1 INFORMATION TECHNOLOGY AT THE TURN OF THE MILLENNIUM: PAST, PRESENT, AND FUTURE TRENDS

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In discussing this conference and the introduction to the proceedings, we found ourselves engaged, quite predictably, in lively conversation about "the times" in which we are living. We talked about information technology and its role in the knowledge economy: the pace of change and the extent to which we were, or weren't, living in unusual or accelerated times. We speculated that each era most likely saw itself as unique and important—where the contributions, struggles, and experiences of its people were unlike that of any other. Indeed, each is unique *but* the nature, import, and legacy of those times remain for us to debate.

What, then, is special about our time? Could it be the very sensitivity that we, as a global community have internalized about time itself: what change means, what access and information-flow enable, especially as we approach 2000, that most daunting marker? Perpetually, we live and work on "fast forward" in an environment where the only constant seems to be change. In his keynote, Peter Cochrane tells us:

> We are living at a time of unprecedented change with technology advancing faster and producing more new opportunities and problems than ever before. Computers and telecommunication (IT) have not only created the means to generate even more information and do more in a shorter time, but they have also created the means of

> storing, accessing and transporting information on a scale that was inconceivable just 10 years ago.

And he warns us of the irony:

> [If we] are to keep up with a world of technology, that is increasingly changing faster than we can now accommodate, we have only one course of action. We have to embrace technology to cope with the changes introduced and provided by technology.

These are important issues to debate. Past events, as represented to us in history books and through news media, document ecological catastrophes and cleanups, population movements of great magnitude, long-standing wars, systematic suppression and repression, economic upheaval, and, indeed, dramatic changes in technology. People who have lived through epochal shifts and transformations might claim that the changes we are experiencing are relatively benign in nature and limited in scope: minor reorientation within larger patterns of global change. When considered against the political and environmental problems we face today, we might liken IT change to the ripples and rings that form after we have tossed a pebble into calm waters. A tidal surge three hundred feet high may be close by.

In keeping with the principle of "bounded rationality" (Simon 1955, 1956, 1991), perhaps we, as "inner members" of the IT clan, have become a little obsessed with IT change and with change for change's sake. Is our objectivity compromised? Is the development and use of IT so anchored in the industrialized Western societies' culture, norms, and economies that we privilege the IT-related changes that claim to make our lives so special?

The true pace of change may not be as rapid as we think; and we may have a significant wait before IT performs as intelligently as humans do—if ever (Stork 1997). In computing studies, it has long been thought that IT would prompt radical shifts in organizational structure and in how work is performed. Here, also, social transformation has not occurred as swiftly as predicted. In 1958, Leavitt and Whisler anticipated that in the 1980s the use of mathematical programming, operations research, and simulation of higher-order thinking through computer programs would become part of the manager's daily routine. Use of the computer would alter managerial work and shrink the middle management layer. For decades these changes eluded us (Hunt and Newell 1971).

More recent developments confirm some of Leavitt and Whisler's predictions (Applegate, Cash, and Mills 1988). Today, the middle management population is reduced. Newly introduced management control systems, executive information systems, telecommunication networks, e-mail, topic-specific global databases, office automation, standard packages, data warehouses, and the multi-media web are just some of the IT services that have facilitated these changes. Leavitt and Whisler speculated that modern computer use would lead to centralization. Today, however, we see centralization, decentralization, and outsourcing occurring simultaneously. And as the role of middle managers shifts from control (over the execution of planned activities) to feeding organizational innovation processes, the need for managers may climb again (Dutton and Ashford 1993).

IT advancements over the past decade still have tremendous usage potential, as yet unexploited and unexamined. Some developments may have questionable benefit for a host of reasons, including cumulative effect and social consequence. For example, what

may be a sound or reasonable decision for an individual organization may, in sum, have problematic social ramifications. Centralization of knowledge and increased efficiency threaten to jeopardize full employment for all (Rifkin 1995).

In 1996, the European Commission recognized precisely these issues in its green paper on the challenges raised by the transition to the information society. The paper acknowledged that while the adoption and widespread use of information and communication technologies offer great opportunity for the creation of wealth and increased standards of living, there are many concerns still to be reckoned with about the impact of the information society on the quality of life. Two key questions are framed:

- Will these technologies not destroy more jobs than they create and will people be able to adapt to the changes in the way they work?
- Will the complexity and the cost of the new technologies not widen the gaps between industrialized and less developed areas, between the young and the old, between those in the know and those who are not? [European Commission 1996]

Meaningful employment for all is clearly a foundation for developing and securing democratic rule. We suggest that the least problem we are facing is that "perfectly reasonable micro decisions make macro nonsense" (Van de Ven, 1986); the real challenge is that "perfectly reasonable micro decisions may make macro calamity." With regard to the IT development process, we recognize a tendency to choose overly simple models. For example, many researchers hold to Rogers' (1995) diffusion of innovation theory, even though there is ample evidence that the theory only works under limited conditions (Wolfe 1994) and that complex innovation processes usually do not evolve along simple paths (Van de Ven and Poole 1995). The information society promises to bring fundamental changes to how we do our work—changes requiring us to rethink our systems and to build complex, dynamic models and simulations: to discover new balances between flexibility and reliability, generalizability and specificity, and innovation and stability.

We may disagree on the magnitude and meaning of the present rate of change in IT. However, there is general agreement that knowledge management represents a major driving force behind organizational learning and change (Argyris and Schon 1996; Brown and Duguid 1991; Lundberg 1991; Nonaka and Takeuchi 1995). As part of an ongoing process, every private and public organization must decide how to utilize IT to gain competitive advantage and support core competencies. Change is something that many of us have to deal with and often: it is not reserved for the elite, for top managers, top engineers, R&D or formal organizational units mandated with innovation. Our ability to manage knowledge and handle change feeds more requirements for flexibility and malleability, in turn raising expectations for products and solutions tailored for smaller and smaller target segments—to *our* needs. Increasingly, tailoring and customization are becoming core activities. This, then, is our pragmatic platform: IT-related change is a part of our everyday lives; we must address these changes to the best of our ability to increase the probability of utilizing this tool to our benefit.

Many books and articles have been published about positive and negative impacts from IS/IT development and use. Examples of impact areas addressed include business value, organizational effects, (work) group effects, deskilling, and effects on the individual level. Within each of these broader areas, economic benefit or loss, magnitude of change, impacts on the formal and informal social structure, changes in job content, and information satisfaction have been explored. Research and trade publications, in

business and public administration, are positioned on all managerial levels: strategic, tactical, and operational.

The subjects we have been discussing here—technological advances that outstrip our understanding of consequences and raise quality of life issues, rapid change in dynamic environments, tendencies to mass customization; the space between being data rich and information poor—are symptomatic of the tensions that many of our conference contributors are seeking to address and critique. From inside this experience, we pause to share ideas and raise questions, to reflect on implications, on hard problems and challenges. The conference, then is a "time out," as it were, to engage in dialogue and exchange of information in the spirit of enquiry.

Conference Theme and Objective

This working conference has been designed to tap new insights and knowledge and bring multiple perspectives together: a WG8.2 focus on organizational and human issues and a WG8.6 focus on the processes of diffusion and innovation.

The Twenty-First Century economy is taking shape. As ideas turn over with increasing rapidity, knowledge and experience are at a premium. Process engineering is giving way to workflow management; object technologies are maturing; and knowledge management is the dominant issue for senior managers. We must make the best use of whatever partial knowledge is available to us. How can we combine highly focused research with the broad lens of experience? How can we make theory practical and practice generalizable?

Since we need to integrate our understanding of the field, as well as envision the challenges ahead, the working conference objective is to present practical and theoretical frameworks that explore the many-faceted nature of IS/IT-related change. Of special value is the coupling among theoretical thinking, effects exploration, and practical managerial guidelines. As we approach the 21st century, we must ask: what do we envision in IS/IT development and use? How might we integrate our understanding of knowledge, processes, and technologies in the organizations of the future, to better serve learning and work?

A joint working conference between IFIP WG8.2 and WG8.6 promises to create a rich forum for addressing the themes and concerns we have discussed here. Three keynote papers were invited from Peter Cochrane, Robert W. Zmud, and Peter B. Checkland; the first two are included in the proceedings. The call for papers brought a total of 65 contributions. The blind review involved three referees per contribution. The program committee and the co-program chairs selected 33 papers, position statements, panels, and tutorials. Contributions were revised by authors, in light of reviewers' and co-program chairs' comments, for inclusion in these proceedings.

Contributions at a Glance

Keynote Addresses

In his address, "A World of Bits," Peter Cochrane puts forth his views on how IT impacts our societies and organizations—past, present, and future. He advocates that IT will lead to drastic changes. Although IT may not yet offer all the services we need in

every respect, solutions will be developed. The future requires continuous learning, adaptation, and the willingness to innovate. Robert W. Zmud's presentation, "Conducting and Publishing Practice-Driven Research," elaborates on what it takes to ensure high quality research in collaboration between academics and practitioners. The benefits are usable and valuable results for practice: projects executed in an objective and rigorous manner, and documented insights from the domains of both practice and academia. Peter B. Checkland has entitled his talk "Is IS IT, or IT IS?" He elaborates on whether IT or IS is the driving force behind the scene. His address is based, in part, on his recent book with Holwell (Checkland and Holwell 1998).

Submissions Accepted Based on the Review Process

The invitation for contributions left considerable room for how authors would position their work; thus, the accepted contributions cover a wide range of themes and issues. We divide them here in three broad categories. The first contains material that is oriented toward IT and IT development. The second broad category includes cases where theory is used as a starting point for discussion or for identifying research models. Our third category is made up of contributions related to educational issues. These three categories are not absolute: rather, our decisions were based on interpretation of the primary emphasis and approach of each work. There are places of overlap where boundaries are not precisely defined.

IT and IT Development

Virtual Realities

Using illustrations from a university setting, Greenhill explores the couplings among concrete ISs and organizational as well as individual information processing. The virtual reality may be interpreted as a synergy effect, which occurs when information is interpreted and processed across time and space. Howcroft and Fitzgerald use the Internet as their baseline to illustrate that a technologically deterministic view frequently results in conclusions that are utopian and dystopian. They observe that technology outcomes are most appropriately understood in a social context.

Software Engineering Practice

As part of an ongoing ESSI-PIE project, Riva and Agostoni explore software quality approach in medium and small size development organizations. They base their work on software reuse and its efficiency. Aaen and Damsgaard focus on the manager's role in software process improvement. They argue that the traditional utilization of standard activities and directives have limited usability. Managers must employ other means, for example, allocation of resources and incentives. Iversen, Nielsen, and Nørbjerg focus on how software quality may be increased. They study problem diagnosis among project managers as the vehicle for identification of critical issues. They recommend that

problem diagnosis should be used actively to formulate commitment structures. For Harvey, positive software development outcome depends on how well (user) needs are articulated. Foucault's theory of power relations is used to explore this issue. Issues and problems within requirements engineering are discussed in a panel with Morris, Masera, and Silva.

Theory

Knowledge Management: Intra- and Interorganizational Issues

Knowledge management is a broad field. As with many theoretical umbrellas of a general nature, writers differ substantially with respect to definition and approach. Schultze explores these contradictions. Baskerville and Pries-Heje find that the key result of knowledge management is the transition of focus from project management to managing innovation capability. In organizations that rely heavily on innovation, Seppänen, Kurki, and Alajoutsijärvi find that fault diagnosis within the R&D competence network play a vital role. Loebbecke, van Fenema, and Powell introduce game theory to develop a framework for understanding the sharing of knowledge among competitors. Knowledge sharing may result in competitive advantage, but competitors may also use the gained knowledge to increase their own market share and value.

Collaboration Technology and Workflow

Karsten uses commonly accepted prerequisites for achieving collaboration as the baseline for an analysis of real deliveries in 15 Lotus Notes cases. She concludes that actors' views and actions determine the outcome: the inherent IT capabilities do not. Monteiro and Hepsø observe that, due to lack of predefinition, the extensive use of Lotus Notes in a major oil company led to a series of decision drifts and improvisations. They found that although these uses were not preplanned, the continuous infrastructure realignments that had to be executed were not arbitrary but formed in accordance with business needs.

Theory as a Vehicle for Exploration

How can theory assist us in understanding the complex interactions between humans and technology? Hemingway defines the social characteristics of knowledge, reason, and action as the elements in problem solving. This is the basis used to explore the impacts of IT on individuals and individuals engaged in collective problem solving activities. Structure and symmetry are key IT characteristics. According to Jones, their relationship to social elements and structure may be better understood in the context of structuration theory and actor network theory. In their panel, Myers, Robey, Sauer, and Walsham discuss whether practical and theoretical frameworks help us in understanding our field or if these "articulations of stability" interfere with and distort our knowledge.

Actors and Networks in Systems Development

Broadly speaking, the four contributions in this section address systems development issues. In order to avoid fragmentation, Gasson sets forward a social action model as a single theoretical platform guiding the systems development process. The main benefit is the rejection of predefined goal structures and the adoption of recursive goal definition throughout the design process. In Kaplan's opinion, a social interactionist framework serves as an effective vehicle for evaluating communication, care, control, and context issues. McMaster, Vidgen, and Wastell observe that the limitation of traditional socio-technical theory is that it views technology and the social setting as two separate entities. An actor network process model has the potential to allow the creation of a single collective view, as illustrated by the case of the Van Sant map of the earth. The need to integrate the technology and the social system of the user is also illustrated by Urquhart. The focus here is on the communication between system analysts and their (user) clients.

Information Systems Strategy

Levy, Powell, and Yetton show us that IT plays a critical role in small and medium sized business organizations. The use of IT is not only a question of cost reduction. Because IT has principal business value to SMEs, use varies among these organizations. Butler and Fitzgerald also conclude that need determines IT strategy. They observe that businesses must focus on the process by which IT systems are developed and implemented.

Standardizing Information Systems

The assumption that every organization is unique often underlies the view that business needs determine IT strategy and that every process development undertaking is different. However, organizations may also benefit from common IT applications and the utilization of standards in the development process.

Application Packages

Damsgaard and Lyytinen focus on EDI in electronic trade. They show us that differences occur in actors involved, development processes used, and design characteristics. Theoretically, models that expand beyond individual organizations are needed. Not only should we expect to see differences between organizations; Leist and Winter convincingly argue that application-package implementation differences also occur within organizations. The effects are differences in modules used and in parameter settings among users. Their next step is the discussion of automation cost as the basis for defining business process steps. Clearly, the notion of what a standard application is must change from the product as such, to how the product is embedded into other systems and how parts of the application are used.

Methods and Models

The development of a common student record among five universities is the focus for Heiskanen, Newman, and Saarinen. They use a social process model to describe the development process and the choices made. While Heiskanen, Newman, and Saarinen explore development standardization within one type of organization, Bauer and Glasson investigate the role of reference models in the diffusion process. The transition involves the use of a banking model to develop an Internet education delivery administration system. The prerequisite for success is that generic similarities between the two industries exist.

Change and Change Drivers

Brooke, Ramage, Bennet, and Gold observe that many organizations have a portfolio of IS that is not developed in accordance with changing business requirements. They propose a legacy system that would assist stakeholders in assessing the costs, risks, and benefits of various methods of technological change. This would allow the organization to move from the status quo to the new technological picture defined in the legacy system scenario. Kirveennummi, Hirvo, and Eriksson focus on structural, managerial, user, and technical barriers. They propose an evaluation and development framework utilizing these barrier areas in combination with the process of unfreezing, changing, and refreezing. In their panel, Agarwal, Ross, and Sambamurthy discuss innovation. They focus on the issues of the management of IT skills, IT infrastructures, and IT relationships for nurturing IT-based innovation.

IS/IT Education: In Academia and Practice

Huynh's tutorial considers the use of groupware by presenting a systematic classification, ideas on how the technology might be used in classroom settings, and lessons learned from experience. Adams observes the need for new requirements for doctoral programs. He addresses recruitment concerns, the difference of focus in practice and academia, and the multidisciplinary nature of IS. According to Fielden, our traditional IS education system does not prepare our student for the true state-of-affairs in the practical world. Fielden outlines new educational principles based on the belief that working within IS requires the ability to accept change as the order of the day. Finally, Fielden recommends that we focus on higher-order thinking skills, communication skills, personal issues, and organizational understanding. Kautz, Malmborg, Pries-Heje explore the role of formal university education in the dissemination of systems development methodologies. In an empirical study, they analyze the diffusion of university taught systems development to individuals and organizations.

Concluding Remarks and Acknowledgments

Professionally, we have benefitted greatly from our experience as co-program chairs. As might be expected, we have read many more conference contributions in more areas than we might usually have done. Our own opinions were thoroughly tested throughout the reviewing process. Necessity taught us much about conference administration and about how the web can be used to support collaborative work, efficiently and with high quality.

First and foremost, we thank our co-editor, Janice I. DeGross. Without her on the team, this proceedings would never have been completed with quality on time. We extend our gratitude to our keynote speakers for their willingness to come forward and contribute to making this event an exciting professional conference. In addition to thanking WG8.2 and WG8.6 officers, the general and organizing chairs of this event, and our program committee, we take this opportunity to express thanks to our own organizations for their support: they have only asked what more could be done to assist us further. Special thanks to our families and friends who (once again!) accepted with patience and loving care that we spent considerable time at work to make the conference happen.

We hope that you will find the material presented in this proceeding stimulating and the discussions at the conference insightful.

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Tor J. Larsen and Linda Levine
Co-Program Chairs

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