerized systems can exert upon individuals,

groups, organizations, institutions, social networks, social worlds, and other social entities. One common theoretical approach is to conceptualize ICTs as a collection of equipment, artifacts or techniques which provide specifiable information processing capabilities and which have identifiable costs, physical characteristics, and skill requirements. As we discussed briefly in Chapter I, it is common for analysts to try to speculate about the possible uses and social consequences of new ICTs by predicting their potential direct effects on organizations or other social settings. In this approach organizational behavior is described by the formal goals, procedures, and administrative arrangements of the acting units, and the use of a computing resource is described by its formal purposes and information processing features[2].

Direct effects theories underlay the earliest efforts to anticipate the social consequences of computerization in organizations. Laudon and Marr (1996) argue that the direct effects model has a strong appeal to researchers because of the seemingly "natural" causality that is implied by the effects of computerization on organizational structure and process. They point to researchers who have argued that, for example, the introduction of computers into organizations will lead directly to the massive elimination of some jobs, such as middle managers, because their information handling roles will be taken over by the machines. As one example, Huber (1990:95) concluded that "use of computer-assisted information processing and communication technologies would lead to elimination of human nodes in the information processing network."

Some case studies support the direct effects models. For example, Applegate and Cash (1988) described two cases of organizational restructuring, and concluded that within weeks of installing a new system, 40% of management in one company was terminated:

> *a sophisticated, on-line executive information systems was developed. It did the work of scores of analysts and mid-level managers whose responsibilities had been to produce charts and graphs, communicate this information, and coordinate operations with others in the company.*

However these direct effects arguments that link the use of new ICTs to organizational and social

[2] Kling (1987, 1992) refers to this conception of ICTs as a "discrete-entity model.

change have not generalized very well[3]. As a body of research develops about possible direct effects of ICTs, such as computerization reducing hierarchy in organizations or the Internet improving the public's access to medical information, the collection of studies usually shows "mixed effects." Sometimes the expected consequence happens (i.e., hierarchies flatten in some organizations; some groups improve their access to medication information via the Internet). At other times, there is no significant impact.[4] And, in some cases, ICT use seems to lead to effects that are opposite to those that were anticipated. The intriguing case made in the 1980s for the rise of paperless offices is worth recounting as an accessible example of this variety of "impacts" from ICT use.

Predictions of Paperless Offices

In the 1980s, some analysts heralded the coming of the paperless office, where all business information and documents would be created, stored, accessed, and disseminated digitally and people would employ a wide range of ICTs, making their routine work practices more flexible.

While some offices, especially those where clerks process large volumes of routinized transactions, such as travel reservations, may function effectively with less paper, the use of computerized office technologies has had a different effect in many professional offices, transforming work in unexpected ways.

In offices where professionals prepare complex reports, they have often used computer systems to create more numerous intermediate drafts. They print more of these drafts to read and edit, to distribute for comment, and for archival purposes. Sellen & Harper (1997) studied how the 900 economists at the International Monetary Fund develop complex reports and determine criteria for the making of loans. They found that report writers had to integrate comments from various colleagues that were written on different intermediate drafts. The use of paper enabled the

[3] Davenport (1988) observed that the direct effects of large scale organizational information systems, such as enterprise resource planning systems, were often relatively minor because so many organization-specific contingencies influenced how they were actually configured and used.

[4] In general, there is no universal pattern found in work groups or in organizations (see Fulk and DeSanctis, 1998). ICT use has also been shown to have different consequences for the way that work is organized, and the extent to which jobs are deskilled (as in the case of telephone operators) or enriched (as in the case of accountants) (See Kling and Jewett, 1994)

economists to mark up drafts, and to lay out several drafts for comparison. (We note that it would take a 27" monitor to readily compare three paper manuscripts, side by side, but large monitors don't make varied annotations easier to jot in text margins, on graphs or in data tables.).

The pervasiveness of fax machines has also caused paper consumption to increase. According to a study of paper consuming office technologies in Australia (Pickin, 1996):

> *Consumption of copy paper was . . . up 17.5% on the previous year and about four times its level of 10 years ago. The enormous increase provides firm evidence that information technology has dramatically boosted paper consumption.*

Furthermore, the integration of ICTs into organizational routines has shifted the locus of many organizational practices, often in unexpected ways. Word processing software has shifted the burden of desktop publishing to the author, who can spend long hours redrafting and formatting documents, thus doing work that a secretary typically has done. Telephone answering machines and voice mail have placed the burden of call selection and screening on those who are called, rather than on an intermediary. Personal digital assistants have shifted the process of organizing a calendar from clerical staff to the PDA owners. Lately, the introduction of the World Wide Web (WWW) to desktops has allowed individuals to do their own information seeking and retrieval instead of turning to corporate librarians.

The cumulative effects of such consequences of computerization in professional workplaces may substantially reduce the productivity gains that some would expect to routinely result from computerization. The quest for the paperless office has led to the increased use of paper in some highly computerized organizations, and to changes in work practices that enlarge many workers' jobs by incorporating additional tasks (particularly information production, organization, and dissemination work) that had been handled previously by others.

This rather lengthy example of paper in office work illustrates the following point: The direct effects models usually predict uniform effects of ICT use. They don't easily predict such varied outcomes as reduced paper in some clerical offices and increased paper use and work reorganization in some professional offices.

Varied Effects Of ICT Use

In general, there is no universal pattern found in work groups or in organizations (see Fulk and DeSanctis, 1998). ICT use has also been shown to have different consequences for the way that work is organized, and the extent to which jobs are deskilled (as in the case of telephone operators) or enriched (as in the case of accountants) (See Kling and Jewett, 1994) .

Social informatics researchers often find these kinds of contradictory effects of ICT developments. This idea can influence ICT design practice. For example, digital library (DL) developers may expect that online documentary systems should increase people's access to materials. However, analysts who have learned that contradictory and paradoxical effects are likely would also try to understand and anticipate how DLs may reduce access to documentary collections (when compared with paper or other traditional media). In some instances, DLs might reduce documentary access by being organized with licensing arrangements that restrict the group of people who may access materials, or when their technological design creates barriers and bottlenecks for some people.[5]

The North American business and popular presses, and indeed even some academic writings, focus primarily on the seemingly positive aspects or successes of ICTs, thus glossing over the more complex or ambiguous outcomes. The most advanced research in organizational informatics emphasizes theories that allow variations in outcomes, and which help to anticipate contradictory consequences. There is general agreement that good theories of ICT design, development, uses and consequences should also help predict the conditions under which systems will fail (by some criteria). To gain a more comprehensive understanding of ICTs' uses and consequences, professionals and researchers need detailed accounts of situations in which ICTs did not meet expectations, in addition to the reports of cases in which they did.

[5] An example of this occurs when university departmental libraries that license proprietary documentary collections, such as Lexis or Dialog, create restricted access when affiliation with the department is required to for an authorizing password. With paper materials it is common for libraries to allow open access of materials to all university faculty, students and staff regardless of departmental affiliation. Technological barriers to access can be created by the use of unusual platforms (X-Windows, in Elsevier's TULIP project) or restrictions on remote printing (a specific university electronic course reserve project).

John Unsworth (1997) amplified this last point forcefully and carefully with respect to the ways that electronic journal projects should be reported in "Documenting The Reinvention of Text: The Importance of Failure":

> *We are in an important evolutionary moment: an important transformation is taking place, and we are a part of it. Many things that we take to be trivial, or embarrassing or simply wrong, will be of interest to our peers in the future. . . . The greatest mistake we could make, at this point, would be to suppress, deny, or discard our errors and our failed experiments: We need to document them with obsessive care, detail, and rigor. Our successes, should we have any, will perpetuate themselves, and though we may be concerned to be credited for them, we needn't worry about their survival: They will perpetuate themselves. Our failures are likely to be far more difficult to recover in the future, and far more valuable for future scholarship and research, than those successes.*

Daniel Robey (1997) goes farther by developing theories that explain "successes and failures." Robey discusses three suitable theories (and their evidence in organizational informatics). He notes:

> *The[se] theories . . . address the common requirement that contradictions be explained, rather than removed. Such theories are likely to be useful in accounting for the observed contradictions in research on organizational transformation. Each theory, in its own way, incorporates a logic of contradiction by including forces both encouraging and opposing organizational change. Each theory sees organizational change as a process in which transformative actions must overcome persistent practices and structures. As intended new structures are greeted by political opposition, cultural and institutional lag, or existing organizational memory, strange new contradictory forms may appear, defying explanation with deterministic theories.*

It is beyond the scope of this report to explain these theories in any detail. But sophisticated theorizing about ICTs and organizational change has also laid the ground for new ways to conceptualize ICTs.

1.2 The Socio-technical Character of ICTs

ICTs are often talked about as tools, like a toaster, even when they refer to complex arrangements of varied equipment and social practices, as in the World Wide Web or airline reservation systems. The tool metaphor is commonplace in discussions of computerization, and the tool metaphor helps people to think about the most likely and appropriate immediate uses of specific ICTs. In practice, however, the tool metaphor is much too simple, since many "systems" are composed of unique configurations and assemblages of components – such as workstations, network protocols, servers, printers, and so on. James Fleck (1994) characterized integrated ICT systems, such as computer integrated manufacturing systems, as examples of configurational technology. Fleck's colleagues summarize this view as follows:

> *Whereas most contemporary applications of ICT[6] have automated discrete, well-delimited functions, which can be standardised and readily obtained through the market, integrated applications of ICT to conduct a range of activities, can rarely be obtained in the form of standard solutions. Instead, firms must customise solutions to fit their particular structure, working methods and requirements. They may be forced to select, and link together, a variety of standard components from different suppliers. The result is a particular configuration - a complex array of standardised and customised automation elements. Moreover, no single supplier has the knowledge needed to design and install such complex configurational technologies. Instead, this knowledge is distributed amongst a range of suppliers (of different technological components) and a range of groups within the firm. Configurations are highly specific to the individual firms in which they are adopted." (Williams and Edge, 1996).*

Since an organization configures systems of these kinds, there is tremendous opportunity to shape the resulting systems to fit the organizing ideas of key participants, be they specific managers, information professionals, or other professionals. For example, organizations such as manufacturing firms can select different combinations of components to make a manufacturing

[6] In the original quote, Fleck used the abbreviation "IT" for "information technology." However, to maintain consistency, we have changed all instances to "ICT" without any significant change in meaning.

control information system (sometimes called Computer Integrated Manufacturing, or CIM). Some kinds of complex information systems, such as enterprise integration systems, are also more variable than they would superficially appear to be, even when they are not composed of discrete components like a CIM. The concept of configurational (or configurable) technologies helps make some of the contradictory uses and consequences of computerization more intelligible. Because many ICTs are so highly configurable, simple labels (such as a CIM) can obscure important variations in socio-technical configurations. Software for AG's SAP R/3 Enterprise Integration system is an interesting case in point[7]. SAP requires that standards be set across an organization, but also allows many parameters to be tailored. It is common to have as many as 8,000 data tables in an SAP database (Xenakis, 1996).

The concept of ICTs as configurable technologies encompasses much more than just the above example. Two additional illustrations can help to demonstrate the scope of this idea. Personal computers (PCs) are often referred to as though they are fairly interchangeable, and the assumption may be made that their use will be similar across situations. However, their role may differ considerably depending on their specific configurations. In an example of "home computers," one family might acquire a PC with high quality audio and video capabilities to allow for many entertainment uses. Another might purchase one with minimal "multimedia" capabilities to be used for primarily for tasks such as word processing. Not only would the uses made of the two computers likely be very different, it would be no surprise if we were to learn that the children in the first family spend much more time using the computer than do the children in the second one. In addition to individual PCs, today's organizational computing networks also fit Fleck's conception of configurable technologies, and this idea again helps us to anticipate that such networks will be used differently and with different consequences in various organizations (Newell, Scarbrough, Swan and Hislop, 1998). This concept of configurable technologies is important in understanding the possible consequences of using specific ICTs, since it implies that different configurations "of the same equipment" may have different consequences for the people who use them.

[7] Many large firms, including Corning, Compaq, Chevron, Borden, Owens-Corning, Mentor Graphics, Fujitsu, Dell, Apple, IBM and Microsoft are using SAP to help integrate far flung operations. SAP/R3's vendor, SAP-AG, is Germany's largest software firm.

It is helpful to view a specific ICT as a "socio-technical network" that brings together diverse resources, including:

- people in various roles and relationships with each other and with other system elements;
- hardware (computer mainframes, workstations, peripherals, telecommunications equipment);
- software (operating systems, utilities and application programs);
- techniques (management science models, voting schemes);
- support resources (training/support/help); and
- information structures (content and content providers, rules/norms/regulations, such as those that authorize people to use systems and information in specific ways, access controls)

These elements are not simply a static list, but are interrelated within a matrix of social and technical dependencies[8]. This socio-technical networks model has substantial repercussions for understanding how ICTs are actually used.

Two organizations that acquire the same set of equipment usually develop different socio-technical "ICT systems." A simple contrast between a typical university library and a typical elementary school that each acquire 20 PCs, a server, and a high-speed laser printer to support Internet access helps illustrate this concept. The university library is likely to have a skilled technical staff (that supports other library systems) to install and maintain the equipment. There are likely to be library staff (or academic computing support staff) who are assigned and trained to answer students' questions, both about computer use and ways to effectively search the Internet. The computers are likely to be connected to a high-speed campus network, and people who wish to use them may be required to have a university network ID.

In contrast, the typical elementary school is unlikely to have its own technical support staff, and

[8] We have referred to these relationships and dependencies as a "web of computing" (Kling and Scacchi, 1982; Kling, 1997).

is most likely to rely upon the school district's computer specialists to upgrade and repair the PCs and printer on request. If the PCs are installed in a lab, students will typically be given access for a class period or after school. (A network ID is unlikely to be required, and visiting parents and short-term school aides may be able to log in on their own.) If the 20 PCs are distributed into 10 classrooms, teachers are more likely to integrate their use into class topics. But the typical elementary teacher still has limited computer and Internet searching skills. In general, technical support is less available at elementary schools, and, as a result, they will have more equipment out-of-service for longer periods of time, and software upgrades will be less frequent.

The organization of instructors' time also differs in the typical university and elementary school. The typical university instructor is in class from 6 to 12 hours per week, while the typical elementary school teacher is in class about 7 hours per day. While university instructors usually have other service and research obligations, they also have much more time to prepare each week's classes and to develop new inquiry-oriented activities for their students.

If we added the offices of a mutual funds investments analysts to this contrast, the "same equipment" and network access would be organized in still different ways. While students would be expected to share computers, and would expect to wait in line, each analyst would expect to have his own PC. In these offices there are often technical staff who anticipate problems and opportunities, and organize preventive maintenance and upgrade the PC and network infrastructure without always being asked. There would be more sustained and reliable access to financial and news databases and the WWW sites that help them track the affairs of selected firms and the fortunes of specific industries.

Financial analysts develop significant expertise in knowing the data sources that they use routinely; in addition there may be special librarians who organize business and financial reports and who keep abreast of new financial information sources. The computing and networking support in high performance organizations, such as urban medical clinics, increasingly resembles that of the mutual fund investment firm rather than the university student computer labs.

No one expects an elementary school to be organized like a university, or either of them to be organized like a mutual fund investment company or a medical clinic. Researchers have found that the character of the organization profoundly shapes the character of the kinds of computing services that the "similar equipment" provides. Consequently, while ICTs may be critical for the functioning of a mutual fund company, they may be much more marginal in an elementary school. Some of the differences are due to the ways that the equipment is supported within the organization. Other differences are due to variations in the quality, selection and relevance of information services and other resources available on the Internet or for purchase. In order to understand the repercussions of computerization in specific settings, one has to appreciate their distinctive socio-technical configurations.

SECTION 2: DESIGNING AND CONFIGURING SYSTEMS

In the 1950s and 1960s, most people who designed and/or used ICTs were scientists, engineers, technicians and programmers. The early "commercial systems" were developed for very structured activities such as accounting, banking, and insurance record keeping, where there were often paper-based and electro-mechanical precursors that were mimicked by the earliest digital systems. People who would use the systems did not have much influence in their designs because technical specialists believed that pre-existing systems could serve as adequate representations for the computerized versions. Not surprisingly, many people had trouble using these computerized information systems because of design flaws. Some systems printed inappropriate checks (e.g., for $.00 or $.01); others printed individual items on whole sheets of paper or wasted clerical time because they did not effectively group items or sort reports.

But even as the development of computer hardware and software improves, designing any sort of complex computer system for ordinary (non-technical) people remains difficult. ICTs can be extremely powerful and complex, doing a vast array of different things with enormous speed. Of course, this is also their advantage and appeal. For example, a communications system such as electronic mail can be designed not only to let a person send an asynchronous text message to another, but also to send multiple messages, create mailing lists, respond automatically, forward, save, retrieve, edit, cut and paste, add attachments, create vacation messages, fax, and so on. However, if the design is not handled extremely well, people will have to figure out a bewildering array of options in order to use their ICTs. As a consequence, some people will spend undue amounts of time trying to learn to use some of the system's capabilities. Others will simply forgo using features that they can't comprehend, and thus will lose some of the value of their ICT (Computer Science and Telecommunications Board, National Research Council,1998). Overall, relatively few people get the full value that they could and should from their ICTs.

The extra time and effort needed to adjust various aspects of computer-based information systems is just one example of the ongoing problems resulting from their increased complexity and power. Another is that information in large organizations is spread across dozens or even hundreds of separate computer systems, and stored in various business functions, regions, factories, or offices. Maintaining these many different information systems is perceived as "one

of the heaviest drags on business productivity and performance now in existence" (Davenport, 1998, p.123). For managers who have struggled at great expense and with great frustration with incompatible information systems and inconsistent operating systems, enterprise integration systems, like SAP's R/3 package, promise the "seamless integration" of all the information flowing through a company. In short, "enterprise systems appear to be a dream come true" (Davenport, 1998, p.121).

Enterprise integration systems are profoundly complex pieces of software. At their core lies a single, comprehensive database that collects data from and feeds data into modular applications supporting practically all of a company's business activities. When new information is entered in one application, related information is automatically updated. Although the marketers of enterprise integration systems promise financial and productivity benefits through flexible configurations, the actual design of these systems often reflects a set of standardized assumptions about the way organizations and businesses should operate.

> *Vendors try to structure the systems to reflect best practices, but it is the vendor, not the customer, that is defining what 'best' means. . . . As a result, most companies installing enterprise systems will need to adapt or even completely rework their processes to fit the requirements of the system* (Davenport, 1998, p.125).

As configurational technologies then, enterprise systems require making compromises, of balancing the way people want to work with the way the system lets them work. Designers of such complex systems are not grappling with well-formed problems but with "messy, indeterminate situations" (Schon, 1987). The design process for large scale systems usually involves a team of designers from different disciplines. The team must interact with the people who will use its product and with the much larger organization of which it is a part. The design and implementation of ICTs typically takes place under considerable limitations of time and resources; it seems unlikely that this will change. Many systems designers are taught to separate organizational issues from technical issues, but in practice this separation is rarely feasible for designing workable systems. In short, the design of technology-based products is inextricably entwined with social and organizational dynamics.

The challenges that designers face in crafting ICTs that will work well for the organizations that adopt them and for the people who use them have grown enormously. People's expectations for flexible and useable systems have risen greatly. In addition, the scope of new systems has often enlarged considerably. Usability[9] testing used to be the sole domain of European software designers. Now, however, there are professional organizations in the U.S. focused on usability approaches to software design (e.g., http://www.upassoc.com/). In the U.S., the incentive to get on the usability bandwagon is still mostly economic. For example, some firms that mass market software, such as Microsoft, have invested in usability testing and problem identification programs in an effort to ameliorate customers' difficulties with their products. Today, many major software firms have their own usability labs. However, there is still a substantial gap between the complexity and prevalence of usability testing by these software vendors versus those who develop customized systems.

While usability testing is becoming more common among mass market software devlopers, these approaches are diffusing rather slowly into organizations that contract for customized ICTs for their own use. Most professional and educational literature still defines user involvement as assessing user requirements for a system on at the beginning of the design process. However, in these early assessments, many users emphasize the major functions and routines of their work, overlooking important variations or exceptions. If user feedback is not continuously sought throughout the design process, then a new system is likely to not effectively handle overlooked exceptions, complexities, and nuances. In fact, most software development textbooks in the U.S. rarely discuss in much detail the social and technical complexities of designing useable ICTs (Salzman & Rosenthal, 1994). We will examine some of these issues in Chapter VI, "Teaching Key Ideas of Social Informatics."

Researchers who have studied the interactions between system designers and their clients have often found that designers rarely appreciate the work and working conditions of the people who will use the systems that they design (See Forsythe, 1992, 1994; Suchman, 1996). When computer systems are ineffective or fail, designers often blame poorly defined specifications

[9] The term *usability* is used to characterize the extent to which a specific ICT is relatively easy for a person to utilize for specific activities.

(e.g., people who will use an ICT did not clearly express the problem) or technical limitations (e.g., hardware constraints).

2.1 Designing for a heterogeneity of uses, people, contexts and data

There is a significant body of organizational informatics research about the importance of "user involvement" in the design of new systems. Even in the 1970s, research monographs, such as Henry Lucas' (1975) *Why Information Systems Fail*, and analytical reviews of the studies of systems failures (e.g., Kling, 1977) identified as one major cause of system failures the exclusion of the people who will be using the system from the design process. Such failures are reported in the Human Computer Interaction research literature (Poltrock and Grudin, 1994; Wilson, Bekker, Johnson and Johnson, 1997) as well as the information systems and computer science literatures (Clement, 1994). In addition, industry surveys show that as many as 40% of systems projects in major corporations are total failures and that not having an ICT's actual users participate effectively in the design of the systems is one major cause (James, 1997).

It is not hard to find professional articles that echo these research findings with calls for designers to "involve the people who will use an ICT" or to build "user friendly" systems to ensure their usefulness. Usability labs can be helpful for refining some aspects of an interface's design. But they don't help designers learn how a person will use a system in concert with other technologies (such as other systems, reports, books, telephone, fax, etc.) in their own workplaces. Many people think of improving usability in terms of improving what a user sees on an ICT (such as menus, buttons, etc.). While this focus can yield many improvements, it is too narrow, as there are many usability issues that are "more than screen deep" (King, http://www.nap.edu/readingroom/books/screen/15.html, 1998).

It is also important to point out that the ICT design communities are not monolithic. Grudin (1991) distinguished between three major kinds of design contexts. In *contract development* , the customer, or user organization, is known from the outset, and the development organization is identified when a contract is awarded. In large contracts, few designers actually visit the user organization. In *product development*, (e.g., "shrinkwrap" products), the developers are known from the outset, but the people who will use an ICT typically remain unknown until the product is marketed. Finally, in *in-house development*, both the people who will eventually use an ICT

and its designers are known at a project's outset. (This is also known as *custom development*, where a specific external developer is engaged from the start to produce or configure a system for a specific customer.)

These distinctions help us understand the different conditions under which ICT designers learn about the work and settings for which their systems are intended. For example, in-house development of ICTs makes it easier to establish and maintain continual contact with likely users. In contrast, contract developers may work thousands of miles away from the people who will use their systems (Grudin, 1991).

When designers are working without much contact with their intended clientele, they frequently develop abstract categories of a system's potential "users." However, the linguistic convenience of easily labeling the people who will utilize an ICT masks their likely diversity. The diverse group of people who use an ICT, and their uses of it, are not best understood by simple categories such as "novice," "expert," or "causal." Further, many designers develop tacit scenarios of the ways that people will use systems that often differ from many actual conditions and uses.

Using oversimplified scenarios of an ICT's use can have serious costs. An extreme example is illustrative of the ways that designers' scenarios of use and actual working conditions may differ substantially. In July 1988, the US military's RCA-designed Aegis missile defense system that was installed on the USS Vincennes, which was patrolling the restricted waters of the Persian Gulf, performed correctly according to its technical specifications. But the Vincennes' crew shot down an Iranian Airbus 320 civilian airliner with 290 civilians on board over the Persian Gulf. This extraordinary and tragic event lead to formal inquiries by the U.S. Navy and the U.S. Congress, as well as an inquiry by five highly-qualified psychologists. It was also investigated by computer science and political science researchers, whose studies form the basis of our account here (e.g., Chapter 9, Rochlin, 1997).

The events of that day are complex. But they included the fact that the Vincennes was under attack by several small gunboats, and that its captain turned rapidly, resulting in the ship's tilting

at a steep angle during this surface battle. According to Rochlin, "the effect was particularly dramatic. Books, publications, and loose equipment went flying off desks. Desk and file drawers flew open. Many of those on duty had to grab for the nearest support to avoid being thrown to the deck. . . . The situation aboard the Vincennes that day was one of confusion and disorder."

Almost simultaneous with the surface attack, the Vincennes' crew interpreted their Aegis displays as signaling an attack by an incoming F-14 fighter. The operator believed that the airplane was descending, although replay of the data clearly indicated an ascending civilian plane. However, once the crew developed the F-14 scenario, they remained committed to it, acted in concert with it, and after ineffective efforts to communicate with it on military voice channels, were authorized to fired two missiles at it, and shoot it down.

The Aegis system aboard the Vincennes had been designed using a range of scenarios that did not cover the chaos and complexities that the Vincennes' crew faced that day. Matt Jaffe, one of the designers of the Aegis display interface, reported that the altitude information was difficult to interpret correctly. Thus, it would be difficult to determine whether the plane was going up, or going down, or remaining at the same altitude (Neumann, 1995). These displays were probably adequate under the specific scenarios envisioned by the designers. However, the designers probably never considered that civilian aircraft, rather than "friendly" or "hostile" combat aircraft, would be so close to a ship like the Vincennes under battle conditions.

The Navy had invested a lot in Aegis, and often officially defended it. The Navy's report on this tragic mishap blamed combat-induced stress as a major factor, thus placing the burden of the problem on "incapable users" while simultaneously exonerating them with a claim of battle stress. The psychologists, who did not have a stake in defending Aegis, felt that the Navy's analysis did not effectively engage important factors. The psychologists criticized the Navy's report and testified to the U.S. Congress that "operator-error" was no longer a suitable explanation for mishaps with complex weapons systems.

Rochlin comments:

> *What are the expectations of a combat system such as the Vincennes, or of the*

> *CIC as a war-fighting center? That stress would be low? That battle conditions would be other than confusing? That the ship could be attacked on the surface, or from the air, but not both simultaneously -- not to mention possible subsurface attacks in other circumstances? If these are or were the assumptions under which the Aegis cruisers were designed, than the Vincennes should never have been deployed into the Gulf.*

The tragic shooting of Iran Air Flight 655 was an extraordinary event whose circumstances were not effectively anticipated. RCA's design engineers, interface experts, and combat-experienced Naval personnel, working on an arms-length contract during peacetime, may have had serious problems in foreseeing the battle conditions under which Aegis would be most important. However, there are also many cases in which system designers have ample opportunities to evaluate the conditions under which people will use systems, and still fail to do so.

In one department of a leading university, faculty posted their syllabi on WWW pages. Links to the pages, and often the pages themselves, were changed from one term to another. This maintenance of pages and links constituted a burden for the department's technical support staff. Without consulting the faculty, they designed a WWW-accessible database to maintain all of the syllabi. They portrayed the shift as a technical streamlining. In their view, "the users" of the syllabi collection were the department's faculty and students who would know the name and number of the course whose syllabus they are seeking. But other people who are unfamiliar with the course titles and course numbers, and who were invisible to the department's support staff, used the syllabi as well. These included prospective students and faculty who are based in other universities and who are developing courses. The shift to a database also hides the syllabi from search engines, such as Alta Vista, and thus from faculty elsewhere who are searching for sample syllabi and teaching materials. This technological shift may have simplified the technical staff's ability to maintain the department's WWW site, but does so with some losses to the field and to the school's external visibility.

2.2 The designing of ICTs continues during their use

The computerization of common organizational activities, such as accounting, inventory control,

or sales tracking, is not a one-shot venture. Computerized systems that are introduced at one time are often refined over a period of years (Kling & Iacono, 1984), and periodically replaced by newer systems. Some computerized accounting systems have histories of 30 or 40 years (McKenney and Mason, 1995), and 10 to 20 years is quite common in manufacturing.

These examples, plus evidence from empirical studies of actual work practices (e.g., Friedman, 1997, Greenbaum & Kyng, 1991, Kiesler, 1997, Suchman, 1996, Wagner, 1994, Johnson & Rice, 1987; Kraut, Dumais and Koch. 1989;Walsham, 1998), reveal that people and groups that utilize ICTs reshape them in ways that their original designers did not anticipate. This reshaping of system use suggests that an ICT will change from its initial design. Henderson & Kyng (1991) identify three reasons why systems design does not end with the delivery of a final product or service:

1. Because most ICTs are designed to be used for long periods of time, circumstances or the *situation of use changes*, i.e., needs change, uses change, people who use the ICT change, and the organization changes.
2. The *complexity* of systems design and the context of use makes it difficult, if not impossible, to anticipate all the issues that will eventually be of importance in the final design. It is inevitable that the designers of ICTs and the people who use them will overlook important issues.
3. The flexible use of ICTs by different groups of people requires that ICTs be designed for many *different situations* of use. Sophisticated software "packages" are often designed to have multiple configurations to allow them to satisfy as many users as possible with a single product.

Configuring a system, or continuing designing in use, is an activity different from initial design. "The activity is related to specific use situations and the result is not a new system, but a modified system; that is, a system with a history which relates it to the earlier version and problems with its use" (Henderson & Kyng, 1991, p.223). Many instances of system failures might not have had such adverse outcomes if the developers had not left the project on its "delivery date." For example, the designers of the Aegis interface, described above, may have improved the clarity of the altitude readings if they had realized earlier the limitations of the

combat system in a hostile environment.

In addition to understanding specific use situations, good design often requires a critical use-oriented perspective to help insure that unintended problems/losses don't result. It is very rare for designers to develop highly successful systems without a substantial understanding of the conditions under which people will use them. Unfortunately, many systems developers and consultants who focus on organizational goals fail to acknowledge how work is carried out in practice. The following case illustrates this point.

One major phone company made a business of installing high speed phone lines in large offices. These installations were not being completed in a timely manner, and the company began to lose customers to competitors because of the delays. Consultants hired to help improve efficiency observed technicians talking with each other and sometimes waiting for each other so they could go out jointly to a customer's site. The consultants recommended that the conversations, which were viewed as socializing rather than working, be greatly reduced, and that technicians be sent out on jobs as soon as they were available. In their view, any technician who had received certain standardized training should be able to fulfill any service request.

The consultants developed the Trouble Ticketing System (TTS), a large database that also functioned as a scheduling, work routing, and record keeping system.[10] While TTS was designed to make work more efficient, it actually had the opposite effect and failed to achieve the company's efficiency goals, as the consultants had not accounted for several important aspects of the technicians' work practices. One of these aspects was the technicians' conversations with each other. TTS was designed to eliminate these conversations. However,

> *In these conversations, they compared notes about what was going on at each end of the circuit. If there was a problem, they figured out what it was and worked on it together. These trouble-shooting conversations provided the occasion for workers to understand what was actually going on in the job, diagnose the situation, and remedy it (Sachs, 1995, p.39).*

[10] TTS is discussed in Sachs (1995).

The consultants also failed to recognize that the technicians had developed specializations after finishing their common training, and that some were thus better able to handle different types of problems. Further, although TTS did not allow for this, the technicians often needed to work jointly with each other in order to deal with complex situations.

When instead of being designed from a socio-technical network perspective (see Table 1 in section 2.3) systems are designed from a view that ignores actual work practices, the users will frequently develop *workarounds* as a way of dealing with poorly designed systems. In the case of TTS for example, workers soon figured out new ways to contact appropriate co-workers in order to problem solve. They then used TTS to provide a record of the conversations by misrepresenting the conversations to appear as though they were work done on site (Sachs, 1995). However, despite the workarounds, the phone company's installation process did not speed up to the extent predicted by the consultants, and they were not regaining their lost market share. In desperation, the company hired an anthropologist to study how the work was really done. With the cooperation of the technician's the new consultant developed a team-based approach to high-speed phone installation. This new approach was substantially more effective in increasing the speed of the installations and allowing the company to regain its market share.

2.3 The social design of ICTs

As the previous discussion reveals, a growing number of researchers and practitioners are working to develop methodologies that take into account peoples' everyday work practices and activities (e.g., Davenport http://www.cio.com/archive/030196_dave_content.html, 1996; Denning & Dargan, 1994, Sachs, 1995). Davenport (1996) believes that system developers need specialists in the field (called "social systems analysts") who will be responsible for communicating with technologists and managing organizational change efforts. Tasks for the social systems analyst might include:

- "shadowing" managers and workers to determine likely uses of the planned system;
- participating in system design efforts to ensure that the system fits the organizational structure and culture;
- facilitating user participation in the design activity;
- assessing current work practices and creating new ones;

- planning the implementation, including education and training; and
- observing the system in use and making appropriate changes.

The field of software design must train its practitioners to be skilled observers of everyday work practices and activities in which a particular community of people engage (Denning & Dargan, 1994, Sachs, 1995). There are some examples of practicing system developers who carefully observe people at work and engage them in design issues. For example Wyatt (1997) reports how Mauro Mauro Design Inc. improved the performance of the New York Stock Exchange trading systems by improving the ways that traders could interact with four new systems. Their process involved six months of observing traders prior to coding new software, and 30 iterations in testing their new systems. Moreover, despite their behaviorally intensive approach, Mauro Mauro reduced the previous system development cycle from six years to two years.

The literature on systems design methodologies uses a variety of terms that embody the concept of socio-technical design. These include user-centered design, customer-centered design, action-centered design, participatory design, cooperative design, usability testing, joint application design, and soft systems methodology. However, as Kling and Star (1998) so aptly point out, any such term "can easily become a trivialized buzzword that could casually be slapped as a label onto any computer application that seemed to help people."

As a way of defining what constitutes the design or use of human-centered computing, Kling and Star (1998) identified four aspects of human-centeredness:

1. Analyses that encompass the complexity of social organization and the technical state of the art. An analysis must take account of various social units that structure work and information, such as organizations and teams or communities, as well as their distinctive social processes and practices.
2. A process approach that takes into account how criteria of evaluation are generated and applied, and for whose benefit. It includes the participation of stakeholder groups, such as involving patient groups in the development of specialist medical technologies, or teachers in the development of instructional technology.

3. An emphasis on more than just the formal functions of an ICT. As with the architecture of buildings, the architecture of ICTs raises questions of their livability, usability and sustainability.
4. Making the question of whose purposes are best served in the development of a system an explicit part of ICT design and evaluation. Thus the question of whose ideas influence the design process is an important one for human-centered systems.

We use the term "social design of computerized systems," or "social design," to characterize the joint design of both the technological characteristics of a computerized system and the social arrangements under which it will be used (Kling, 1987). These "social choices" are an integral component of computerization, even though they are usually not formally decided or completely within the control of any one person. They can even be byproducts of oversight, such as managers who neglect to train their staffs in a new computing application because they assume that it's "just like the old one" or "very user friendly." An example of social choices can be seen in the case example of phone line installations discussed above. ICTs to support this kind of service are designed with assumptions about the number of technicians who will work on a service request -- either one or a team. Choices such as these are social -- they reflect the ways that work will be (re)structured.

As another example, organizations that adopt portable computers to improve the flexibility of people's work situations and relationships must do more than simply acquire technologies to realize these specific advantages. Some of the desired convenience will hinge on technological choices, such as acquiring machines that run software compatible with that which is used in the office. But much of the resulting flexibility will depend upon social choices as well. For example, if organization A requires its employees to report to work daily during regular working hours even when they have the portable computers, then people gain relatively little flexibility in work location if that policy is not also changed. People may be able to take portable computers home after hours or on weekends, or on the road while they travel. Thus, organization A may gain some unpaid overtime work with these policies. But the men and women who work in organization A will not gain much of the "control over the location of work" which many people attribute to portable computing. In contrast, if organization B allows its employees to work at

places and times which they choose, then its employees can use portable computing to have even greater flexibility in their work practices. In each of these cases, those who procured the equipment and constructed the work policies and practices for organizations A and B created distinct socio-technical configurations -- or social designs. And these social designs, rather than the technology alone, will have different consequences.

Table 1 highlights the differences between the social design of ICTs and designs rooted in engineering. For example, engineering-centered conceptions of work and design take an explicit view, represented by visible sets of defined tasks and operations. In contrast, socio-technical conceptions of work analyze everyday work practices. Taking a look at whole activities as distinct from particular tasks means taking a look at how working people communicate, think through problems, forge alliances, and learn.

Table #1
Approaches to Designing ICTs for Workplaces

Standard Task-Technology Models	**Socio-Technical Network Models**
Explicit views of work	**Tacit view of work**
Work is documented, visible, and articulable	Aspects of work that are silent and understood by the group
Training	Learning
Tasks	Knowledge
Position in the hierarchy	Informal political networks, network of contracts
Procedures and techniques	Conceptual understanding
Work flow	Work practices
Methods and procedures	Rules of thumb, judgment
Common Goals:	**Common Goals:**
Improve efficiency Reduce human error	Improve work practices Observe how people discover and solve problems
Design Assumptions:	**Design Assumptions:**
User needs are identified by what is visible and documented	Information requirements emerge from observing everyday work practices
	Design is iterative
	Prototyping
	Collaboration and collaborative learning take place in a social context
Efficiency is a desirable outcome	Skill development is a desirable outcome
Technological Choices	**Technological Choices**
People can adapt to technologies chosen to support organizational values	Configurations matter and interact with human activities, such as work

2.4 The design and deployment of ICTs is influenced by the interests and orientations of some groups

Stakeholders for an ICT design differ depending on the nature of the ICT and the designing organizations. The stakeholders may include the design team itself, the people who will actually utilize the ICT, people and groups that depend upon the functioning of the ICT (even if they do not use it directly), and the designing organizations. Thus, the development of ICT applications requires the collaboration or involvement of a variety of distinct communities, composed of workers with different skills using different representational frameworks. This necessary heterogeneity poses a number of problems which cannot be removed simply by ensuring good

communication between the differing groups.

For example, the Worm Community System was an information system for molecular biologists who worked in hundreds of university laboratories to help them share information about the genetics of certain worms (nematodes). Its required socio-technical infrastructure for network connectivity and UNIX computing skills was dependent upon each laboratory's work organization (and local university resources) (Star and Ruhleder, 1996). Star and Ruhleder found that the Worm Community System was technically well conceived. But it was actually rather weak in supporting scientific communication because of the uneven and often limited support for its technical requirements in the different university labs. The system had been designed by a group of computer scientists who preferred UNIX. However, few of the bio-labs who would benefit from the system had UNIX expertise, and therefore they found the system puzzling and cumbersome to work with. In short, lack of attention to local infrastructure can undermine the workability of larger scale projects.

Because of their costs and socio-technical complexity, new ICTs don't "just happen." Groups or organizations that commission a customized ICT (such as a state motor vehicle agency seeking a newer vehicle registration system) have to mobilize and coordinate the resources to design an ICT package (or subcontract the project). This mobilization effort is rarely a neutral activity; it is easiest for upper managers or entrepreneurs to mobilize resources by emphasizing the social or organizational values that a new ICT can enhance. However, there may be a conflict between the values of those who want to have a given system used and those who will be having to use it. For example, the manufacturing division of one major computer company developed an elaborate order entry system to schedule orders. In order to generate a price for customers, the salesmen, who worked in a separate sales division, had to specify all of the computer's components, from the expensive hardware down to the relatively inexpensive connecting cables. Manufacturing staff wanted this type of detailed and accurate specification, because their division bore the costs of configuration errors or "dirty orders." However, many salesmen wanted to use the system to give customers rough estimates of the prices of different configurations. The salesmen were rewarded for their sales volumes and were not penalized for "dirty orders." Thus, the salesmen ended up rarely using the system because it required too

much time and effort to fill in all the information about the numerous inexpensive parts that the system required them to specify. This system was not able to fulfill the needs of the salesmen and their customers for quick estimates.

Manufacturing managers and their system analysts thought that a new interface would make the system more usable for the salesmen. They conducted a multimillion dollar interface redesign project, which had little effect. While the interface was improved, the redesign did not address the conflicts of values between the manufacturing staff and the sales force.

Similarly, assumptions about what how people work are often embodied in ICT design choices (Agre & Schuler, 1997). For example, e-mail systems that order messages for a person to read based on technical criteria such as their recency or length also influence the recipients' social relationships by encouraging more attention to some senders and their message than to others. An analysis which informs design should not just focus on optimizing the technical capacities of ICTs, but also recognize and the support social relationships which they influence (Kling & Star, 1998).

Technological artifacts may embody a single set of values, or several groups may influence the design of ICTs. In these complex design contexts, representing multiple views is difficult, messy, and often politically charged (Star & Bowker, 1995, p.41). The design of ICTs which work well for people and help support their work, rather than make it a little more complicated by getting in the way at times, is a subtle craft. It is not obvious, and it can not be well taught without an understanding of how people work and what kind of organizational practices obtain. Simple criteria -- such as get more advanced technology (whether it is faster or easier to use); get better technology; or organize systems so that they are more efficient -- have not been good enough (Kling, 1998). Organizations will have to learn to cope with issues such as re-evaluating how work is done; increasing communications between administration, technical support, and front-line employees; re-training employees; and continuously evaluating changing hardware and software needs. We should promote the design of ICTs that are really workable for people, rather than simply advocating technologies that may occasionally work and occasionally be valuable, but are often unusable, and thus incur extra cost and misplaced hope.

SECTION 3: THE CONSEQUENCES OF ICTs FOR ORGANIZATIONS AND SOCIAL LIFE

Understanding more generally the consequences of ICT on organizations and social life is a major concern for many information professionals, policy analysts and the public. Today, for example, the educational and social consequences of schools enabling their students to use the Internet in specific ways is a topic of discussion among politicians, educators, and parents, as well as researchers. In contrast, other topics, such as whether enterprise integration systems will push organizations to streamline their operations or will become costly forms of "electronic bureaucracies," are of more specialized interest -- to information professionals and managers in large firms, and to researchers. But whether the forms of computerization are those that most directly concern specialized professionals or are of broader public interest, the themes of "what the consequences of computerization will be" are very pervasive.

Understanding the organizational and social consequences of ICT is important for rational professional practices and social policies. There is a large body of writing about these topics, produced by researchers, professionals, consultants, journalists and pundits, among others. We consider the most reliable body of literature to be that which has been produced by researchers who study these topics analytically or critically.

The body of empirically-anchored social informatics research that systematically examines the consequences of ICT use has been developed since the early 1970s. Much of the research was conducted inside organizations because they were the major sites of computerization, until the later 1980s. We have listed a number of research reviews and research anthologies in Appendix I. There is a large body of research but only a few relatively general ideas can be mentioned in this short report.

Earlier, we indicated why direct effects theories of the consequences of computerization have not been very effective. Similar to direct effects models, technological determinism treats ICTs as information processing systems whose technical characteristics **cause** specific social changes when they are adopted and used. While technological determinism can be applicable and useful in situations that are characterized by high degrees of control and short time frames, it has

limited value in dynamic and complex situations that unfold over longer periods of time. Technological determinism cannot adequately account for the interactions between ICTs, the people who design, implement and use them, and the social and organizational contexts in which the technologies and people are embedded.

Systems rationalism (Kling, 1980) is a perspective that conceptualizes ICTs as rule-bound and carefully structured and then generalizes these characteristics to people, groups, and organizations. From this perspective, organizations and the people who work in them constitute rational systems, with formal common goals and work practices carefully designed to meet these goals; these systems can be analyzed at varying levels of granularity, in terms of the costs and benefits of alternative sets of goals and practices.

Systems rationalism can be useful as a starting point to help understand the value of ICTs in organizational practices, social activities, and work life, but it is not a good endpoint for analysis. Like all analytical models, systems rationalism simplifies the nature of technologies, the nature of people and their relationships, and the ways in which people interact with technologies. However, the problem with systems rationalism is not only that it represents a simplification, but rather that it represents a simplification that tends to emphasize formalities. For example, people's work is represented by their formally defined tasks, such as a journalist's work tasks being formally defined as conducting interviews and writing articles. This differs substantially from a worker's *actual* tasks, which, in the journalist's case, may include such things as borrowing from other news stories, spending much time figuring out whom to interview, updating PC software, or scavenging for a new printer cartridge in order to print out a story draft. The vast discrepancy between a formal listing of job tasks and how employees actually spend their time also includes the issue of how formal job descriptions overlook the amount of dependency that workers have on other people. Systems rationalism depicts as streamlined processes that are much more messy and complex. Thus, conceptions such as systems rationalism may be useful primarily in cases where the ICTs are designed and implemented to resolve a narrow set of well-understood organizational problems and there are high levels of consensus about problems and solutions by the major participants.

There is usually a conflict between the practical importance of being able to make predictions about the consequences of using ICTs and the knowledge that predictions may be fairly unreliable. Much of the reliability and robustness of consequential predictions depends upon:

- the time frame (shorter term may be more reliable than longer term),
- the units of analysis (it is easier to predict average behavior for many groups or people than it is to predict the behavior of specific individuals), and
- the level of prediction (it is easier to make "rough cut" predictions about the organizational or social consequences of technological change than more fine-grained predictions. For example, it may be easier to assess whether a new electronic forum will improve the quality of discussion in a professional association than to be able to predict the number of association members who will participate routinely.)

3.1 Communicative and computational roles of computer systems

One important aspect of the direct effects and systems rationalist theories of computerization is that their proponents tend to emphasize only some of a computer systems' information processing features, such as the size and contents of the corpus of a digital library or the mathematical approach of a forecasting model. However, computerized systems usually play communicative roles as well.

The earliest computer-based systems emphasized computational capabilities, primarily for diverse scientific applications and business data processing. However, groupware applications that are designed to enhance teamwork must be viewed in communicative terms. Similarly, computer networking, heightened by the multimedia presentations in the WWW, highlights the communicative roles of today's advanced information technologies.

Human communication plays a role in systems that emphasize intensive computation, as well: the mathematical models that are supposed to enhance human decision-making are interpreted within settings where communication between people is preeminent. Professionals and managers discuss (and negotiate) the assumptions behind mathematical models, their structure, the results of modeling runs, and their meaning (Dutton/Kraemer 1985).

Sometimes computer systems provide important social communication channels and media. Kling and Iacono (1984) reported an interesting example in large manufacturing firms which used certain computerized inventory control and production scheduling systems, called MRP (Material Requirements Planning systems). MRP systems are transaction-oriented ICTs whose data refer to materials (e.g., quantities of parts and subassemblies to be ordered or manufactured by certain dates). Conventional theories emphasize the ways that use of MRP can help their reduce their costs by significantly reducing their inventories. However, Kling and Iacono found that a MRP system can also serve as a social control system because it gives the staff in various departments information about the detailed activities of those in other departments. Purchasing departments are responsible for ordering parts, and different manufacturing departments are responsible for transforming purchased parts or grouping them in sub-assemblies. Manufacturing staff can attribute chronic shortages in certain kinds of parts, such as electronic circuits or motors, to the specific employees who specialize in buying that family of parts. Similarly, manufacturing staff can use an MRP system to track the performance of other departments in constructing subassemblies or in performing related activities, such as inspection and testing. Acknowledging the communicative aspect of ICTs is important because it increases our understanding of their uses and consequences by including the *social behavior* of people who use them.

3.2 There are important temporal and spatial dimensions of ICT consequences

Some of the popular conceptions of the consequences of ICTs for space and time are misleading. For example, it is an advertising cliche to say that "computer networks eliminate space and time." It is also hyperbole, when in practice organizations have been able to reduce some temporal and spatial barriers for work, communicating with their clients, and so on. Woody Allen once joked that "history is God's way of keeping everything from happening all at the same time." An ICT that eliminated space and time might seem to offer tremendous convenience for individual users. However, since they could also be continually accessible to others - regardless of their locations or time zones - people who are working with many other people could be easily inundated with communications and demands. ICTs are enabling people and organizations to reduce some of the communicational restrictions of space and time -- in ways that we do not understand very well.

On the other hand, time and space are also important considerations in understanding how long the consequences of ICTs take to show up, and where. The consequences of ICT deployments may be relatively immediate (i.e., develop over weeks or months), especially when their use is essential and requires only a few well-defined and easily-learned skills. Or their consequences may take time to build. For example, a new digital library or electronic journal may take several years to develop a constituency, especially when use is discretionary and the people who may potentially use it have alternative information sources. The affected parties may also be spatially distributed, as is often the case with networked ICTs.

3.3 ICTs are interpreted and used in different ways by different people.

The simplest conception of an ICT (or service), such as e-mail, a specific digital library, a project scheduling system, etc. is that it embodies the same meanings for everyone who uses it. However, social informatics researchers have found that people frequently interpret and interact with ICTs in more complex and varied ways (see Kling, 1980, 1987; Orlikowski, 1993; Newell, Scarbrough, Swan and Hislop, 1998).

The following case study of Lotus Notes' use at a major consulting firm illustrates this idea[11]. This consulting firm, which we will call Alpha, bought specialized equipment and 10,000 copies of Lotus Notes for their staff in 1989[12]. Lotus Notes, a documentary support system, is superficially similar to an Internet-like system with bulletin boards, posting mechanisms, discussion groups, and electronic mail for organizations. Depending upon how Notes is used, it can act as an e-mail system, a discussion system, an electronic publishing system, and/or a set of digital libraries.

Alpha is an international consulting firm with tens of thousands of employees worldwide. Their Director of Information and Technology believed that Lotus Notes was such a powerful technology that its usefulness would be patently evident, and that the main thing to do was to

[11] For fuller discussion of this case, see TIS SI, in press.
[12] Alpha's unusual mass purchase of Notes for all of their consulting staff was the subject of several reverential stories in the technical and business press.

rapidly roll it out to the consulting staff and let them use it in order to find creative ways to share information. The Director of Information and Technology felt that Notes was so revolutionarily valuable that people didn't even have to be shown illustrative business examples for its use, and that providing examples would be counterproductive as it might stunt employees' imaginations. The consultants should simply be given an opportunity to use it, and they would learn how to use it in creative ways.

The Director of Information and Technology was concerned that his firm was employing thousands of "line consultants" in different offices all over North America who were working on similar problems, but rarely sharing their expertise. Sometimes a consulting team in Boston would be dealing with an issue very similar to one being handled by a consulting team in Toronto or San Francisco. The consultants had no easy way of sharing their solutions to the problems they were facing with consultants in other offices. The plan was that the firm's line consultants would use Notes to store what they knew, and then share it.

The first test of Notes was with the information technology staff. They tended to use Notes; they found it interesting, and used it fairly aggressively for sharing information about their own projects. Alpha's tax consultants in Washington, D.C. were another group that used Lotus Notes (Mehler, 1992). The tax consultants disseminated tax advisories to Alpha offices around the country about shifting changes in tax legislation that might affect their clients. Alpha's tax consultants made substantial use of Lotus Notes to broadcast their tax advisories.

The line consultants were intended to be Lotus Notes' primary users. However, organizational informatics researchers found that the senior line consultants, who were partners in the firm, tended to be modest users, while the more numerous junior line consultants, called associates, were actually low users. They often seemed uninterested in learning how to use Notes, readily gave up if they faced early frustrations with Notes, and as a group did not spend much time with it. Here we have a pattern of different groups within an organization having different practices in working with Notes. How can we explain such differences?

One explanation focuses on the incentive systems in the firm. A good place to start our analysis

is with the associate consultants and the partners. Alpha -- and many other large consulting firms in North America -- reviews its consultants through a demanding promotion system. The associates receive an "up or out" performance review every two years. In the first few rounds at major firms, about half of the associates are fired at each review. In their "up or out" system, the goal of many of the associate consultants is to be promoted to the status of partner.

The associates are valued for their billable hours, and are effectively required to bill almost all of their time. As they become more senior, their ability to attract new business becomes more critical. "Billable hours" means that they have an account that they can charge their time to. Lotus Notes, the revolutionary technology, was not provided to them with a "training account" to bill their time to. Consultants who wanted to use Notes had to have an account to charge their time against, and the initial learning time was in the order of 20 to 30 hours. In 1991, the consultants were billing at about $150 an hour, so they had to find a client who would be willing to pay $3,000 to $4,500 for them to learn a system whose value wasn't yet clear to them. Many had trouble justifying that amount of expenditure to any of their clients at the time that they were participating in the Notes rollout. There was also an important question as to what the consultants would actually do with Notes after they learned how to use it. Consequently, relatively few associates saw much value in Notes, and there were no exemplary demonstrations showing them how other successful line consultants used Notes.

On the other hand, the partners had substantial job security (which was similar to university tenure). They could afford to experiment with Notes. They were more willing to invest some time to explore, often using e-mail, occasionally developing and sending memos, and so on. Overall, this case study contradicts the popular "Nintendo generation" explanation: "In the future, we don't have to train people about computing, because the Nintendo kids (or the Net kids) will learn quickly." In this case, the younger consultants generally had less incentive to learn Notes than did the middle-aged and older partners.

But what about the information technology staff and the tax consultants? These groups also had an advantage in their forms of job security. Many of the information technology staff were technophiles who were willing to work with an interesting new application. Lotus Notes has

been helpful for people who can invest time in learning how to use it, especially when they have joint projects and substantial motivations for communicating, for documenting work, for sharing memos, and so on.

The tax consultants, who were located in Washington, D.C., had a significant incentive to show that they were visible and valuable in the firm. In their case, fixed salaries not based on billable hours allowed them more freedom to explore Notes' uses. Lotus Notes allowed them to broadcast for visibility: it gave them the ability, in effect, to electronically publish their advice and make it quickly available to many of the consultants around the firm who wanted to read the Notes database. They hoped it would enhance their visibility, and thus show that the Washington office was not just overhead, but an important contributing part of the firm.

In short, although they proved to be of considerable importance, organizational incentive systems were not part of the original marketing story of Lotus Notes. It was the interesting information processing features enabled by Lotus Notes that were emphasized in numerous stories in the technical press (see, for example, Kirkpatrick, 1993.)

This case illustrates varied consequences of Notes' use in a large consulting firm, as opposed to one fixed effect. Finding such varied, conflicting consequences in different settings is common in this body of research. Social informatics researchers do not simply document the various consequences of computerization, but also to develop empirically-grounded concepts that help us to predict (or at least understand) variations in the ways that people and groups use information technologies (see Lamb, 1996; Robey, 1997). For example, analysis of the different organizational incentive systems for different professionals increases understanding of the disparate outcomes in the above case. (Also see Markus and Keil, 1994 for a case study of a little-used, large-scale expert system whose use was not supported by organizational incentive systems.)

One key idea of social informatics research is that the "social context" of ICT development and use plays a significant role in influencing the ways that people use information and technologies, and thus influences their consequences for work, organizations, and other social relationships.

Social context does not refer to some abstracted "cloud" that hovers above people and ICT; it refers to a specific matrix of social relationships. For example, social context may be characterized by particular incentive systems for organizing and sharing information at work. In the cases described above, different groups within Alpha and Beta have different incentives to share information about the project knowhow, and this affects their use of Lotus Notes.

The use of the WWW in university instruction today is another interesting example. A small fraction of university faculty are eager to explore the WWW as a way to enhance some aspect of their teaching -- whether it is making class materials more readily available to their students, developing on-line discussions or devising new forms of interactive activities. Many faculty, especially non-technical faculty at research universities, are much less interested in working with the WWW because they believe that using it would require a lot of time to learn HTML and other ICTs, to develop and maintain materials, and so on. These stances are further mediated by the extent to which the faculty's departments provide technological help or teaching assistants to help with the development of WWW materials. There are many other contingencies that can also influence the ways that university faculty interpret the WWW in relation to their teaching. The main point is that these interpretations are not uniform -- people's interpretations of an ICT are based on prior beliefs, and the perceived new opportunities and demands it creates relative to their other opportunities and commitments. How people interpret an ICT is of considerable importance because people (and organizations) with different interpretations will adopt and use ICTs differently.

3.4 ICTs enable and constrain social actions and social relationships

ICTs are sometimes called "technologies of freedom" because they extend the abilities of people and organizations to access data, communicate, etc. It is common for many technology-centered accounts of new ICTs to emphasizes the ways that they enable new kinds of action that were previously more costly, difficult or impossible. However, many of ICTs' freedoms come with some less visible constraints.

The shift from paper to electronic documents offers some interesting examples. People who work with paper documents often face the constraints of needing to travel to a library to obtain

them. However, once they are in hand, they can be read virtually anywhere. In contrast, digital libraries open the possibility of having documents accessible on one's desktop. However, unless they are then printed out, people can't easily read them on planes, in bed, at the beach, etc.

Researchers frequently find that ICTs, in use, do not simply "open new possibilities" for organizational action, for organizing work, for professional communication, for supporting education, and so on. Rather, they restructure information processing (and social relationships). For example, a team may use group calendaring software to help coordinate their activities. One advantage is that team members may be able to more easily schedule meetings. However, team members also bear additional responsibilities to keep their own schedules up-to-date (and thus to log in as they schedule and reschedule meetings and other activities during their workdays). (See Pino and Mora, 1998).

The ways that developers and local implementers configure ICTs to restructure social arrangements can take place at the level of whole organizations as well as in smaller scale settings such as work groups. To manage increasingly complex supply chains, streamline business processes and coordinate resources around the world, a growing number of the world's biggest corporations are implementing enterprise-wide IT management systems that are supposed to facilitate sharing data and tracking operations both around the world and across functional areas. These "enterprise systems" are touted as a means of reducing the operational and maintenance costs of running stand-alone systems and providing an opportunity to implement real global change. Today, many large business firms are investing hundreds of millions of dollars each in enterprise systems. They may be spoken of as tools to help people manage more effectively, but in practice, each enterprise system tends to impose a more centralized information structuring regime on a firm. Some mangers have found enterprise systems to be congruent with their current management practices, while others have restructured their businesses to fit the constraints of their new enterprise systems. A few organizations have abandoned enterprise integration projects after spending up to $500 million because the gains from the systems did not seem worth the new constraints (Davenport, 1998). Some of these firms reverted to information systems whose architectures better supported their more decentralized ways of managing and working. In a few cases, the firms embarked on developing

new enterprise system projects whose technological architectures seemed to offer a more appropriate set of opportunities and constraints.

3.5 ICTs and the control of users

When they are first introduced into social settings, the relationship between ICT use and social structures is reciprocal. Organizational informatics researchers have found that ICTs can restructure workplaces through the ways in which they are incorporated into the everyday lives of those who use them (Barley, 1986; 81). Technologies are also shaped by the everyday actions of those who routinely use them and the social settings within which they have been implemented (Orlikowski and Robey, 1991; 151). However, organizations usually stabilize around some configurations of work practices and ICT configurations. Thereafter, changes are incremental until there is some substantial "outside change" - such as changing physical locations, a shift to a new kind of ICT, a major shift in the mix of work or services being produced, etc.

Once organizations stabilize around some technological configurations (especially standards for complex infrastructures such as networking protocols, operating system families, and databases), they become taken for granted and institutionalized in ways that impede other subsequent innovations (Kling and Iacono, 1988). Today, for example, PCs are commonplace forms of workstations in virtually any kind of organization. However, in the early 1980s, mainframes or minicomputers running large DBMS and analytical programs and connected to workers via "dumb terminals" dominated the organizational computing landscape. Few central Information Systems organizations supported PCs or encouraged their use. Many departments obtained their first PCs when professionals and managers "snuck them in" -- by hiding their purchases under safe accounting categories, such as "word processors" or "engineering instruments," or even by physically carrying their own PCs into their offices.

3.6 ICTs often have important political consequences

In scientific communities, the term "politics" has an ambiguous status. When analysts use it to refer to governance processes in the larger society, such as the election of public officials, debate on public policies, development of legislation, etc, it can have a positive valence. However,

some scientists view the term "organizational politics" with some distaste, as if political processes are necessarily dysfunctional and inappropriate. In fact, in the 1960s and 1970s, some analysts had hoped that computer models could take "the politics out of decsion-making" inside organizations as well as within public agencies. This hope was not realized (Dutton and Kraemer, 1985).

Researchers who study organizations have found that organizations do not function simply as task systems. In practice, a view of organizations as political networks has added an important dimension to the study of organizations generally and to understanding the roles of ICTs in organizational change in particular (Laudon, 1974; Pfeffer, 1981; Danziger, Dutton, Kling and Kraemer, 1982; Markus, 1981). When viewed as political networks, organizations can be seen to have governance structures, ways of allocating important resources, and ways of legitimizing their actions. Groups within (and outside) an organization are often trying to influence a specific organizations' governance, allocations or forms of legitimization. Organizations differ in the forms of their political networks: some are more autocratic while others allow (and sometimes even encourage) conflict between competing groups and coalitions. When ICTs are significant organizational innovations, they require money and staff to acquire and implement, and it requires some legitimacy to restructure other people's work to align with the new practices that the ICT is supposed to enable.

For example, e-mail systems enhance professional communication only when people actually use them. In the late 1980s and early 1990s many managers, professionals and technologists who were enthusiastic about e-mail tried various ways to make e-mail use appropriate and legitimate in their organizations. From a political perspective, e-mail is not simply a "technical solution" that helps solve communication problems (such as reducing the frequency of "telephone tag" between people who are not always in their offices). Researchers have found that e-mail use can give greater visibility (and thus influence) to "peripheral participants," such as people who work at night or in field offices (Sproull and Kiesler, 1991). In this way, e-mail has "political outcomes" -- some people gain influence (and resources) while others do not.

In the mid-1960s, political scientist Anthony Downs speculated about the power payoffs of ICTs

in organizations and argued that power would shift towards those who collected information. Organizational informatics researchers have found that many ICTs actually can shift the balance of influence and power in organizations by restructuring access to information, technical staff, and the kind of legitimacy that informational resources can bring (Danziger, Dutton, Kling & Kraemer, 1982). Political processes are not static, and political analysts examine the ways that groups jockey for influence as the nature of the opportunities, stakeholders, coalitions, etc. change over time (Kling and Iacono, 1984)

One important contribution of the political networks view of the role of ICTs in organizational change is that it helps to deepen our understanding of the motivations for different groups supporting and opposing specific forms of ICT developments. Markus (1981) explained the support and opposition for a new centralized accounting system in terms of perceived power shifts. Her explanation contrasts with that of analysts who view people's support or opposition to new ICTs as a psychological disposition of being either pro-innovation or being technophobic. In a rich case study, Markus showed how the professionals who supported a new system were those who expected to gain influence from its use, while those who opposed it expected to lose control over their data through its use.

Hodas (1996) developed a power-based analysis of many school teachers' indifference or opposition to ICTs in K-12 schools. He observed that many K-12 teachers place a high value on having control over their students (such as having quiet, orderly classes). Many computerization projects in K-12 schools can upset teachers' control strategies since they require students to move around within classrooms, or between classrooms and laboratories. In addition, for a variety of reasons, children can develop greater expertise in computer use than their teachers (including time on task), and many teachers fear that their authority through expertise will be undermined.

Kenneth Laudon (1974: 164-166) found that the relative power of central administrators was critical in determining whether and how information systems are adopted in county governments. This insight may help explain some of the implementation failures of enterprise systems (mentioned in 3.4). For example, groups who have sufficient power and perceive threatened reductions in their influence may stymie the efforts of headquarters-based managers and

technologists who try to impose a more centralized managerial regime on them. Today, some of the debates about the value of electronic scientific publishing could be usefully examined from the perspective of expected gains and losses of scientific influence.[13] These power-oriented explanations differ from those explanations that simply focus on what advantages an ICT will afford some group.

3.7 There can be negative consequences of ICT developments for some stakeholders

New ICT developments are usually promoted by their sponsors in terms of their forseeable, direct benefits to some groups. However, it is common when mobilizing support for them to downplay or ignore their disadvantages. For example:

- Many large business firms have introduced Enterprise Resource Planning systems that can help them to streamline their information flows, solve Year 2000 problems, and save support costs by having a common systems infrastructure. However, deploying these systems has led to significant centralization in some firms, as well as disruption (Davenport, 1998).
- Many business firms, large and small, are encouraged to develop WWW sites as a way of enhancing their marketing and increasing their sales. However, many are losing significant amounts of money on their efforts at electronic commerce (Grower, 1999; Nelson, 1999) – with resulting stress on their staff.

But many ICT developments do often have some negative consequences which some key stakeholders did not want. Lynne Markus' (1994) careful case study of the social consequences of e-mail use between the staff at the headquarters of an insurance firm (HCP) helps to illustrate this idea. She found that HCP's upper managers required their staffs to rely upon e-mail, and it was the major medium for internal corporate communications at the time of her study. HCP's staff used e-mail to speed communications and bring people closer together. But they also reported significant negative effects, such as feeling that HCP was a less personal place to work. Electronic mail was often used to avoid face-to-face confrontation or unpleasant situations, and

[13] **Note to authors: Extend the argument in a more macro and SI direction & back to social shaping by drawing upon Mansell, Robin & Silverstone. *Communication by Design: The Politics of Information and Communication Technologies* (Oxford, 1995)]**

often in-office visitors were ignored while employees tended to the demands of messages on their computer terminals.

People use ICTs in ways that restructure some aspects of their social relationships. When these kinds of uses are systematic, social life is changed, and in ways that may improve some kinds of social relationships and activities at the expense of others. Sometimes, some groups are advantaged at the expense of others, as in the case of some implementations of Enterprise Planning Systems. It is common for ICTs to have systematic political repercussions with "winners and losers" (Danziger, Dutton, Kling & Kraemer, 1982; Markus 1981, 1983).

While the creation of "losers" from the implementation of ICTs may be done purposefully on some occasions, or considered an unavoidable side effect at other times, there are times, like at HCP, when no one foresees the negative impact that some people will experience from computerization. No one "wanted" HCP to feel like a less personal workplace. Even so, HCP's employees integrated e-mail into their worklives in ways that sometimes added barriers between themselves and their colleagues.

Sometimes these negative repercussions are relatively minor, and the benefits of computerization may be of much larger value to many participants. Sometimes the negative repercussions loom large for people who have the power or influence to block a computerization project, or to alter the ways in which systems are used. As an example of the latter, Saetnan (1991) studied the attempts of designers of a surgical room scheduling system, PREOP, to have it adopted in Norwegian hospitals.

PREOP was supposed to make more efficient use of staff time and physical resources by automatically scheduling arrangements for operations. However, Saetnan found that the scheduling algorithms did not effectively mesh with the work of doctors and nurses. After some frustration, the staff used the computer system simply to record schedules rather than to optimize them. The nurses had significant influence in scheduling the rooms, and were reluctant to submit to the surgeons, whose preferences were reflected in the design of the new system. Saetnan notes:

> *Having learned to master PREOP by overriding parameters, nurses could force*

> *PREOP to set up schedules exactly as they had before. . . . PREOP became a slave to the old routines and thus reinforced them (Saetnan 1991 434).*

On other occasions, one group is able to force another group to utilize a particular ICT in a specific way that disadvantages them (Kling, 1980; Kling, 1983; Markus, 1981). For example, credit cards and debit cards serve similar functions. However, the U.S. laws regulating credit cards give the public much more control in disputes with merchants than do the regulations regarding debit cards. The proponents of debit cards could have argued for the protections offered to credit card holders. Instead, they successfully lobbied for weaker protections for the debit card holders.

The distribution of goods and bads is a political outcome. The choice of which groups gain or lose is a political decision. There are numerous examples of ICT deployment within organizations that illustrate this idea. For example, in one large university, the central ICT staff changed the technical protocols that supported email use in order to make better use of new central mail-server computers. The transition to new mail servers was well-advertised. What was not well advertised was that the central ICT support staff was also dropping support from some popular e-mail programs that they had previously distributed. Faculty, staff and students who used these e-mail programs learned about the loss of support only when their e-mail did not work properly on the new e-mail servers. Their phone calls to a university ICT help center put them in contact with sympathetic staff who could not really help since they were not taught how to advise about problems with the e-mail software who support had been discontinued. In retrospect, it appeared that the central ICT staff continued to support and had tested the e-mail packages that they preferred in their own worklives. Some e-mail packages that were preferred by faculty or students who worked at home as much as on campus were not used in the central ICT organization. Support for these e-mail packages was quietly dropped to help simplify the work of the university's ICT organizations. It was possible to configure these programs for the university's new e-mail servers by finding technical tips that were posted on the WWW of central support organizations at other universities! But this technical self-help was very disruptive and unnerving for the faculty and students who spent several hours doing it, while their professional communications via email was unexpectedly interrupted. In this example, the

faculty, students and staff who used the e-mail packages that were personally preferred by the central ICT support staff were advantaged while those who relied upon different (and often technically better) e-mail packages had their professional lives disrupted.

3.8 ICTs rarely cause social transformations

Much of the popular literature about ICTs and social change emphasize "social transformations" and the ways in which ICTs create new social worlds. Empirically-oriented social informatics researchers who carefully study ICTs and social change find that the pace of change is relatively slow, and that there are usually important continuities in social life in addition to the discontinuities.

Bold claims have been made about how ICTs have "transformed work." Guzdial and Ord's (1996) claim that: "The nature of work is currently undergoing a complete transformation. . . . Information technology is underpinning this transformation" typifies a commonplace claim in the business and technology press. Some pundits go further in emphasizing the rise of virtual offices, the replacement of jobs with project-level assignments, the demise of large organizations, and so on.

In the U.S., worklife has changed in many ways in the last 15 years since PCs became popular. However, some of the shifts have come from a changing mix of work – from manufacturing production to services. Other shifts are the result of increasing numbers of professional and managerial jobs requiring heavy travel as firms scale up geographically. However, Kling and Zmuidzinas (1994) found that managers had at least 18 different directions in which they could reorganize work. And, in practice, many computerization projects played only modest roles in restructuring white collar workplaces.

Chapter III: Social Informatics for Public Policy Analysts

SECTION 1: BACKGROUND AND CASE STUDIES

> *Communications policy is characterized by constant struggles and disagreement and not by some monolithic ideology. Policy "issues" are always hotly contested. Knowing what those issues are, who is involved, and what is at stake is part of the job of the communications policy expert. Communications policy is hardly a straightforward matter of engineering. It is not a clean, neutral, predictable, mechanical, or routine process. (Thomas Streeter)*

This chapter examines how social informatics research can be of value to information and communication technology (ICT) policy analysts. In North America and Western Europe, there are numerous ICT public policy issues, that include the extent to which public agencies should aggressively encourage ICT use (in arenas that range from electronic commerce to education), ways to effectively protect the privacy of digitized personal information, adjucating rights to intellectual property that is stored in digital media, and subsidizing Internet access for economically or regionally disadvantaged groups.

Analyses to examine appropriate policies on matters such as these rest, in part, on one's social philosophy and applicable legal traditions. However, they also rest on beliefs about how ICTs are developed and used in practice, and with what social consequnces. For example, some politicians argue that it is imperative to expand K-12 students' access to the Internet by financing the costs of schools acquiring more computers that are connected to the Internet. This stance makes important assumptions about the abilities of school sites to keep their equipment "up and running," the abilities of teachers to effectively integrate resources that are available on the Internet into a richer, inquiry-oriented curriculum, and the ways that K-12 students will use these resources when they are available (ie., primarily to enhance their learning, primarily to chat on-line and/or primarily to play games). Research that examines socio-technical assumptions such as these (but which does not directly evaluate specific policies) is often called policy-relevant research.

Some of the findings and theories of social informatics research can help to inform public policy-making, even when the research does not evaluate specific policies. We shall examine some examples in this chapter. Porter and Hicks (n.d.) observe that policy-relevant research can be very influential in policy analysis and policy-making, but these influences are usually slow and indirect.

> ... policy-relevant research seldom has an immediate or direct impact on government decisions; more typically its influence is indirect and incremental. New technical knowledge tends to "creep" into policy making, gradually altering the background assumptions and concepts that frame policy discourse. Because these kinds of cognitive and linguistic shifts are fairly subtle and diffuse, and often are only observable over a span of years, the impact of (social) scientific research and analysis on policy making is often underestimated (Porter and Hicks, n.d.).

In the first two chapters, we highlighted several key social informatics thema. Of those, are specially important for ICT policy analysts. They are listed below in Figure 1

Embeddedness: ICTs do not exist in social or technological isolation--their cultural and institutional contexts influence their development, implementation, use, and role in organizational and social change.
Configuration: ICTs are socio-technical networks that can configured in ways that influence their uses and social consequences.
Duality: ICTs have both enabling and constraining effects on groups, organizations and larger scale social orders.

Figure 1. Key Social Informatics Thema

We begin our discussion with the first of two brief case studies. This first case illustrates how ICT policy analysts might have used social informatics to modify, rethink, or abandon an ICT deployment proposal. Following this study, we will examine some historic and current ICT policy analysis organizations in the United States and Europe (the principal loci of ICT policymaking during the past decade) to determine where social informatics thema have a presence, and to suggest places where they could be of benefit. We will then present a case

study about the Next Generation Internet (NGI), as informed by social informatics, in order to provide a counterpoint to the first case study. We conclude by offering suggestions for how ICT policy analysts can incorporate social informatics thema into their current and future discourse.

1.1. Notebook Computers for Textbooks

In the fall of 1997, the Texas Board of Education proposed what seemed to be a very cutting-edge idea: replace public school textbooks with notebookfenhance computers. Their motivation? Cost-savings. Facing a $1.8 billion bill for new textbooks over a six-year period, the board's chairman, Dr. Jack Christie, developed a plan to put durable, low-cost notebook computers into the hands of every Texas public school student and save the state nearly $300 million each year. These projected savings would come from shifting materials costs from the state to parents. Instead of purchasing textbooks, the state would require parents to lease a notebook computer for every child. The monthly lease fee would be $10 per child per month and the total lease cost would be $500. Currently, the state of Texas spends $450 on textbooks for each student per year, or $37.50/month (UIC and NYT20May98). Asking parents to pay for books or other educational materials is not unusual. Indiana, for example, charges parents an annual $100 textbook rental fee for every child they send to public school.

Christie presented his plan to the state legislature in May 1998. Surrounded by supporters from several educational software vendors (who lauded Christie as a "visionary"), he enthralled his audience with predictions of higher test scores, happier, more engaged students, future tech-savvy employees, and significant cost savings. He argued that notebook computers would be better than textbooks because available educational software would be more current (as well as inexpensive and quick to update), and the notebook computers would contain modems so that students could connect to the Internet. With the state saving so much money, some of Christie's supporters could envision additional benefits, such as a reallocation of funds to construct new schools in order to decrease classroom size and teacher-student ratios.

Despite all the possible economic and educational benefits, the proposal still has not received legislative approval. Why would such a pro-education, pro-student proposal stall in the legislature? While the plan seems to have key ingredients to ensure easy approval, the following

two questions may have caused some legislatures to scrutinize the proposal more closely:

- How much do notebook computers enhance student learning at K-12 schools, thus increasing the value of education?
- What are the actual costs of supporting millions of notebook computers for students and teachers?

With regard to the first question, some other states currently use ICTs to help remediate some public education deficiencies. School districts in South Carolina, Ohio, and New York have been experimenting with variations of "the notebook computers for students program" for some time, albeit with mixed results. A teacher in one poor New York City school district claimed that notebook computers made one of her students "write longer and more thoughtful assignments" (CSM). Other teachers are skeptical about the positive benefits of replacing books with notebook computers and argue there is no systematic research that demonstrates that computer use improves student learning or achievement. More empirically-anchored research on the role that computers play in K-12 classrooms should be conducted by education researchers grounded in curriculum and instruction theory (e.g., Coley, Cradler and Engel, 1997; Schofield, 1995).

The second question, that of technical support infrastructure costs, is more complex. The Texas proposal focused on cost savings. However, it did not provide a short or long-term plan for ICT implementation, training, upgrading, and maintenance. An organizational informatics analysis of Christie's proposal would question the absence of such plans. A smooth implementation of any networked system requires, at the very least, some technological standardization within school districts or at least school sites. Computer training requires a level of standardization and a significant time commitment. Proficiency in any field takes years of formal or informal experience. For example, people who want to be public school teachers must follow a certified curriculum at an accredited university and (in some states) they must also pass a battery of standardized tests. Successful completion leads to certification (essentially, a license to teach) and potentially to a job in a public school. Maintaining that certificate requires additional education, either by studying for advanced degrees or by taking continuing education courses. It is conceivable that a move to notebook computers could alter pre- and post-certification

requirements to ensure that teachers can integrate notebook computers into their curricula. None of these benefits, however, comes without an additional price tag.

Organizational informatics helps to understand the significant costs associated with providing a technical support infrastructure for the notebook computers in Texas. This kind of analysis would consider small hidden costs that could scale up, such as the cost of spare notebooks to replaced damaged units, or even the increase in school electricity bills because notebook battery life is limited and students would have to have their notebook computers plugged into electrical outlets for the majority of the school day. But, most seriously, they would also identify major expenditures that would come from having to hire technical support personnel to maintain and upgrade millions of notebook computers in Texas. The current industry technical support model is one systems administrator (who typically earns $50,000/year) for every 100 computers. A simple calculation using these and Christie's numbers reveals that the monthly cost of providing a critical technical infrastructure would be approximately $42/month. It is inconceivable that all Texas parents could afford $52/month ($10 notebook lease fee plus $42 support fee) per student. If the state of Texas agrees to pay the $42 fee, the projected $1.8 million cost savings would evaporate. Instead, there would be an increase of $54 per student. In short, Christie's plan cannot deliver the cost savings that he promised.

Social and organizational informaticians have already researched infrastructure issues similar to the Texas notebook computer proposal (Schofield, 1995; Kling 1992; Kling and Star 1998; Kling and Scaachi 1992; Star and Ruhleder 1996; Suchman 1996; Schmidt and Bannon 1992; Gasser 1986). Their research has demonstrated that the deployment of ICTs has far-reaching but subtle consequences and indicates that those responsible for ICT deployment often overlook or fail to see those consequences. The Texas notebook computer proposal is another good case in point and one which could have benefited from social informatics research.

Christie's initial vision did not include a networking element. But if the Texas proposal, like Clinton/Gore proposals to connect all U.S. K-12 schools to the Internet, included a plan for networking the notebook computers to allow unrestricted access to the Internet, social informaticians would also examine the issues of pedagogical value, Internet filtering and

intellectual property rights. It is worth commenting on the first of these issues, pedagogy, very briefly. Most of the rationales for providing Internet access to K-12 schools are based on (often tacit) assumptions that such access will enable students to learn through inquiries that are enriched by a wide array of resources that cannot be readily found in K-12 school libraries and locally in many communities. Most of the educational technology projects funded by the National Science Foundation in which schools use Internet access also emphasize inquiry-based pedagogies. This model has strong appeal to many academics who see processes of disciplined inquiry as an important element of continuous personal learning (as well as being reflective of a scientific or scholarly orientation, more generally).

However, developing a new inquiry-oriented set of teaching practices that integrate major new resources, such as the heterogeneous array of reports and discussions available through the Internet, takes significant time for teachers to develop and to refine. Unfortunately, K-12 teachers have relatively little slack time for developing new teaching approaches. A U.S. Presidential Advisory Committee with some participants who were well informed about social informatics research raised the issue of teacher time in these terms:

> On average, teachers have only ten minutes of scheduled preparation time for each hour they teach. Since this is generally insufficient to adequately prepare for their classroom responsibilities, they typically spend additional hours outside the school day preparing lessons and grading student work, resulting in an average of 47 hours of work per week. Given such schedules, most teachers find it extremely difficult to reshape their teaching on an ongoing basis around a rapid series of technological innovations.While some of the technology available to teachers application packages designed to provide assistance with various administrative, record-keeping, and student assessment tasks, for example may free up a certain amount of time, this effect is unlikely to offset the additional time required to effectively utilize computers on an ongoing basis. Estimates formulated by various researchers suggest that it will take the typical teacher between three and six years to fully integrate information technologies into his or her teaching activities, and ongoing technological changes are likely to ensure that the learning curve never levels off completely. Unless additional time can be made available through the elimination or de-emphasis of other, less critical tasks, such demands are likely to represent a significant ongoing obstacle to the effective utilization of educational technology.
>
> The problem of insufficient teacher time encompasses both a logistical question (how to restructure the school day to give teachers time to develop technology-related teaching skills) and an economic question (how to pay for the additional

> time associated with technology-related professional development and class preparation) (PCAST, 1997).

The point of these observations was not to criticize the national project of connecting K-12 schools to the Internet. The point adapted a deeper social informatics finding – that the value of ICTs usually comes when social practices are changed as well as technologies; changing (or adding) technologies alone rarely produces many transformative benefits. In the case of providing K-12 schools Internet access, the Presidential Advisors are noting that school reform will also depend upon giving teachers more time to learn how to integrate Internet resources into enriched forms of teaching.

The case of Texas, however, illustrates some of the deeper ironies of technology-based school reforms. Texas is one state whose recent governors and State Board of Education have embraced high-stakes standardized testing, in an effort to improve education and the accountability of schools to their publics. High-stakes standardized testing – in which students' scores on a standardized test are used to decide such matters as who will receive high school diplomas, annual raises for teachers and school principals, and the kinds of state funding available for school sites – is a highly controversial educational reform (Khattri, Reeve, and Adamson. 1997). Some educational researchers are enthusiastic about standardized testing to help improve school accountability, but are less enthusiastic about high stakes testing. Some politicians, such as the current and previous governor of Texas, are among the most committed to high stakes testing. In contrast, numerous educational researchers claim that high stakes standardized testing reduces the quality of education for many students, because many teachers "teach to the test (Grant, 1999; Mabry, 2000; Rallis and McMullen, 2000) in ways that limits the effective curriculum and de-emphasizes "authentic" inquiry oriented instruction. Some educational researchers have been seeking forms of testing that are compatible with authentic inquiry-based teaching and learning (Mabry, 1999; Rallis and McMullen, 2000). But these are new, localized, experimental efforts.

From our earlier discussion of the adoption of ICTs in organizations, we discussed how local incentive systems strongly shape behavior; in fact, they are often "designed" to do so. In a state like Texas high stakes testing is supposed to shape the behavior of many school administrators and principals. The high-level rationale is that the testing regimes will lead teachers to teach in

ways that improve students' learning. However, those Texas teachers who are spending their limited "slack time" in learning the tests and how to teach test content, will have even less time to develop the inquiry-oriented pedagogies that Internet access could support. In short, the two reforms – expanding inquiry opportunities with Internet access in the K-12 schools and tightened school accountability through high stakes standardized testing – will clash when they make extremely conflicting demands for how teachers use their time. He extent of these conflicts in practice is an empirical matter. But indirect evidence such that the different educational reform efforts that are sweeping the U.S. may be incompatible in terms of classroom practices. This does not mean that reforms should not be advocated. Rather , it indicates that the concrete demands of reform programs in the classroom and on students and teachers' time and orientation has to be brought center stage to set appropriate expectations for their practical value.

1.2 U.S. ICT Policy Analysis (1970 – present)

For the past twenty years some government organizations, especially in the United States and Western European, have been systematically publishing policy studies and policy-relevant studies about the impact of ICTs on economies and society (see Table #2).

ORGANIZATION	REPORTS TO	PERIOD OF ACTIVITY	WWW SITE
Office of Technology Assessment (OTA)	U.S. Congress	1972-1995	http://www.wws.princeton.edu:80/~ota/
Computer Science and Telecommunications Board (CSTB)	**National Research Council -- Commission on Physical Sciences, Mathematics, and Applications**	1987-present	http://www4.nationalacademies.org/cpsma/cstb.nsf
President's Information Technology Advisory Committee (PITAC)	Executive Office of the President	1998-2001	http://www.ccic.gov/
National Telecommunications and Information Administration (NTIA)	U.S. Department of Commerce	1978-present	http://www.ntia.doc.gov/reports.html
Secretariat for Electronic Commerce	U.S. Department of Commerce	1997-present	http://www.ecommerce.gov/
Programme on Information and Communication Technologies (PICT)	Economic and Social Research Council (ESRC) (U.K.)	1985-1995	http://www-rcf.usc.edu/~wdutton/pict.htm
Information Society Promotion Office (ISPO)	Information Society Activity Center of the European Commission	1994-present	http://www.ispo.cec.be/

Table #2 -- Some Major ICT Public Policy Analysis Organizations or Programs

In the 1990s, a number of private policy-oriented organizations have systematically examined ICT-related issues – including the Internet Policy Institute, the Benton Foundation, and the Electronic Privacy Information Clearinghouse, and the Progressive Policy Institute. In addition, many other organizations articulate (and try to publicize) ICT policy preferences for topics that intersect their areas of concern. For example, the American Library Association has developed policy positions and given testimony to the U.S. Congress on topics such as copyright, using software filters to restrict children's access to internet sites, and subsidies for libraries in disadvantaged areas to access the Internet (see http://www.ala.org/oitp/). In this chapter, we will

focus upon those organizations and programs that have produced a significant number of elaborate ICT policy analyses or ICT policy relevant research.

1.2.1 U.S. Congress's Office of Technology Assessment (OTA)

Studies conducted by researchers at the Office of Technology Assessment (OTA) in the United States, and from 1980-1995 underscored the need to understand the relationship between ICT developments and society. The OTA was created as a Congressional office in 1972 to provide. The OTA's scope was very broad and included energy, transportation, international security, space, telecommunications, commerce, health, education, and the environment. It was designed to provide non-partisan "objective" scientific and technical analyses for Congressional committees. The OTA was governed by a bipartisan Congressional technology Advisory Board which approved all of its substantial studies. The studies were conducted by a full-time professional staff that created stakeholder panels for each study and also often hired consultants and university-based researchers to gather and analyze new data. OTA was seen as an important model for helping to inform politicians about the likely consequences of their legislation, and it stimulated the development of similar programs in a few Western European countries. Bimber (1996a) observes that:

> As is often true about the role of substantive expertise in the policy process, the effect of OTA's work was limited almost exclusively to early stages of policy-making, during agenda-setting processes. Staff and key committee members used OTA work in judging the salience of problems, in framing issues, and in identifying policy options--typically well before bills were even introduced. Legislators rarely drew the agency into the more publicly visible processes of debating bills, voting, and publicly explaining decisions. This fact contributed to OTA's low profile inside Congress and especially outside of it.

Unfortunately, the OTA was "defunded" in 1995 when a coalition of conservative Republican Congressmen were looking for ways to show that they could reduce the size of the Federal

government, including Congressional support services. OTA's elimination represented a concrete accomplishment, or "budget trophy, " even though its 22 million dollar annual budget represented a tiny fraction of the hundreds of millions of dollars that these politicians hoped to eliminate. From the Congressional budget and even less of their aspirations of elliminating billions of dollars in Federal spending. The politics of OTA's operations and demise lay well outside the scope of this report[14].

OTAs approximately 50 book-length reports about ICT developments included studies of Federal governments information systems (for policing, social security, tax administration, and postal services), ICTs in healthcare, finance and education, privacy issues, workplace issues (from manufacturing shop floors to offices), and communications infrastructure in rural and metropolitan areas. Social informatics researchers participated in some of these studies as panel members or as contract researchers. However, OTA's ICT panels that examined private sector developments often seemed to be dominated by various commercial interests[15].

One report, *Critical Connections: Communication for the Future*, (U.S. Congress, Office of Technology Assessment, 1990) is worth noting for the ways that it integrates the key social informatics thema listed in Figure 1. Its summary acknowledges dramatic changes in the U.S. communication system and views these changes as being potentially positive for society. However, it recognizes and articulates clearly that rapid technological change can also bring about negative consequences:

> *New technologies hold promise for a greatly enhanced system that can meet the changing needs of an information-based society. At the same time, however, these technologies will undoubtedly generate a number of significant social*

[14] Interested readers can learn more about the OTA in Bimber (1996b).

> *problems. How these technologies evolve, as well as who will be affected positively or negatively, will depend on decisions now being made in both the public and private sectors. (OTA, p. 3)*

In the discussion about policy issues and congressional strategies, *Critical Connections* states that the first priority for consideration is "equitable access to communication opportunities." Earlier OTA research revealed that "changes in the U.S. communication infrastructure are likely to broaden the gap between those who can access communication services and use information strategically and those who cannot" (p. 11). In present discourse, this gap is often referred to as "information haves and have nots" (in Europe, "social exclusion"). The "have nots" include the urban and rural poor, those isolated from technology because of geographic location, and other groups of individuals who, because of economics, abilities, or location, cannot readily access ICTs. Many technologists believe that reductions in computing costs will alleviate this gap. However, *Critical Connections* indicated that this gap will probably widen because of increasing costs associated with the development of new ICTs as well as communications policies which may affect how ICT developers and providers conduct business in the future.

In addition to making society rather than technology the focal point of ICT policymaking, *Critical Connections* also provides a conceptual framework for analyzing policy issues affected by the rapid emergence of ICTs. This framework includes two opposing perspectives; one (Innis and McLuhan) views technology as shaping society, and another views societies shaping the technologies and technological configurations that they adopt (OTA, p.34). Although "conceptual frameworks" are common in scholarly publications, their incorporation in this OTA report helps its audience understand the relationship between ICTs, policy, and society. Like research informed by social informatics, it also identifies the stakeholders involved and the

[15] The processes of commercial domination were often informal. In addition to serving on OTA's panels, commercial representatives could often provide key data that the OTA staff needed for their studies. In addition, representatives of commercial firms (or their industry trade groups) were more likely to "drop in" at OTA on trips to Washington than were the much less well-funded representatives of more public-interest groups. These commercial representatives did not always share policy preferences; by design they were selected to represent commercial groups with different stances in the topic under study. Between 1980 and 1995, OTA's ICT studies were conducted within a program that had several changes of managers. The managers who had the greatest expertise in social informatics were capable of working with commercial representatives without much undue influence. In contrast, those with the least substantive expertise in social informatics seemed to rely more seriously upon commercial representatives for guidance.

positive and negative aspects of ICT impacts, and it foreshadows potential policy decisions.

1.2.2 The Computer Science and Telecommunications Board (CSTB)

Many academics are aware of the National Academy of Sciences (NAS), and view it as a highly prestigious and elite scientific society. The NAS was not founded to serve as an elite scientific society. It was founded in 1863, during the U.S. Civil War, to help advise the U.S. Government on scientific and technical questions – such as appropriate standards for weights and measures. Over the last 140 years the organization has expanded its structure (with National Academies of Engineering and Medicine, a National Research Council to organize its research, and a National Academies Press to publish its reports). And the range of topics that the National Research Council (NRC) examines now include ICT innovation and their social aspects.

The NRC's Computer Science and Telecommunications Board (CSTB) is the primary organization within the National Academies to examine these ICT issues. Over the last 15 years, it has conducted several dozen systematic studies and issued a comparable number of book-length reports. Given their breadth, it is difficult to summarize the scope of the CSTB's charter in a few sentences. It is broader than the OTA's and also includes the health of Computer Science and Computer Engineering as academic disciplines. Some recent reports include examine the role of the U.S. Library of Congress in an era when many documents are published in digital formats, ways to improve the reliability of healthcare information that is available on the Internet, programs of social and technical research that would advance our knowledge about how to make Internet access easier for "ordinary people," ways of adjucating property rights to digitized information, and ways to improve the public accessibility to electronic government information (see http://www4.nas.edu/cpsma/cstb.nsf/web/published).

With the demise of OTA, the CSTB is arguably the most significant ICT policy analysis organization in the United States. There are numerous important differences between the OTA's organization and processes and those of the CSTB. In brief, the OTA's studies were subject to Congressional approval, supported by Congressional funding, conducted primarily by a full-time professional staff with the assistance of occasional contract assistance, and guided by study

panels who represented politically identified stakeholders. In contrast, the CSTB's studies are subject to approval by scientifically-oriented NRC review boards, funded by Federal agencies (ie., Defense Advanced Research Projects Agency, Air Force Office of Scientific Research, National Institute of Standards and Technology, National Science Foundation, Office of Naval Research) and industrial firms (ie., Cisco Systems Sun Microsystems, Hewlett-Packard, Time Warner Cable), carried out on a voluntary basis by prominent scientific and technical experts, and guided by the CSTB. The CSTB's rotating membership is composed of primarily Computer Scientists and Computer Engineers from research universities, and a few industrial Computer Scientsists who have made noted technical contributions to the field. In addition, OTA reports avoided making policy recommendations: policy making is the domain of their Congressional sponsors. In contrast, NRC reports often advocate policy action.

The CSTB's staff argues that their reports "changes the way people think about information technology and public policy." They are take credit for advancing action recommendations which have often been adopted and adapted by the Federal government and some commercial firms. The CSTB also claims a unique and important role in altering the perceptions, beliefs and actions of many academic computer scientists:

> CSTB has additional impact as an institution: service on the Board and on the committees it oversees has expanded the public policy awareness and public service contribution of hundreds of computer scientists, while enhancing the insight into information technology of the other experts it engages. Several of these individuals have adapted their own research programs and undertaken new and more substantial public service commitments as a result of the introduction and education they associate with CSTB (at http://www4.nas.edu/cpsma/cstb.nsf/web/cstb's_impact)

We (this reports' authors) have heard the CSTB's reports discussed in positive terms by senior Federal staff who deal with ICT policy, program managers in research agencies (such as the NSF) and academic computer scientists. The reports are not as well valued within the social informatics research community because they tend to emphasize a more

dated view of ICT uses in social contexts rather than ICTs as socio-technical configurations and accomplishments.

One popular CSTB study, *Information Technology in the Service Society* (CSTB, 1994), illustrates some of these limitations. This ambitious report examines the problem of measuring productivity changes that may result from the adoption and implementation of new information technologies. While US service companies spent more than $750 billion in the 1980s just on computer and communications hardware, official productivity statistics had only grown an average of 0.7 percent a year. The study attempted to explain this paradox and report why standard measures of productivity are inadequate. The report includes a careful study of productivity statistics and some discussions of the economic changes from computerization in organizations. The reports authors assume that computerization *must* improve productivity in organizations. But they observe that "For the most part these productivity measures do not reflect aspects of service quality, such as speed or convenience that are affected by information technology, nor the alternative cost of what would have happened without it."

However, several brief discussions within the report reflect the social informatics finding discussed earlier that the value of ICTs usually comes when social practices are changed as well as technologies; changing (or adding) technologies alone rarely produces many transformative benefits. The report cites an example provided by Raymond Caron, President of CIGNA Systems that ICTs designed to save insurance underwriters work proved to be of little value because their was no effort to "design change in the overall process" of underwriting work (CSTB, 1994: 170). In one passage, the report picks up the social informatics finding and notes:

> "Indeed, the full realization of benefits from using IT generally requires not just an extensive investment in hardware, but a complete overhaul of the firms' traditional organizations, systems practices and culture. …. A majority (60 percent to 80 percent) of companies interviewed by the committee fount that the use of IT had an impact on their organmizational structure (e.g., changing spans of control, facilittaing organizational flattening, or encuraging use of self-directed teams). But very few made a full transition to supporting their new organizational

> structures with both new customer-oriented measures of performance and new reward systems. (CSTB, 1994:180)"

The report also observes that:

> "Direct and intimate user involvement in the specification, design, and implementation of IT systems was a strong contributing condition for success in the vast majority (over 85 percent) of the companies interviewed. (CSTB, 1994: 181).

However, these ideas do not percolate into the reports' concluding chapter or recommendations. Many readers could readily interpret the CSTB's report as saying that ICTs readily improve organizational productivity, but that the national statistics are amiss and new forms of measuring commercial performance need to be devised.

It is ironic, that the NRC published another report about ICTs and productivity in the same year: *Organizational Linkages: Understanding the Productivity Paradox (*CBASSE, 1994). *Organizational Linkages* reports a study conducted by the NRC's Social Science Commission. Its report foregrounds some of the social informatics insights that are mentioned, but buried, in the CSTB's report. Its authors try to break new ground by better understanding how organizational practices and coordinated change programs are integral to creating value from ICTs. *Organizational Linkages* does more to help make sense of the productivity paradox as represented in the survey data collected by the CSTB than does the CSTB's own report.

Some of the social-analytical limitations of CSTB's reports seem to derive from its tacit role to help to legitimate Computer Science within the NAS (and by extension, the hardware and software that are part of ICTs, which are seen as the fruit of Computer Science research. Further, the CSTB is composed of elite Computer Scientists whose technical and scientific accomplishments helped to anchor their appointments. Many of them have a deep concern that ICTs be developed and used in socially benign ways, but have little grounding in the social informatics research literature. They are predominantly people who would be viewed as broad-

thinking by their academic and industrial colleagues. However, the question at hand is whether the CSTB's world view is sufficiently engaged with the relevant social informatics research so that it can effectively lead the nation in how to view ICTs in the social world.
Further, the Computer Science research community, which influences the staffing of the CSTB and its studies, has generally avoided a close study of the actual uses of the kinds of ICTs which organizations and households routinely use. John King makes this point in an appendix to another CSTB report about designing ICT interfaces for "ordinary people":

> … important aspects of research into group, organizational, and institutional usability have been under way for many years. Although largely ignored by the computer science research community, the vast range of economically vital computing applications in organizational information processing have drawn much attention from researchers in management information systems, library and information science, medical informatics, and other fields. Transaction-processing systems, which remain among the largest and most complex computerized information systems, were made possible only by careful study and learning-by-doing design to meet interface needs at the individual, work group, organizational, and institutional levels. To pick just one case in point, designers of the airline reservations system, which literally revolutionized air travel, had to overcome numerous complicated problems at all social levels, including being modified to comply with court-ordered remedies against unfair competitive practices. Similar stories can be told regarding credit data-reporting systems, financial accounting and reporting systems, personnel management systems, computer-integrated manufacturing systems, and so on. The lesson here is that a great deal of useful information on the development of effective interfaces at the higher social levels is available in the applications-oriented research communities. (King, 1997)

As we indicated above, the CSTB plays an incredibly important role in investigating ICT public policy in the U.S. today. It is arguably the most likely organization to bring relevant social informatics insights into national policy discussions. Like all organizations, the CSTB is imperfect. Unfortunately, some of those imperfections

significantly limit its ability to effectively draw upon the most relevant research

1.2.3. President's Information Technology Advisory Committee (PITAC)

Today several executive branch organizations play significant roles in shaping the current technology development and ICT policy agendas in the United States Government: the Executive Office of the President (with its Office of Science and Technology Policy and various groups that report to it), and two offices in the U.S. Department of Commerce. One of the groups that advises the White House is **President's Information Technology Advisory Committee (PITA**C)[16] whose membership includes 26 prominent academic computer scientists and ICT industry leaders. PITAC was charged with providing an independent assessment of the Federal government's role in information technology R&D. PITAC had a two-year tenure (which was extended until 2001) and issued a major report early in 1999. This report lead the White House to propose a 336 million dollar increase in Federal ICT research.

PITAC organized its inquiry through several subgroups. Their major foci and expertise lay in technologically focussed topics, such as scalable ICT infrastructures and high speed computing. But they also included a Socio-Economic and Workforce Impacts (SEW) panel. PITAC's SEW panel included a key social informatics argument in its overview, namely that ICTs have both enabling and constraining effects on social settings. The committee wrote, "we must understand the transformations and potential dislocations affected by technology adoption and diffusion" (www.ccic.gov). In an interim mid-1998 report, SEW illuminated the processes and consequences of ICT use and again underscored the need for more empirically-anchored research:

> *Much more social science research on the impact of IT on our society is needed to inform ongoing debates and policy decisions on IT-related issues. Such research can also help IT researchers develop technical solutions for some difficult policy problems (e.g. development of new metadata tagging standards and*

> *micropayment technologies for managing intellectual property). Moreover, insights derived from social science research may be able to contribute to the better designs of information systems. The design of GroupWare, for example, should be driven by research on how groups of people share information and make decisions (*PITAC, 1998).

Social science research differs from social informatics research. Social informatics is not a stand-alone discipline, like Sociology or History; its thema cut across multi-disciplinary boundaries. Because the majority of the PITAC members have business, computing, or engineering backgrounds, it is unlikely that they were aware of social informatics research. However, their recommendations for possible research include many areas presently being investigated by social and organizational informaticians. These areas include, but are not limited to, transformations of social institutions by ICTs, sustainable use of large ICT infrastructures, electronic groups and communities, and barriers to ICT diffusion. For example, SEW focuses on the design of GroupWare and how groups of people share information and make decisions. For about fifteen years, social and organizational informaticians have researched the nature of group work and information sharing, as well as the use of ICTs that support teamwork work (such as Lotus Notes).

PITAC asked for a significant level of funding to conduct this line of research at Expedition or Enabling Technology centers. These centers are likely to be attached to research universities, places more likely to have faculty who conduct social informatics research or specific centers for social informatics research.

1.2.4 U.S. Department of Commerce

In the U.S., the Clinton-Gore administration has enthusiastically supported the widespread use of the Internet for numerous education, scientific, civic and commercial applications since they took office in 1992. By 1997, the White House articulated a framework for global electronic commerce (U.S. Government, 1997) which advanced five major policy principles:

[16] PITAC was established via Executive Order 13035 on February 11, 1997.

1. The private sector should lead (e-commerce development);

2. Governments should avoid undue restrictions on electronic commerce;

3. Where governmental involvement is needed, its aim should be to support and enforce a predictable, minimalist, consistent and simple legal environment for commerce;

4. Governments should recognize the unique qualities of the Internet; and

5. Electronic Commerce over the Internet should be facilitated on a global basis.

U.S. Commerce department reports about a 'digital economy" and electronic commerce are much more advocacy documents, than the kind of objective technology assessments that were supposed to be produced by the Congresses OTA. These reports take principles, such as these five, as foundational.

In 1998, the U.S. Department of Commerce published *The Emerging Digital Economy* (Margerio et al., 1998). It focuses principally on electronic commerce and its economic impact on organizations, the transfer of goods and services, consumers, and ICT workers. The report places emphasis on expanding the Internet to ensure that enough bandwidth is available to both business and consumers so that both can take full advantage of electronic commerce opportunities. It exhorts policy analysts to eschew implementing any Internet taxes, which would inhibit the free-flow of electronic commerce. The report also acknowledges that a growth in the digital economy will potentially bring about some downsides for society:

> *. . . the digital economy may bring potential invasions of privacy, easier access by children to pornographic and violent materials and hate speech, more sophisticated and far-reaching criminal activity and a host of other as-yet unknown problems." (p. 51)*

However, the report is generally decoupled from the complexities that organizations face in effectively moving on-line. Most of the projects are described in terms of a series of tasks, and give us little clue about how organizations changed to accommodate new practices. Improvements in organizational sub-systems are treated as organization-wide gains. For example, a description of the way that General Electric's Lighting Division developed an on-line procurement system focuses upon the efficiencies in the procurement department (faster orders, 30% cost reduction, and 60% staff reduction). However, there is no account of the costs of

developing the on-line procurement system, deploying and maintaining numerous new workstations in the Lighting Division, training those who request materials ("the internal customers") to correctly specify orders on-line to effectively use the on-line forms with digital drawing attachments, and so on. There may still be important net savings after these costs are factored in, but the cost reductions would not be so dramatic. The magnitude and characteristics of the co-requisite organizational changes would also be clearer.

Most seriously, this expanded view suggests that IT should not be conceptualized simply as a "tool" which can be readily applied for specific purposes (see Table #1 in section 2.3). GE Lighting's on-line procurement system has important features as a complex technological system in which the orchestration of digitized product drawings and purchase orders has to be synchronized. It has important social properties regarding the authorizations to initiate an electronic purchase order, the control over product drawing versions that have been subject to engineering changes or manufacturing changes, and so on. In short, organizational researchers have found that systems like this are better conceptualized as "socio-technical networks" than as tools. In practice, the boundaries between what is social and what is technological blurs because some of the system design encodes assumptions about the social organization of the firm, in this case GE Lighting.

A different kind of example that could have enriched this report comes from the experience of Charles Schwab and Co. to develop an on-line trading operation (e.Schwab) in 1995-1996 (Schonfield, 1998). Like many firms, Schwab initially set up a new small division to develop the software, systems, and policies for e.Schwab. To compete with other Internet brokerages, Schwab dropped its commissions to a flat fee that was about one-third of its average commission. Schwab's regular phone representatives and branch officers could not help e.Schwab customers. e.Schwab customers were allowed one free phone call a month; all other questions had to be e-mailed to e.Schwab. While over a million people rapidly flocked to e.Schwab, many of these customers found the different policies and practices to be frustrating. In 1997, Schwab's upper managers began integrating e.Schwab and "regular Schwab." This integration required new, more coherent policies and training all of Schwab's representatives to understand e-trades. It also required the physical integration of e.Schwab's staff with their

"jeans and sneakers" culture into the offices of regular Schwab staff with a button-down "jacket and tie" culture. One result was the development of a more flexible dress code in Schwab's headquarters.

e.Schwab has been discussed in some business articles as a tool or a technological system. But the policies and procedures for any trading system -- including pricing, trade confirmations and reversals, and advice – are integral to its operation. These are social practices without which there is no e.Schwab. Consequently, the standard "tool view" is insufficient for adequately understanding the design of e.Schwab, its operations, and consequently the character of the organizational change required to develop this line of business (Kling and Lamb, in press).

The Department of Commerce's Department's National Telecommunications and Information Administration has issued three reports about the social distribution of telephone, computer and Internet access in the United States (NTIA, 1998; NTIA, 1999). The studies are are based on data collected by the Census Bureau from 48,000 U.S. households and seriously engage the data. According to the most recent (1999) report:

- Between 1997 and 1998, the divide between those at the highest and the lowest education levels increased 25 percent and the divide between the highest and the lowest income levels grew 29 percent.
- Households with incomes of $75,000 or higher are more than twenty times as likely to have access to the Internet than those at the lowest income levels and more than nine times as likely to have a computer at home.
- Whites are more likely to have access to the Internet from home than Blacks or Hispanics have from any location.
- Black and Hispanic households are approximately one-third as likely to have home Internet access as households of Asian/Pacific Islander descent, and roughly two-fifths as likely as White households.
- Rural areas are less likely to be connected than urban areas. Regardless of income level, those living in rural areas are lagging behind in computer and Internet access. At some income levels, those in urban areas are 50 percent more likely to have Internet access than those earning the same income in rural areas. (NTIA, 1999)"

Since ICT costs were generally declining between 1997 and 1998, the expected decrease in the costs of acquiring PCs and Internet service won't automatically redress these increasing differences. It is an open question about how these differences – the digital divide – translate into other inequalities, such as access to better jobs, business starts, improved education, and other social goods. Even so, these NTIA reports provide a sound empirical basis for informing ICT policy.

However, the policy analysis arm of the U.S. Department of Commerce that has developed the Digital Economy reports lacks the kind of social informatics research capacity that OTA demonstrated in its best studies. Nor does it know how to articulate the kind of empirically-grounded, constructive skepticism that added the question mark to the U.K.s's Virtual Society? research program.

1.2.6 Private ICT Research Institute's in the 1990's

In the 1990s, a number of private policy-oriented organizations have systematically examined ICT-related issues – including the Internet Policy Institute, the Benton Foundation, and the Electronic Privacy Information Clearinghouse, and the Progressive Policy Institute.

The Progressive Policy Institute's (PPI) *The Internet and Society: Universal Access, Not Universal Service* is concerned with the impact of the Internet on society. The authors see universal Internet access (as opposed to universal service) as the goal policy analysts should strive for since universal access ensures that people who want or need to access the Internet can. They suggest that the goal of universal access could be met if the government provided Internet access in places such as libraries, rural health centers, and schools, all of which qualify for the U.S. government's E-Rate Program. Moving toward a universal service model is not recommended, since the authors do not find enough evidence to indicate that widespread demand for Internet access exists at present. They also present evidence to indicate that "the real technology divide in the nation is one caused by technology-related changes at work and

increases in income inequality, not differences in ownership of various technology devices" (p. 7).

These reports from the U.S. Department of Commerce and from the PPI are anchored in the concept of the "New Economy." According to the PPI, the "New Economy" has been emerging in the United States for the past 15 years and is shaped by information technologies and new communications networks like the Internet (http://www.dlcppi.org/ppiexperts.htm). This conceptualization embraces technological determinism by seeing the "New Economy" as being shaped by ICTs and, apparently, nothing else. Supporters of the "New Economy" also appear unwilling to engage in discussion about broader social concerns such as the impact ICT deployment will have in the workplace, in the home, and on the individual.

1.3 European ICT Policy Analysis (1985 – present)

European ICT policy analyses reflect the diversity of European national governments. A few countries, such as the Netherlands, have developed national technology assessment programs that were influenced by the OTA. In contrast, many European countries produced national-level "information society" proposals in the mid-1990s, even if they had little other systematic ICT policy analysis capacity or effort. For simplicity, we will focus on one major national research program and ICT policy analysis in the European Commission.

1.3.1 The U.K.'s Programme on Information and Communication Technologies (PICT)

The Programme on Information and Communication Technologies (PICT), a ten-year (1985-1995) social informatics research initiative based in six university-based centers in the United Kingdom, loosely parallels some of the research that is reported in OTA's ICT's studies. Unlike OTA, whose studies were driven by the agendas and foci of a national political body, PICT was a sustained social science research initiative. PICTs researchers examined and published numerous books and hundreds of articles about the social shaping of ICTs, as well as examining associated policy issues (Dutton, 1996, 1999; Kubicek, Dutton and Williams, 1997). Bill Dutton (1996), PICT's last director, characterizes the main themes of PICT research as falling into four major areas: 'Production' (the social shaping of technology), 'Utilization' (organizations,

management and work), 'Consumption' (reactions of the individual consumer and citizen) and 'Governance' (policy and regulation). Much of the research conducted under the first three rubric was policy-relevant research. While PICTs research should inform ICT policy-making, we have noted that these influences takes many years to develop. Even the U.S. Congress's OTA – which was much more closely coupled to a policy-making body -- was not well integrated into the full stream of Congressional policy analysis and policy-making.

In an integrative review of PICTs research, Duttton (1999) discusses his search for an all-embracing integrating theme and that he believes that the concept of the social "shaping of tele-access." His book illustrates how the concept of the social "shaping of tele-access."

> "can help integrate the findings of research on ICTs across the social sciences generally. Many social and economic issues -- ranging from issues of information inequality, privacy, and censorship, to the role of the Internet, and information superhighways in economic development -- can be better understood if viewed as products of a process that is quite literally reshaping social and economic access in this digital age of new ICTs."

The analyses that underlay the social shaping of tele-access are basically those that we discussed in Section 1.2 when we examined how ICTs should be viewed as configurable socio-technical networks. Our analysis in that section drew upon some of the PICT research, as well as research conducted in the U.S. PICT research has been able to be more fundamental and cumulative than OTA's. OTA's research was driven by the shorter-term interests of Congressmen and their staffs, and also influenced by practitioners who served on study panels. In contrast, PICT was much more influenced by the values, norms and processes of the British social science research communities.

PICT disbanded in 1995 and was superceded by a substantial new "Virtual Society?" research program that addresses three major policy-relevant themes:

*. Skills and Performance: the impact of new electronic and communications

technologies on human and organizational potential, performance and learning.

* Social Cohesion: the role of new electronic techniques in relations between people and in modifying processes and degrees of social inclusion and exclusion.

* Social Contexts of New Electronic Technologies: the changing social contexts and factors influencing the transformation and adoption of electronic technologies (at http://www.brunel.ac.uk/research/virtsoc/over.htm)

Both PICT and the Virtual Society? research program have had an interesting critical edge to them. The Virtual Society? description claims that it

> "benefits from research which retains some (analytic) scepticism about the claims made for the new technologies. The "?" in "The Virtual Society?" signals this analytic stance."

Unfortunately, there is no program of policy-relevant research of comparable scale and quality funded in North America.

1.3.2 European Commission's Information Society Project Office in the 1990s

Information Society Promotion Office (ISPO) is the European Commission's key organization for developing studies of ICT policy. Like the OTA, it is part of an official policy-making organization. Unlike the OTA, it does not have a substantial staff that is grounded in social informatics. Like the NCO, it relies upon the work of blue-ribbon committees and volunteers to produce many of its reports. The ISPO was originally named the Information Society Project Office when it was founded around 1993. It changed its name to the Information Society Promotion Office in November 1998.

It's worth noting that the term "information society" as used by the ISPO tends to emphasize the development of new ICTs within market arrangements. There is a well-developed literature about the concept of an information society that is much richer (Bell, 1973; Bell, 1980; Webster 1975). One of the earliest theorists of an information society, Daniel Bell (1980), identifies

three elements of a post-industrial/information society: (1) the change from a goods-producing to a service society; (2) the centrality of the codification of theoretical knowledge as a driving force in society; and (3) the creation of "intellectual technology' (such as management science) as key elements of production. None of these three criteria could be satisfied primarily by the development of new ICTs. The shift to a service society is a shift in the industrial mix in a n economy; the codification of theoretical knowledge and the creation of new intellectual technologies, is labor and skill intensive. Bell's argument that knowledge is the key strategic resource in information societies and they "replace labor as the source of added value in the national product" (Bell, 1973: 506) In substituting this "knowledge theory of value" for Marx's "labor theory of value," Bell's information society represents a major discontinuity break with the industrial era. Bell's theories of an information society have stimulated considerable debate which goes well beyond the scope of this report. The key point is that the working concept of an "information society" that is reflected in most of the ISPO reports is much more technologically focussed than is the concepts' scholarly development.

One early and widely circulated report, *Europe and The Global Information Society*, was produced by a committee chaired by former European Commission Vice-President, Martin Bangemann. The report is written with the heady optimism and excitement that characterized some of the early Clinton-Gore reports about a National Information Infrastructure in the U.S. The Bangemann report emphasizes the importance of markets in a fueling an information revolution that can benefit Europeans.

The Bangemann report proposed large public investments in 10 application areas, including teleworking, distance learning, networks for universities and research centres, telematic services for small and medium enterprises, road traffic management, an integrated European air traffic control system, healthcare networks, electronic banking, a trans-european public administration network, and city information highways. Like the U.S. Department of Commerce's more recent, *The Emerging Digital Economy*, it assumes that these kinds of applications can be readily built and produce tremendous social value if there is simply sufficient funding.

The Bangemann Report was an important and easily readable polemic to help stimulate

discussions of market alternatives and trans-European ICT developments. However, it's breathless quality gives no space in which to ask about the complexities of activities, such as distance learning. It's authors ignored the best empirical research about ICT developments. And their polemic stance hardly allows the "question mark" that is integral to the U.K.'s Virtual Society? Research Program. The Bangemann Report motivated some within European ICT policymaking circles to call for policy which is more socially embedded. The ISPO formed a High-Level Expert Group (HLEG) which encouraged future researchers and policy analysts to move away from a technologically deterministic focus toward one that embraces concepts of social embeddedness.

HLEG's final policy report, *Building the European Information Society for Us All* (April 1997), identifies the problem of policy discourse within the EC regarding ICT implementation, namely that it had "been dominated by issues relating to the technological and infrastructure challenges." However, continued work which looked closely at how these "challenges" would impact society led HLEG to conclude that "the field has expanded rapidly, with social aspects of the emerging IS [information society] moving to the top of the policy agenda." HLEG builds on this by creating an outline or "vision" for future policy discourse and by providing recommendations for implementation.

Like the OTA's *Critical Connections*, the HLEG report views the rapid emergence of ICTs as both a potential blessing and as a potential curse. It describes the need to find a policy model which "avoids social exclusion and creates new opportunities for the disadvantaged" (HLEG, 1997). It also makes an important distinction between data, information, and knowledge: "The generation of unstructured data does not automatically lead to the creation of information, nor can all information be equated with knowledge". This advances the notion that the emergence of ICTs does not necessarily make for a "wiser" society. Further, HLEG overtly rejects the framing of any policy regarding ICTs in the language of technological determinism:

> *The social integrationist vision that the HLEG espouses explicitly rejects the notion of technology as an exogenous variable to which society and individuals, whether at work or in the home, must adapt. Instead, it puts the emphasis on technology as a social process.*

With regard to future ICT policy development, HLEG states that "the new ICTs embody a radically different set of parameters for potential growth and development opportunities." It identifies ten policy challenges that provide a "broad agenda for policy action involving a range of actors." Some of these challenges include social exclusion, knowledge and skill acquisition, and bridging geographical distance. The report tries include on an optimistic note by identifying new social possibilities that ICTs enable. But it also comments;

> New structures are nevertheless needed which reflect the new possibilities of the IS (information society) and which permit the development of demand for new ICT-based services. Organisations and structures of the past are not necessarily going to meet this demand. We could be defensive about this and try to hang onto the treasured aspects of the old systems, or we could try to define a better more open path, which overcomes some of the centralisation and authoritarian aspects of the traditional bureaucracies and governance structures to be found in Europe.

Unfortunately, the HLEG report has been removed from the ISPO's web site. Its complex social vision probably is bit too discordant with the 'can do" tone of other ISPO reports. In December 1999, the European Commission launched an initiative entitled "eEurope – An Information Society for All", which proposed ambitious targets to bring the benefits of the Information Society to all Europeans. The initiative focuses rapidly accelerating broad public ICT access in ten priority areas, from education to transport and from healthcare to the disabled. The report sets aspiration levels for the next three years. Unfortunately, the report doesn't have any serious or systematic empirical reference points, such as we find about the Digital Divide in the NTIA's report series. In short, the ISPO seems to be a promotion office without a significant research enterprise that is coupled to its proposals and helps to shape them.

1.4 ICT Policy Analysis in the Next Decades

What emerges clearly after studying current and historic ICT policy is the infrequent connection

of current ICT policy discourse to research and theory informed by social informatics. This situation – of a disconnect between research and policy development -- is very common. In the case of ICT developments, the research often finds that developments are more difficult to utilize than many participants expect, and that workable ICTs often involve important changes in social practices. This makes ICT-focussed social plans, such as those promoted by the ISPO to be problematic. Policy Scientist Aaron Wildavsky wrote *Speaking Truth to Power* to help engage this kind of issue. But the now disestablished OTA's research capabilities, as imperfect as they were, were arguably the most systematic and institutionalized efforts to bring social informatics knowledge to bear on a variety of ICT policy issues.

It is conceivable that the policy discussions, such as those about ICT access will be focus primarily on technological and economic practices rather than by social ones. This would be regrettable since governments have placed so much emphasis on access being the lynchpin for providing more opportunities for all. Fortunately, this situation can be remedied by including a social informatics perspective in the discourse. The following section presents a case study about the Next Generation Internet (NGI) from a social informatics perspective. It is included here to provide an example of how social informaticians examine ICT deployment and associated policy.

1.5 Public Access to the Next Generation Internet (NGI): A Social Informatics View

The Internet is a wonderful extension of the nation's (and world's) communications infrastructure, and is widely used in education, journalism, and research, as well as for commerce and entertainment. The first generation of the Internet supported these varied uses, but its popularity was fueled primarily by e-mail. The WWW supported a new array of documentary and pictorial communications, as well as a continuing stream of innovations in applications such as electronic publishing, digital libraries, and electronic commerce. The NGI will be designed in part to facilitate real-time video communication, and will lead to a new array of applications in areas such as health care, education, scientific research, emergency services, and entertainment.

The opportunities of the NGI that people currently envision could be lost if the primary complexities are seen as technological, and if policy analysts underestimate the ways in which

social factors influence the adoption, uses and usability of advanced information technologies. Because these applications highlight new possibilities enabled by the NGI, it might appear that technological access is the primary roadblock. Technological access refers to the physical availability of suitable equipment, such as computers that are of adequate speed and equipped with appropriate software for a given activity. There is an important, but partial truth to this observation, since today's Internet is incapable of effectively supporting any of the numerous intriguing NGI applications that appear in the NGI Concept Paper, congressional testimony, and white papers.

As opposed to technological access, social access refers to expertise, a mix of professional knowledge economic resources, and technical skills, to use technologies in ways that enhance professional practices and social life. The ability of diverse organizations and people from many occupations to actually use these services constitutes social access. This will be critical if they are to move from the laboratories and pilot projects into widespread use where they can vitalize the nation and the economy.

The total number of people who have access to the Internet appears to have been doubling every two years since the early 1990s. At any given time, the estimates can vary by a fact of two or more, depending upon the stringency of the criteria that characterize Internet access or Internet use (e.g., having an account for receiving or sending e-mail, having WWW access, having used the account within the last N months) (Hoffman, Kalsbeek, and Novak, 1996). Nevertheless, even when stringent criteria are applied, it can be seen that the number of people using the Internet is continuing to rise rapidly.

Individuals' demographic characteristics, such as their education, income and locations, are highly correlated with their use of the Internet. While families with college graduates were twice as likely as those of high school graduates to use network services in 1993, these disparities decreased since the late 1980s (Anderson, et. al. 1995: 24-29). Some studies find that the average and median incomes of people who use the Internet are declining towards "mainstream levels" (GVU, 1997). However, there is evidence that averages mask important differences, and that the disparity in computer network use is actually growing between poor and wealthy

households (Anderson, et. al., 1995: 24-29).

Aside from costs, one reason that lower income families use the Internet less is that of various "externalities," such as needing technical support and access to a community of other online users. Unlike television and Nintendo, e-mail is useful primarily if one's friends or family also has access (see Boltier, 1998). One key study found that the Internet is a social medium for many ordinary people: compared to use of the web, electronic mail use was more popular, more stable, and drove continued use of the Internet overall. One reason is that e-mail sustains ongoing dialogues and relationships. In contrast, the Web has more bounded properties, in which information gathering for things such as school assignments, purchase decisions, or paid employment is satisfied with a limited number of visits. The Internet is a social and emotional technology, and that it sustains social networks (Kiesler, Kraut, Mukhopadhyay, and Scherlis. 1997).

There is also some data on the extent to which schools are connected to the Internet. In February 1998, the National Center for Education Statistics reported that 78% of the U.S. schools had Internet access, twice the percentage of 1994. However, the distribution of online resources in uneven. Only 63% of schools with a high percentage of poor students offered Internet access. 84% of schools in the suburban areas had Internet access, while 74% of schools in the urban schools had Internet access. It is common for urban high schools to have 1500-2500 students. A large school with a lab of six PCs connected to the Internet is counted as "connected" to the same extent as a small school that has six Internet connected PCs in every classroom. The meaning of numbers like these comes primarily from anecdotal evidence, and we know very little about the actual use of the Internet in schools.

Many ordinary people access computers and the Internet through community centers and public libraries. Mark, Cornebise, and Wahl (1997) examined community technology centers and reported that:

> *community technology centers provide computer access to a majority of people who do not have technology access elsewhere. And, for individuals who have technology access at libraries, homes or elsewhere, community technology*

> *centers provide them with additional technology applications, such as the Internet or scanners, that they do not have access to at other locations. . . . The informal, learner-centered atmosphere that encourages exploration also was cited as a reason for preferring a community technology center to other locations.*

Community centers can often provide skilled assistance that increases social access to network services and may play an important role in making complex NGI-based services effectively available to many ordinary people.

The NGI promises to be a profound advance in the nations' telecommunications infrastructure. The high bandwidth capabilities of the NGI can support promising applications for managers, professionals and their clients. While the NGI is a critical enabling technology, it will have to be shaped as part of larger socio-technical computing systems for these applications to yield the anticipated social benefits. Social access to the NGI will be as crucial as technological access. This will require assessments of the overall computing packages that are used and experienced by people at home, in schools, work and other places.

This early stage of planning is a critical time to undertake research into the social aspects of ICTs that will help them work for ordinary people in varied social settings, outside of the laboratory and specially-supported pilot projects. One straightforward way to fund this research is to devote 1%-2% of the NGI's research budget on social research that will identify ways to improve its value for ordinary citizens, as well as for service agencies such as schools and libraries. (The Human Genome Project, for example, devoted 1% of its budget to social and ethical investigations.)

SECTION 2: SOCIAL INFORMATICS AND ICT POLICYMAKING

The examination of historic ICT policy analysis in the United States and western Europe reveals that in the past, policy analysts (particularly those affiliated with OTA and PICT) strove to include concepts of social embeddedness as a primary concern in ICT policymaking. However, current discourse seems to show greater interest in ICT development and its role in fueling the "New Economy." There are two possible explanations for this. The first lies in changes in the composition of research or committee teams who formulate ICT policy. OTA and PICT, for example, included many social science researchers on their respective teams. Consequently, much of their work looks closely at the impacts of ICTs on society and is framed in the language of social embeddedness. NCO and ISPO have a few of these individuals, but the majority comes from computer science, engineering, economics, and private industry. While these people have deep domain knowledge within their respective fields, many may not be grounded in social theory. Therefore, it is not surprising that policy emanating from NCO and ISPO focuses more on technology development and economics than on social impact.

Another explanation may have more to do with timing. Both OTA and PICT were organized before the Internet became such a worldwide phenomenon. Both organizations examined the relationship between technology (in a broad sense) and society.

ICT development has been transformed in the last decade. For example, the Internet is no longer solely the domain of universities and the government. With the advent of commercial ISPs (e.g., AOL and Earthlink) and graphical user interfaces (e.g., Netscape and Internet Explorer), the public has been able to access vast sources of information. In addition, there has been a political shift from right to left both in the United States and in Western Europe. Since taking office in 1992, Bill Clinton and Al Gore have championed the widespread use of ICTs and see the Internet as providing countless opportunities for all. One sees this same level of enthusiasm from the Blair administration in the U.K. Taken together, these factors might account for the shift in ICT policy discourse during the past decade. Regardless of the reason for this shift in emphasis, any future discussion of ICT policy must include an integrated social focus, if publicly stated government goals of providing more opportunities and a better quality of life for society (locally and globally) are to be achieved.

Building upon existing or commissioning new research informed by social informatics would help ICT policy analysts to ensure that new ICTs are shaped so that they benefit those who use them either at work or at home. It will also help policy analysts to better address questions like these: Does everyone need Internet access? Will the "New Economy" bring prosperity to all and eliminate the gap between information "haves" and "have nots"? How will we resolve the IT worker shortfall? Will ICTs displace workers and, if so, what stopgap measures will be in place? Will ICTs give us a better quality of life? Answers to these questions cannot be provided simply, nor solely through social informatics research, but such research is an important contribution for developing sound answers.

Chapter IV: Teaching Key Ideas of Social Informatics

SECTION 1 WHY TEACH SOCIAL INFORMATICS?

This chapter explains why ICT-oriented students should learn key concepts of social and organizational informatics. ICT-oriented disciplines are those that educate students in the design, development, implementation and support of ICTs. Today, the majority of computing oriented students study in computer science and information systems programs.[17] In this chapter we: (1) highlight the core concepts of social informatics and how these concepts add value to a ICT-oriented education (at both under-graduate and graduate levels) and (2) discuss some good ways to teach social informatics theories and concepts in ICT-oriented disciplines. This attention to the role of social and organizational contexts in computing- oriented curriculum reflects the ongoing efforts in science, mathematics, engineering and technology (SME &T) disciplines to develop students' abilities to more effectively use their technical education's (NSF, 1996).

This chapter is written for three audiences: administrators, curriculum committee members and interested academics/ educators. For administrators, the chapter provides a comprehensive introduction to the importance, and contemporary treatment, of social informatics teaching. This chapter discusses how and where social informatics concepts should be included in curricula.

Social informatics knowledge is important for many students who are not matriculated in ICT-oriented curricula. But, the emphasis and exact content is typically tailored to meet the specific educational and anticipated work-related needs of the various disciplines that prepare ICT-oriented students for working with ICTs. For example, information systems students typically learn some organizational informatics concepts as part of their course in systems analysis. Computer science students are often able to take social informatics-focused courses, that also include ethical issues of computing; but they usually have less access to organizational informatics ideas in their curricula. More broadly, the professional computing community

[17] Much of the discussion in this chapter specifically focuses on these two disciplines. ICT-oriented students also are educated in information science and various social science disciplines (such as communication and education), though we do not have the space in this chapter to discuss specific issues relative to the Organizational and Social Informatics content in the education of these other students.

generally agrees that computing oriented students should learn social informatics concepts and theories. However, these social informatics concepts and analytic techniques are rarely taught in ICT-oriented curricula. There are several reasons why this is so, including concerns about computing curricular being the proper academic location for social informatics concepts, ignorance of social informatics literature, an even hostility regarding certain findings about the negative effects of ICTs in some settings. The paradox between value and provision helps to frame this chapter.

Following a discussion of how the rising importance of teaching social informatics concepts in ICT-oriented disciplines reflects the broad trends in science-oriented education, the chapter continues in four parts. In part one the basis for, and objectives of, a social informatics component of an ICT-oriented education is presented. In the second part, we present a summary of the current teaching of social informatics and issues with the current state of affairs. Part three contains an outline of key social informatics issues and some suggestions for how to present key concepts. Part four provides both a summary of this section and some recommendations regarding constructing social informatics-informed curricula.

1.1 Social informatics teaching in the context of broad trends in science-oriented education

While a technically/scientifically educated student is highly valued by contemporary organizations – and more broadly by society – the numbers of college graduates in many of the science, mathematics, engineering and technology (SME&T) disciplines is declining (NSF, 1996). Some disciplines, like physics, have seen a 71% decline in graduates over the past ten years (AAPT, 1996). Computer science graduates are down about 34% in the same ten year span, though there has been a small upswing in enrollments since this report (ITAA, 1997). The decline is even more alarming when looking at the enrollments of minorities and females. Further, over this period, enrollments in information systems/ information science programs (the traditional source of most systems analysts and many network administrators) have remained steady (or trended slightly upward).

Over this same period of steep declines in computer science enrollments and modest increases in information systems students, there has been a growing demand for computer-oriented students,

especially for those who combine technical expertise with excellent organizational/interpersonal skills and knowledge. For example, the US Department of Commerce projects the number of systems analysts positions to more than double in the next 10 years – an aggregate need of 520,000 new systems analysts (OTP, 1/1998). This report also projects a more modest 20% growth in programming jobs and a near doubling of computer-science/engineering positions by 2006. However, the total growth in programming is less than 30% of the growth in systems analysts positions.

This means that even as the number of SME&T - trained college graduates (and specifically ICT-oriented graduates) is either stable or dropping. There is a rising demand for their skills in the workforce. This contradiction has, in part, helped bring about a sense of a crisis regarding the value and basis of SME&T education (Abraham and Hoagland, 1995) For example, the American Association of Physics Teachers (AAPT) has urged college educators and administrators to make extensive and fundamental changes to how physics is taught (AAPT, 1996). This call for fundamental change in science education is further echoed by an NSF assessment of teaching in SME&T disciplines (NSF, 1996). Generally, these calls encourage SME&T educators/ curriculum to focus on:

1. *The process of developing scientific knowledge through exploration, invention and expansion.*
2. *Developing and communicating scientific understanding through collaborative learning.*
3. *Developing reflective judgement and the ability to apply creative, flexible and analytic thinking to help solve problems.*
4. *Understanding science/technology issues as they exist within social and cultural contexts (Carr, 1997).*

These general themes, and the crisis that has been a part of their genesis, are more muted concerning ICT-oriented education students because of the heady demands for their technical skills. This muting is dangerous. For example, most computer science graduates lack any rigorous and empirically based exposure to social informatics concepts, findings and analytic techniques (Huff and Martin, 1995). Most information systems students derive great value from

their exposure to organizational informatics concepts and analytic techniques. However, some research suggests that non-technical skills (that is, social informatics-focused) are seen as very critical, and often still underdeveloped in the education of current information systems/ information science graduates (Sawyer, Eschenfelder, Diekema and McClure, 1998).

ICT-oriented educators have a sterling opportunity to increase both the relevance and the value of such education before a crisis similar to that seen in Physics (and other SME&T disciplines) ensues. Thus, we focus the rest of this chapter to address the issues regarding point four, above, relative to computing oriented students' formal education. That is, *why – and to what extent – should ICT-oriented students be aware of social informatics concepts, materials, research findings and analytic techniques*?

Given the pervasive nature of ICTs in society, the ever-greater interdependence between ICTs and work, and the increasing belief that to be a contributing member of contemporary life requires technical knowledge, understanding the broader aspects of the ICTs' roles is a critical, and often missing, element of ICT-oriented education (Huff and Martin, 1995). The most straightforward example of the value of social informatics topics in ICT-oriented curricula is that this knowledge (and its absence) is a central force shaping the design, construction and implementation of ICTs. A primary goal of the research and findings of social informatics is to influence these actions. The examples from previous chapters shows that when this collective body of knowledge is known by students who will become designers, developers and implementers of ICTs, the systems they construct are more likely to be economically efficient, useable and useful.

There are at least four reasons to include social informatics concepts and analytic techniques in ICT-oriented student's education:

- To provide a set of conceptual frameworks for computing oriented students to organize and assimilate the social and organizational forces affecting the functionality embedded into ICTs.
- To help these students understand how the design, configuration and implementation of ICTs is a socio-technical process – one that is charged with both social and organizational

implications.

- To help these students develop a set of analytic techniques to help identify and evaluate the social consequences of ICT-based systems.
- To assist technically trained people in developing a more critical (by which we mean reflective, inquiry-focused and problem-based) appreciation of the benefits and limitations that ICTs provide.

As we have discussed in previous chapters, the potential of new ICTs to reshape work and life (both positively and negatively) is both powerful and diffused. Because of the nature and effects of ICTs, we believe it imperative that the social informatics findings are summarized and included in the early stages of formally educating ICT-oriented students. This literature can serve as one basis for learning about technology – just as logic and mathematics form another. Like many SME&T disciplines, there is a growing awareness of the need to including contextual issues (which are essential elements to social informatics research) in ICT-oriented teaching.

In the absence of a research-based presentation of the social and organizational implications in the design and use of ICTs, much of the present education regarding computing reflects an under-representation of the importance of social and organizational forces. Many ICTs are developed based on a poor understanding of how people are likely to want to use them. For example, Fred Brooks, a pioneering software engineer observed that "*Hitching our research to someone else's driving problems, and solving them on the owner's terms, leads us to richer computer science research*" (Brooks, 1996, pp. 64-65). While the focus of this quote is research, the implication is clear: ICTs are most valued when they are set into the social or organizational contexts in which the problem arose.

ICT-oriented students learning about the roles of technology should be able to understand that (1) the design, development, and implementation of ICTs is not value neutral and (2) that outcomes of using ICTs are often paradoxical. Students presented with a mechanistic and technologically deterministic perspective are often uncomfortable with the challenges to this simplified view that both personal experience and broad-scale evidence provides. An example of the power of pro-technology enculturation (and the potential to reify the value of ICTs) is

reflected in Microsoft founder Bill Gates' (1995) comment*: "Because the most efficient businesses have an advantage over their competitors, companies have an incentive to embrace technologies that make them more productive. (p. 135)"* This over-simplification ignores both the productivity paradox and confuses efficiency with embracing technology.

On a more practical level, ICT-oriented students need to learn social informatics analysis techniques. Their absence leads to an increased risk of designing, selecting or configuring systems that occasionally work well for people, occasionally are valuable, are sometimes abandoned, are sometimes unusable, and thus incur extra costs and inspire misplaced hopes. If nothing else, this justifies the added effort required to teach social informatics concepts. The social and organizational influences on the processes of designing, constructing, and embedding ICTs into social/organizational systems are both subtle and far-reaching. These subtle influences are also not clear-cut, or even easily accommodated. For example, the rising use of electronic work teams supported by email and other computer-mediated communication systems highlight the difficulty dispersed work groups have in reaching consensus, including the tendency to see less pro-social behavior (flaming) (Kiesler and Sproull, 1991).

ICT-oriented students should also be aware that human behavior (especially in organizations) is paradoxically bounded. For example, human behavior can often be more understandable than would at first be perceived by a naive technologist. Conversely, this behavior is also never as predictable as the direct effects models of ICT design/use suggest. In this broader view, ICT design becomes a more difficult and nuanced effort, requiring a depth of social and organizational understanding that demands practice and guidance to do effectively. Thus, simplified caricatures of organizational life relative to systems design that are often found in most introductory MIS texts discredit the difficult and nuance-laden process of ICT design/implementation (i.e., Beath and Orlikowski, 1994).

At a broader scale, discussions of social informatics and ethical issues allow computing oriented students to engage in systematic analysis about effects and implications of ICTs at multiple levels. For example, Huff and Martin (1995) provide a means to conduct such an analysis by combining in a matrix the ethical issues and social issues for a particular ICT. This, and other

techniques, help students to both frame and explore social informatics and ethical topics. As we have mentioned, accreditation bodies (such as the Computer Science Accreditation Commission[18]) have begun to require that such topics be taught to computer science students.

While these four comprehensive purposes undergird the importance of presenting social informatics concepts and methods to ICT-oriented students, this population is heterogeneous and their needs differ. Three primary differentiators are:

- Disciplinary affiliations (as discussed above)
- The type of work these students will obtain upon graduation.
- The level of education (B.S. v. M.S.)

An example of work differentiation is that information systems students will tend to find work focused on the early design and/or implementation and support of ICTs. Computer science students will tend to find work involving the design and constructions of ICTs -- often in software houses or hardware manufacturers (and, thus, away from the life worlds of the people who will use them). ICT-oriented students from other disciplines may also differ by the locus of their work. For example, information science students may be involved in developing specific types of ICTs. As the role of the WWW in society expands, the development of web-based systems and the emerging work category of "content providers" will further expand the set of disciplines that are "ICT-oriented." Like many of the growing number of ICT-oriented jobs, this work is tied to the organizational and social contexts in which these systems exist.

The differences in their educational levels will also be reflected in their likely work after graduation. Both undergraduates and graduate students may work in the same general area, but with differing levels of responsibility. For example, the information systems graduate student is often expected to take on a managerial or leadership role while a computer science graduate student is often asked to be a technical leader or focus on specific technical issues.

[18] Guideline IV-17 of the 2000 "Criteria for Accrediting Programs in Computer Science in the United States" "There must be sufficient coverage of social and ethical implications of computing to give students an understanding of a broad range of issues in this area." (see http://www.csab.org/criteria2k_v10.html). This guideline is more vague than, Guideline IV-10, which requires "at least 15 semester hours of mathematics." However, this report suyggests the range of relevant organizational and informatics ideas that should be required under Guideline IV-17. For more information about the Computer Science Accreditation Commission and the Computing Sciences Accreditation

These differences suggest that the social informatics topics should be tailored to meet the specific interests of the student sub-populations. While these groups of students are not rigidly differentiable, the locus of their future work to define what they should be taught. The closer their future work is to the people who use ICTs, the more central social informatics concepts are to their own routine work (Keil and Carmel, 1995).

Board, Inc., see http://www.csab.org/

Sample Introductory Social Informatics Courses

Note: See the Social Informatics Home Page for additional courses

Computerization in Society (L564)
Instructor: Professor Rob Kling, Indiana University SLIS (graduate course).

This course examines the social and economic impacts of computing and information technologies on groups, organizations and society. Topics include computerization, and changes in the character of worklife, organizational mediation of computer-based services, social control and privacy, electronic communities, and risks of safety critical systems to people.

This course goes behind the headlines and front-page stories about hackers, viruses, multimedia computers, and new chips. It provides an in-depth examination of computers as they relate to productivity in business firms, workplaces, communities, public policy, communication, social control, safety, privacy, and moral values. It also explains how controversies about computerization often rest on hidden conflicts between competing interests.

This course highlights numerous questions that computerization raises as computer use expands into virtually every corner of everyday life. When does computerization really improve the productivity of organizations? What risks do computerized medical devices involve? Is computerization reducing personal privacy because organizations can now easily share or sell records about their clients? What possibilities does telecommuting really offer people for working at home, while at the same time reducing gas consumption and air pollution? Do electronic mail and computerized conferences promote the formation of new "communities", or do they undermine intimate interaction? Does computerized surveillance of workers establish a new and troublesome precedent, or is it a fundamentally legitimate activity with strong historical roots?

Social Issues of Computing (MIS411)
Instructor: Professor Suzie Weisband -- University of Arizona email: sweisband@bpa.arizona.edu

Topics include CMC (electronic communication and teamwork), and examples comes from readings on cyberporn, freedom of speech, the NII, hackers and cyberpunks, intellectual property, and privacy.

Sample Advanced Social Informatics Courses

Seminar: Information Superhighway

Instructor: Professor Harmeet Sawhney (hsawhney@indiana.edu), Indiana University Department of Telecommunications

This seminar takes a comprehensive look at the "information superhighway" concept and the issues related to it. We will first analyze the current public policy discourse, emerging network structures, and the expectations about future that are guiding our current actions. Then we will step back and ask deeper questions: How metaphors shape our thoughts? Do different countries have different "styles" of network development? How are investment decisions made when there is so much uncertainty about future demand? What can we learn from the experience with earlier network technologies--railroads, highways, electrical grids, telegraph, and early telephony? Do a few patterns keep repeating themselves? Why is disparity in access to information disconcerting when there are gross inequalities in all other facets of life? Are networks mere conduits? Or are they something much more than that? The approach will necessarily be multidisciplinary with readings drawn from diverse disciplines--economics, political science, public affairs, cultural geography, regional planning, cultural studies, history, information science, education, and communications. You are most welcome to make your own contribution to the brew!

Ethnography of Information Systems - LIS 450EI (a graduate course)

Instructors: Geoffrey C. Bowker and Susan Leigh Star (GSLIS) - University of Illinois

Ethnographic research is becoming increasingly important at key points in the design, testing, and evaluation of new information systems. Since approximately 1980 a number of collaborations have arisen between ethnographers (fieldworkers: anthropologist s, ethnomethodologists, and qualitative sociologists of organizations and science) on the one hand, and designers, library and information scientists, engineers and computer scientists on the other. Early work focused on philosophical and epistemological divergence, with a critical edge and somewhat arms' length relationships (e.g. Suchman, 1988). Since the mid-1980s, full-fledged partnerships have grown. The nature of these partnerships differs with domain, national emphasis, and team skills. Yet all have in common the goal of analyzing the contingencies of information-based work practice as situated in particular times and places, and using that analysis to inform user-sensitive infor mation systems design.

Students with a "bilingual" background in ethnography and information systems will be increasingly in demand in research and teaching settings which emphasize design of information systems, computer-supported cooperative work, organizational aspects of HCI, studies of the Internet and virtual communities, information-related policies, and the impact of advanced information systems, including on and in libraries and large text projects. There are also many emerging basic research opportunities on "virtua l culture", the culture of the Internet, cyberspace, etc.

Chapter IV: Teaching key ideas of Social Informatics

Section 1: Why teach Social Informatics?

SECTION 2: SUMMARIZING THE TEACHING OF SOCIAL INFORMATICS

In this part, we summarize current status regarding the teaching of social informatics concepts. This begins with a discussion of the intellectual roots of social informatics and a review of the current offerings about scope and content. The second subsection of this part presents some issues with the current status of the social informatics teaching with respect to current pedagogical guidance from both the computer science and information systems fields.

2.1 Current Status of Teaching Social Informatics

As we indicated at the outset, there is general agreement that social informatics concepts and analytic techniques are important for computing oriented students. Currently, there exists a broad variety and impressive number of rigorous social informatics courses offered at both the undergraduate and graduate levels. These courses are taught in many universities in a variety of disciplines. For example, a search on the WWW (using a simple search sequence on a public search engine such as Alta Vista) returns dozens of syllabi that include social informatics content. These syllabi present a rich, diverse, and extensive sampling of potential topics, pedagogical approaches, projects and other activities that are being used in these social informatics-focused courses. Moreover, the number and breadth of coverage in social informatics classes are expanding.

Departments that offer social informatics courses include, for example, computer science, information systems, information science, and various social science departments such as sociology and communications. Typically, social informatics offerings in computer science departments are upper-division electives and often focus on "computers and society". These courses have been offered in many computer science departments since the mid 1960s (see CACM, 1972) and supporting textbooks are available (i.e., Kling, 1996; Agre and Schuler, 1997). Further, the 1998 accreditation guidelines for computer science programs (CSAC) includes a recommendation to provide: " . . . the equivalent of one semester-hour coverage of social and ethical issues of computing." in an undergraduate computer science degree program (CSAC, 1998b, p. 3). This was changed for the 2000 guidelines to be: "There must be sufficient coverage of social and ethical implications of computing to give students an understanding of a broad range of issues in this area (CSAC, 2000)."

The social informatics offerings in information systems, where the department is typically housed in a business school, are focused primarily on organizational informatics issues. Most introductory MIS textbooks provide some coverage of organizational informatics (and a few touch on social informatics issues and/or ethics). Most systems analysis and design texts (and there are many available) explicitly discuss organizational informatics issues in the context systems design. Further, the texts on change management and implementation of ICTs typically focus on organizational informatics issues. Courses in both human-computer interaction (HCI) and computer-supported cooperative work (CSCW) often include organizational informatics topics. There are links to a wide array of social informatics courses and degree programs on the Social Informatics Home Page (see http://www.slis.indiana.edu/SI/).

In the ongoing curricular efforts of the professional societies involved in business-school/information systems education, there is also explicit discussion of (undergraduate) students to be educated on organizational informatics (and to a lesser extent, social informatics) issues: "Creating systems in organizations includes issues of innovation, quality, human-machine systems, human-machine interfaces, sociotechnical design and change management" (Davis, et al., 1997, p. 7). Parts of three (of the ten recommended) courses (including two of the first three) have, as part of the course's goals, organizational informatics (and some social informatics) concepts and techniques.

Graduate business education in information systems has also been actively influenced by social informatics concepts and literature. An exemplar of how organizational informatics concepts are integrated into the MBA program is presented in Silver, Markus and Beath (1995, MISQ). There is also an ongoing collaboration between the AIS/ACM and other computing societies to develop graduate-level curricular guidance to match the IS'97 effort of Davis, et. al. 1997.

The information science school offerings (mostly at the graduate level) teach some social informatics topics. Along with those centered around systems design (such as HCI and CSCW) are the issues of information policy such as access, copyright, and intellectual property. There are also varieties of courses offered in some social science departments that cover social informatics topics. This broad, and diverse, collection of course offerings has also led to a

number of text books and anthologies that focus on social informatics issues in design, implementation, and use of ICTs. Between these two broad communities, we estimate that there are more than 100 distinct courses taught annually in North America that teach some social informatics concepts.

From a geographic perspective, social informatics concepts and literature are more integrated into the curricula of European (and Australian) computer science, information systems and information science programs. This is particularly the case in Scandinavia, where participatory design is often mandated in union contracts. This geographic distribution also provides a source for rich cross-cultural comparisons of approaches to the design and use of ICTs, (e.g., Markus and Bjorn-Anderson, 1987).

2.2 Issues with the Current Status of Teaching Social Informatics

While the general status regarding social informatics teaching seems both impressive and improving, the picture is much less benign when we examine what fraction of ICT-oriented students take these courses. There is no national-level empirical data regarding enrollments in such courses: primarily this is because social informatics is not required. As we have discussed above, this is further complicated by the heterogeneity of these students educations, career paths, and work roles/locations. Put simply, in most ICT-oriented programs, these topics are rarely covered in any depth. And, when they are covered, the social informatics concepts and analytic techniques are either compartmented in an elective course or simplified to such a level that they have little discernable value (or connection to the rigorous empirical research from which they came). So, the question becomes: If social informatics concepts are acknowledged as important, why are they not taught in most ICT-oriented programs?

For example, in most computer science programs there is no requirement to have any social informatics courses. When they are offered, specific social informatics courses are usually an upper division (or, for graduate students, a higher level) elective. Often these courses are offered on an infrequent basis. In some departments, the value of these courses are degraded through the process of assigning the teaching of these courses to instructors or adjuncts who may not be versed in the rigorous empirical social informatics literature. This reflects a disappointingly

narrow view of what is – and is not – computer science. Most social informatics courses are taught by committed faculty who are heavily invested in both the content of the course and overall importance of this literature in the education of their students. When this is not the case, both the value of the topics, and the centrality of their value to ICT-oriented students, is undermined.

The Computer Science Accreditation Board (CSAB) recognizes the importance of social informatics concepts to computer science education, mandating one credit's worth of education regarding social and ethical aspects of computing in their accreditation guidelines. However, accreditation is not, yet, widespread. Further, the responses of those few computer science departments at Carnegie Level I US universities who have sought CSAB accreditation provides some insight regarding how the social informatics component of a computer science education can be handled. At MIT, the computer science department employs external experts from other departments and schools in the area to staff its social informatics-related courses.

The computer science department at Georgia Tech has chosen to develop (and maintain) internal expertise, having faculty who are invested in social informatics issues teach these courses. However, these topics do not appear to be taught in Computer Science at some universities (such as UC-Berkeley) although certification demands it. At UC-Berkeley, for example, an upper-division elective course is maintained in the catalog, but it has not been offered since the sponsoring faculty member retired and the current faculty show no interest in developing (or contracting for) social informatics expertise.

Conversely, for students in information systems programs, social informatics concepts (albeit primarily organizational informatics) and analytic techniques are important aspects of their education. Thus, social informatics concepts are often taught in a number of common/core courses (such as the introductory course, the systems analysis course and the project and/or change management course). Further, social informatics-related issues of ICT design, implementation and use – and the resulting organizational and work-related changes – are currently extremely viable and fruitful areas for information systems faculty's research. This also encourages faculty to engage their students with social informatics concepts. Social

informatics content is also likely to be found in other departments in business schools (such as organizational behavior or economics). Thus, most information systems students are at least exposed to organizational informatics (and to some extent social informatics) issues in a number of classes.

Despite the general growth of social informatics courses, and the particular emphasis on organizational informatics issues in most information systems curricula, there are very few computer-oriented programs that require social informatics courses. Further, the example of how Carnegie Level 1 computer science departments deal with the social informatics and ethical analysis topics mandated by the CSAB highlights three forces which affect the otherwise rosy picture regarding the teaching of social informatics. These three forces are: (1) the perceived value of the course in the over-all computer science curriculum, (2) the quality of the social informatics course's teaching, and (3) the number (and frequency of offering) of social informatics courses.

SECTION 3: TEACHING SOCIAL INFORMATICS

1. The context of ICT use directly affects their meanings and roles.
2. ICTs are not value neutral: their use creates winners and losers.
3. ICT use leads to multiple, and often paradoxical, effects.
4. ICT use has moral and ethical aspects and these have social consequences
5. ICTs are Configurable – they are actually collections of distinct components.
6. ICTs follow trajectories and these trajectories often favor the status quo.
7. ICTs co-evolve during design/development/use (before and after implementation)

Figure 2. Key Social Informatics Issues

This part of the chapter is organized into four sections. The first section contains a presentation of the key issues undergirding the teaching of social informatics. Section two presents a discussion of how these issues may be tailored to emphasize points most germane to specific curricular needs. Section three includes a discussion of the importance of developing a critical perspective on computing (and the use of debate to help achieve this). Section four contains a summary of other issues relative to teaching social informatics. The goal of this part is to highlight themes and issues that should be a part of ICT-oriented curriculum, not to identify a general social informatics class. This focus on issues for inclusion in a curriculum allows for these concepts and techniques to appear in a number of classes.

3.1 Key Social Informatics Ideas

Figure 2 summarizes some key social informatics ideas. These are discussed in the rest of this section.

The context of ICT use directly affects their meanings and roles

As we say in Chapter 2: Context matters. The design of ICTs is linked to social and organizational dynamics, and these dynamics are contextual. This means that an ICT is always linked to its environment of use (Orlikowski, 1993; Kling and Scacchi, 1983). This means that an ICT can not be considered independently from the situation in which it will be used.

ICTs are not value neutral: their use creates winners and losers

Given the contextual nature of ICTs, it follows that they are often designed, implicitly or explicitly, to support social and organizational structures (Kling 1995). As the Jones Beach Bridge design we highlighted indicates, this is not unique to ICTs. Further, this may be as simple as those with electronic mail being able to communicate more easily than those without.

ICT use leads to multiple, and often paradoxical, effects

The contextually dependent nature of ICTs suggests that similar ICTs can have different outcomes in different situations. As the discussion in Chapter 2 highlights, the belief that ICTs will lead to a paperless office, or even increased productivity, plays out differently in practice. Paper use may increase in some places even as it decreases in others, productive efforts may be spent in places where the value added is difficult to assess. These effects may seem contradictory based on the level or perspective from which they are viewed.

A second aspect of the multiple and often paradoxical effects of ICT use are the rise of both intended and unintended consequences (Tenner, 1996). For example, new ICTs are introduced to a one department in a local government to improve organizational effectiveness and efficiency. This leads to a state where that department staff's work processes soon become enmeshed with the new ICTs. The departmental staff become dependent on the infrastructure to do their work (the intended effect). However, the lack of systematic maintenance and upgrading of this infrastructure leads to where the ICTs become unreliable. This lack of reliability means that, over time, the office is actually less capable of achieving its mission (an unintended effect).

ICT use has ethical aspects

The contextual nature of ICTs means that development and use raises moral and ethical issues (Friedman and Nissenbaum, 1994). This set of topics often reflects the most well known of the key social informatics issues. Many of these issues, such as an individual's rights concerning privacy in the use of email, are being contested in contemporary society. More subtle issues involve the coding and construction of systems that support assessing credit risks (where biases are built into rule bases) or the use of ICTs to remove entire classes of work (and workers) from

an organization are not as broadly discussed. ICT-oriented students should be aware that these moral and ethical issues are often presented in small ways and lead to value choices that are often made implicitly.

ICTs are configurable

The term, ICT, actually reflects collections of distinct components. These components – many of which are nearly commodities – are assembled into unique collections for each organization (or social unit, depending on the level of analysis). This leads to unique socio-technical networks. These socio-technical networks arise from the confluence of social use and similar components may lead to different technical networks in each social system (see Brown, 1998). Furthermore, the multiple functions and ability to reprogram (or alter and extend) these functions makes each technical network of ICTs highly re-configurable.

ICTs follow trajectories

The configurational ability of ICTs is underlain by the trajectories of the components. A trajectory means that any definable component can be seen as an evolving series of products (or versions) (see Quintas, 1994). That is, they have a history and a future.

Thus, since ICTs are socio-technical entities, their evolution is as much social history as technical progress. For example, this concept of a trajectory underlies the current debate about the functions of Microsoft's Windows and its integration with browser functionality. Certainly, these computer programs are being shaped by social structures and political forces. These shaping forces are often both difficult to decipher and hard to anticipate due to the confluence and interaction of so many events. Further, this discussion regarding Windows and Explorer has many parallels with IBM's practice, up until the US Department of Justice intervened in1968, of enforced bundling of hardware and software. What this simple example also suggests is that trajectories tend to favor the status quo[19](until a major event forces a change). This also reinforces the point that ICTs are not value neutral.

Co-evolution of ICT system design/development/use

The configurational ability of ICTs also underscores the socio-technical process of ICT design, development and use is reflected in every stage of an ICTs life. Projects are selected based on the political and strategic perspectives of decision-makers. ICT design reflects an ongoing discourse among developers, and between developers, people who will use the ICTs, and other stakeholders. Implementation is a social activity, centered on the re-orientation of work (or life) around a new system (Barley, 1989). A systems' use unfolds over time in a form of mutual adaptation between the ICT and the social system into which it has been placed (Leonard-Barton, 1988). This ever-unfolding process, a "design in use", also implies the variations in social power that define much of the discourse between the professionals who develop and ICT and the people who will use it (Kling and Iacono, 1984).

Additional Topics

In addition to some key social informatics, concepts such as those discussed in this report, it is common for students to examine concrete issues, such as these:

1. Examine a specific topical listserv, usenet discussion group, or talker archive. What are the purposes, forms, content, difficulties, and results of communications on the Internet using this particular utility or group?
2. Businesses and government have long invested in technology to automate the counting of objects of interest (e.g., people, industrial accidents, orders, inventory, etc.) In what sense were the tabulating machines from the British census information technology? Why were they adopted? Were they transformative technologies?
3. Discuss the influence on Vygotsky on situated learning and how these concepts influence design of information systems?
4. How does the theoretical framing of human information behavior influence the specific design suggestions in these readings? How might a reflexive relationship between behavior and systems be incorporated into design?
5. What are the attributes of jobs that make them desirable? How can you deploy IT to automate or control uncertainty without degrading these components of jobs? How important a consideration should job security or quality of work life be in software design

[19] study by Olesen & Myers re. Lotus Notes. +reinforcement politics.

decisions?

6. Analyze the role of computers in one safety-critical system (e.g. intensive care unit; air traffic control; car diagnosis; nuclear power plant). How do you computers add to the risk involved, or decrease it?
7. Examine a specific attempt to make the Internet more democratic. Is it working? In what ways? What kinds of limits are there to democracy on the Internet?

These example questions were taken from the syllabi of actual courses taught in several different kinds of departments.[20] Answers to these questions require some knowledge of actual practices of ICT development and use. They mix observations about ICT developments with value judgements about work, communication, and politics with ICTs. These instructors provided their students relevant research-based articles or book chapters to help them analyze these issues in meaningful ways.

3.2 Tailoring Social Informatics Concepts for Specific Curricular Purposes

We have highlighted that the student populations involved in an ICT-oriented education reflect a variety of disciplines and each discipline has particular needs relative to social informatics concepts. This suggests that presenting the social informatics concepts must be tailored to meet the curricular needs of that discipline. Thus, the question becomes: how might the key concepts of social informatics be presented in ways that the specific sub-populations of ICT-oriented students might best benefit?

Comparing the needs of computer science and information systems students highlights a philosophical difference. Most computer science programs are designed (often implicitly) to prepare students for graduate school (or for advanced degrees) while most information systems programs are housed in professional schools and are focused on industrial preparation. As fewer computer science students continue in graduate school, the ability of these programs to provide students with professional preparation become ever more important (CACM, 1998; Huff and Martin, 1995; NSF, 1996).

Given this philosophical difference, the two programs differ in focus. For example, computer science student's education is often focused on the technical and logical bases of computing. The most relevant social informatics issues would be those that help them put these issues in a broader context. Conversely, information systems student's education is focused on understanding and meeting an organization's needs for ICTs. Thus, the focus of their education is on bringing ICTs into organizations to support broad-scale (strategic or operational) needs. The relevance of social informatics concepts is that these enable the students to more readily contribute to making ICTs align with organizational goals. These same concepts, presented in a different context, can also help computer science students design and develop more useful ICTs.

Tailoring the discussion of these concepts for various ICT-oriented students brings practical significance to these issues. Take, for example, the concept of ICTs following technical trajectories. For computer science students, the debate about current operating system's functionality can only be understood in the light of IBM's move to a common operating system for many of its products, the spread of Unix, and the expansion of simple PC-based DOS support. The same concept of technical trajectory can be illustrated to information systems students by outlining the growth of a market for enterprise resource planning (ERP) systems and the broader move from organization's building their own software to buying packaged software (Davenport, 1998; Carmel, 1997).

The tuning of these concepts to reflect issues germane to the various student populations can range from broad-scale (as the previous example of technical trajectories suggests) to nuanced. An example of a more nuanced discussion of social informatics concepts is one where ICTs are not value neutral and their use creates winners and losers. For computer scientists this can show up in subtle ways, like in decisions regarding what information an application should provide to a user. Application designers who choose to pass cryptic messages to users when a program does not operate correctly carry the implicit or explicit belief that the user would not know what to do about such an error. This demands that the people who use it have access to technical help when these cryptic messages appear: having the offending stack overflow data displayed on

[20] These example come from Professor Leigh Star's Computers and Society course at the University of California, San Diego, Professor Robert kraut's Organizational Informatics course at Carnegie-Mellon University , Prof. Lisa Covi at Rutgers University and

screen is rarely helpful to the person who sees it.... From an information systems perspective, the focus on supporting the people who use it may be based on an a belief that they are either naive and/or their jobs relatively simple and routine (see Beath and Orlikowski, 1994; Suchman, 1989).

3.3 Social Informatics as Informed Critical Thinking

Since the underlying principles of social informatics imply a tension between the positive and negative effects of new ICTs, the best way to characterize these core issues is to develop an ability to think critically about the roles and value of ICTs. By critical thinking, we mean developing in students the ability to examine ICTs from perspectives that do not automatically and "implicitly" adopt the goals and beliefs of the groups that commission, design, or implement specific ICTs.

This critical orientation entails developing an ability to reflect on issues at a number of levels and from more than one perspective. This is a difficult and lofty goal, one that is central to most curricular reform efforts in SME&T education (NSF, 1996). Further, since an informed critical perspective means being able to draw on the research and theories used to develop the findings, this approach implies that high quality research must be synthesized for use by faculty and practitioners in the ICT-oriented communities.

It is important for IT professionals to be able to understand ICT designs, configurations, related social practices and choices about these practices from multiple perspectives. There are various means to help students analyze the value conflicts and to explore different perspectives in these situations. Faculty who teach these topics have found that having students engage in explicit debates about ICTs alternatives is one powerful teaching approach to help them confront ICT choices that they might otherwise ignore or dismiss. Since the premise of social informatics is that social forces help to shape technology, to understand this dynamic requires a discussion of the major social forces involved. These social forces represent multiple perspectives and rarely have clear-cut answers. In fact, focusing on finding answers may obscure the fact that many of these problems have no closed-form solution.

By developing such a critical perspective, ICT-oriented students will be more prepared to contribute to the public debates on the uses and goals of ICTs. Since the importance of ICTs to both the economy, and their broader role as a societal force, are constantly being explored by people from many perspectives. In the nascent years of computing, discussions by leading scientists were very influential (e.g., Vanever Bush's "As We May Think." of 1945). More recently these discussions of the social and organizational effects of ICTs have often been polarized. For example, Dertouzos' (1997) bestseller, What *Will Be,* presents a relatively uncritical perspective on the potential roles of ICTs in society, despite its effective portrayal of complex technologies in an understandable form. More commonly, though, discussions regarding the values and uses of ICTs are informal and local – speaking with peers in an office setting – where the individual ICT professional will be an important (and often undervalued) voice.

The goal of bringing computer-oriented students to a point where they have the ability to draw on techniques to enable reflective, inquiry-oriented, analysis of ICT design and use suggests that the social informatics material supporting this education be centered on examples, case studies, and student-led projects of local/personal interest (in university or local community). Further, to achieve this perspective building, the concepts of social informatics should be introduced early, if not immediately, in a technical education. This introduction should be neither compartmented in a separate class or as an end-of-semester topic in an introductory class, nor deferred (i.e., as an optional elective to be taken in the latter stages of a program of study). Effective presentation of social informatics concepts and techniques implies a broad inclusion across the formal curriculum.

3.4. Issues with teaching social informatics

We argue that social informatics findings and concepts provide students with a set of frameworks to help them organize social and organizational forces and make otherwise seemingly idiosyncratic and odd behaviors more understandable. However, there are several issues that affect the teaching of social informatics concepts and the inclusion of these concepts in ICT-oriented curriculums. These include having contemporary computing oriented educators formalize requirements for social informatics topics in the curriculum.

1. The ability of contemporary ICT-oriented faculty to effectively represent social informatics concepts and techniques.
2. Difficulties with synthesizing social informatics literature that is mostly research-based and spread across numerous disciplines.
3. Issues with helping students integrate social informatics concepts and techniques with their own experiences.
4. Dealing with existing mental models which students bring to social informatics issues.

Motivating contemporary ICT-oriented educators to value (and include) social informatics concepts and techniques in the curriculum.

This has three inter-related elements. Firstly, instructors may themselves be unaware of social informatics research. Thus, they may not be able to articulate this perspective well or appreciate their role in propagating implicit and explicit norms regarding the approach to the roles of ICTs in either organizations or the larger society. If social informatics concepts are presented as anecdotal without a grounding in the empirical research, students are doubly under-educated. These students are robbed of an extensive and insightful body of relevant literature that will assist them in their work and they are likely to continue developing ICTs that fail to meet the diverse needs of those who use them.

The second element of under-valuing social informatics concepts in an ICT-oriented curriculum is that the quality of teaching in these courses may suffer. If the social informatics concepts and techniques are seen as secondary, then the teaching of the topics may be relegated to lesser instructors – perhaps a colleague who is seen as a 'jack-of-all- trades' or someone who is willing to do such a course as a service, even though there is no passion (or even much interest). This type of devaluing is more insidious than just ignorance. It demeans both the importance of social informatics concepts and devalues the hundreds of dedicated faculty who are both passionate regarding social informatics research and excited to teach the concepts and techniques to ICT-oriented students.

The third element of this under-valuation of social informatics concepts in computer-oriented

curricula involves the focus of the program of study. Many of the contemporary computer science curricula are structured to prepare students to enter post-graduate programs in computer science, not entry-level ICT-oriented jobs. This attention often downplays the social informatics topics. Ultimately this both weakens the program graduate's value to the market and, if current attendance numbers continue, also reduces the number of these students who continue on for graduate work. There is a growing recognition that ICT-oriented programs may need to create separate foci for those heading towards post-graduate education – akin to the differing education's that research-oriented medical doctors have as compared to doctors who are being trained for clinical practice.

The ability of contemporary ICT-oriented faculty to effectively represent social informatics concepts, findings and techniques.

ICT-oriented faculties often find social informatics concepts difficult to present since this often requires a different mode of teaching than is typically found in computer science and other ICT-oriented disciplines. For example, the lack of teaching skill is a cause of concern in computer science in general (see Gal-Ezer and Harel, 1998) and specifically with regard to presenting social informatics concepts such as ethics and social responsibility (Huff and Martin, 1995).

Difficulties with synthesizing social informatics literature that is mostly research-based and spread across numerous disciplines.

This means that the findings are both diffused and written in specific ways and stylized forms to meet the needs of the academic publishing outlets where they appear. Like any body of research, there is a range of quality across a variety of approaches. Furthermore, since the focus is on the social and organizational aspects of technology, excellent lessons driven by outdated technologies are difficult to make clear if students are fixated solely on the value of the ICT in question. One intermediate step is to use excellent anthologies regarding the social and organizational aspects of computing (such as Kling, 1996; Huff and Finholt, 1994; Kraut, et al, 1990). However, there are few texts that assemble social informatics literature together in a way that can be used to support the multiple needs of the various ICT-oriented sub-domains particular needs. And, when these texts oversimplify the issues of organizations (such as implying that all members of an organization both know and follow all rules) or under-emphasize the social

aspects (i.e., highlighting only positive outcomes of ICT use) the texts can actually impede the teaching of social informatics concepts.

Issues with helping students integrate social informatics concepts and techniques with their own experiences.

As we discussed, above, students may be exposed to important concepts relative to social informatics in their sociology, psychology, history and economics courses as part of their broader studies (Davenport, 1996). However, when these concepts and issues are not brought into the context of IST design and use, it is difficult for students to sustain such relationships.

*Dealing with existing mental models which students bring to social informatics topics***.**

In the absence of research-based presentation of social informatics issues, students will often develop their own – typically naive – conceptualizations. While students with practical experience may be more responsive to (or at least recognize) the issues, they may have created unstable or poorly defined mental models to deal with social informatics interests. For example, Ellen Ullman (1997) writes in *Technophilia*, a book about her work as a software engineer "*Corporate end users: wildebeests of the programming food chain, consumers, roaming perilously far from the machine"* (p. 17) Mental models such as these, where the user is so distant and easily discounted, are then difficult to change – even when findings from rigorous empirical research supports such re-orderings.

Many of these issues are similar to those present in other SME&T education efforts. For example, physics texts are being criticized for both over-simplifying events and at the same time not being able to bring theoretical concepts into practical use (McDermott, 1993; Redish, 1996; McDermott and Redish, 1999). An example of the latter is that many advanced physics students can describe the formula underlying a particular occurrence but are unable to present a realistic scenario of such motion (McDermott, 1993). This example reflects the same issues that arise in the discussion surrounding user-participation in information systems design.

SECTION 4: RECOMMENDATIONS

In this final section, we present a set of recommendations regarding the inclusion of social informatics concepts and analytic techniques into ICT-oriented curricula. This inclusion mirrors the attention being paid by many SME&T disciplines to broadening the value and applicability of the technical aspects of the education by tying the aspects to the larger social context. Our recommendation center on curricular, not course, guidance since course-level content must be carefully constructed to focus on the particular needs of the many ICT-oriented disciplines.

Recommendation 1: Social informatics topics should be an integral aspect of all ICT-oriented curriculum.

1. Social informatics content should be seen as an integral aspect of the curriculum. Including social informatics concepts also reflects existing accreditation and curricular guides of the ICT-oriented professional societies.
2. Social informatics concepts and analytic techniques should be sustained across the curriculum. This allows students to develop critical thinking skills to support such analyses.
3. Social informatics literature can also serve as a means for organizing issues related to design, construction, implementation and use.

Recommendation 2: Social informatics concepts should be integrated into the formal education of ICT-oriented students.

1. These concepts should be based on contemporary social informatics research.
2. The social informatics concepts should be introduced early in the curriculum, perhaps in the first class.
3. The social informatics concepts should also be highlighted in later courses, perhaps best done through practice-based experiences such as internships and co-operative education.
4. The social informatics concepts must be both organized and presented in a way that satisfies the particular curricular emphasis of all ICT-oriented disciplines. This implies that additional attention is needed to develop appropriate pedagogical materials.
5. The social informatics material should provide a set of organizing principles to help

students organize and understand issues.

6. Including social informatics concepts also means helping students develop a set of analytic techniques so that they can continue to draw on this material through their education and subsequent career.
7. The integration of social informatics material into ICT-oriented curricula can be done in various ways such as: modules in a number of early courses, stand-alone courses, and/or the inclusion of pertinent courses from other disciplinary areas that have been tailored to meet the particular needs of the program's students.
8. This integration also implies that faculty involved in teaching computer-oriented topics must invest in developing competence with social informatics concepts and the means to teach this material.

Recommendation 3: The social informatics topics should be taught in ways that develop critical thinking skills.

1. Critical thinking means developing skills as a reflective practitioner, understanding the failure costs, consequences, and risks regarding ICT design/construction and use, having the skills to be both flexibility and creative regarding ICT design/construction/use, instilling a sense of inquiry and developing a problem-centered perspective on ICTs. This last point highlights the policy issues regarding ICTS.
2. This approach provides students a chance to practice contributing to public debates regarding ICTs.
3. This approach also provides a means for students to use field/learning experiences to build on classroom experience.
4. This suggests that social informatics approach be process-oriented.

Current efforts to reform the curricula of ICT-oriented curriculum reflect the ongoing concerns with the lowered interest in SME&T education even as the need for this type of education is growing. This disparity between interest and need is seen in ICT-oriented program graduation rates, most keenly so in computer science. The recommendation we set out suggest that academic units who are charged with teaching computer-oriented programs find ways to both incorporate social informatics material and concepts into the curriculum. This attention will both

increase the value of their students and, more importantly, enable these students to design, construct, implement and support the use of better (more useful and useable) ICTs. The recommendations also provide a basis for policy makers to set out guidance regarding the curricular and accreditation requirements for ICT-oriented curricular needs. Guidance for ICT-oriented curriculums that includes attention to social informatics material and concepts has identifiable outcomes. By recognizing the existence of a large body of rigorous empirical work that provides both guidance on how to better develop ICTs, including analytic techniques and frameworks for orienting and organizing the uses of ICTs in organization and in our society, students will be able to more readily realize their potential technically-oriented contributions to our organizations and the broader society in which we live.

Chapter V: Communicating Social Informatics Research to Professional and Research Communities

SECTION 1: Learning from Organizational and Social informatics

Up 30% last year. Double-digit gains for each of the previous seven years. Forecasts of another big increase this year... From Detroit to Decatur, Ga., companies are spending billions each week to automate design and production, to track sales and inventory, and to share information through ever-larger computer networks, including the Internet. Adjusted for price fluctuations, information-technology outlays now account for more than one-quarter of all U.S. investment and more than half of business spending on new machines.

Anders and Thurm (1999)

It is widely known that many large-scale change management projects involving new information technology (IT) fail for reasons unrelated to technical feasibility and reliability.

Markus and Benjamin (1997)

These two quotes illustrate two sides of a problem that has been part of the integration of information and communication technologies into business and other complex organizations. The cost of information and communication technologies (ICTs) continues to increase as does the amount of corporate investment in ICTs, and many large scale ICT projects continue to fail.

Is each new ICT project so unique that nothing can be learned from the past? Do systems designers and implementers develop ineffective systems because they have an inadequate conception of the people for whom they design these systems (Forsythe, 1992, 1994; Suchman, 1996)? Are ICT professionals so focused on technical requirements that they are not paying attention to academic research on systems success and failures? Markus and Benjamin (1997) argue that one reason for persistent systems failures is social - IT specialists, line managers and others involved in the change effort hold a "magic bullet theory" where they believe that "IT itself has the power to create organizational change." McKeen and Smith (1997; 17) agree and, coloring their bullet silver, state that "All too often IS managers have been guilty of looking for a

silver bullet from technology. The one magic answer that will solve all of their problems."

The costs of this belief are immense and growing. Many expensive information systems are underutilized, not producing their promised value, or are outright failures, yet organizations allocate increasing percentages of their operating budgets to expenditures on systems. So long as ICT professionals continue to think of ICT as a magic, they have few incentives to turn their attention to the findings and insights that have come from the careful academic study of both successful large scale change management projects and system failures. The critique of the technological determinism on which this perspective is based has been in the literature of information systems for a while (and it is raised again in Chapter 2), however many ICT professionals have not yet gotten the message. What can be done to disabuse them of the notion that the implementation of ICTs is sufficient to cause organizational change? What can be done to broaden their perspective on roles of ICTs in social and organizational change?

This chapter asks social informatics researchers to shoulder the responsibility for communicating the core of social informatics (defined here as its assumptions, concepts, theories, insights, and findings) to ICT professionals and other academic research communities. It begins with a brief description of these two groups, describing them as the main audiences of social informatics outreach efforts. After a discussion of some of the challenges involved in attempting to reach out to these audiences, several strategies are offered as ways to remove the barriers to and improve the flow of information between social informatics researchers and these audiences. Some of these strategies are low cost in terms of time and effort and can begin immediately. Others are more difficult and will require more concerted collective action to accomplish. The responsibility for outreach activities is great, but the stakes are high - organizations must learn to manage their growing investment in ICTs more effectively. This requires a change in the ways in which ICT professionals think about technologies, organizations, and social change.

SECTION 2: AUDIENCE

Social informatics research should be communicated to three distinct groups: ICT professionals, researchers and teachers in a range of academic disciplines, and policy makers, particularly those involved in funding research into the social and organizational aspects of computing. Reaching ICT professionals is of primary importance because they are responsible for managing their organizations' investments in ICTs as in Chapter III, "as many as 40% of systems projects in major corporations are total failures" (James, 1997). Many ICT professionals have an understanding of ICTs and the people who use them that is inadequate when applied to the challenge of developing systems that work. By many indications, this is a rapidly growing group of professionals who can be expected to have a major impact on the ways in which ICTs are designed, managed and used in the next decade. As has been made clear in Chapters II and III a major goal of social informatics is to develop theories and produce reliable, empirically-based knowledge that can help those who design, implement and manage ICTs by enabling them to improve the lives and work of the people who routinely use these technologies. The insights of social informatics can be used to broaden and deepen their conceptions of the relationship between ICTs and organizational change. This chapter will describe set of strategies that can be used to communicate to this audience.

Communicating social informatics research to other academics, both researchers and teachers, is important because "the value of social informatics material transcends ICT-oriented curricula" and has relevance across a range of disciplines (p. 39). The challenge is to draw social informatics work together and begin to make it known to other academic research communities in the United States and abroad. This is difficult because social informatics researchers are distributed across a wide range of academic disciplines.

We estimate that there are about 100 people in the United States doing social informatics research and probably another 100 in Western Europe, Israel and Australia. They are working in such diverse fields as information science, computer science, information systems, sociology, anthropology and communications. There is a need to educate a wide group of academics about the work of these social informatics researchers. An understanding of the research can enrich their teaching, and will begin the work of legitimating and raising the profile of social

informatics. This chapter will describe several strategies that can be used to gather social informatics work from these diverse sources and make it accessible to the wider academic community.

In addition, as is argued in Chapter VI, many ICT-oriented disciplines do recognize the significance of social informatics research, but it is not given adequate treatment in many classes. Better communication can increase the familiarity that other academics have with social informatics theory and research, improving their own teaching and research. This is particularly important for those involved in training the next generation of ICT professionals. Chapter V provides an extensive discussion of the case for including the core concepts, frameworks, and research exemplars of social informatics in the undergraduate and graduate curricula of ICT-oriented disciplines. In this chapter, the emphasis is on communicating the research to other academics outside of classroom and on suggesting strategies that are associated with discipline building such as hosting workshops and conferences and producing publications.

Communicating social informatics research to potential funders of research is also important. This community should have a familiarity with the core concepts, questions, frameworks, and research exemplars of social informatics, so that they can make informed decisions about supporting social informatics research proposals. Finally, communicating social informatics research to policy communities is essential if there is to be continued and broad-based funding and other support for further research. As policy and other decision makers become familiar with the basic themes, concepts, and findings of social informatics, they can make better decisions about funding research into the design, development, procurement, deployment, management, and use of ICTs. This chapter will discuss strategies that can be used to reach the ICT professional and academic research communities.

SECTION 3: COMMUNICATING TO ICT PROFESSIONAL AUDIENCES

Which ICT professionals could most benefit from an awareness and knowledge of relevant social informatics research and findings? A partial list of occupations includes those who design, implement, manage, and work on ICTs, those who make decisions about ICT development, procurement and deployment, and those for whom ICTs assume a central role in their work.

ICT professionals include:

ICT project managers	ICT system designers
Software and hardware designers	Quality and usability testers
ICT consultants	Information managers
Project managers	Systems analysts
Middle managers	Knowledge workers (e.g., corporate librarians)
Executives	Recruiters and human resource managers

Why is it important to communicate with this community about the role of social and organizational contexts in the design, implementation, and use of ICTs? One answer is that the incorporation of key ideas and findings from social informatics research on ICTs can improve professional practice. Managers, analysts, and consultants can benefit from a deeper understanding of how people and organizations work with ICTs. They can benefit from social informatics research because they gain more sophisticated understandings of the effects of the social and organizational contexts on ICT use, and of the ways in which people actually use these technologies. ICT developers can make use of social informatics research to develop more efficient, usable, and useful information systems that can be smoothly integrated into the social and organizational settings for which they are designed. By becoming familiar and keeping current with research that focuses on ICTs and social and organizational change, they can improve the systems they design and implement, making them more workable for the people who use them (Kling, 1999).

Costly systems fail, under perform, or do not return the value of their investment for reasons other than their technical configuration of feasibility (Markus and Benjamin, 1997). Another

answer is that greater understanding and awareness of social informatics research can help ICT professionals avoid implementation failures. When information systems projects fail, there are direct and indirect consequences for the organization. In addition to economic costs, there are social costs. Those involved in designing and implementing the system may feel alienated or experience lowered morale. Those who were to use the system may experience strained relations with the ICT professionals involved in the project. The decision makers in the organization may have less trust in those who championed the project and in the vendors who supplied the system components. Turning to social informatics research ICT professionals can take advantage of analysts who systematically and rigorously study how people work with information systems in a range of organizational settings. For example, they can learn that systems fail because:

- Designers lack an understanding of the current situations of those who will use the new systems. How locked in are people to their current systems? What are the switching costs involved in changing over to a new system?
- They lack an understanding of the organizational setting in which the systems will be used;
- The systems have not been adequately designed for those who will be using them. They do not have the types of features and functionality that is needed for the tasks at hand and cannot easily be integrated into the existing work flow;
- The costs of learning the new systems outweigh the benefits that workers can get from using them. One factor that can tip workers against the adoption of new systems is increased complexity that does not carry a clear payoff;
- The design process has not taken into account what people actually do. A system that is developed to handle a well defined set of tasks may not be able to cope with the unstructured and fluid portion of a worker's job. In many cases, this may claim a significant amount of the worker's time.

Understanding this type of research does not guarantee the success of every ICT implementation project. However, it does provide ICT professionals with the type of knowledge that can improve their design, development, and implementation processes by placing the technical design specifications of the new system in a broader social and organizational context. This allows them to anticipate the types of problems that could arise when people are being asked to

move to new information systems. It also encourages them to stretch the time horizons of projects to be able to observe the systems in use. Awareness of these types of social informatics research and findings also allows them to challenge the assumptions they have about the people who will be using the systems they are designing. For example, by taking into account what people actually do when they are using a current system, ICT professionals can ask questions about what the new system will do and how people are likely to react to it. How much of a change will people be asked to go through as a consequence of the implementation of the new system? What will people have to do to integrate the new system into their work? How will their work be changed? What are some ways that they may reconfigure the ICT as they work with it?

It is especially important to reach this group because the number of ICT professionals is expected to grow rapidly over the next seven years. According to projections from the Bureau of Labor Statistics (1998), four of the top ten fastest growing occupations are in the ICT sector. The fastest growing occupations between 1996 and 2006 are (Silvestri, 1997; 62):

> *Found in the very rapidly growing computer and data processing services industry, which is expected to double its employment size to 2.5 million workers by 20056. The three fastest growing occupations have significant employment in this industry: database administrators, computer support specialists, and all other computer scientists; computer engineers; and systems analysts.*

In general, the number of positions for the computer, mathematical, and operations research occupations is expected to double by 2005 with almost 1.1 million new and replacement jobs becoming available. This is a projected increase of 98% over 1996. More specifically, the number of positions available for systems analysts, for example, is expected to more than double during this time period with almost 500 thousand new and replacement job openings expected in 2006. This is a projected increase of 103% over 1996 (Silvestri, 1997; 78).

These professionals can be expected to have a profound effect on how ICTs will be designed, implemented, and used in a wide range of organizational settings. They will have learned a set of technical skills in their formal education, on the job and in career development courses.

Hopefully, they will have acquired the ability to learn how to learn, so that they will be able to keep their skill set current. For those whose work is many steps removed from the front lines of ICT use, technical skills may be all that is needed. However, there is a growing awareness among educators and employers that a technical skills set is necessary but not sufficient for ICT professionals who are closer to those who use systems routinely in their work.

For these people, computing and systems expertise must be augmented by knowledge of the organizational and social impacts of computerization. This knowledge is not typically found among graduates of information systems, information science, and computer science programs (Sawyer, Eschenfelder, Diekema, and McClure, 1998, Huff and Martin, 1995). By implication, it is also not present to any significant extent among many in the current ICT workforce. One of the values of social informatics research is to provide insights and findings that can be used by current and future ICT professionals to improve peoples' abilities to work effectively with ICTs. As the costs of ICTs increase and the systems designed around them become more complex, the pressures on ICT developers and managers to implement successful systems will also increase and this knowledge will increase in value.

Communicating social informatics research effectively to ICT professionals means influencing two crucial components of their worldview. The first is how they conceptualize processes of software, hardware, and systems development, implementation and use. The second is how they understand the complex relationship between ICTs and the social and organizational contexts in which they are embedded. Familiarity with social informatics research turns ICT professionals' attention to the social and organizational contexts of ICTs, the mutual shaping of technology and its contexts, and the configurability of ICTs, broadening their world view and enabling them to improve their practices. In Chapter V, we argue that for the critical importance of reaching the next generation of ICT professionals by integrating social informatics concerns into graduate and undergraduate curricula. Here, the focus is on reaching the current generation.

There is also another reason why the effort to communicate with this audience is worthwhile. There has been a long history of support for academic research on ICTs from the professional community and this support, both in terms of funding for research and in the provision of access,

must continue. Westfall (1998) makes the point cogently, stating that "As an applied field, we need financial support and institutional validation from practitioners." Although Westfall is addressing researchers in Information Systems, this point can be generalized to social informatics researchers as well. In order to maintain this type of relationship with ICT professionals, it is incumbent upon social informatics researchers to convince practitioners of the worth of their research. They must make clear the value of understanding the powerful ways in which ICTs shape organizational and other contexts and are, in turn, affected by these contexts, and demonstrate the ways in which the design, development, and implementation of ICTs affect and change work. They must impress upon the community the importance of continued support for research into the organizational and social impacts of computerization.

Two main challenges when communicating social informatics research to ICT professionals are:
• Perceptual: the research must be seen by this group as relevant, timely, and valuable • Competitive: academic social informatics researchers are not the only group "selling" research to ICT professionals.

There are two main challenges that must be addressed when communicating social informatics research to ICT professionals. The first is perceptual; the research must be seen by this group as relevant, timely, and valuable and must contain suggestions that can be realistically implemented in their practices. The second is competitive; academic social informatics researchers are not the only group that is "selling" research to ICT professionals (Davenport, 1997).

3.1 Perceptions of the relevance of social informatics research

Perceptual barriers:
• Potentially relevant research is not easily accessible to ICT professionals • The ICTs that this audience works with are not the focus of much research

The first challenge in reaching this audience is to overcome the two barriers that seem to exist

between ICT professionals and academic social informatics researchers to contribute to the perceptions of the former that much academic research on ICTs is not worthy of their attention. These barriers are rooted in the academic research process; the first is related to the conduct of research and the second arises from the choices made by researchers about what they will study. As is detailed in Chapter V, many ICT professionals currently believe that research from the academic community is largely irrelevant and that attention to the social contexts of ICT design, implementation, management, and use is not important to their work (Agre, 1998, Senn, 1998). For example:

- [The] Society of Information Management International (SIM), whose membership is primarily CIO's, decided in 1995 to stop bundling MIS
- Quarterly with membership. Few members opted to continue their subscription even at a discounted price, and non-academic subscriptions declined by more than 60 percent. (Westfall, 1998)
- In an interview, a CIO stated that "The work is not relevant, readable, or reachable." (Senn, 1998; 23-24)
- "Few IT academics are viewed as the world's authorities on IT in business; we are seldom sought out for our opinions on contemporary IT issues. The journals in which academic IT research is published are rarely read by practitioners" (Davenport, 1997).

These examples are supported anecdotally by Kling (1996; 34), who comments that:

> *. . . Relatively few of the practicing technologists whom I have met in some of the nation's top industrial and service firms read broadly about the social aspects of computerization. Sadly, a substantial fraction of computer specialists focus their professional reading on technical handbooks, such as the manuals for specific equipment, and on occasional articles in the computer trade press.*

Why do such perceptions and patterns persist? Why do ICT professionals not read academic research, especially articles containing social analyses of computing in the types of organizations in which they work? What could make sound, reliable, and potentially valuable academic research appear to be irrelevant and unreadable? What barriers come between researchers and professionals that reinforce the latter perceptions that the research lacks applicability to their

workplaces? One barrier may be rooted in the process of academic research, which poses a dilemma for researchers wishing to reach the ICT professional community. To create and maintain a stream of research may take three to four years because of all of the articulation work that must be done. There are proposals to be written, grants to be sought, access to be gained to research sites, long periods of data collection and analysis, and, finally, articles and research reports to be written. An important goal of this process is to generate reliable knowledge about ICTs and social and organizational change. At times during this process, researchers are faced with a choice - when should research be presented to peers and when should it be presented to practitioners? The dilemma here is that there is a different criterion that influences the writing for each audience.

Researchers have to follow one set of norms to publish research for their peers and another to publish research for a non-academic audience. To publish in peer-reviewed journals and create the type of research output recognized as a standard "scientific article," academic researchers must report research in a style that conforms to a widely accepted set of standards. This involves the use of a particular structure, writing style, and logic of argumentation. Characteristics of this format may contribute to the perception among practitioners that much academic research is difficult to read and irrelevant. For the academic audience, however, these same characteristics are indicators of the reliability of the research. For example, two sections of an academic research report that are required for peer-reviewed publication are the literature review and description of the methodology. Both of these sections may make research articles more difficult for a non-academic to read, since they do not contain descriptions of findings or pragmatic suggestions for improving practice.

To publish in a trade or industry journal read by ICT professionals requires a more journalistic writing style. There is more emphasis in this type of writing on accessibility, on the explicit linking of the research findings to improvements in the professional's practice. Vivid and compelling examples are an important feature of this type of article. The standard structure used when writing an academic research publication is not the standard in this domain. There will not be a lengthy problem statement or intricate discussion of the strategies used to control error or to maximize reliability and validity. The emphasis is on the pragmatic implications of the research.

Articles typically conclude with suggestions, strategies, or tactics that can be used in the workplace to improve some aspect of organizational performance or structure.

Clearly, there are some important differences between the type of research report that can pass through academic peer review and that which can withstand the critical eye of an editor of a practitioner-oriented publication. Writing for an academic audience emphasizes reliability; articles for ICT professionals emphasize accessibility. When faced with the choice of pursuing the scholarly or practitioner-oriented publication of research, many researchers decide write research reports, which conform to the norms of formal scholarly communication. There are many good reasons for pursuing this option. It is an important and understandable choice. Scholarly publication is an essential step in advancing both the researcher's individual stream of research and the larger body of reliable and accepted research in the academic domain in which the researcher works. Peer-reviewed articles are important in the academic reward system and writing for practitioners becomes a lower priority for many researchers. As a consequence, ICT professionals do not find many research articles to be reader friendly. Such a reaction is sensible, given the realization that the work is written for an academic audience and not for them. In order to overcome this barrier, it may be necessary to provide career-advancing incentives to encourage researchers to write for ICT professionals.

A second barrier that may contribute to the perception among ICT professionals of the irrelevance of academic research is a consequence of the choices made by some researchers who study ICTs in organizations. According to Attewell (1998), some researchers get caught up in the tidal wave of rapid technological change in ICTs and face "a constant temptation to turn away from studies of current outcomes of existing information technologies, and instead turn toward a kind of futurology or speculative stance about what might be the case in the future." Those who have given in to this temptation, he argues, have produced research that has had "unfortunate implications." For example, this type of work typically has an emphasis on speculative theoretical models rather than on careful empirical studies of existing systems ("ought" instead of "is").

In addition, some researchers choose to focus on the most innovative ICT applications in the

most forward-looking and dynamic organizations instead of on the routine uses of ICTs in average organizations, "the point being that what one observes in the largest, most resource-rich, and most committed settings is not a good predictor of the typical effects of a technology in the larger world" (Attewell, 1998). He also points towards a tendency to minimize the importance of findings that indicate problems with ICT design, implementation, and use by attributing the effects to the "beta" versions of systems. This tendency is a form of technological determinism because it attributes the presence of problems to the direct effects of ICTs. The implied assumption is that when later versions of the system are implemented, these problems will disappear, being designed out of the system. Much social informatics research can act as a corrective to this tendency if it can be brought to the attention of ICT professionals. As discussed in Chapter III, there is a stream of research that for two decades has been demonstrating that approximately "40% of systems projects in major corporations are total failures," in large part because of a lack of attention to social and organizational factors.

There is a perceptual barrier among ICT professionals that academic research on ICTs is not relevant. Two factors that contribute to this perception are the academic style of writing that is a normal outcome of the research process and the focus of some IT researchers on more innovative applications of ICTs. Articles that are written for academic audiences emphasize the reliability of the research in ways that make the articles less accessible to professional audiences. If the ICTs being studied are too far in advance of the types of ICTs that form the installed base in many organizations, the professional audience may have a hard time extracting the findings and insights that will be of practical value to them. This barrier must be overcome if social informatics researchers are to have a chance to change the perceptions of ICT professionals and make them aware of the important and potentially relevant findings of social informatics research.

3.2 Competition for the attention of the ICT professional audience

Competition:

The second challenge in reaching ICT professionals is due to the fact that social informatics researchers have not cornered the market on ICT research. In fact, there is strong competition from ICT research and consultant companies for "mind share," or the collective attention of ICT

professionals. Many ICT professionals and their organizations are in the interesting position of being more willing to purchase research reports from these companies at high prices than to cull relevant research findings from the free academic literature. There are some good reasons for this. Searching for, retrieving, evaluating, and repackaging academic findings involves greater opportunity costs, in terms of time and money, than ICT professionals are willing to pay. As mentioned above, the research is difficult to read, generalized, and not easily applicable to the specific problems of specific organizations. Extracting practical insights that can be used to improve practice is not a trivial task.

ICT research and consultant firms have an advantage because they can work with academic research more easily than can ICT professionals and can interpret and package it in ways that address a client organization's specific needs. Because the consultant's report is written expressly for the client using language that is native to ICT professionals, it appears to be more readable and relevant that a standard academic research report. Social informatics researchers are at a disadvantage when it comes to the ability to present research in "practitioner-friendly" packages.

ICT research and consultant firms can also bring many more resources (human, material, and economic) to bear on a problem than can most academic researchers. Teams of consultants and analysts can be dedicated to specific projects on a full time basis, allowing them work more quickly can than academic researchers. Their research products have to satisfy internal criteria of quality and do not have to go through external review. This means that they can conduct research with a much faster turnaround time than is typical of academic researchers, who have to put their work through lengthy processes of peer review and revision. While this is one way of ensuring that published work conforms to academic standards of quality, it also means that many months, and sometimes as much as a year, can elapse between the submission of a research report and its publication. Social informatics researchers are at a disadvantage when it comes to timeliness.

Consultants typically focus their research much more narrowly on the specific problems of the organization for which they are consulting with a goal of developing specific resolutions to these

problems. Their success depends on their ability to demonstrate to ICT professionals that their work can resolve the problems they have investigated in cost-effective and timely ways. Most academic researchers studying ICTs in organizations are not motivated by these same goals. Where research and consultant firms are conducting research to develop pragmatic resolutions to problems with ICTs in specific organizations, academic researchers tend to pose broader research questions, looking for patterns among organizations. Academic researchers may also use data collection techniques, such as ethnography or participant observation that are much more time- and data-intensive. Organizational Informatics and social informatics researchers are at a disadvantage when it comes to allocation of resources for research and the pin-point focus that generates research relevant to specific organizations. Research and consultant companies therefore present a significant challenge to academic researchers attempting to wrest some "intellectual market share" out of this marketplace.

Social informatics researchers face two main challenges when communicating their research to the ICT professional community. They must develop strategies that will enable them to overcome the perception that their work has little relevance for practitioners, is not timely, and is not focused on the "real problems of real organizations." They also have to develop strategies that will allow them to draw the sustained attention of ICT professionals, whether this means competing or cooperating with ICT research and consultant firms. The following section outlines five strategies that address these challenges.

3.3 Strategies for communicating to ICT professional audiences

Five strategies to improve communication between social informatics researchers and ICT professionals:

- Developing a current empirical assessment of what we know about the worlds of ICT professionals
- Conducting and communicating research that is useful for these professionals given what we know about their typical problems, concerns, and information behaviors
- Focusing on speaking to and writing for ICT professionals
- Holding regular forums that bring academics together with ICT professionals;

- Influencing current professional practice through workshops, seminars and life
- long learning
- Creating "ICT extension services"

To manage competition with research and consultant firms, social informatics researchers can:

- Distinguish their work from that done by the firms emphasizing the value that can be added to practice from academic work
- Explore ways to cooperate with these firms

What can be done to improve and extend vibrant and stable two way channels of communication between social informatics researchers and the ICT professional audience? What are some reasonable strategies that social informatics researchers can use to communicate their work to ICT professionals in ways that positively affect professional practice? What can be done to change the perception that research on ICTs is difficult to read and seemingly irrelevant? How can the competition with ICT research and consultant firms be managed so that their market share is not impacted, and the insights and findings of social informatics research brought to the attention of ICT professionals?

This section addresses these questions with a set of six broad and related strategies that may provide researchers with ways to get their work into the hands of the ICT professional audience. The first strategy is to develop a current empirical assessment of what we know about the work worlds of ICT professionals. The second is to conduct and communicate research that is useful for these professionals given what we know about their work. Their typical problems, concerns, and information behaviors. The third is based on publicity and focuses on speaking to and writing for ICT professionals. The fourth strategy is learning from ICT professionals by bring them together with social informatics researchers in regular forums. The fifth strategy is to influence current professional practice through workshops, seminars, and life long learning. The sixth strategy is to support the development of "ICT extension services," based on the model of agricultural extension services.

The long term goal of this effort is to persuade this community that they can turn to academic

social informatics researchers for high quality research findings and insights that will be useful in their work. Stated more strongly, the professional ICT audience should look routinely to social informatics researchers for ways to improve their practice and deepen their understanding of the complex interrelationships among ITCs, the people who work with them, and the organizations in they work.

1. Learning about ICT professionals

What do we know about the worlds and information behaviors of ICT professionals? How do they seek and use research on ICTs?

The first strategy is to develop a current and reliable understanding of the social and organizational contexts of ICT professionals. To improve and extend lively and ongoing channels of communication with this audience, social informatics researchers must learn how to communicate with ICT professionals, instead of expecting that this audience will change its habits to accommodate the constraints of academic research. To do this, social informatics researchers should have timely empirical knowledge about what ICT professionals do and how they work, particularly in terms of their information seeking and use. This requires an understanding of the organizational information environments in which ICT professionals routinely operate and the range of information behaviors they enact in these environments. Initial research might segment ICT professionals into the different groups that make up this audience. Then, some questions to ask might be about these different groups such as:

- What are the main channels through which ICT professionals obtain information about research?
- What are their patterns of environmental scanning?
- What types of research about ICTs are they most likely to seek out?
- At what points in their workflow and for what purposes are they most likely to use research?
- In what forms should research be presented to them to maximize the chances that they will read and use it?
- What are the typical time frames of these professionals as they engage in information

seeking and decision making about ICTs?

Answering these questions is a step towards being able to use social informatics research to provide ICT professionals with the research information they need when it is needed, in the forms in which it is needed. This type of empirically based background information can be used to develop strategies for communication that can be much more precisely developed for this audience.

Some of these questions can be answered by examining state of the art literature reviews of ICT managers and professionals and their uses of information about ICTs, and, if necessary, conducting new reviews (see Katzer and Fletcher, 1992). For example, there is a significant body of research about the information behaviors of designers, developers, managers, and executives to understand how these organizational members seek and use information through environmental scanning. According to Choo (1998; 93), people in organizations:

> *Scan using a variety of methods, ranging from the irregular, ad hoc scan to continuous, proactive information gathering as part of an institutional scanning-planning system. The size of the organization, the industry it is in, the organization's dependence on and perception of the environment, and its experience with scanning and strategic planning are some of the factors that affect the choice of scanning method.*

Another important facet of organizational information seeking and use is the role of research information in organizational decision making. This is one part of the ICT professional's work where social informatics researchers would hope to make a difference. For example, when ICT managers are in the midst of a process of purchasing ICTs, such as when making an upgrade to a call center, at what points in the decision making process does research information make a difference? How is this information sought out, evaluated, and used? In what forms is this information most likely to have an effect on the manager? Some research is not comforting - managers will use information in a post-hoc way to support and justify decisions that they have already made (Meltsner, 1976). They will not pay attention to the work of their own analysts and will instead make decisions "on the basis of politics and personal loyalties rather than the

information that the analysts have to offer" (Feldman, 1989; 93). However, there is a need for an analysis of recent research on the uses of information in organizations to check on these findings. Also to assess the changes that have occurred as organizations make use of new ICTs in their routine business and communication processes. Such an analysis would provide a contemporary description of ICT professionals' information seeking, evaluation and use behaviors, giving social informatics researchers a better understanding of how, when, and in what forms they can communicate their research to this community. It is also possible that new research may be needed, especially if ICT professionals' use of research information is shown to fall into the domain of "artful integrations," defined by Suchman (1996; 407) as a concept intended to:

> *Draw attention to aspects of systems development and use that have been hidden, or at least positioned in the background or shadows, and to bring them forward into the light. These include various forms of professional configuration and customization work, as well as an open horizon of mundane activities involved in incorporating technologies into everyday working practices, and keeping them working.*

2. Redesigning the research focus

How can researchers begin to develop compelling examples from their studies that illustrate the social embeddedness of ICTs? How can they demonstrate that the mutual shaping of ICTs and their settings helps to explain instances of successful system design and implementation and of large scale system failures?

A second strategy is to redesign the approach used when conducting the type of research that is intended to address problems and issues of importance to ICT professionals and generate findings to be communicated to this audience. The purpose of this redesign would be to produce research that has the qualities (relevance, timeliness, and readability) that this audience seeks in the literature it is likely to read and use. This strategy should be based on the outcome of the first strategy, which should produce a set of problems and issues that are relevant to ICT professionals and engage the interest of social informatics researchers. In a paper on improving research on information technology, Attewell (1998) suggests that researchers "should pursue

empirical studies of existing technologies in real settings, as distinct from speculative or purely theoretical exercises", and that "care should be taken to include representative organizations/ settings, not just cutting-edge or high-tech ones." This prescription directs researchers towards more typical organizational settings within which they should make social and organizational contextual variables central to the analysis of computerization, increasing the chances that their findings will have more relevance to ICT professionals. An interesting question is whether the "product to market cycle" can be shortened without sacrificing the quality of social informatics research intended to influence ICT professionals. Should academic institutions create small, flexible research groups that focus on ICT research for the professional audience?

By focusing on the fundamental themes of social informatics, as described in detail in Chapter III and presented in tabular form in Chapter V, researchers can begin to develop compelling examples from their studies which illustrate the social embeddedness of ICTs. They will be able to demonstrate that the mutual shaping of ICTs and their settings helps to explain instances of successful system design and implementation and of large scale system failures. For example, a National Research Council report (NRC 1998), describes a study by anthropologist Julian Orr. He conducted fieldwork among Xerox service technicians and found that they relied on shared narratives instead of company literature to solve problems in the field.

System designers took this information and used it to develop a "community-validated Ôtips' database" which, upon implementation, was accessed more than 1,000 times daily. The importance of attention to the social and organizational contexts in the successful deployment of this information system is described in the NRC report (1998):

> *Both developers and managers attribute the success of this system in part to the effort to take seriously social science ideas about community. They learned that local knowledge conveyed in the community vernacular by community members is useful to technicians troubleshooting unfamiliar problems. And so the system was designed to support vernacular content. They learned that community knowledge could spread much more rapidly than standard corporate publication or validation cycles. And so the system was designed to include many human validators in order to ensure very short validation cycles. Initially, developers*

> *and managers worried that they might have to provide economic incentives for technicians to contribute tips. But they learned that technicians value the social validation that comes from other community members who appreciate their tips.*

Research attention to the unintended consequences of ICT design, implementation and use also can provide the types of findings that can help ICT professionals understand the importance of the configurability of the technologies with which they work.

An intriguing possibility for redesigning the approach to social informatics research that is intended to influence ICT professionals is to create research-based partnerships with organizations in which they work and involve them in the research. Researchers can engage in action research where the insights of social informatics is put into practice in organizations during the investigation of some problem. One goal of this work would be to publicize the results of the research indicating, with empirical evidence and the support of the ICT professionals in the organization, that there were gains and benefits that accrued to the organization as a consequence of the research. For example, Longnecker et. al (1996) describe a project involving local government officials and their University based on:

> *A partnership between the City of Mobile and the University of South Alabama School of Computer and Information Sciences for the purpose of providing an excellent realistic learning environment for the students of the Information Systems analysis and design classes, an opportunity for knowledgeable faculty to be involved in strategic enterprise level systems development, an opportunity for the City of Mobile to receive considerable service from large student teams, and an opportunity for the citizens of Mobile to benefit from the new services developed.*

If ICT professionals are brought into the research process at early stages, there is a greater chance that they will provide more support for the study. Especially if there will be clear benefits to their organization as a consequence of the research. They can also help to sharpen the focus of the problem statement, research questions, or hypotheses since they have deep local knowledge. As they become more invested in the research, they will be more likely to find the

results relevant to their situations. This type of participatory research, however, is more likely to influence local practice in the organizations that are studied. The challenge is to leverage the support that should be forthcoming from the local ICT professionals into acceptance of the findings from their peers at other organizations.

3. Publicizing social informatics research to the ICT professional audience

How can social informatics researcher bring their work to the attention of ICT professionals?

A third strategy involves writing for and speaking to ICT professionals about the findings and insights of social informatics research. One of the products of the first strategy should be a listing of the publication outlets that are frequently used by ICT professionals when they are searching for and reading research-based information. The list should be complemented by an analysis of the forms in which research information is most likely to gain and hold the attention of ICT professionals. Social informatics researchers should then develop versions of their research reports for these publication outlets.

The articles should be written in a journalistic style, and emphasize the research findings in pragmatic ways that can influence the practice of ICT professionals. Reports of system failures can lay out the chains of events that led to the failure so that readers can learn what to avoid or how to recognize the early warning signs. Problem-driven reports can be prepared which present useful data generated by social informatics researchers about issues and problems of concern to ICT professionals. These reports could include survey results, illustrative case studies, meta-analyses of ICT research, and syntheses of research findings. There are examples of "crossover" academics who write effectively for this audience, see, for example, Davenport (1997) and Markus and Benjamin (1997). There are also publishing opportunities for social informatics researchers to write books intended to "inform the practice and management of information systems;" for example, the Wiley Series in Information Systems is seeking monographs which explicitly address issues of practice. In addition, social informatics researchers should consider presenting their work at the conferences that ICT professionals attend.

If this strategy is to succeed there must be some type of reward or recognition within the

academy for social informatics researchers who choose to write for and present to the ICT professional audience. They are choosing a riskier career option compared to a traditional academic research's career trajectory. This time they spend reaching this audience means that they are producing fewer peer reviewed research articles and, if they wish to publish their research in traditional scholarly journals, are actually writing second versions of their articles for practitioners. There should also be institutional support for researchers who present their work at practitioner-oriented conferences.

4 Holding regular forums that bring academics together with ICT professionals

What can be done to bring academics and ICT professionals together in a setting where the practitioners can educate the academics about the issues and challenges of importance to them?

Another way to communicate with ICT professionals is to solicit their input on issues and challenges that are important to them. Social informatics researchers can invite managers, designers and other ICT professionals to attend meetings. These practitioners can discuss with each other matters of practical importance to them and in doing so help their hosts understand what they need to know about ICT, organizations and change. Such an arrangement takes advantage of the knowledge and experience of ICT professionals who are "on the front-line of the information technology wars in organizations" (McKeen and Smith, 1997; xi). It provides them with an opportunity to interact with each other, share their insights and experiences, and develop a "wish list" of topics that they would like to see researchers investigate. Each meeting should be focused on a single topic and, guided by their hosts, participants would be encouraged to discuss the ways they had addressed the topic in their organizations. Through conversations with professionals who design and manage ICTs in organizations throughout the economy, social informatics researchers can learn about the problems and challenges that characterize ICT systems development, the use in different economic sectors, and about the trends that are shaping professionals' jobs. T his is a way for social informatics researchers to shape their work in ways that has practical relevance to this group. In return for their participation, IT practitioners receive research reports about the topics they have selected that incorporate the discussion they had, relevant social informatics research, and practical strategies that can be used to address the topic in their organizations.

A successful example of this strategy can be found at the School of Business at Queen's University in Kingston, Ontario, where two professors have been running the "IT Management Forum" since the early 1990s (see http://business.queensu.ca/research/consortia/home.htm>). McKeen and Smith (1997; 2) periodically bring senior IT managers together to discuss an issue that has been selected by the participants. Forum sessions follow the following format:

- "members jointly select a topic of interest to them;
- they research the topic within their own organization following an outline prepared by the facilitators;
- each member makes a presentation about how his or her organization is managing the issue;
- members have an opportunity to critique and discuss each presentation and to agree on best practices;
- draft copies of each paper are reviewed by members as well as selected IS and user managers in the member's organizations;
- responses are incorporated into the final papers."

These meetings provide the participants with practical strategies based on relevant research that they can implement in their organizations. They provide the researchers with a set of research problems based in the practitioners' work that they can investigate. The reports that result from this work are made available to the practitioners who implement the relevant findings in their organizations. This relationship allows research to directly affect practice that works, in part, because the impetus for the research is provided by the CIO's themselves. Membership in this forum is limited and fee based; annual participation costs $5,000(CA) and access to the reports is another $1,000 (CA). McKeen and Smith (1997: 2) report that the reaction to the reports has been positive among the members.

5. Providing continuing education for ICT professionals

How can social informatics research be used to inform continuing education for ICT professionals? What types of workshops and seminars will be of the most value for them?

Another way to reach ICT professionals is through an ongoing series of workshops and distance education experiences. Accepted conventional wisdom among ICT professionals is that the pace of technological change is increasing, and many acknowledge the difficulty of staying current in their specialties. Social informatics researchers can take advantage of this belief by sponsoring workshops based around the theme of using social informatics research to improve organizational practice. This experience should involve both the continual upgrading of technical skills and the ongoing discussion of the importance of the social and organizational context of ICT design and use. According to Fletcher et. al (1995):

> *It must be recognized that it is not possible to teach students all they need to know for a successful career within the confines of a four-year bachelors degree program or a two-year masters. We have long proclaimed our belief in lifelong learning, but we have not adapted our curricula to that belief. Curricula need to be developed with a model of change as its underpinning.*

For example, the Tavistock Institute hosted a workshop on "Planning and Sequencing Successful Organizational Change: An Interactive Workshop Introducing a New Methodology" which was developed for (1998):

> *Senior line managers, human resource managers and in-company change facilitators and managers, working in sectors undergoing comprehensive change. These include construction, manufacturing, financial services, healthcare or local government.*

The purpose of this type of workshop is to provide participants with an experience involving a mix of theoretical insights, empirical research findings, and practical exercises designed to give them the tools and strategies they need to make immediate and observable changes in their organizations. They should involve participants in the analysis of appropriate cases, and the application of the principles of the workshop to the participants' individual situations. A workshop series for ICT professionals can be sponsored by a professional academic association to which social informatics researchers belong, such as the Association for Information Systems (AIS) or the American Society for Information Science (ASIS).

6. Creating Research Based Fmajor "ICT extension services"

How can "ICT extension services" be used to translate social informatics research for ICT professionals?

An intriguing strategy is to create "ICT extension services," built on the model of agricultural extension services[21]. Agricultural extension agents work with members of their communities educating them about the latest developments in agricultural research and helping them with problems that arise during the course of agricultural work. Some agents develop outreach programs that involve different types of audiences. The University of Connecticut Cooperative Extension Service wanted to share information "and resources in the areas of food production, food distribution, nutrition education, resource conservation, energy conservation, and waste recycling with the urban community" in New Haven Connecticut (McKenna and Barber, 1987).

What extension services share, however, is the commitment to translating research done in the universities with which they are affiliated into terms that are practical and useful to their constituencies. For example, the mission of the Agricultural Extension Service of Nashville and Davidson County, Tennessee is to ". . . extend . . . the research and knowledge from the Land Grant Universities (UT and TSU) to the residents of Davidson County" (1999). In more specific terms, at the University of Arizona, agricultural extension work is defined as "giving practical demonstrations in agriculture and home economics, and imparting information on those subjects through field demonstrations, publications and otherwise" (ALIS, 1999). The Department of Agricultural and Extension Education at Michigan State University is "focused on the providing of expertise in the areas of pedagogy and communication, . . . and facilitating learning for a diverse group of learners in formal and non-formal settings" (Michigan State University, 1998).

Agricultural extension agents are trained in universities; in its Department of Agricultural Education and Studies, Iowa State University offers a "Agricultural Education Extension Secondary Major" which prepares students for extension work by teaching them about extension

[21] In the United States, agricultural extension services tend to be affiliated with land grant universities. They operate as quasi-independent agencies with an explicit outreach function

history, operations, program planning and development, 4-H programs, instruction and evaluation techniques." They also learn how to "deal effectively with the public through studies in business communication, public relations and publicity, public speaking, and related areas" (Iowa State University, 1996). Training is critical to the success on an extension office; according to an FAO report (Qamar, 1998):

> *The positive relationship between training of extension personnel and their performance, both in office and in the field, is well known. To a great extent, the effectiveness of any agricultural extension service is determined by the competence and qualifications of its staff. Studies have shown that the improvement in farmers' knowledge, skills, attitude, efficiency and productivity are positively correlated to the training level and quality of extension staff.*

How then can this model be appropriated by social informatics researchers? An "ICT extension service" based at state universities where social informatics researchers are on the faculty may provide a very interesting way to bridge the gap between researchers and ICT professionals in small to medium enterprises. Just as farmers are not expected to read the agricultural research, perhaps ICT professionals should not be expected to read academic social informatics research. The mission of this type of extension service would be to gather the relevant research on ICTs and repackage it for its constituents. Extension agents would be involved in outreach to the ICT professionals in organizations that might not be able to afford the rates charges by large research and consultant firms, but need access to the type of research and services that such firms can provide. The agents would be, in effect, problem driven information brokers who would be able to read the research, extract the relevant insights, and develop the practical implications of the work in ways that help ICT professionals improve their practice. They would be able to go into ICT professionals' organizations, provide demonstrations, and give presentations about the social informatics research relevant to these audiences.

These extension agents would be trained by their universities. Perhaps in programs that emphasizes both the grasp of ICTs and a deep understanding of information technologies, organizations, and social change. Two examples of programs which could be used to train ICT extension agents are the Masters in Information Science at Indiana University

<www.slis.indiana.edu/Degrees/mis/misindex.html> and the Masters in Information Resource Management at Syracuse University <http://istweb.syr.edu/design/academic/degrees/grad/irm/index.html>. The public universities that would host these extension services should lobby to have a line created for the service in the state budget. The argument can be made that providing this type of service to ICT professionals in small to medium enterprises is as important to the overall health of the state's economy as is support of the state's farmers. In Indiana, the Purdue University County Extension Service received approximately $4.3 million in FY1998. Some $20 million was allocated for agricultural extension services in Pennsylvania and $50 million in Texas. Funding somewhere between these extremes would be an investment that would pay off handsomely for the states that develop these services.

7. Managing competition with research and consultant firms

How can social informatics researchers differentiate their work from that produced by research and consultant firms? Under what conditions is it sensible to cooperate with these firms?

One way to manage to competition with research and consultant firms for the attention of ICT professionals is for social informatics researchers to distinguish the ways in which their work differs from the work of these firms. They can emphasize the ways in which social informatics research provides a different type of value for practitioners. The types of findings and insights that constitute the best of social informatics research are qualitatively different from those produced by these firms and can have a different impact on ICT professionals' practice. An important difference is that social informatics research is embedded in a theoretical framework that allows these findings and insights to be generalized so that, according to the NRC (1998):

> *The value of social science research comes not from tracking the frequency of use of the latest technologies but rather from helping to develop common social and economic principles that can be applied to new circumstances. Those designing or relying on technology and those making policy decisions about the use of technology without reference to systematic theories of human behavior or economics will likely find themselves approaching each new issue in ignorance.*

ICT professionals can gain insights from social informatics research that is not typically found in the reports prepared by research and consultant firms. This type of research is grounded in a broader conceptual framework than a typical consultant's report and has a level of generalization that is not a goal of the consultant. For example, research about how people in organizations are actually using ICTs in their work, the types of problems that they have with existing and new information systems, and the ways in which their organizations are effected by the implementation of new systems can help ICT professionals broaden their understanding of the interrelationships among ICTs and their social and organizational contexts. This, in turn, can enrich the design and development processes in ways that may allow ICT professionals to improve the work lives of the people who use these new systems. In contrast to the type of research produced by research and consultant firms, this implies that social informatics researchers:

> *Do not simply count things. When they count (to answer how much, how many, how frequently), a theoretical context, involving systematic theories of human behavior, motivates the counts . . . [however,] . . . the goal is not to count, but rather to understand how the frequency of one kind of behavior affects the dynamics of a social institution. Such understanding enables more reliable forecasts and more trustworthy inferences about causal relationships.* (NRC, 1998)

An advantage that academic social informatics researchers have in comparison to consultants is that their work provides a "socially rich" account of ICTs, organizations and social change. This is in contrast to consultants reports, which are usually "socially thin" (Kling and Tillquist, under review). Socially rich accounts conceptualize organizations as environments within which people are enmeshed in a web of dynamic and complex social relationships characterized by "subtle interdependencies, periodic conflicts, and multiple interpretations" (Kling and Tillquist, under review). This type of approach emphasizes the importance of such social elements as incentive and reward structures, differential social statuses, power relationships, and mutual interdependencies as factors in understanding the uses of ICTs in organizational settings. These elements are glossed over in the socially thin accounts produced by consultants, which can lead

to a conception of work practices that discounts "concerns for work intensity, pacing, and workplace routines" (Kling and Tilquist, under review).

A second way to manage the competition with research and consultant firms is to work with them when possible. Social informatics researchers can make their work available to these firms, which are likely to have people on staff whose job is to scan and work with the relevant academic literature. Once they locate research that appears to be useful to the firm, they repackage it and disseminate it to the consultants who can use it. Researchers can also send their work to large organizations, which are also likely to have people who follow academic research. In effect, the work of translation from academic to practitioner-oriented language can be outsourced. Research and consultant firms can be used to bridge the gap between social informatics researchers and ICT professionals.

The implementation of the first two of these six strategies will take time, since sustained research efforts will be required to develop an adequate understanding of the information environments of ICT professionals. Social informatics researchers will have to consider carefully the costs and benefits of refocusing research agendas on the problems and issues of importance to this audience. Exploring the ides of ICT extension services will also take some time. The remaining strategies can be enacted immediately. Researchers can begin writing for and speaking to the ICT professional audience now. Workshops and seminars can be conducted ,if sponsors can be found. Forums can be started that bring ICT professionals into academic settings, and social informatics researchers can begin to manage the competition with research and consultant firms. Sometimes this will involve distinguishing their work from that done by consultants and other times by building contacts with these firms and sharing their research. The next section examines strategies for reaching a second audience, members of academic and research communities outside of social informatics.

SECTION 4: COMMUNICATING TO ACADEMIC AND RESEARCH COMMUNITIES

4.1 Audience

Social informatics research should also be communicated to research communities across a range of academic disciplines that share a focus on the social contexts of computing including information science, computer science, information systems, sociology, anthropology, management information systems, and communications. Regular and pervasive communication of social informatics research is an important component in raising awareness among academic researchers about the themes, insights, and findings of social informatics. This is a sensible move because the core concepts, frameworks, and findings of social informatics cut across many of these disciplines and increasing the familiarity of other academics with social informatics can improve their research and teaching. This effort is necessary to legitimate the social informatics research among the wider academic community, and bring its concerns to the attention of potential funders of social informatics research. It can also help to grow the community, as researchers and teachers outside of social informatics begin to learn more about the field and, if they are intrigued, begin to explicitly identify themselves as belonging to the social informatics community. Many ICT-oriented disciplines already have researchers who are investigating questions and problems that characterize social informatics. Strategies are needed to bring their work to the attention of their colleagues and to cross-pollinate their disciplines with relevant research from other disciplines.

4.2 Challenges of communicating to academic and research communities

One main challenge of communicating to other research and academic communities is to routinize boundary spanning activities

One main challenge to be faced in communicating social informatics research to a range of academic and research communities is crossing the boundaries among disciplines. Scholarly communication typically takes place within well-defined communities of discourse, each of which has its traditions, literature, research issues and controversies, theoretical and methodological approaches, and conceptions of criteria for adequate research. The gatekeepers of these communities, journal editors and referees, understand these norms well and use them

effectively to maintain the standards of quality in their disciplines. One consequence is this practice is that researchers within a community of discourse will draw upon the resources of their community in their work more heavily than they will use those of others. Citation studies bear this out, indicating that cross-disciplinary patterns of citations in research articles are less common than patterns of citation that remain within the discipline of the author's primary affiliation. In practical terms, this means that a researcher in library and information science will have a difficult time placing an article in a management journal because the work will not "look like" what editors and referees are used to reading.

To cross academic communities of discourse requires boundary spanning activities. At individual levels, boundary spanners are researchers and theoreticians whose work is respected and used by scholars in many disciplines and whose professional networks range across the academic landscape. Their work overlaps with scholars outside of their discipline of primary affiliation. These people can publish and present their work in these disciplines and are valuable actors in scholarly communication because they can spread ideas across disciplinary boundaries. They can stimulate the types of research and theorizing that create links and channels of communication across disciplines. However, these people are rare. Institutional efforts to encourage boundary spanning are also valuable and increasingly important because they offer opportunities for researchers from different disciplines to interact and learn from each other. For example, the National Science Foundation has sponsored a series of workshops that have had the explicit goal of bringing together researchers from a range of disciplines who share interests in common topics such as digital libraries, electronic commerce, and social informatics. How can boundary spanning activities be routinized?

4.3 Strategies for improving communication with other academic and research communities

What can be done to improve the communication of social informatics research to scholars and researchers outside of social informatics? How can the profile of social informatics researchers be raised across a wide range of disciplines in which the themes of social informatics are present? How can scholars and researchers who are currently outside of social informatics be encouraged to join the community?

In this section, five strategies are proposed that can be used to communicate social informatics research to academic and research audiences. The first is to raise the profile of social informatics research at academic conferences. The second involves expanding the publishing options for social informatics researchers, providing them with opportunities to bring their work to the attention of scholars outside of their primary disciplines. The third strategy takes advantage of the well-connected digital information environment within which academics routinely interact to provide easy access to research and other information about social informatics activities. The fourth involves a series of research initiatives, and the fifth is based on developing greater institutional support for social informatics research at colleges and universities.

Five strategies:

- Raising the profile of social informatics research at academic conferences
- Expanding the publishing options for social informatics researchers
- Taking advantage of widespread and easy access to network-based digital information
- Engaging in a series of research initiatives that will produce useful outcomes that gain attention for social informatics research
- Developing greater support for social informatics research at colleges and universities

1. Raising the profile of social informatics research

What can be done to bring social informatics research to the attention of researchers and scholars outside of the field?

There are three initiatives to raise the profile of social informatics research at academic conferences. These include the creation of social informatics special interest groups (SIGs), the organization of research tracks and panel discussions of social informatics research and issues, and the development of an entire conference devoted to social informatics research.

Established social informatics scholars can set up SIGs in professional organizations, drawing interested members together, providing them with regular opportunities to interact. Some professional associations are aware that they have members who are deeply concerned about

social informatics issues. For instance, organizations such as the Association of Computing Machinery (ACM) or the Association for Information Systems (AIS) can be approached about starting a social informatics SIG. There may be a way to combine SIGs from a variety of related groups to build a large enough population to co-sponsor conferences. Umbrella or confederation groups might be another way to pull the field together. Group leaders could plan activities or tracks at existing conferences that might attract more people than small specialty conferences.

Second, members of various professional organizations such as the ACM, ASIS, and the International Conference on Information Systems (ICIS) can begin to set up research tracks at their regional, national, and international conferences. Such tracks are useful because they provide a venue for researchers who wish to identify themselves with social informatics and can bring social informatics research to the attention of a wider academic audience. In the last two years, there have been social informatics track and panels at a number of national and international conferences. For example, there has been a social informatics track at Association for Information Systems America's Conference since 1997 and one has been proposed for 1999. Here is a partial listing of conference activity:

Kling, R. and Lamb, R. (1998). Advances in Social Informatics and Information Systems. Association for Information Systems 1998 America's Conference (20 papers) http://www.isworld.org/ais.ac.98/proceedings/si.htm

Rosenbaum, H. (1998). "Advances in Social and Organizational Informatics:

Implications for Information Science" Panel session as National Meetings of the American Society for Information Science, Pittsburgh, PA.

The First Kyoto Meeting on Social Interaction and Communityware (June 8-10, 1998 Shiran Kaikian, Kyoto, Japan)
http://www.lab7.kuis.kyoto-u.ac.jp/km/

Kling, R., Rosenbaum, H. and Travica, B. (1997) Mini-Track: Advances in social informatics

for Information Systems. Association for Information Systems 1997 Americas Conference(6 papers). http://hsb.baylor.edu/ramsower/ais.ac.97/program.html

IRIS 20: Social Informatics. Hank Fjordhotel, Norway, August 9-12, 1997. http://www.ifi.uio.no/iris20/conference.html

Should there develop a critical mass of scholars and researchers interested in the issues of social informatics, a third initiative is to host a series of high level conferences among a group of people acquainted with the literature of social informatics, and engaged in common discourse in order to reinvigorate themselves intellectually. An annual conference would have the effect of moving the field away from identification with one institution or individual and could include a support network for doctoral students, and opportunities to bring people and ideas together from the various disciplines concerned with the social and organizational impacts of ICTs on social life and work.

The conference would be interdisciplinary, relatively small (about 100 people) and would have a research focus. It could be paired with a larger and a more established conference in which there would be some overlap. There could be pre-conference workshops on pedagogy or teaching and a doctoral consortium.

2. Increasing publishing options for social informatics research

Which publishing outlets can be used to disseminate social informatics research more widely within the academic research community?

The second strategy is to increase the options for publishing social informatics research by targeting appropriate journals, writing textbooks, and editing collections of exemplary social informatics research.

There should be a concerted effort to identify and target relevant journals that have significant impact among their readers and would be interested in publishing social informatics research. This list could be compiled by individual researchers and submitted to a central location for

compilation, such as the Social Infomatics web site <http://www.slis.indiana.edu/CSI>. As a way of sensitizing editors, referees and readers to social informatics issues, social informatics researchers should edit special issues of prominent journals in different disciplines. For example, a Special Issue on Social Informatics in the *Journal of the American Society for Information Science* presented seven research papers which, outlined some current issues and findings of social informatics for an information science audience (Kling, Rosenbaum and Hert, 1998). Where possible, articles about social informatics can be placed in journals that will bring the discipline to the attention of a wider academic audience. Kling (1999) wrote an article on the nature of social informatics, "What is Social Informatics" that he published in *D-lib Magazine*, a publication read by members of the digital libraries research community.

There also should be an effort to develop a corpus of literature around the core of social informatics. To reach the next generation of academic researchers and ICT professionals, there might be edited volumes of social informatics research and cases for classroom use. Social informatics researchers should consider writing textbooks that present the core of social informatics in ways that assist teachers; this is one good strategy to help define a field. This strategy is developed in detail in Chapter IV. Compilations of social informatics papers from a variety of conferences would be a useful reference source for researchers and teachers. Participants at the NSF workshop on "Advances in Social Informatics" suggested the creation of a scholarly " Social Informatics Handbook" with articles that would be commissioned from experts in advance. This volume would be targeted at researchers. It would contain "state of the art" literature reviews, research exemplars, concise statements of major theoretical approaches in social informatics, and current bibliographies.

3. Taking advantage of easy access to networked digital information about social informatics

How can social informatics researchers exploit the web to disseminate their work more widely? What type of model should be used to create a vibrant online Organizational Informatics and social informatics community?

The third strategy is a set of computer-mediated initiatives, which takes advantage of the digital information environment within which many academic researchers work. These initiatives

involve the creation of an online social informatics community, with a web site and other forms of digital communication, such as listservs and newsgroups. Such a community could be build along the model used by ISWORLD <http://www.isworld.org/isworld.html>, which is supported by professional organizations and educational institutions and is run as a distributed web. ISWORLD is an online community for information systems academics that provides research and teaching resources to its members. Faculty members at different educational institutions bid for the responsibility for organizing and maintaining specific sectors of the web. For example, the Research and Scholarship sub-web is maintained at the University of Michigan <http://www.umich.edu/~isworld/reshome.html>, the Teaching and Learning Division is sponsored by the College of Business Administration at Bowling Green State University <http://www.cba.bgsu.edu/amis/facstaff/smagal/teaching/>, and the Research Working Paper Series is maintained at the School of Information Systems, University of South Australia <http://business.city.unisa.edu.au/isworld/workingpapers/>. There is also a set of active online discussion groups and a listserv that is used to disseminate information and announcements of interest to the IS community.

Such a site for social informatics researchers could take advantage of the digital infrastructure already in place. It should include links to other professional organizations that have well-developed and relevant web sites, including the IAMCR (mass communication research in Europe), the TPCR (telecommunications policy research conference), OCIS, and IRIS (Scandinavian conference on social informatics). The beginnings of a social informatics website can be found at the Center For Social Informatics (CSI) at Indiana University <http://www.slis.indiana.edu/CSI>, which "is dedicated to support research into information technology and social change." There is a listing of the Fellows of the Center, and the doctoral students who are working on social informatics research for their dissertations. There is a growing collection of working papers. Many are available in full text with annotated lists of social informatics workshops, seminars, conferences, and journals. This site can serve as a central hub for information about social informatics and can be a point of access for research, academic programs, courses and a wealth of other resources that focus on social informatics. The CSI web site is a small and growing resource for information about social informatics, but it needs support to grow into a community.

There needs to be a directory of social informatics faculty with names, addresses, email, phone numbers so that people can see who else is involved in the field. Initial seed money could be used to produce the first directory. To follow the ISWORLD model, it will be necessary to create a distributed network of social informatics websites at different locations, each of which with the mission of developing some section of social informatics. Workshop participants suggested creating and maintaining a set of data and other information about social informatics. The data would be in digital form and in the public domain so that interested academics could begin to learn about the type of work that characterizes the field.

Three mailing lists have been set up for people interested in social informatics. Once these lists gather a critical mass of subscribers, another channel of communication to open is in community building across academic disciplines. The first, SI-ANNOUNCE-L@ indiana.edu, is a one way mailing list for announcements of conferences, workshops, calls for papers, and the like that are related to the field of social informatics. The second, SI-TEACH-L@indiana.edu is a discussion list for issues concerning the teaching of social informatics including teaching methods, curricula, and teaching materials. The SI-RESEARCH-L@indiana.edu mailing list is intended to be used as a forum for communication among people who are interested in the field of social informatics (subscription information for all three lists is offered below). I ts focus is on the issues of developing the field of social informatics with an emphasis on the development and methodology of research and research issues in the field. Subscription information for these lists is provided below in Appendix A.

4. Research initiatives to raise the profile of social informatics

What types of large-scale collaborative research can be undertaken to increase the awareness of social informatics research among the wider academic and research-funding community?

The fourth strategy involves a series of research initiatives designed to raise the profile of social informatics research in the academic community. A team of social informatics researchers should convince a funding organization to sponsor a national or international survey on ICTs in organizational settings. The team of social informatics researchers should prominently direct the survey. The results should be widely publicized and made available in a variety of formats.

Subsequently, a professional social informatics organization could sponsor the survey on an annual or biennial basis, so that it could become a reliable "science and technology" indicator. This would be a valuable source of information for policy makers, researchers and teachers in a wide range of disciplines. Small subcommittees or teams can be developed to work on different parts of the survey.

The survey could cover the social impact of technology and technology dissemination and be done at the individual, household, business, organization level - perhaps at a different level each year. There could be different questions for the different levels. It could cover infrastructure issues, households, spending patterns, etc. There could be questions on opinions about technology, spending and usage patterns, infrastructure counts. It would be non-partisan and sponsored by universities instead of corporations. A workshop could be held to construct the survey so that many researchers could contribute questions from their research. The survey results would be a reason for policy makers to consider the field important and to fund further social informatics research. This type of project would be useful to researchers and would help promote the field to the National Science Foundation, which has a new section on science indicators that is looking for data.

5. Increasing institutional support for social informatics research

How can social informatics researchers encourage cross-institutional collaboration? What can they do to encourage their institutions to increase funding for their work?

The fifth strategy is based on developing greater institutional support for social informatics research at colleges and universities. Social informatics researchers should encourage their institutions to sponsor faculty exchanges, allowing interaction to occur across organizational and perhaps disciplinary boundaries. Such exchanges could be beneficial to universities because it provides a way for institutions to fill temporary vacancies with visiting scholars and researchers on sabbatical. This would save the universities money and help promote social informatics and the research being done.

If implemented, these five strategies can begin to routinize the boundary spanning activities that

are necessary for social informatics researchers to be able to communicate easily with other academic and research communities. They can also make it easier for researchers and teachers not affiliated with social informatics to learn about the research, programs, courses, and other resources that constitute the corpus of social informatics. The first three strategies could be done with relatively low cost in terms of time and money. Social informatics researchers are already raising the profile of social informatics research at academic conferences by sponsoring panels and research tracks. There has been a special issue of a major professional journal focusing on social informatics, and a manuscript about social informatics is in preparation. Articles have appeared in a variety of journals, expanding the publishing options for social informatics researchers. The Social Infomatics web site is continually under development and the social informatics listervs are online, taking advantage of widespread and easy access to network-based digital information. The last two strategies are more difficult and will take more time, because of the efforts involved in coordinating a large scale research initiative. Such as an ICT indicator survey, that will produce useful outcomes that gain attention for social informatics research. In times of tight budgets, developing greater support for social informatics research at colleges and universities is always a struggle, but it part of an ongoing effort in which social informatics researchers are always engaged.

SECTION 5: CONCLUSIONS

This chapter has discussed the communication of social informatics research to professional and academic research communities. It has argued that social informatics researchers should increase their efforts to communicate their research, insights, and findings to ICT professionals because the knowledge that they can impart can have real and immediate value to these practitioners. As the costs of ICTs and information systems increase, ICT professionals will come under increasing pressure to ensure that the systems they design and implement maximize the organization's return on investment. If these practitioners continue to hold to the magic bullet theory described by Markus and Benjamin (1997), the failure rate of systems implementations is not expected to decline. The insights and findings of social informatics research are a corrective to this view, but if they cannot be persuasively communicated to ICT professionals, they can have no influence on their professional practice.

It was argued that in order to reach the audience that two main challenges need to be surmounted. The first is perceptual, and involves a belief among ICT professionals that social informatics research is not relevant to their work. The second is competitive, because social informatics researchers are not the only group that is trying to communicate with ICT professionals. Research and consulting companies pose a threat to the ability of social informatics researchers to gain the attention of ICT professionals. A series of strategies were suggested to help social informatics researchers communicate more effectively with this audience:

- Developing a current empirical assessment of what we know about the worlds of ICT professionals
- Conducting and communicating research that is useful for these professionals given what we know about their typical problems, concerns, and information behaviors
- Focusing on speaking to and writing for ICT professionals
- Holding regular forums that bring together academics and ICT professionals
- Influencing current professional practice through workshops, seminars and life long learning
- Creating "ICT extension services"

To manage competition with research and consultant firms, social informatics researchers can:

- Distinguishing their work from that done by the firms emphasizing the value that can be added to practice from academic work
- Exploring ways to cooperate with these firms by sharing research

The long term goal of this effort is to persuade ICT professionals that they can rely to social informatics researchers for high quality research findings and insights that will be useful in their work. The professional ICT audience should look routinely to social informatics researcher for ways to improve their practice and deepen their understanding of the complex interrelationships among ITC's, the people who work with them, and the organizations in they work.

To reach members of the academic community, the main challenge is to cross the boundaries that separate disciplines. While individual boundary spanners are valuable in this effort, they are rare and are typically "found" and not "trained." Five strategies are suggested to improve the communication of social informatics research to other academic and research audiences:

- Raising the profile of social informatics research at academic conferences
- Expanding the publishing options for social informatics researchers
- Taking advantage of widespread and easy access to network-based digital information
- Engaging in a series of research initiatives that will produce useful outcomes that gain attention for social informatics research
- Developing greater support for social informatics research at colleges and universities

These strategies will improve the ability of social informatics researchers to make their work known to others outside the social informatics community. They will also provide many opportunities for researchers and teachers outside of the social informatics community to learn about social informatics and encourage them to incorporate social informatics themes, theories, concepts, findings, and insights into their research and teaching. These strategies may also help to grow the community be encouraging more researchers and teachers to explicitly identify themselves as being interested and involved in social informatics.

This work will not be easy and will take time and concerted effort from social informatics

supporters. It will be critically important in the process of building the field and raising its profile among two of the communities that must be reached, ICT professionals and academic researchers and teachers.

Chapter VI: Conclusions (Provisional and for comment)

Social informatics research examines information and communication technology (ICT)use and social change in social settings. Social informatics researchers are especially interested in developing reliable knowledge about ICTs and social change based on systematic empirical research. This research is critical for informing our conceptualizations of ICT in use, public policy debates about such use and professional practice around use. The attention may focus on a specific organizational or household context, or broader scale or more informal settings. The research has also developed concepts to understand the design, use, configuration and/or consequences of ICT's so that they are actually workable for people.

This careful contextual and empirically grounded analysis contrasts with high-spirited but largely a-priori promotions of technologies. Such optimism leads to ICTs that may occasionally work well for people and may occasionally be valuable, but are sometimes abandoned or unusable and thus incur needless waste and inspire misplaced hopes. Moreover, careful empirical research may not be as catchy as the IT pundit's enthusiasm. The cumulative findings from social informatics research provides a reservoir of learning that helps to frame new ICT – even as popular conceptualizations characterize these as revolutionary.

This report discussed a variety of ICTs, including local government information systems, computer networks, and public access to the Internet. It identified cases in which ICT professionals and managers relying on the standard Tool Model (Table #2) devised systems that were underused relative to their expectations or potentials. These are not just isolated examples, but rather represent a widespread phenomenon. Various studies (e.g., Kling and Scacchi, 1982; Kling, 1992; Markus and Keil, 1994; Attewell, 1996; Suchman, 1996) have shown that utilization of the standard Tool Model can result in considerable losses of various kinds (e.g., money, time, productivity, efficiency). However, because many of these losses occur "behind closed doors", they may be unseen by the general public. Indeed, even those who observe them may not be fully appreciative of their scope and depth, being unaware of the extent to which other groups suffer similarly.

The conventional Tool Model tends to both underestimate the costs and complexities of computerization and overestimate the generalization of applications from one setting to another. The resulting problems from the use of this model is similar to an "invisible" health problem, such as migraine headaches. Those who suffer migraines experience severe pain and the resultant missed opportunities, decreased productivity and generally reduced efficiency[22]. Others who live or work with them can also be distressed or discommoded by migraine sufferers' increased emotional volatility or unreliability caused by their ailment. However, many of us are almost completely oblivious to the chronic but publicly invisible suffering and loss being experienced by millions of people due to migraines.

In similar fashion, we may be ignorant of the needless waste and human distress that improperly conceived ICTs may cause. However, even if we do not work in an organization that suffers from poorly realized technologies, these wastes and distresses may affect us more directly and more frequently than we realize. Financial losses to private organizations will result in our paying more for their products and services (although we will not be aware of the reasons for the price increases). Similar losses in public organizations may raise our taxes, or result in a diminution of services to us. New services that we might want to try may prove to be considerably more frustrating than we expect. For example, there is growing evidence (e.g., Hara and Kling, in press) that many students in Internet-based distance education courses have been extremely frustrated because all involved (instructors, administrators, students), approached this type of educational experience as simply a new way to present courses, and thus overlooked critical social factors. To be most effective, computerized distance education will require the recognition that new conventions will be needed, such as the development of new communication practices under conditions of asymmetrical power.

Social informatics researchers try to use specific ICTs in specific settings to develop concepts and theories that apply to many kinds of ICTs in many settings. In each of the cases discussed in this article, we have suggested how a social informatics analysis could have helped the participant's design or configure the ICTs differently, and/or alter some social practices to

[22] For example, a recent study estimates that the effects of migraine headaches cost American employers approximately $13 billion each year, with another $1 billion per year being spent on direct medical costs (Hu, 1999)

improve their usage. This is one important way that "social informatics matters" and one that we have emphasized in this article. This view of social informatics has important repercussions for public policy, professional practice and the education of ICT professionals (see Kling, 1993; Kling and Allen, 1996; Kling, Crawford, Rosenbaum, Sawyer, and Weisband, 2000).

Social informatics research also investigates intriguing new social phenomena that emerge when people use information technology. Such as the ways that people develop trust in virtual teams (Iacono and Weisband, 1997) or the ways that disciplinary norms influence scholars' use of electronic communication media (Kling and McKim, in press). These phenomena would be the focus of another article. In this article, we have identified a few key ideas that come from 30 years of systematic analytical and critical research about information technology and social life. There are other sources for more expanded reviews (see, for example, Kling, 1993; Kling and Allen, 1996; Bishop and Star, 1996; Kling and Star, 1998; Kling, Crawford, Rosenbaum, Sawyer, and Weisband, 2000). Also research anthologies (see Dutton, 1997; Huff and Finholt 1994; Kling, 1996; Kiesler, 1997; Smith and Kollock, 1998; and DeSanctis and Fulk, 1999).

It is all too common today for ICT professionals, managers and policy analysts to treat each new kind of ICT as so unique that little could be learned from examining other kinds of ICTs. In effect each ICT community, such as electronic publishing, digital libraries, distance education and electronic commerce has to learn expensive "lessons" anew. A major concern of social informatics researchers is to make accessible the cumulative body of research that will help many people effectively shape ICTs so that they can improve people's work and lives. Such research is trans-technologies and trans-institutional – i.e., it develops concepts and theories that are applicable to understanding numerous kinds of ICTs and highly varied social settings. This is a major challenge.

The possibility and value of a social informatics perspective is illustrated by some of the key ideas developed in this article. The social shaping of ICTs, the conceptions of highly intertwined socio-technical networks, the roles of social incentives in energizing new electronic media, and the conceptualization of ICT infrastructure as socio-technical practices and resources. As we develop more elaborate ICTs and try to use them in almost every sphere of social life, we face

fresh theoretical challenges for social informatics. However, social informatics already offers an indispensable analytical foundation that this report briefly introduces.

Glossary

Analytical orientation: Studies that develop theories about ICTs in institutional and cultural contexts or empirical studies that are organized to contribute to such theorizing.

Artifact: An object created by people for practical use.

Attribution theory: From the field of psychology, this theory describes the perception of people or things as causal agents. Attribution theory has three steps: perception, judgment, and attribution. For example, if a person witnesses someone throwing trash out of a car window, that person might think the following: I saw you litter (Perception of action); You wanted to litter (Judgment of intention); You are a disgusting person (Attribution of disposition).

CIM system: Computer integrated manufacturing system. A system that utilizes a shared manufacturing database for engineering design, manufacturing engineering, factory production, and information management. See also *Enterprise integration system*.

ICT-oriented curricula: Courses whose content teaches students how to design, develop, implement, and support ICTs.

ICT-oriented education: The various disciplines (e.g. information science) that educate students in the design, development, implementation, and support of ICTs.

ICT-oriented student: Students who take courses or conduct research within the framework of ICT-oriented education.

Configuration: A complex array of standardized and customized automation elements.

Configurational technology: Technology, such as a computer integrated manufacturing system, which is configured to meet the specific structure, working methods and requirements of an organization. An Intranet is an example of a configurational technology.

Contract development: Within the context of system design, the user organization is known from the outset and the development organization is identified after the contract is awarded.

Critical orientation: The examination of ICTs from perspectives that do not automatically and "uncritically" adopt the goals and beliefs of the groups that commission, design, or implement specific ICTs.

Custom development: See *In-house development*.

DBMS: Database management system. Computer programs that facilitate the retrieval, modification and storage of information in a database. A DBMS can run on a PC or a mainframe.

Digital library: A federated repository of documents—encoded in multimedia and/or digital formats—that are locally or remotely accessible via computer networks.

Direct effect theories: Theories that allow analysts to anticipate the social consequences of computerization in organizations.

Displacement: The replacement of workers by technology.

Distance education: The delivery of a course, workshop, or degree via electronic means to participants or students located away from the delivery origination point in a synchronous or asynchronous format.

Domain: A sphere of work or activity.

Domain of action: A sphere of work or activity in which a particular community of people is engaged.

Electronic commerce: The conducting of business or the facilitation of commerce on the Internet.

Electronic publishing: The creation, publication, and dissemination of digital documents on the Internet.

Empirically anchored theory: Theories that allow variations in outcomes, help to anticipate contradictory consequences, explain successes and failures, and predict conditions under which [ICT] systems will fail by some criteria.

End user: Anyone who uses a computer. Same as *user*. It is a misnomer to think that there exists a generic user. From a Social Informatics perspective, the term *user* is a convenient fiction that marginalizes or homogenizes the individual.

Enterprise integration system: A system that integrates information across parts or all of an enterprise. Information integration essentially consists of providing the right information, at the right place, at the right time for an enterprise operation. See also *CIM system*.

Firewall: A system designed to prevent unauthorized access to or from a private network such as an Intranet.

GroupWare: Computer software and hardware that allows people to work together locally or remotely.

Host: A computer system that holds data and is accessed by remote users using TCP/IP.

Human computer interaction: The discipline that looks at the design, evaluation and implementation of interactive computing systems for human use.

Human-centered system: A system designed to be used easily and effectively by people such that the global needs of the organization served by the system are met. See also *Organization-centered system*.

ICT: Information and communication technology—artifacts and practices for recording, organizing, storing, manipulating, and communicating information. ICTs include a wide array of artifacts such as telephones, faxes, photocopiers, movies, books, and journal articles. They also include practices such as software testing methods and approaches to cataloging and indexing documents in a library.

Information processing system: A system that performs operations upon data.

In-house development: Within the context of system design, both the eventual users and the developers are known at the project outset. This is also known as *custom development*, where a specific external developer is engaged from the start in producing or configuring a system for a specific customer.

Intensification: An increase in work pressure and/or working hours due to the presence and/or use of computers.

Internet: A decentralized electronic communications network that connects computer networks and organizational computer facilities around the world.

Intranet: A network based on TCP/IP protocols belonging to an organization, usually a corporation, accessible only by the organization's members, employees, or others with authorization. An Intranet's Web site looks and acts just like any other Web site, but the firewall surrounding an Intranet fends off unauthorized access. Like the Internet itself, Intranets are used to share information. Secure Intranets are now the fastest-growing segment of the Internet

because they are much less expensive to build and manage than private networks based on proprietary protocols.

Mainframe: A very large computer (or supercomputer) that is capable of supporting hundreds of users and running numerous programs simultaneously.

MRP: Material Requirements Planning systems. MRPs—or computerized inventory control and production scheduling systems—are transaction-oriented ICTs whose data refers to material. The purchasing departments of manufacturing firms rely on MRPs as a means of reducing inventories, thus reducing costs.

Normative orientation: Research whose aim is to recommend alternatives for professionals who design, implement, use or make policy about ICTs. It has the explicit goal of influencing practice by providing empirical evidence illustrating the varied outcomes that occur as people work with ICTs in a wide range of organizational and social contexts.

Operations research: The mathematical science that seeks to carry out complicated operations with maximum efficiency.

Organization: An administrative or functional structure and the personnel associated with that structure.

Organizational Informatics: Social Informatics analyses that are bounded within organizations, where the primary participants are located within a few identifiable organizations. Many studies of the roles of computerization in shaping work and organizational structures fit within organizational Informatics.

Organizational politics: Exercises of power or influence within an organization in order to further one's self-interests and personal goals or to strike a balance between competing interests.

Organization-centered system: A system designed to meet the needs of an organization and not

its personnel. This system makes excessive demands upon people in order to use it effectively. See also *Human-centered system*.

PC: Personal computer. Based on the Intel microprocessor or Intel-compatible microprocessor, a PC is designed to run a DOS, Windows, or LINUX (a version of UNIX designed for PCs) operating system.

Personal digital assistant: Also known as PDA. A handheld ICT device that combines computing, telephone, and fax capabilities. Instead of using a keyboard for the inputting of data, a PDA uses a stylus that can incorporate handwriting recognition features. Voice recognition is another feature incorporated in some PDA's.

Product development: Within the context of system design, the developers are known from the outset, but the users typically remain unknown until the product is marketed.

Productivity paradox: Attributed to Nobel Laureate Robert Solow, this term addresses the phenomenon of computers not making an impact on productivity statistics in spite of their widespread use.

Social determinism: The theory that posits that society shapes technology. It is the opposite of *technological determinism*.

Social Informatics: The interdisciplinary study of the design, uses and consequences of ICTs that takes into account their interaction with institutional and cultural contexts.

Socio-technical package: A way of viewing an ICT as a complex, interdependent system comprised of people, computer hardware and software, techniques, and data.

System: A network, composed of discrete components, which distributes information electronically.

Systems rationalism: A perspective that conceptualizes ICTs as rule-bound and carefully structured and then generalizes these characteristics to people, groups, and organizations.

TCP/IP protocols: Transmission control protocol/Internet protocol. UNIX-based communication protocols that are used to connect hosts on the Internet in order to transmit data.

Technological determinism: The theory that posits that technology shapes society. It is the opposite of *social determinism*.

Telecommuting: An alternative method of working wherein an individual, employed by an organization, performs his or her job away from the organization [typically at home] through the use of ICTs.

UNIX: A multi-user, multi-tasking operating system developed by Bell Laboratories in the early 1970's. UNIX is the standard operating system of workstations.

Usability testing: The testing of a system by its developers and is intended users to determine if that system meets the requirements and abilities of those users. Used during the development of computer interfaces to determine their efficacy and reliability.

User: See *End-user*.

User-friendly: A system designed so that it can be utilized by as broad a range of individuals as possible.

Workstation: A co~~mputer that is designed to run UNIX.~~

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Appendix A

Appendix B

Structure and Process of the workshop

A workshop on *Advances in Social informatics* was held at Indiana University in Bloomington, Indiana (US) in November 1997. The main focus was the articulation of two emerging interdisciplinary research domains, called *organizational informatics* and *social informatics*, that focus on the social dimensions of the integration of computerization and networked information into social and organizational life. Briefly, the relation between these two is that organizational informatics is a sub area of social informatics. Findings and theories belong to organizational informatics when they can be characterized in terms of the participants of organizations. Using this criterion, research about the adoption, use, and impacts of GroupWare fall well within organizational informatics. In contrast, the Internet is used by millions of people outside of their work lives, and the character and consequences of the public's use of the Internet is a topic outside of organizational informatics, but within social informatics.

The main purpose of this workshop was to clarify systematically the domains of social informatics by exploring the state of knowledge about the integration of computerization and networked information into social and organizational life, and the roles of information and communication technology (ICT) in social and organizational change. This was be done by gathering a group of experienced and recognized scholars and researchers whose work overlaps with the concerns of social informatics (a list of participants is included in the Appendices). By focusing on the range of concepts, theories, and findings that are being brought to bear in the study of the roles of ICTs in organizational and social change, participants in the workshop assessed the fields of organizational informatics and social informatics, defined their research frontiers, and reflected on their place in the academic landscape.

The workshop brought together twenty five scholars and researchers from several different disciplines, including information science, sociology, communications, information systems, social psychology, computer science, and anthropology for two days of intensive interaction, the goals of which were to:

- provide input into this report, which more sharply characterizes organizational and social informatics,
- better identify the state of knowledge, and
- outline a set of research issues that could constitute effective and plausible advances in both social informatics.

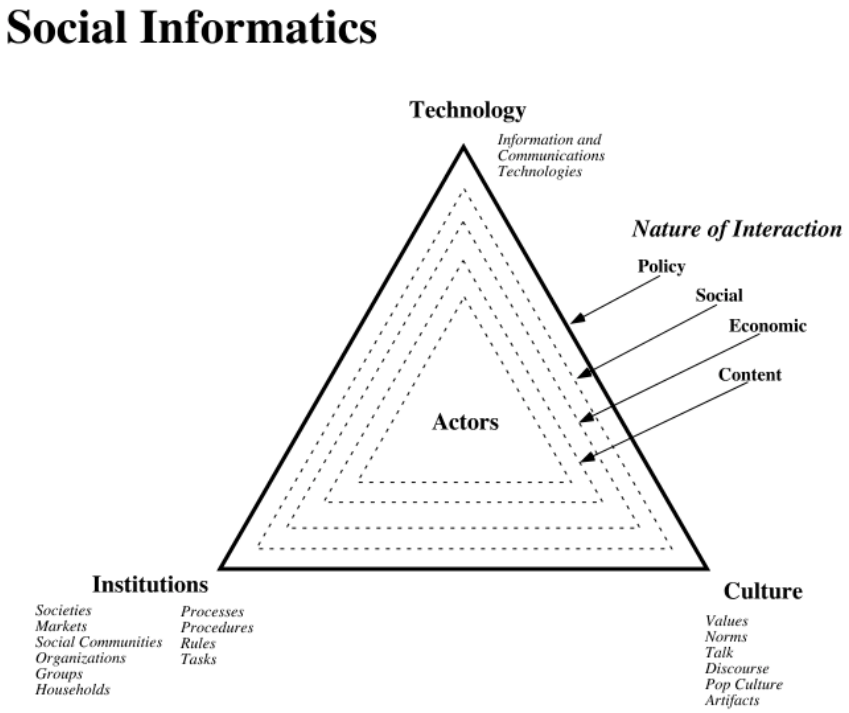
Workshop participants were invited based on two criteria. First, their research interests overlapped with the concerns of social informatics. Their work includes research on the social contexts of ICT design, implementation, and use in a variety of social and organizational settings. Second, they had interdisciplinary experience and a willingness to engage in dialog with researchers working in different but cognate disciplines. A workshop computer conference was established and participants were able to meet and interact with each other through this conference, providing introductions and statements of their research interests. The online discussion was seeded by the workshop organizers, who used the conference listserv to disseminate the workshop agenda and a list of discussion questions. In addition, a workshop website was established and used to gather together and make available documents considered by the organizers, the advisory committee, and participants to be within the domain of social informatics.

At the workshop, participants discussed the range of research directions and problems in social informatics that were considered strategic, timely, and tractable given the present state-of-the-field. They also discussed research directions based on a range of criteria. Such as the extent to which the research would encourage the progress of and growth in social informatics, the likelihood of success, both in the short and long run, current and future funding possibilities, and national needs. Participants worked in teams. They prepared short position papers on the definition and domain of social informatics, potential research problems and directions. Strategies for expanding the research community interested in social informatics and strategies for incorporating the concerns of social informatics into graduate and undergraduate curricula were also addressed.

Appendix B

Workshop participants developed the following triangle diagram to help portray the scope of social informatics:

Triangle Diagram[23]:



Technology Technology

The diagram and definition of social informatics helps to emphasize the key idea that ICTs do not exist in social or technological isolation. Their "cultural and institutional contexts" influence the ways they are developed, the kinds of workable configurations [that are proposed], how they implemented and used, and the range of consequences for organizations and other social groupings.

More workshop details are in Appendices C and D. Participants & reviewers

[23] Based on *The Culture of Technology* by Arnold Pacey

Appendix C. Workshop Participants

(in addition to the book authors)

Mark Ackerman
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Gerry Bernbom
Werner Beuschel
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Andrew Dillon
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Linda Garcia
Suzanne Iacono
Ken Kraemer
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Leah Liverow
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Rick Weingarten
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Appendix D. Additional Report Reviewers

Phil Agre
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Laku Chidambarum
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Elisabeth Davenport
Lisa Covi
Jonathan Grudin
Rudi Hirscheim
Chuck Huff
Robin Peek
Sharon Ross
Ralf Shaw
Leigh Star
Rolf Wigand

Appendix E: Social Informatics Resources

Social Informatics Home Page (http://www.slis.indiana.edu/SI)

The Social Informatics Home Page has numerous links to courses (and syllabi), conferences, and research programs.

Subscribing to Social informatics mailing lists:

To subscribe to these lists, send email to:

listserv@listserv.indiana.edu

with the following command in the body of your email message (if you want to subscribe to "SI-ANNOUNCE-L"):

subscribe SI-ANNOUNCE-L yourID@your.internet.address

or (if you want to subscribe to "SI-RESEARCH-L"):

subscribe SI-RESEARCH-L yourID@your.internet.address

or (if you want to subscribe to "SI-TEACH-L"):

subscribe SI-TEACH-L yourID@your.internet.address

The LISTSERV system allows for automatic web archiving of all postings and we believe that this will benefit the Social informatics community. The URLs for the social informatics web archives will be available at:

SI-RESEARCH-L:

http://listserv.indiana.edu/archives/si-announce-l.html

SI-ANNOUNCE-L:

http://listserv.indiana.edu/archives/si-research-l.html

SI-TEACH-L:

http://listserv.indiana.edu/archives/si-teach-l.html