

Chapter 1 Computerization Movements and the Diffusion of Technological Innovations

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Abstract [A]

What explains why organizations adopt computing technologies? Management and organizational research on diffusion of technological innovations has emphasized features of technology, organization, and environment that shape diffusion in response to some economic need. However, several computer scientists have argued that diffusion takes place in a broader context of interacting organizations and institutions which shape utopian visions of what technology can do and how it should be used. This broad environmental dynamic has been called a “computerization movement”. A computerization movement is a type of movement that focuses on computer-based systems as the core technologies which their advocates claim will be instruments to bring about a new social order. These advocates of computerization movements spread their message through public discourse in various segments of society such as vendors, media, academics, visionaries, and professional societies. Computerization visions often legitimate continuing large investments in technology based on the benefits promised by an ideal vision. However, there is often a gap between the vision and reality, which may be caused by limitations of the technology, social adaptation to the technology, or in the nature of the vision

itself leading to failures or setbacks towards successful diffusion of the technology. This book examines this diffusion process across many platforms and contexts by examining computerization movements for the promotion of technologies ranging from small individual artifacts to large-scale computer-based systems. The chapters are organized across five themes representing key utopian vision regarding computerization movement outcomes: productivity, democratization, death of distance, freedom and information rights, and ubiquitous computing. In this chapter, we give a brief overview of these underlying themes characterizing them as utopian visions of various computerization movements through the years and discuss them in relation to their historical place in a particular era of computing identified as the Mainframe era, the PC era, the Internet era, or the Ubiquitous Computing era. Finally, we introduce the chapters in this book by illustrating the themes through examples from the case studies presented in the chapters in this book.

Keywords [A]

Computerization movements, technological action frames, utopian visions, counter-computerization movements, innovation diffusion theory, productivity, democratization, death of distance, free software, open source software, information rights, ubiquitous computing

Introduction [A]

What explains why organizations adopt computing technologies? This is the fundamental question addressed by this book. The management and organizational research on diffusion of technical innovations has tended to emphasize features of technology, organization, and environment that shape diffusion in response to an economic need (Thompson, 1965; Tornatzky

& Fleischer, 1990). Environment has been conceived narrowly as constituting pressure for adoption due to firm, industry, or global competition. But several computer scientists have argued that environment needs to be conceived as a richer construct that captures more of the dynamics of diffusion within society (Kling & Iacono, 1988; King, Kraemer, Gurbaxani, McFarland, Raman & Yap, 1994). That is, diffusion takes place in a broad context of interacting organizations and institutions which shape visions of what the technology can do and how it should be used. Those socially constructed visions of the technology shape the perceptions of people in organizations and drive diffusion.

Innovation diffusion theory (Rogers, 2005) emphasizes the importance of the relationship between the features of technological innovations and the context of adopting organizations or societal groups in achieving diffusion of technology such as computers or information communication technologies (ICTs). Diffusion occurs when the innovation has reached a stage where organizations or society have adopted an innovation in practice. Sociologists and economists have theorized that diffusion in organizations is influenced by the specific context of the adopting organizations and by specific features of the technology or technological process being adopted (Rogers, 2005; Tornatzky & Fleischer, 1990; Zhu, Kraemer, & Xu, forthcoming). Examples of context might include organization size, adoption costs, technical background of potential users, or similar features. Various aspects of a technology, such as competitive advantage, return on investment, usability of the technology, or fit with work practices, might intervene in the diffusion process.

Although innovation diffusion theory is helpful in understanding the adoption and use of specific technologies in organizations, it does not address the broader societal context that influences technological diffusion, such as ideological beliefs or visions surrounding innovation.

Many groups within society, such as vendors, media, academics, visionaries, and professional societies, are instrumental in promoting the adoption and diffusion of technology through *utopian visions* of what the technology can do to change or improve social or work life. Kling and Iacono (1988, 1995) have called this broad environmental dynamic a “computerization movement” (CM) to signal its separation from, yet affiliation with, technology and social movements more generally. A CM is a type of movement that focuses on computer-based systems as the core technologies which their advocates claim will be instruments to bring about a new and better social order. CMs can be characterized as consisting of three components which interact with and shape each other (Iacono & Kling, 2001): 1) technological frames, 2) public discourse, and 3) organizational practice and use. Technological frames (Orlikowski & Gash, 1994) are composite understandings about how a technology works and could be used. These frames are built up in public discourse about a particular computer-based system in the form of mass media, scientific journals, public speaking, and trade journals (Iacono & Kling, 2001). Over time, a technological frame pervades and becomes the dominant frame representing a particular CM or group of CMs. Public discourse and technological frames influence how technology is used in organizational and inter-organizational contexts.

With this brief introduction, the remainder of this chapter elaborates on CMs and illustrates central themes that have emerged over the last fifty years. It first defines CMs as a concept and discusses the broader intellectual background from the social sciences and from previous CM research. Next, it presents a conceptual model of CMs that illustrates the principal components and their interactions. It then identifies the following five technological action frames that have emerged in previous CM research and writing:

- Productivity

- Democratization
- Death of distance
- Freedom/information rights
- Ubiquitous computing

Finally, it explains each of these themes and uses examples from some of the chapters in the rest of the book to further illustrate and elaborate the themes, as well as to introduce the chapters.

CMs as a Concept [B]

The notion of a CM was first defined by Kling and Iacono (1988) as a particular kind of social movement whose distinguishing feature is that advocates focus on computer-based systems as instruments to bring about a preferred social order. We characterize a CM as a specific kind of social and technological movement oriented towards the mobilization of bias for continuing investments in computer technology and related uses based on utopian visions of better social worlds. CMs advance computerization, in ways that go beyond the effect of promotion by the industries that produce and sell computer-based technologies and services. CMs communicate key ideological beliefs about the favorable links between computerization and a preferred social order, which helps legitimate relatively high levels of computing investment or other resources (e.g., personal time as occurs with the Free Software Movement (FSM) for many potential adopters. These ideologies also set adopters' expectations about what they should use computing for and how they should organize access to it.

The CM construct refers to the loosely organized coalitions which promote technology and mobilize membership via professional or other organizations. Some CM organizations may

be highly organized around a central group such as the Free Software Foundation (FSF), which promotes the FSM, or the National Information Initiative (NII), which promoted nationwide Internet access during the Clinton-Gore administration. Others are loosely linked subgroups of professional organizations, or informal groups. In addition, activists who write for broad national audiences, but who do not belong to professional organizations, contribute to technology diffusion through their creation in public discourse of utopian visions for technology use. These visions shape “technological frames” that form key ideas about how a technology works and how it could be used. Over time, the development and diffusion of new technologies can result in stabilization of the meaning of technologies in the form of dominant or master frames. These master frames promote large investments in the technology based on the benefits promised by the ideal vision.

There is often a gap between this vision and the way technology is realistically used by organizations and society. This may be due to limitations in the technology’s performance, in social adaptation to the technology, or in the nature of the vision itself that leads to failure or to setbacks towards eventual success. As time goes by, contending discourse may evolve, through scientific studies and/or public journalism, showing how the actual use of technology does not match the expectations of the utopian vision. New dominant technological frames may emerge, replacing the original utopian vision with one more reflective of actual use of the technology. This reframing process may also result in the design of new technology.

Sociologists have used the term “movement” to study various types of collective behavior with the term “social movement” often used to refer to movements in general (Blumer, 1969). Movements can start out as general in nature (i.e., the women’s rights movement) and evolve into specific movements based on the ideology of the general movement but with more specific

objectives and supporting organizations. For example, the National Organization of Women (NOW), established in 1966, grew out of the broader women's rights movement, but focused on modern equality issues related to politics, and increased educational and employment opportunities. Similarly, CMs may be viewed as specific movements centered on a general CM that promotes mass computerization (Kling & Iacono, 1988). Distinguishing between the general and specific CMs provides a way of characterizing distinct wings of the larger, continually evolving computerization effort in the United States and elsewhere in the world, including developing countries. This distinction enables researchers to show how similar conceptions about modes of computerization found across many organizations or social settings can be understood in a more general way.

Specific CMs may generate specific counter-computerization movements (CCMs) that oppose certain modes of computerization which their advocates view as bringing about an inappropriate social order (Kling & Iacono, 1988). There is no evidence of a general CCM forming in response to the general CM, but several specific CCMs have been identified (Kling & Iacono, 1988, 1995). For example, since 1990, the Computer Professionals for Social Responsibility (CPSR) group has served as an anti-war group opposing militant types of computer-based systems such as StarWars. It has also focused on other public issues of computerization such as workplace democracy and information rights. A general CCM is unlikely as it would have to rest on a technologically anti-utopian vision of all computerization in society. There are a few technologically anti-utopian books or articles (Mander, 1991), but no visible general CCM.

CM Background and Previous Research [B]

Sociologists have studied a variant of CMs in the form of technological movements (McCarthy & Zald, 1977; Useem & Zald, 1982), such as the nuclear power movement in which particular technologies are central to a vision of a preferred social order. Technological movements are unique in comparison with typical social movements in that their mobilizing ideologies center on the promotion of an improved social order via the use of a particular family of technologies (Kling & Iacono, 1988). A key mobilizing resource of technological movements is the movement organization (McCarthy & Zald, 1977) which identifies their goals with a movement or counter-movement, and attempts to implement those goals. While movement organizations may play a role in promoting a CM, of utmost importance in mobilizing support for use of a particular computer-based system are the activists who write or speak for broad national audiences (Kling & Iacono, 1988) but may not necessarily belong to any particular movement organization. Such activists are illustrated by technology writers such as John Seely Brown, Howard Rheingold, and Nicholas Negroponte; business writers such as John Hagel and Arthur Armstrong; academics such as Jonathan Weisner, and Sherry Turkle; and journalists such as Walt Mossberg; but there are legions of such activists at all levels within society. The fact that these activists have a positive influence on CM mobilization is a *key* distinguishing feature of CMs compared with other technological movements. The majority of CM mobilization for membership is advertised and successfully recruited through their public discourses in the mass media, professional organizations, public speeches, popular stories, television shows, and magazine articles (Kling & Iacono, 1988).

In previous research, Kling and Iacono (1988) analyzed CM ideologies of computerization based on a study of the historical trajectory of specific CMs. They examined the

literature and did case studies of five CMs: artificial intelligence (AI), computer-based education, urban-based information systems, office automation, and personal computers (PCs). They identified the following ideologies as characterizing each of the five CMs:

- Computer-based technologies are central for a reformed world.
- Improved computer-based technologies can reform society.
- More computing is better than less, and there are no conceptual limits to the scope of appropriate computerization.
- No one loses from computerization.
- Uncooperative people are the main barriers to social reform through computing.

In later research (Kling & Iacono, 1995), they stated that the five ideological beliefs could be replaced by a simpler discussion by referring to them as forms of “technological utopianism.” *Technological utopianism* is a rhetorical form which places the use of some specific technology, such as computers as key enabling elements of a utopian vision. Later still (Iacono & Kling, 1996), they expounded upon *technological utopianism* as a key device used by movement advocates to envision the renewal of society through technology.

Technological utopianism does not refer to the technologies themselves but to the analysis in which the use of specific technologies plays a key role in shaping an ideal or perfect world. For example, in 1993, when the White House issued an agenda for the NII, better known as the “Information Super Highway,” readers were asked to imagine a world where people can live anywhere and telecommute to work. Without mention of the economic and political strife associated with computer networking, the NII report is a rich example of technological utopianism. Finally, in Iacono and Kling (2001) utopian visions are said to appear in public

discourse and influence the emergence of *technological action frames* which form key ideas about how a technology is used in micro-level contexts – currently and in the future.

The Concept of Frames in CMs [B]

Snow and Benford (1988) originally defined frames as the conscious strategic efforts by groups of people to fashion shared understandings of the world that legitimate and motivate collective action. The concept of frames is used by social scientists of several disciplines – sociology, cognitive psychology, linguistics and discourse analysis, communication and media studies, and political science and policy studies – to describe and analyze the “interpretive schemas” people use to understand and act upon beliefs regarding the way things are now and how they should be changed in the future. The framing concept has been applied analytically and examined in empirical studies in sociology more extensively than in other areas (Benford & Snow, 2000; Snow, Rochford, Worden, & Benford, 1986; Snow & Benford, 1988, 1992).

Goffman (1974) first described frames as “schemata of interpretation” that enable people to identify occurrences within their life span and the world at large. Since frames help to make events meaningful to people, they serve as a guide to action. Collective action frames (Benford & Snow, 2000) serve as a simplifying mechanism combining individual attitudes and perceptions with negotiated shared meanings of the movement ideology. They serve to mobilize movement actors to recognize the need for change and to take action to make the necessary steps toward accepting an alternate way of doing things. Collective action frames are action-oriented sets of beliefs and meanings that support the goals of a social movement organization.

In their study of Internetworking as a CM, Iacono and Kling (2001) combine the sociological notion of “collective action frames” with the definition of “technological frames”

(Orlikowski & Gash, 1994) to coin the term “technological action frames.” Technological action frames are composite understandings that support high levels of investments in new technology and form the core ideas about how a technology works and how it could be used. They work at the macro-social level in motivating people to join a CM. Individuals and organizations then appropriate these frames into their micro-social contexts. These frames circulate in public discourses designed to mobilize membership in a particular CM. Iacono and Kling (2001) present a process of societal mobilization with the following three primary elements:

- Technological action frames – multi-dimensional composite understandings that legitimate high levels of investment for potential users and form key ideas about how a technology is used – currently and in the future.
- Public discourse – written and spoken public communications that develop around a new technology found in government discourses, the discourse of scientific organizations, mass media discourses, and organizational and professional discourses.
- Organizational practices – ways that organizations and groups of individuals put technological action frames and discourses into practice in a micro-level social context.

These three elements are related in a recursive fashion, as illustrated by the arrows in Figure 1.1. To simplify our discussion of frames throughout this chapter, we refer to “technological action frames” hereafter as frames or technological frames. Moving from left to right in the figure, *technological frames* shape and structure *public discourse* which then shape and structure organizational use and practices related to the technology. Over time, the development and diffusion of new technologies can result in stabilization of the meaning of technologies in the form of *dominant or master frames*.

In turn, organizational practices can influence public discourse and result in a “reframing” process. This occurs when there is a gap between the *utopian vision* conveyed in public discourse and the actual organizational use of technology. As time goes by, *contending discourse* evolves in public discourse through scientific studies and journalism regarding this gap. Eventually, new *dominant frames* emerge, resulting in either new technology or new use of the same technology. This process is further described in the following section where we introduce the conceptual model of CMs.

[Insert FIGURE 1.1 Here]

Conceptual Model of CMs [A]

Using these primary elements, we developed a conceptual model of the life cycle of a CM and the various paths that it may take from emergence to finale. Figure 1.2 presents the basic model.

Moving from left to right in the figure, as new *computer technologies* are introduced into society, people in diverse organizations create *utopian visions* about these technologies. These visions are of improved social worlds enabled by the technology. The utopian visions are expressed in *public discourses* in the media, academic writings, user groups, industry associations, and professional societies and result in the emergence of dominant technological frames which influence choices by organizations and individuals about technology adoption. These visions and technological frames serve to *mobilize individuals, organizations, and society* to invest in computer-based systems, thereby promoting *diffusion* of the technology broadly within society.

[Insert FIGURE 1.2 Here]

Depending upon the fit between the utopian visions and reality of technology use, the technology may fade, reach critical mass, or stimulate a new cycle. Similarly, the CM involved with the technology may fade, continue with the same *dominant frame*, merge with another CM, or face a CCM. As the CM continues, *contending discourse* may evolve in which the actual technology is described as not being used as in the original *utopian* vision. Continual *contending discourse* may eventually result in the replacement of the *dominant frame*, or may result in a new or revised technology. We discuss each of these key ideas next.

Computer Technology [B]

Computer technology refers not only to the physical artifact of the computer but to the whole package of hardware, software, infrastructure, and organizational practices required for its effective use. Since the 1990s, user applications (software) and computer networks have become key technologies that are complex and increasingly required for effective use, but are mainly in the background. Typical users are not aware of the hardware and software that enable Internet connections. What they see is e-mail, instant messaging, and bulletin boards – primarily, software applications on the network. Increasingly, it is software that provides utility to users and thus it is not surprising that CMs have arisen around software such as enterprise systems and collaboration technologies. Organizational practices have also come to be recognized as key to successful use of software in order to achieve expected benefits. Thus, both software and organizational practices are part of the social fabric of the environment of use and therefore

adoption and use of computing are more complex than with previous innovations such as the typewriter or the adding machine. This is perhaps the key reason that CMs have come to play a primary role in the diffusion of complex computer-based systems into social worlds within organizations and society.

Utopian Visions [B]

CMs are most distinguished by their particular utopian visions about what the technology can do and how it should be used and organized. These visions are “utopian” in the sense that they depict how things could be in ideal social worlds where the technology actually would do what it was supposed to do and both people and organizations would be perfectly attuned to the demands of the vision in terms of knowledge and skills, structure and control, and goals and objectives. The visions are sometimes far from reality. The technology does not work as envisaged, or perhaps does not work at all. People and organizations cannot or do not wish to make the required adaptations. If the vision is powerful, however, and people stay with the technology over time, the vision might eventually be achieved as a result of improvements in the technology, a subsequent new and related technology, or a unique organizational adaptation.

One such utopian vision can be seen in the FSM which advocates that software, in the form of source code and executable files, should be provided free to individual and organizational users rather than charging a price as in current practice. This concept is anathema to typical software development firms which charge a price for proprietary software and generally include only executable files. Thus, typical users of software in organizations or individually rely on proprietary firms for software changes which usually result in more fees. Although wider diffusion would be a result of free software, this is not the only purpose. The vision also appeals

to a general and high ideal of “freedom.” Richard M. Stallman, the leader of the movement (known as RMS in the free/open source software (F/OSS) communities), postulates many altruistic reasons why all people should give away source code, but they all come down to doing so in the name of freedom in keeping with the tenets of the Founding Fathers who wrote the U.S. Constitution. (See <http://www.fsf.org> for several essays articulating the benefits of free software.) In response, big business enterprises like Microsoft are claiming anti-utopian outcomes from free software such as the end of capitalism and the downfall of enterprise-oriented companies like Microsoft.

Mobilization of Participants Through Public Discourses [B]

People are mobilized to join a movement by becoming aware of modes of computerization through activities and by-products of CMs: advocates, public speeches and written works, popular stories, television shows, and magazine articles (Kling & Iacono, 1988). Some CM advocates represent themselves and others represent organizations. Although various computer users and vendors contribute to creating interest in computerization, CMs help shape expectations and stimulate demand that traditional market analyses ignore. For example, the first PC hobbyists were part of a grassroots CM focused on building or buying home PCs, with CM membership spreading by word of mouth or electronic communication. In this way, they did not identify with the computer industry and were probably ignored by people marketing IBM PCs. CMs are centered on collaborations of individuals with diverse interests. Some CM participants are mobilized by outside influences such as popular press, and friends and family, while others are motivated by organizations which advocate specific computer-based systems (such as AI).

Public discourse is essential in the mobilization of people to join a CM. Technological frames circulate in these discourses and are borrowed by agents who use them in their own organizational or societal contexts and discourses and, at the same time, often extend them (Iacono & Kling, 2001). In this way, the spreading of dominant frames in discourse at macro-levels of analysis (like professional associations) influences and shapes the micro-level context of discourse and practices. The four levels of public discourse outlined in Iacono and Kling (2001) include:

- Government discourses – discourse circulated in government documents such as the NII agenda and on government Web sites devoted to promoting the use of computer-based systems in government settings.
- Scientific discipline discourses – discourse produced in scientific fields from research on the development and use of computer-based systems in organizations and society. This discourse borrows heavily from the social science theory to explain what these new technologies might mean to the people who use them.
- Mass media discourses – discourse taking place daily on television (shows such as CNN, Frontline, etc.), in newspapers and magazines, and over the Internet. Activists using mass media package their stories in such a way that the unfamiliar technology becomes more familiar and accessible.
- Institutional and professional discourse – this layer of discourse arises in individual organizational settings and in specific professional associations. The technological frames espoused by the government, scientific disciplines, and the media are operationalized within specific organizations and professional associations. This discourse also identifies which societal or professional problems can be alleviated through the use of specific

computer-based systems. Within the micro-level settings, social groups struggle to understand the new technologies as they change or contend with the dominant technological action frame to fit their own preferences and goals. As a result, organizations may be restructured or professions redefined. While occasionally, best practices regarding the use of new technologies are discussed in trade magazines or business publications, more often discourses about actual practices are hidden within organizations. Through historical analyses, ethnographic studies, and case studies of actual technology use, *contending discourse* arises and new technological frames are developed.

Contending Discourse [B]

Contending discourses arise in the mass media, within scientific disciplines, and within organizations as scientific studies of the actual use of technology are published showing the gap between the intended use and actual use of the technology. These contending discourses, by framing technologies in alternative ways, can then have powerful influences on the development of new meaning about technology and the development of new technological frames. For example, the critical discourses about the work automation frame during the mainframe and PC eras developed into discourses about more collaborative technologies, resulting in new families of technologies such as computer -supported cooperative work (CSCW) and groupware (Iacono & Kling, 1988).

The Diffusion Process [B]

Technological diffusion is a multi-stage process comprised of adoption, use, and widespread incorporation into organizations or society. Adoption, which is the first stage, refers to making the decision to use a new technology for personal or organizational purposes. Yet adoption does not always result in widespread use of the technology. It needs to be accepted, adapted, and assimilated into an organization or into general society such as in home computing. This is the second or use stage. Finally, the technology needs to be incorporated where it is institutionalized as an integral part of the individual's or the organization's activities.

This understanding of diffusion as a complex, multi-stage process helps to explain why CMs develop and why any particular technology may take decades to diffuse to its intended audience. As part of the diffusion process, improved new technologies may come along and displace the earlier ones. Alternatively, despite being better than the original technology, the new version may not displace earlier technologies because of the previous investments and due to the high costs of changeover.

Outcomes [B]

Depending upon the fit between the utopian visions surrounding the technology and users' actual experience, the technology may fade, diffuse to critical mass, or influence the innovation of new technology which incorporates lessons learned from a failure. Once a technology reaches critical mass, it becomes institutionalized and several things can happen to the CM. The CM may fade out, continue and provide further support for diffusion, or merge with other CMs, creating discourses which promote new technological frames regarding the same or another technology.

A further outcome, which may occur at any point in the diffusion process, is that the utopian writings associated with specific CMs may spawn a CCM related to that CM's specific computer artifacts (hardware or software). The anti-utopian views of CCM advocates usually arise in response to a threat from the use and development of the specific technology promoted by a CM. Using the example cited earlier, Microsoft's purported efforts to downplay the advantages of free software with anti-utopian visions of the end of capitalism could be characterized as a CCM.

CM Compared with Other Research Methods [A]

Most research on information technology and organizational change has concentrated on adoption and change within single organizations. The macro-social and cultural environment is largely ignored and studies do not look at why or how organizations attempt to implement the same information technology at the same time with different levels of success (Iacono & Kling, 2001). For exceptions to this, see (Orlikowski, 1993, 2000) and (Orlikowski & Gash, 1994). In the social movement literature, the emphasis is less on the social action and change in organizations and more on the wide-scale mobilization of participants for social change. In CM research, researchers bring together these bodies of study (Iacono & Kling, 2001). The analysis of CM research is at a macro-level, showing how the broader environment is critical to the adoption and diffusion of technology into social and work lives within society and between organizations. In this section we review other theoretical approaches to studying adoption and diffusion of technology at the individual and organizational levels. We then compare their strengths and weaknesses with those of the CM theoretical construct. Table 1.1 shows the five frameworks, their levels of analysis, and comparisons with CMs as a research framework.

[Insert TABLE 1.1 Here]

Web of Computing [B]

The web of computing framework (Kling & Scacchi, 1982) is a framework for use in a social analysis of computing at the organizational level. It has been used to show the complex network behind end-user computing. Web models view IS as complex social objects which are influenced by their context, infrastructure, and history. However, in their scope of analysis they are limited to within organizations. Web models (Kling & Scacchi, 1982) focus on the way that some focal computing resource is produced by a network of producers and consumers referred to as a production lattice. Web models examine both the social and economic organization of computing activities focused at the organization level of analysis. The production lattice for a particular computer-based system or resource consists of a social organization which is embedded in the larger picture (macrostructures) of the social and economic relations and is dependent on a local infrastructure. Web models enable the analysis of how the macrostructures relate to the local availability of technology resources at each node of the lattice. Web models view computing systems as a complex web of historical commitments and infrastructure changes throughout time. Thus, web models provide a social analysis of computing developments constrained by their organizational context, infrastructure, and history. They are most suited for complex computer-based systems and services which connect many different groups in the production lattice during development, operation, and use of a computer-based system. In a detailed presentation of web models and their use, Kling and Scacchi (1982) showed how using a

web model enabled insight into the social and technically complex embedded computing developments within sample organizations.

Structuration Theory and Technology Use in Organizations [B]

Structuration models portray technology as embodying structures (rules and resources) built in by designers during technology development and later appropriated by users of the technology (Orlikowski, 1992). Orlikowski (2000) developed a more advanced application of structuration theory to accommodate the constant redefinition of the meaning, properties, and applications of technology long after development. Technologies such as screen displays do not structure human action until they are routinely mobilized in recurrent use patterns which then produce and reproduce a particular structure of technology use. Structuration theory applied to technology use indicates that researchers and managers interested in estimates of technology performance prior to investment may get more meaningful results if they look for returns on the *use* of technology instead of just the *technology* itself. The application of structuration theory to technology is appropriate at the organizational level.

Actor-network Theory [B]

Actor-network theory (ANT) offers a framework for describing the process of technology adoption with emphasis on social construction as well as on technical innovation. Social interactions are viewed within a network society, providing a rich environment for viewing social networks. One of the most important contributions of ANT is that people along with their technologies comprise social networks known in ANT as actor-networks. This theory has been used by researchers to characterize the role of users of online IS as social actors in IS research

(Lamb & Kling, 2003) and to analyze the socio-technological construction of China's strategy for the transformation of the telecommunications market (Gao, 2005). ANT is used as an analytical tool at the group level within organizations and societies.

Technology Acceptance Model [B]

The technology acceptance model (TAM) proposed by Davis (1989) gives an explanation for user acceptance of information technology. Adoption and diffusion of information technology have been studied in depth by many researchers in the IS area. In the TAM model, adoption refers to the decision to accept, or invest in, a technology. The TAM model focuses on the individual level and states that an individual's adoption of IT is dependent on their perceived ease of use and perceived usefulness of the technology. The TAM model has been used to study the adoption of various technologies (Venkatesh & Morris, 2003; Venkatesh; 2000; Dasgupta, Granger, & McGarry, 2002) and to predict user acceptance of an IS (Davis, 1989; Venkatesh & Morris, 2003). Davis (1989) first proposed TAM when he verified that the perceived ease of use and perceived usefulness of an information system determine the behavioral intention of the user to use the system.

Advantages of Using the CM Framework [B]

Using the CM framework enables researchers to use a macro-level analysis and historical picture of adoption and diffusion. This encourages researchers to use a deeper analysis of tacit and apparent attitudes and motivations for adoption and consequent diffusion of technologies in societal groups and organizations. The emphasis is on professional and public discourse which influences the creation of technological action frames that motivate people to purchase and

integrate computer-based systems into their daily lives. Thus, analyzing the diffusion of technology through the CM lens shows that the spread of computer-based systems is more than just the by-product of ambitious marketing from high-tech companies.

Looking at macro-level issues related to diffusion of computer-based systems in organizations and society focuses the researcher on issues often missed when analyzing computer-based systems at the individual and organizational levels. The analyses of various computerization environments have come from careful scientific studies of work practices. These discourses are needed to help correct the many misrepresentations and misunderstandings about the nature of organizational restructuring and how new technologies influence work practices (Iacono & Kling, 2001).

Furthermore, using the CM construct affords the opportunity to examine computerization on a global level which may be missed using another technique. For example, the web of computing is intended for analysis of the social and economic organization of computing activities without an analysis of the global influences related to software adoption and use. In the 2000s, global economic transactions are becoming more common, with e-commerce taking place over the Web. Analysis of general and specific CMs helps us understand the social forces behind the global information society of the future.

A disadvantage of using CMs as the focal point of social analyses of computing is that it may result in overlooking important aspects of the individual and organizational adoption of technology. For example, using an individual-level approach such as TAM can show the influence of individuals' perceptions regarding technology's usefulness on the success or failure of technology diffusion in an organization. Even though the "death of distance" technological frame may have a powerful influence on the rate of adoption of certain ICTs, individuals'

perceptions regarding technology's usefulness (as shown by the TAM approach) may also be influential in success or failure of technology diffusion in any particular organization.

Dominant Technological Frames in Four Computerization Eras [A]

We have shown the importance of CMs in the real world of diffusion of computing innovations. Our analysis of CMs indicates that the utopian visions underlying CMs are especially critical as they form the basis for the mobilization of individuals and organizations to use the technology and make continuing investments in it. We have shown how public discourse influences the derivation of technological frames in micro-social contexts of organizational and personal use, and how there usually is a gap between the actual use and the utopian visions projected in the discourse and frames. In our study of CM and computerization literature, we have found that five dominant technological frames – productivity; democratization; death of distance; freedom and information rights; and ubiquitous computing – have permeated the utopian visions found in public discourse over a period of four general computerization eras: mainframe, PC, Internet, and ubiquitous computing. Table 1.2 shows the eras, new technology introduced in that era, and corresponding dominant frames. These frames are used as the book's section headings, with papers grouped according to their connection with that particular frame. In this section we begin with a brief description of the eras and their dominant technological frames, followed by a section on each frame with discussions on existing CMs and on sample chapters in this book highlighting that particular frame. In the last chapter of this book, we give a comparative analysis of the dominant frames in each era, concluding with predictions for dominant frames and CMs in the ubiquitous computing era.

[Insert TABLE 1.2 Here]

Eras of Computerization [B]

In general, CMs have been instrumental in promoting computerization since the 1950s. As technology evolves through the years, new CMs emerge to support adoption and use of particular computer-based systems. We have identified four computerization eras and related CMs. The five technological frames represented by the various CMs discussed in this book are related to the four eras. Some frames such as *productivity* appeared in the CM literature during the mainframe era and are still being used to promote technology use today and into the future in the ubiquitous computing era. Two of the frames – *democratization and freedom/information rights* – began during the PC era and became emboldened by the advancement of the Internet era. The *death of distance* and *ubiquitous computing* frames were a direct result of the Internet era and continue to be discussed as an advantage of ICTs in the ubiquitous computing literature.

Technological advancements in the last thirty years have resulted in major cultural shifts in how people in businesses and homes view and use computer technology. Table 1.2 shows the growth of technology and the corresponding changes to CMs from the 1950s to the anticipated future. The mainframe era of the 1950–1970s gave way to the PC era. During the 1980s, IBM and Macintosh manufactured PCs that became popular with both home hobbyists and businesses. Around 1985, the Internet era began with the creation of the ARPANET, the forerunner of the Internet, resulting in online communities exchanging messages on Usenet groups. By the late 1980s, e-mail was beginning to appear in select scientific and government communities, and more and more people were participating in Usenet groups.

In the 1990s, the advent of the World Wide Web (known as the Web) enabled virtual communities to evolve into social and work worlds such as the F/OSS movement. The Web is the universe of network-accessible information. It began as a networked information project at CERN, where Tim Berners-Lee developed a vision of what the Web could be with a prototype in 1992. The Web has a body of software which enables anyone to easily roam, browse, and contribute to Web sites through the use of hypertext and multimedia software.

The 2000s brought the use of advanced technologies for ubiquitous computing where people can connect to the Web through personal digital assistants (PDAs), mobile phones, and Blackberries (for reading e-mail). As with most social movements, there is an ebb and flow to the support and popularity of CMs and sometimes the movement fades out altogether (Kling & Iacono, 1995). For example, the AI movement popular in the early 1990s has been replaced by intelligent agents, knowbots, and data mining. Meanwhile some movements, like the FSM and the open source software movement (www.opensource.org), have proliferated with the advent of the Web.

Productivity [B]

The notion that computers and other information technologies would improve productivity was the earliest vision behind CMs, and has been a continuing *dominant* frame to the present. In the mainframe era, when computing was the province of management information systems (MIS) departments in larger organizations, the emphasis was on organizational productivity through computerization of back-office activities and through automation of production. Computers were expected to substitute for people or to make people more productive by extending their capabilities. Similarly, they were expected to make equipment more

productive through optimization of its operating features, performance time, output, and/or extending its life. In the PC era, the dominant frame was related to personnel work on personal and work group productivity and enhancing personal or group capabilities. In the current Internet era, the productivity promise is extended beyond organizations to interorganizational networks such as the value chains involving lead firms like Wal-Mart or Dell, Inc. and the hundreds of suppliers and business partners affiliated with them in bringing products to customers globally.

Vendors and reporters in the business and popular press produce public discourse about the benefits of computerization for decreasing costs or increasing productivity. Executives and others in organizations are often motivated to invest in new computer technology due to the expectations of increased efficiency created by these discourses. Academic research examining the claimed benefits was not conducted until the mid-1980s and until around 2000 was equivocal about whether computers actually improved productivity. Recent research has concluded clearly that it does, although not without considerable caveats regarding organizational complements such as reengineering, skills development, decentralized decision-making, and the use of team structures. Despite the uncertainties surrounding the productivity payoff, firms continued to invest until the dot.com bust in 2001. The predominance of “productivity” as an underlying motivation, justification, and organizing frame to explain the success or failure of technological diffusion is nicely illustrated by two chapters in this book, Chapter 3, *The Computerization Movement in the US Home Mortgage Industry, 1980-2004*, and Chapter 4, *Visions of the Next Big Thing and the Mobilization of Support for New Technologies*.

A Long Way to Productivity: Automated Underwriting in Mortgage Banking [C]

The first chapter in the productivity section, Chapter 3 by Lynne Markus, Andrew Dutta, Charles Steinfield, and Rolf Wigand, illustrates the importance of the productivity framing of the automated underwriting CM in the successful diffusion of such systems over a twenty-year period. The authors suggest that three interrelated factors influence the success of this CM. One is the technological frames which are reflected in discourse about the innovation. The second is the reflection of these frames in intermediating organizations, such as industry associations, government enterprises, and leading firms in an industry. The third factor is information about the performance of the technology from early adopters and the emergence of a dominant frame resulting in a dominant design for automated underwriting. They show how over a twenty-year period, the productivity theme is reflected in standardization efforts and technology development initiatives in mortgage banking. In addition, they show how reports of productivity gains by early adopters set the tone for later diffusion. And they show how the interests of some lenders beyond productivity resulted in rejection of successful technologies despite their productivity benefits. In this way, a gap developed between the utopian expectations of the productivity frame and the actual use of the technology.

They analyze articles from the *Mortgage Banking* journal from the 1980s to the present, providing a fascinating historical account of the diffusion of automated underwriting, how it was driven by the promise of greater productivity, and how it eventually fulfilled the promise. They show how this particular CM was successful due to more than just the economic needs of lenders to decrease loan defaults and reduce processing costs. It was influenced by institutional support in the public discourse of the leading industry association – the Mortgage Bankers Association (MBA) of America – and, eventually, by the technology's performance.

Surprisingly, until the mid-1990s, the mortgage process was mostly a manual, decentralized process, with thousands of mortgage lenders using their own guidelines to review borrowers' credit reports and documentation to determine creditworthiness for mortgage lending. Technology became a topic of interest in the mid-1980s, when there was a national increase in mortgage defaults. Both lenders and government-sponsored enterprises (GSEs) sought automated mortgage-scoring tools in order to more effectively measure borrowers' creditworthiness prior to lending, i.e., to increase the productivity of loans.

Historically, the mortgage lending process involved an assessment, by local savings and loan associations, of borrowers' credit ratings, evaluation of property value, lending money to borrowers to purchase a home, and collection of mortgages. In order to overcome regional differences in mortgage rates, the U.S. government chartered two GSEs (Fannie Mae and Freddie Mac) to buy and securitize mortgages so that there would be a national market that ensured more competitive rates for consumers. Today, these federal corporations play a significant role in how primary lenders evaluate and approve loans because they now publish guidelines by which they will assess the loans they purchase. The MBA, the leading industry association for companies in the real estate finance business, worked closely with the GSEs to specify technology standards for automated underwriting.

Both Freddie Mac and Fannie Mae promoted this approach by developing computer-based systems to perform automated underwriting. By the later 1990s, they were promoting automated underwriting not only to reduce credit risks but also to reduce the costs of loan processing, and more and more underwriters started using these systems. Reports of productivity gains in professional discourse in the mortgage banking industry mobilized users through the *productivity technological frame*. However, there were setbacks along the way, creating a gap

between the utopian vision of productivity in automated underwriting and the actual use by mortgage bankers.

To support automated underwriting on a large scale, mortgage lenders needed to supply credit data at the same time that they submitted loan applications for underwriting to Freddie Mac and Fannie Mae. Starting in 1995, these two government agencies provided underwriting software with a fee-based electronic data exchange network for lenders. The lenders reacted with skepticism about the costs and benefits, and were slow to adopt the system. Some lenders viewed the GSE's automated underwriting system as a way to tie them closer to the federal corporations, causing total dependence on the GSE's technology. Furthermore, other lenders were more interested in developing their own computer-based systems since they processed their own loans or sold them to investors (instead of selling them to Fannie Mae or Freddie Mac).

The lenders focused on underwriting systems that could provide them with borrowers' credit ratings at the "point of sale." The advent of the Internet promoted the development of such systems and by 2002 a company proclaimed that by using the Internet, it could underwrite and fund online in less than four hours from start to finish. This discourse further fueled the technological frame of productivity gains by using computer-based tools and encouraged other lenders to adopt systems that bypassed mortgage brokers and federal corporations' systems.

The battle over the federal corporations' systems and lenders' systems and the attempt at standardization in automated underwriting is ongoing. But the case shows how the productivity theme in the automated underwriting movement changed course over the years, from appealing to national interest to self-interest to accommodating multiple systems. As automated underwriting has moved to the Internet, it appears to be evolving into the standard dominant frame and expectation of "how to process a mortgage loan." The story is still evolving on

whether the mortgage banking industry may settle for a dominant design/technological frame or continue with competitive systems.

Productivity and PDAs [C]

A second example of the productivity theme is illustrated in Chapter 4 in this volume by Jonathan Allen. He shows how various PDA products are proposed, manufactured, and eventually fail before two vendors create PDAs that reach mass diffusion.

Although hailed as tools for personal productivity as part of the early discourse regarding the utopian vision of the PDA CM, the earlier versions of PDAs did not meet users' needs and failed in the marketplace. From 1987 to 1998, three separate industries – PCs, telecommunications equipment, and consumer electronics – considered the PDA to be the “next big thing.” During this period, North American and European manufacturers produced seventy-one versions of consumer-oriented PDAs. These failures are an example of what can happen if technology is not diffused (see Figure 1.2) – new frames evolve based on the failures of the previous models and a new technology or revised technology emerges in the form of the Psion and PalmPilot.

Allen shows how various PDA products were proposed and rejected until two companies, Psion and Palm, developed successful versions. In both cases, the companies resisted the temptation to follow the “frames” that were evident in discourse at that time – that PDAs would increase productivity for busy executives and workers who could not type by introducing pen-based input. Psion developed the Series 3 operating system and included keyboard as opposed to pen-based input. The Series 3 also had application programs and file systems.¹

Palm Computing developed the PalmPilot as a “connected organizer” – having seamless connectivity with a PC and easy-to-use personal applications such as calendars and address books.² Rather than following the vision of the PDA industry that pen-based autonomous control was what executives wanted, Palm thought that a vision of users downloading files from their PDAs to PCs would resonate with busy executives and professionals. In addition, the company modified the strict pen-based input to include pen input one character at a time, using a specially modified alphabet.

Chapter 4 shows how a new technological frame can succeed in the face of a competing industry standard. The vision of the PDA CM was to fill a need of all those left behind by complex PCs, keyboards, and typing skills. The productivity theme in the initial vision for PDA usage promoted PDAs as a way to remain connected to both family and work “any time, anywhere.” Also the thought was that executives and consumers who were keyboard phobic would be delighted to use the pen-writing devices. However, these initial PDAs failed to become adopted by large masses of consumers and hence some manufacturers gave up on this vision altogether (e.g., failed Newton by Apple). Then Palm and Psion developed their own visions for a PDA, partly based on the failure of the initial PDAs. Both the automated underwriting products and PDA products are still evolving. More recent versions of PDAs include sharing of files with a PC in addition to the ability to send and receive e-mails on a cell phone. The media reports recent trends with teens using cell phones, PDAs, and PCs to remain connected to their friends on a 24/7 basis using instant messaging (IM) from cell phones (Jones, 2005).

We now turn to CMs that serve to promote the acquisition of new technology to democratize groups of people in organizations and society.

Democratization[B]

The second frame that underlies many CMs and shapes their utopian visions is democratization. Democratization is defined at <http://en.wikipedia.org/wiki/Democratization> as “the transition from authoritarian or semi-authoritarian systems to democratic political systems, where democratic systems are taken to be those approximating universal suffrage, regular elections, a civil society, the rule of law, and an independent judiciary.” Democratization with regard to technology refers to the utopian vision that technology will transform organizations and societies into more egalitarian institutions by opening up new forms of communication (bottom up, interactive, two way, peer to peer). This theme occurs in the visions of various Internetworking CMs (Iacono & Kling, 2001) related to democratization within and between organizations, within local communities, and within societies. We show in case studies of specific CMs in several chapters in this volume that a gap exists between the achievement of democratization and reality.

Researchers and users have envisioned the use of computer-mediated communications (CMCs) as a means to facilitate democratic communication due to the pervasiveness of networking in organizations and because of the decontextualization inherent in such communication (Kiesler, Siegel, & McGuire, 1984). Social decontextualization refers to the lack of visual cues as to a person’s true identity and facial expressions. For example, in a male-oriented discussion group, a female could “pretend” to be a male by joining an all-male discussion and consequently might be more accepted. As part of this vision, the use of CMCs such as groupware or decision support systems will transform an organization into a more open, democratic setting where there is a flattening of hierarchical boundaries. Research has shown that the use of e-mail in an organization can enable people who are peripheral to become more

visible, and lower-level employees to communicate with upper managers more easily (Fountain, 2001; Sproul & Kiesler, 1991). However, adopting CMC technologies does not guarantee democratization in an organization, as several chapters in this volume illustrate.

Another vision related to democratization, focused around e-mail and the Internet, is the grassroots efforts to involve citizens in local government. The technological frame regarding democratization in this area involves communities having direct access to government officials, open access to government information, and easy, instant communication about issues that concern citizens. It is illustrated by the early movements to create electronic city halls such as Santa Monica (CA) Public Information Network (Dutton & Guthrie, 1991) and by current e-government projects focused on citizen-government communication and information exchange such as citizens' open access to court schedules and case dispositions via Web site connections.

The e-government CM is one of the emergent Internet CMs that is being promoted in government discourse around the world, with the dominant frame of providing citizens with more access to government information. For example, a five-year study of e-government services (West, 2004) at both the state and federal level showed that in 2004, 56% had services that were fully executable online (e.g., no court visit necessary to obtain a document or information), up from 44% the previous year. In addition, of the 1,629 Web sites studied, 93% had e-mail addresses that the general public can use to request information, up from 91% previously. This vision of democratization of information for citizens assumes that people will eagerly use the Internet to access these e-government networks. As we will show with chapters in this section, reality does not always meet the CM visions.

Reinforcement vs. Democratization of Hierarchy [C]

Chapter 6 in this volume, by Barry Wellman and Anabel Quan-Haase, shows that IM and e-mail usage in a heavily networked organization did not democratize the hierarchy as expected, but actually reinforced it. Thus, this shows another gap between a utopian vision and actual use of IM and e-mail in an organization. However, IM did foster trust, collaboration, a community of practice, and commitment to the organization. Wellman and Quan-Haase found that employees of a company called KME used IM for communication whether they were collocated or physically separated.

Thus, IM was used for both local and global communication. Employees used multiple media, often answering an IM and glancing at an e-mail while holding a face-to-face conversation. Even though people were collocated at KME, they preferred IM over face-to-face and telephone contact. Although the utopian vision of the democratization frame indicates that this increase in IM would result in more egalitarian relationships among higher- and lower-level personnel, that in fact did not happen at KME. If lower-level IT professionals were working with someone face to face and they received an IM from their supervisor, they responded immediately, whereas IMs from colleagues might be disregarded. This study showed that while democratization was not enabled using IM at KME, it did engender collaborative community and trust within and between departments while at the same time creating information overload and distraction while at work. The authors suggest that hierarchy and roles continue to influence interactions, even in the hyperconnected environment of KME. However, the organization is still more flexible and hyperconnected than a traditional bureaucratic organization.

Reinforcement but not Democratization of Civic Engagement [C]

In Chapter 7 in this volume, by John Carroll, an example of using the Internet in the small in the Blacksburg Electronic Village (BEV) project is presented. Here the entire community was networked together with the utopian vision that the community would become more civic-minded and community-oriented. The results counter that assumption, showing that people in the Blacksburg community who made use of the Internet for civic purposes tended to already be activists in the community prior to the use of the Internet. Thus it did not change or democratize relationships, but reinforced previously existing ones.

The BEV project was an experimental project established in 1993 and backed by the Clinton Administration's NII initiative. The technological frame associated with this project was that the use of Internet technology would enhance the quality of life for residents of Blacksburg by electronically linking them to each other and to the Internet. It was created as a partnership among the town of Blacksburg, Virginia, the local telecommunications company, and Virginia Tech, and it was sponsored by both state and federal funds. By the early 2000s, adoption and use of the Internet were widespread in Blacksburg.

Carroll and a team of researchers designed an evaluation project to investigate the effects of the adoption of technology on the people of Blacksburg and Montgomery County. They evaluated people's use of the network by using a random sample of 870 Montgomery County residential addresses using a ten-item survey to classify the participants. Next they surveyed all participants with a lengthy questionnaire, logged Internet usage with some, and interviewed others. For this chapter, they focused on two key results from the wide range of variables collected: local activism and feelings of belonging. They found that the people in Blacksburg and the surrounding Montgomery County community "who make use of the Internet for civic

purposes (for example, people who say they look for news online, or participate in local online groups) tend to be activists in the community (they feel they have ideas to improve the local community, they say they work with others to solve community problems, and so on).” In other words, people who were already connected to civic affairs continued to be involved, while those who were not connected to the community prior to the Internet use did not increase their civic activities. However, those who made use of the Internet for social purposes (e-mailing friends and family) reported a greater sense of community belonging.

The Death of Distance [B]

The third frame that underlies CMs is the “death of distance.” It refers to the utopian vision that computers, telecommunications, and various kinds of software tools would overcome the barriers of geography and distance, thereby enabling the virtual equivalent of working collocated. This frame was behind the telecommuting movement of the 1970s and 1980s. Then, the idea was to substitute ICT for transportation (Nilles, Carlson, Gray, & Hanneman, 1976; Nilles, 1983, 1998). Advanced ICT would be used to link headquarters offices in central cities with satellite offices in the suburbs. These offices could be shared by companies and workers and would reduce traffic congestion for cities, lower the cost of office space for companies, and reduce commute time and stress for workers, thereby making them more productive and effective. Governments and business leaders underwrote experiments with telecommuting in major cities throughout the U.S. and consultants made bold predictions and claims about take-up and success. But the movement never really caught on sufficiently to reduce urban traffic congestion to any measurable degree. The experiments also revealed that telecommunications was costly and unreliable; that the activities that could be relocated mainly involved information

input or the MIS function; that management showed concerns about worker productivity (how do you know people are working if you can't see them); and that there were serious costs to employees in such remote work, including feelings of isolation and concerns about lack of visibility and therefore opportunities for promotion (Kraemer & King, 1982).

After 1995, when the Internet technology began to flourish, the rhetoric about geographically distributed collaboration changed to terms like CSCW, virtual teams, and online communities. Both academic publications and popular media began discussing and promoting virtual teams throughout the 1990s as more organizations invested in Internet technology and experimented with concepts like process reengineering, self-organizing teams, quality circles, and total quality management. The discourse during this period indicated that virtual teams will make organizations more efficient, will empower employees, and will transform business processes to be more successful (Townsend, DeMarie, & Hendrickson, 1998).

There are several current incarnations of the death of distance frame under work at home, distant/remote work, and distributed work. Each has subtle differences such that the visions appeal to different target markets. "Work at home" is an appeal to urban professionals, small businesses, and certain kinds of office workers who could achieve the ideal integration of work life and home life. It is promoted by housing developers for urban infill housing as well as suburban and exurban housing developments. Housing tracts and entire new communities are being developed which promote this vision, e.g., Ladera Ranch in California (Venkatesh, Chen, & Gonzalez, 2003).

In contrast, remote work and distributed work are appealing to companies and office workers, but with important differences. Remote work is similar to the earlier telecommuting appeal whereas distributed work is an appeal to companies with knowledge workers whose

expertise is distributed across multiple locations. The idea here is that ICT and collaboration technologies enable firms to bring the right mix of expertise to bear on projects regardless of their location. The promoters here are packaged software companies, computer scientists, and academics who see sales opportunities or who simply buy into the utopian vision because of its affinity with their own style of work.

Failure to Close the Distance Gap in Virtual Collaboration [C]

The death of distance frame is illustrated in Chapter 9 in this volume, by Kiesler et al., in which they explore the distributed work CM. The authors examine the role that internetworking and collaboration tools played in a large company with different divisions in various locations around the U.S. The utopian vision was that the firm would be able to link and integrate distributed work groups to pull together the expertise needed for different projects, and that this would uniformly enhance the individual, the distributed groups, and the virtually integrated groups.

They studied the American Institutes for Research (AIR), a successful non-profit organization that carries out applied research, consulting, and technical services. AIR employs over 1,000 employees at seven major locations and a number of minor locations. Project teams originate and are managed from one site to perform the work for customers. The data are drawn from a large study of how managers decided to create dispersed projects from 1996 through 2000 (Boh, Ren, Kiesler, & Bussjaeger, 2005). In 1996, the Chief Operating Officer (COO) at AIR read a book on dispersed teamwork and decided to attempt to implement the use of CMC technology to augment the team project management at AIR. He hoped that this would enhance the firm's ability to utilize expertise across the growing firm. However, by 2003, computer-based

tools for sharing files and collaborative work spaces were not yet fully developed and so failed to meet the firm's expectations. Managers did not see a strong connection between investments in technology, collaboration, and the bottom line. Contrary to the dominant frame of the virtual teams CM, the COO authorized investments in technology only as they could be demonstrated to support business operations.

The authors conclude that there are two visions of virtual teams – high-tech and low-tech. The high-tech version expects companies to invest in the “state of the art technology” in order to operate with virtual teams. In the low-tech world of AIR, the authors point out that the virtues of collaboration over distance appealed to managers but not necessarily with dependence on technology. For example, AIR had no teams connected by networked communications. Kiesler et al. conclude that the virtual teams rhetoric will continue to evolve and to motivate technology development despite limited achievement of the vision.

In Chapter 9 virtual teams in a low-tech environment breached vast distances by using CMC combined with face-to-face meetings to collaborate. Thus, the technology operates in the background for many users, making the death of distance a kind of reality that does not necessarily include the utopian vision.

Freedom and Information Rights [B]

The fourth frame to emerge is related to freedom and information rights which have been at the core of the U.S. society since its inception, with the ideology embedded in the U.S. constitution and the Bill of Rights. Terms such as “freedom of speech” and “freedom of choice” are at the core of our individual liberties as part of being a U.S. citizen. In the U.S. democratic society, many freedoms we experience on a daily basis are taken for granted – vestiges of the

free nation we live in. In other societies people do not have the freedom that is inherent in the U.S. constitution. The freedom theme is evident in the Internet CMs that foster information privacy and democratization. For example, e-government initiatives foster the freedom of individuals to access public information. This human right to access information to promote equity is also referred to as building and maintaining an “information commons” or public informational sphere (Schuler, 1996).

The freedom frame is instantiated in the FSM (Dibona, Ockman, & Stone, 1999; Williams, 2002), which promotes the freedom to run, copy, distribute, study, change, and improve source code. Free software is defined by the FSF (www.fsf.org) as software which is “free as in freedom, not as in beer” (also known as “libre” or “freedom” software). Richard M. Stallman (www.gnu.org) founded the FSF in 1985 to promote his concept of free software. His essays on the FSF Web site proselytize the importance of all software being free and promote the use of the “copyleft” principle – the copyleft license enables free software to be used, copied, studied, modified, and redistributed. His goal is nothing less than to eliminate proprietary software from the world some day. The FSF beliefs are encoded in the General Public License (GPL) and are based explicitly on the ideals of the American Revolution of 1776 (Elliott & Scacchi, forthcoming). In the GPL, the following definition of “free software” is listed:

[A] matter of liberty, not price. To understand the concept, you should think of “free” as in “free speech,” not as in “free beer.” Free software is a matter of the users’ freedom to run, copy, distribute, study, change, and improve the software. More precisely, it refers to four kinds of freedom, for the users of the software:

- The freedom to run the program, for any purpose (freedom 0).

- The freedom to study how the program works, and adapt it to your needs (freedom 1). Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbor (freedom 2).
- The freedom to improve the program, and release your improvements to the public, so that the whole community benefits (freedom 3).

Unlike other CMs discussed in this book, the FSM assumes that people have access to computing technology and instead promotes a new software development process and licensing concept. This community commons of free software is facilitated by the Internet CM since this enables free software communities to thrive, with contributors working together from all over the world to build, distribute, and maintain “free” software systems.

Although the FSM has been in action since 1985, its counterpart, the open source movement supported by the OSI (www.osi.org) was started in 1998. A group of free software developers decided to promote free software to businesses, changing the name to open source software and including software licenses with fewer restrictions so that companies could more easily combine “free software” with proprietary software. While the two movements differ somewhat in philosophy, their software is often referred to as free and open source software (F/OSS)...

As the Internet has flourished and made a big impact on the way people process information, information-rights activists have formed several information rights-oriented CMs related to, and including, the FSM:

- Community networking – to promote universal access to enhance local community-based economic and social development.
- Free/open source software – to advocate the development and use of free/open source software over proprietary software.
- Informational privacy – to protect personal information.

The community networking CM was described in the section on democratization, and Carroll's chapter on the Blacksburg project is a fine example of community networking. The core belief system that has propelled this movement into action is that of universal access to the information/communication infrastructure and the widening panoply of information available over the Internet. The dominant frame is that providing universal access will promote social equity, as in closing the "digital divide," but it is also concerned with building and maintaining a virtual public space. As this space widens, attention is focusing on the informational privacy movement by government and individuals.

The informational privacy movement started in the 1960s with the growth of massive computerized data banks of personal information. Alan Westin explicated the rights ideal in his books, *Privacy and Freedom* (1967) and *Databanks in a Free Society* (Westin & Baker, 1972), providing this definition of informational privacy: "... the chain of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others (Westin, 1967)." Through the years it has grown into a powerful movement due to the increasing encroachment of privacy with the commercialization and expansion of the Internet. Identity theft through accessing records on the Internet and stealing credit card information has flourished, with sophisticated hackers accessing online database systems and personal computers.

Information Rights as a Freedom [C]

In Chapter 12 in this volume, Andrew Clement and Christie Hurrell suggest that the three information rights-oriented CMs listed above may potentially merge to form a future information rights movement comparable to the emergence of the environmental movement formed from several separate movements. They suggest that although currently fledgling, all three movements will eventually coalesce based on alliances to form one overarching information rights movement. They explore the similarities (and differences) between the nascent information rights movement and the much more fully developed environmental movement.

They first give a historical account of the rise of the environmental movement in North America, starting with the post-World War II period to the present. They trace how the wilderness movement with its emphasis on preserving remote wilderness areas, the campaign to preserve wetlands, and the growing concern for personal and community health all converged to form the environmental movement. They claim that “what unites these three broad areas of environmental concern is their grassroots social and political drive: they were not typically tied to particular power groups or political parties.” The environmental movement succeeded in bringing a wide range of disparate advocacy efforts into one unified movement for social reform by forming an agenda that integrated the themes of commons, ecology, and environment. They suggest that this principle could be applied to community networking, F/OSS, and informational privacy to form a new information rights movement.

Clement and Hurrell suggest that the software used in community networking to date includes proprietary, homegrown, and shared, but that there is growing interest in using F/OSS to support this “grassroots” effort. Although the F/OSS movement was not formed around concern

for information privacy, the two movements do share a strong and fundamental commitment to the ideal of personal “freedom.” Clement concludes that these three CMs all share a focus on human rights issues beyond their focus on computerization. Similar to advocacy organizations in the early stages of the environmental movement, these movements presently work in relative isolation from each other. Drawing on lessons from the environmental movement, he suggests that these three CMs could form a more unified force by developing an integrative conceptual frame centered on their common themes of freedom, commons, and privacy, and by joining forces with non-computer movements such as civil liberties or global justice. This chapter, in addition to its identification of a new and important theme, is a nice illustration of how computerization and other movements might merge and become more powerful influences in society.

Freedom as in Free and Open Software [C]

In Chapter 13, the antecedents for success of the FSM are explicated. Margaret Elliott traces the historical growth of this movement and what factors have led to its ongoing success and diffusion into traditional methods of software development. This chapter explores how the ubiquitous computing era facilitates the success of this movement by providing vast opportunities for the spread of the FSM ideology and for global access to the movement’s software and articles on free software. The stages of a typical social movement are traced using four stages: social unrest, popular excitement, formalization, and institutionalization. To accommodate the unique aspects of CMs, technology adoption is added to the formalization stage. Once a CM reaches the institutionalization stage, its technology has reached the diffusion stage in organizations and/or society. The FSM has reached the institutionalization stage and its

technology is becoming more and more prevalent in businesses and society. For example, the free software Unix-like operating system, Linux, is quite popular in businesses and is known for its high quality and reliability (Dedrick & West, Chapter 16, this volume).

The ultimate utopian vision of RMS is to replace proprietary software with free software all over the world. This vision is a driving force for many volunteers who design, create, test, and maintain free software on the many F/OSS development projects posted on Web sites. The FSF promotes the notion of freedom by posting many articles by RMS. “In Free Software is a Matter of Freedom?” (www.fsf.org), he states:

Society also needs freedom. When a program has an owner, the users lose freedom to control part of their own lives. And above all society needs to encourage the spirit of voluntary cooperation in its citizens. When software owners tell us that helping our neighbors in a natural way is “piracy,” they pollute our society’s civic spirit. This is why we say that free software is a matter of freedom, not price.

Elliott shows in her chapter that the success of the FSM in institutionalizing the field of F/OSS around the world is largely due to the strong belief system in freedom and free software that members share. In addition, the pervasiveness of being able to communicate and contribute to F/OSS development any time, anywhere in the ubiquitous computing era has contributed to the resounding success of F/OSS projects. However, even though the number of F/OSS projects registered on the SourceForge Web site (<http://sourceforge.net/>) has almost reached 1 million, there is a gap in the FSM vision and reality. Many people depend on and trust software vendors to maintain software, offer technical support, and customize the software for a fee as the customer requests. While many organizations have adopted F/OSS (especially the Unix-like

operating system Linux), the goal of replacing all proprietary software with free software is far-fetched and too difficult to achieve. Consequently, the FSM will most likely proliferate and continue to draw advocates to its cause for many years to come, thereby continually adding to the diffusion of F/OSS technology.

Although ubiquitous computing software development environments are in their nascent stages, some are now being used and promoted by F/OSS developers. For example, the MIT Project Oxygen has a vision of computation that centers on people, not machines. Several technical challenges await, such as the requirement that Oxygen systems must be “pervasive,” “embedded,” and “nomadic.” A nomadic environment refers to the ability of users and computations to move around freely, according to their needs. Software systems will adapt with minimal user intervention and without interruption to services they provide (www.oxygen.lcs.mit.edu/Overview.html).

F/OSS programmers who use the GNU/Linux operating system can now easily move from one location to the next by using the Knoppix GNU/Linux distribution. While not standard practice in all F/OSS projects, the Knoppix CD paves the way for ubiquitous computing in F/OSS development. The Knoppix distribution CD is a free/open source real-time Linux CD that boots and runs completely from CD. It includes recent Linux software and desktop environments, with several F/OSS programs such as OpenOffice.org and Mozilla as well as hundreds of other F/OSS programs. Users of Knoppix can work on software development on any hardware platform that accepts Linux. This gives F/OSS developers the ability to contribute to F/OSS projects “any time, anywhere.. We now discuss the ubiquitous computing dominant frame and how the vision of “seamless computing any time, anywhere” does not match up with reality in a study of professional executives using mobile devices.

Ubiquitous Computing [B]

The fifth frame that has more recently evolved and is ongoing in its conceptualization is ubiquitous computing any time, anywhere. Mark Weiser coined the term “ubiquitous computing” in 1988 at the Computer Science lab at Xerox PARC, Palo Alto, California. He envisioned future computing devices that would become invisible and fade into the background of people’s lives (Weiser, 1991). During the period 1988–1994, Xerox PARC built several experimental devices to support this vision in the form of “tabs,” “pads,” and “boards.” Tabs are inch-scale machines that resemble active Post-It notes – the pads are foot-scale ones that are similar to a sheet of paper (or a book or a magazine) and the boards (which are now commercial products) are yard-scale displays that are the equivalent of a blackboard or bulletin board. This research inspired the creation of many ubiquitous computing workshops and conferences.

The ubiquitous computing era promotes a utopian vision and dominant frame that people will be able to connect to other people and computers “any time, anywhere.” The social and the technical aspects of organizational and social life are melded together such that the technology purportedly will disappear into the background of our social lives (Sorensen & Gibson, Chapter 17, this volume). The CM outcomes of this vision are increased global access to information and increased awareness of freedom and information rights such as privacy. The ubiquitous computing movement emphasizes how the acquisition of technology enables one to connect “any time, anywhere” to business associates, friends, or family with such technology as PDAs (Allen, Chapter 4, this volume) and mobile phones (Sorensen & Gibson, Chapter 17, this volume) but at the same time results in sensitivity to information rights such as privacy.

Researchers, vendors, and magazine writers portray utopian visions of the advantages of being connected all the time, including the elimination of desktop PCs. Futurists predict that people will use “wearable computing,” with devices becoming part of clothing connecting people to each other via wireless technology. In the U.S. and Europe, mobile phones have become increasingly popular, providing access to the Internet, IM, digital cameras, computer games, video clips, and execution of Java programs (Mattern, 2002). Handheld Blackberries (www.rim.com) are becoming popular with business executives and university professors for constant e-mail access (Sorensen & Gibson, Chapter 17, this volume). As with other CMs, the vision of the ubiquitous computing CM does not always match up to reality in organizations, as shown in the study of business executives’ use of mobile devices in (Sorensen & Gibson, Chapter 17, this volume).

Connecting “Any time, Anywhere” – an Opaque Reality for Business Executives [C]

In Chapter 17, Carsten Sorensen and David Gibson investigate the extent to which the vision of ubiquitous computing is a reality for a group of sixteen professionals who use mainly mobile ICTs on a routine basis as an integral part of their work. Their study showed that all the core ICTs did not in fact disappear as in Weiser’s original ubiquitous computing vision but instead proved a stable and important aspect of working life, such as the mobile phone. Geographical mobility was a significant aspect of the daily existence of most of those interviewed.

The interviewees were highly skilled and educated professionals, selected as a representative sample of modern work life with advanced use of ICTs. Other indications that the participants were part of a networked society were that some had broadband Internet access at

home, some were globally mobile, and others spent 80% of their time working in clients' offices (increasing the demands for ICTs). The theme of the interviews was based on the day-to-day activities and use of ICT, how the ICT supported their work, and their opinions regarding acceptance of mobile and ubiquitous support. The questions generally focused on workplace technologies such as e-mails, workflows, database systems, desktop computers, laptops, enterprise resource planning computer-based systems, PDAs, mobile phones, pagers, etc.

The authors' results showed that the two main barriers for widespread mobile and ubiquitous support were bandwidth and battery life time. For example, two interviewees were from financial institutions that require broadband networked PCs in order to work at real-time speeds. Others complained about low battery life times and that depending on mobile devices required constant concern for adequate battery power. For example, a pediatric surgeon spoke about the importance of her pager's battery power: "*The battery runs out when you're in the middle of some emergency and they can't get to you.*" The empirical data from this study clearly suggest that the disappearance of ubiquitous computing devices into the background as smooth seamless support is not happening yet in professional executive environments.

The surprising conclusion was that the PDA was presented by the interviewees as a topic of failed adoption due to issues such as infrastructure standardization and poor usability because of short battery life. They concluded that one of the most promising technologies is the wireless e-mail client, like Blackberry (www.rim.com), which allows busy professionals to check and send e-mail while on the move. The basic conclusion from this study is that the ubiquitous computing vision of "computing any time, anywhere" is still an opaque reality.

Conclusions [A]

As the foregoing review of the dominant frames underlying CMs has shown, CMs are an important part of the real-world diffusion of computing innovations. They seem to be necessary to motivate diffusion and use because computer-based systems have historically been complex and difficult to use. We have shown that utopian visions appear in the ideology surrounding all CMs. These visions may not be realized even though the technology may become diffused. Alternatively, visions may become reformulated even though the underlying technology is similar. Subsequent movements may develop more refined visions that appeal to different audiences and also take advantage of newer technologies that overcome the limits and failures of earlier technologies.

By studying the emerging ubiquitous computing technologies from the CM perspective, one can explore the power of the utopian predictions and the true impact of ubiquitous computing devices on the melding of social and work life. Weiser (1991) suggested that ubiquitous computing devices should “disappear” into the background and become invisible in such a way that the work of everyday life can become indistinguishable from them. As these devices “disappear,” people can focus on true organizational goals. However, researchers have shown that this vision is not yet a reality (Sorensen & Gibson, Chapter 17, this volume). In the final chapter in this book we will consider the lessons learned from earlier CMs, plus the emerging lessons from new CMs related to early technologies of the ubiquitous computing era to develop generalizations about the likely diffusion, dominant frames, and outcomes of the ubiquitous computing era.

References [A]

- Benford, R. D., & Snow, D. A. (2000). Framing process and social movements: An overview and assessment. *Annual Review of Sociology*, 26:611-39.
- Blumer, H. (1969). Social movements. In B. McLaughlin (Ed.), *Studies in Social Movements: A Social Psychological Perspective* (pp. 8-29). New York: Free Press.
- Boh, W. F., Ren, Y., Kiesler, S., & Bussjaeger, R. (2005). Expertise utilization in the geographically dispersed organization. Working Paper. Pittsburgh, PA: CMU.
- Dasgupta, S., Granger, M., & McGarry, N. (2002). User acceptance of e-collaboration technology: an extension of the technology acceptance model. *Group Decision and Negotiation*, 11:87-100.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3):319-339.
- DiBona, C., Ockman, S., & Stone, M. (Eds.). (1999). *Open Sources: Voices from the Open Source Revolution*. Sebastol, CA: O'Reilly & Associates Inc.
- Dutton, W. H., & Guthrie, K. (1991). An ecology of games: The political construction of Santa Monica's public electronic network, *Informatization and the Public Sector*, 1(4):1-24.
- Elliott, M., & Scacchi, W. (forthcoming). Mobilization of software developers: The free software movement. *Information, Technology, and People*.
- Fountain, J. E. (2001). *Building the Virtual State: Information Technology and Institutional Change*. Washington D.C.:Brookings Institution Press.
- Gao, P. (2005). Using actor-network theory to analyse strategy formulation. *Information Systems Journal*, 15:255-275.

- Goffman, E. (1974). *Frame Analysis: An Essay on the Organization of the Experience*. New York: Harper Colophon.
- Iacono, S., & Kling, R. (1996). Computerization movements and tales of technological utopianism. In R. Kling (Ed.), *Computerization and Controversy: Value Conflicts and Social Change* (2nd Ed.) (pp. 85-105). San Diego, CA: Academic Press.
- Iacono, S., & Kling, R. (2001). Computerization movements: The rise of the Internet and distant forms of work. In J. Yates & J. Van Maanen (Eds.), *Information Technology and Organizational Transformation: History, Rhetoric, and Practice* (pp. 93-136). Thousand Oaks, CA: Sage Publications.
- Jones, T. Y. (2005, June 23). Teens Get The Message. *Los Angeles Times*, p. A1.
- Kiesler, S., Siegel, J., & McGuire, T. M. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist*, 39(10):1123-1134.
- King, J. L, Kraemer, K. L., Gurbaxani, V., McFarland, F. W., Raman, K. S., & Yap, C. S. (1994). Institutional factors in information technology innovation. *Information Systems Research*, 5(2):39-169.
- Kling, R., & Iacono, S. (1988). The mobilization of support for computerization: The role of computerization movements. *Social Problems*, 35(3):226-242.
- Kling, R., & Iacono, S. (1995). The mobilization of support for computerization: The role of computerization movements. In S. L. Star (Ed.), *Ecologies of knowledge: Work and politics in science and technology* (pp. 119-153). Albany: State University of New York Press.
- Kling, R. & Scacchi, W. (1982). The web of computing: Computer technology as social organization. *Advances in Computers*, 21:1-90.

- Kraemer, K. L., & King, J. L. (1982). Telecommunications/transportation substitution and energy conservation. *Telecommunications Policy*, Part I, 6(1):39-59 and Part II, 6(2):87-99.
- Lamb, R. & Kling, R. (2003). Reconceptualizing users as social actors in information systems research. *MIS Quarterly*, 27(2):197-235.
- Mander, J. (1991). *In the Absence of the Sacred: The Failure of Technology and the Survival of the Indian Nations*. San Francisco: Sierra Club Books.
- Mattern, F. (2002). Ubiquitous computing: scenarios for an informatized world. Working Paper. Zurich:ETH.
- McCarthy, J., & Zald, M. (1977). Resource mobilization and social movements: a partial theory. *American Journal of Sociology*, 82(6):1212-1241.
- Nilles, J. (1983). *Micros and Modems: Telecommunicating with Personal Computers*. New Jersey: Prentice-Hall.
- Nilles, J. (1998). *Managing Telework: Strategies for Managing the Virtual Workforce*. New York: John Wiley & Sons.
- Nilles, J., Carlson, F. R., Jr., Gray, P., & Hanneman, G. J. (1976). *The telecommunications-transportation tradeoff: Options for tomorrow*. New York: John Wiley and Sons.
- Orlikowski, W. J. (1992). The duality of technology: rethinking the concept of technology in organizations. *Organization Science*, 3(3):398-427.
- Orlikowski, W. J. (2000). Using technology and constituting structures: a practice lens for studying technology in organizations. *Organization Science*, 11(4):404-428.
- Orlikowski, W. J., & Gash, D. (1994). Technological frames: Making sense of information technology in organizations. *ACM Transactions on Information Systems*, 12:174-207.

- Rogers, E. (2005). *Diffusion of Innovations*, 5th Ed. New York: The Free Press.
- Schuler, D. (1996). New community networks, wired for change. Retrieved December 5, 2005, from <http://www.scn.org/ncn>.
- Snow, D. A., Rochford, E. B., Worden, S. K. and Benford, R. O. (1986). Frame Aainment processes, micromobilization, and movement participation. *American Sociological Review*, 51:464-481.
- Snow, D. A. & Benford, R. O. (1988). Ideology, frame resonance, and participant mobilization. *International Social Movement Research*, 1:197:218.
- Snow, D. A. & Benford, R. O. (1992). Master frames and cycles of protest. In A. D. Morris & C. M. Mueller (Eds.), *Frontiers in Social Movement Theory* (pp. 133-135). New Haven, CT: Yale University Press.
- Sproul, L., & Kiesler, S. (1991). *Connections: New Ways of Working in the Networked Organization*. Cambridge, MA: MIT Press.
- Thompson, V.A. (1965). Bureaucracy and innovation. *Administrative Science Quarterly*, 10(1):1-20.
- Tornatzky, L.G., & Fleischer, M. (1990). *The Processes of Technological Innovation*. Lexington, MA: Lexington Books.
- Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. (1998). Virtual teams: technology and the workplace of the future. *The Academy of Management Executive*, 12(3):17-29.
- Useem, B., & Zald, M. (1982). From pressure group to social movement: organizational dilemmas of the effort to promote nuclear power, *Social Problems*, 30(2):144-156.

- Venkatesh, V. (2000). Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model, *Information Systems Research*, 11(4):342-365.
- Venkatesh, A., Chen, S., & Gonzalez, V. M. (2003). A study of a Southern California wired community: Where technology meets social utopianism. Working Paper, Irvine, CA: Center for Research on Information Technology and Organizations, UC Irvine.
- Venkatesh, V., & Morris, M. G. (2003). User acceptance of information technology: toward a unified view. *MIS Quarterly*, 27(3):425-478.
- Weiser, M. (1991). The computer for the 21st century. Pre-press for *Scientific American* article, available at <http://www.ubiq.com/hypertext/weiser/SciAmDraft3.html>.
- West, D. M. (2004). State and federal e-government in the United States. New York: Center for Public Policy, Brown University, available at <http://www.OutsidePolitics.org>.
- Westin, A. (1967). *Privacy and freedom*. New York: Atheneum.
- Westin, A., & Baker, M. A. (1972). *Databanks in a Free Society: Computers, Record Keeping and Privacy*. New York: Times Books.
- Williams, S. (2002). *Free as in Freedom: Richard Stallman's Crusade for Free Software*. Sebastopol, CA: O'Reilly & Associates.
- Zhu, K., Kraemer, K.L., & Xu, S. (forthcoming). Assimilation of electronic business by firms in different countries: a technology diffusion perspective. *Management Science*.

Endnotes [A]

¹ Psion PLC was founded in Britain in the early 1980s as a software company, but shifted its focus in the late 1980s to pocket-sized computers for business executives. In 1991, it released the Series 3 pocket-sized computer, which was a success.

² Palm Computing was founded in 1992 and its first products were application software for PDA handwriting recognition and desktop connectivity. However, its software business did not flourish so it decided to develop its own version of a PDA in 1996. The PalmPilot became one of the fastest-selling computing products of all time.

Figure Names for Chapter 1

FIGURE 1.1 Computerization Movements – Relationship between Discourse, Dominant Frames, and Organizational Use and Practices

FIGURE 1.2. Conceptual Model of Life Cycle of Computerization Movements