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Journal

Twenty-Third Annual Hawaii International Conference on System Sciences, 3

Authors

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Publication Date

1990

DOI

10.1109/hicss.1990.205394

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SOCIAL ANALYSIS IN MIS: THE IRVINE SCHOOL, 1970-1990

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ABSTRACT

The Irvine School of research and instruction in information systems is distinct in its focus on the social and organizational implications of information technology. Over two decades, the Irvine School has developed and employed empirical research methods to study automation in a wide array of organizations. In the process, the school has produced a number of seminal findings on the nature of innovation, the politics of technological change, and the effects of computerization on productivity, performance, and work life. The major approaches of the school are discussed, the essential findings of the research are reviewed, and emerging directions are presented.

INTRODUCTION

The Irvine School of research and instruction in information systems was born in the early 1970's with a series of studies on policies for managing computing and assessing the impacts of computing in American municipal corporations¹. The intellectual base of the research was the literature on technical innovation and organizational change. The practical motivation for the research was a desire to address the problems and issues facing managers of organizations in implementing advanced systems, and to assess empirically popular predictions about the impact of the use of information technology on organizations. Since that time research and instruction in information systems at Irvine has involved faculty and doctoral students from management, computer science and social science, working separately and in teams, concentrating on the social, management and economic aspects information technology in complex organizations. The original foci of the Irvine research program have remained, but in recent years the scope of the program has broadened to incorporate interests of new faculty and graduate students.

Today the Irvine School maintains a highly interdisciplinary program of research and graduate education through a cross-unit program in Computing, Organizations, Policy and Society (CORPS). This program involves faculty from Management, Information and Computer Science, Sociology, Political Science, and Economics. CORPS instruction is targeted primarily toward the Ph.D. level, although CORPS elements form part of the B.S. curriculum in Information and Computer Science, and the MBA and MBPA programs in Management.

The Irvine School is probably best known for its approach to research in the information systems field. Therefore, the balance of this paper discusses the salient features of research at Irvine. This paper first describes these features of the Irvine research program in detail, then describes contributions from the program. The paper concludes with a discussion of emerging directions of the program.

NATURE OF THE IRVINE RESEARCH PROGRAM

From the beginning of its work in the early seventies, seven features have characterized the Irvine school. These include: (1) social analysis of automation, (2) multiple perspectives in research, (3) a critical stance towards automation, (4) a focus on technical innovation and organizational change, (5) an empirical research strategy, (6) an emphasis on history and change over time, and (7) a concern with policy implications of automation.

Social Analysis of Automation

Research in MIS is distinguished by two major models. The first is engineering oriented, concerned with moving from concepts to prototypes to production and operation of systems. The engineering aspect focuses primarily on the characteristics of technology, and on the design, development, implementation and operation of the technology in various application domains. The second is social analysis to develop explanations for consequences of use of information technology. This research moves from the impacts of the technology to the causes leading to the impacts. Social analysis focuses on the human and behavioral aspects surrounding the introduction, adaptation, use and continuing innovation with the technology. In the process, it incorporates analytical perspectives from all of the social sciences, and examines the effects of information technology at the level of role types, groups, organizations, institutions, social networks, and other social entities. Social analytic perspectives are illustrated by studies of the effect of information technology on the nature of work and work organization, on the behavior of individuals and groups as economic entities, the character of decisionmaking, and the distribution of power throughout organizations. [3, 12, 16, 17, 18, 19, 27]

The Irvine school incorporates an engineering oriented perspective through the participation of Information and Computer Science, as well as in special projects on systems analysis and design. And recent projects have been designed to integrated development and

analytic perspectives more closely. Nevertheless, the most notable distinguishing characteristic of the Irvine School's work is its special attention to social analysis. Scholars at other institutions share similar concerns, but there is no other group that covers such a wide variety of social analytic views².

Multiple Perspectives in Research

Social analytic research requires understanding and use of multiple disciplines for viewing the interaction of technology and organizations. As noted above, the Irvine School's work uses perspectives from engineering and computer science, and several of the social sciences (management, political science, economics, sociology and psychology). Perhaps more important than the multidisciplinary character of this research, however, is the use of multiple intellectual perspectives on fundamental causes of social change.

All meaningful explanations of the social aspects of the use of information technology proceed from an ideological base. Every scholar has interests and values that influence the theories and explanations they construct. These interests are important not only in prescriptive work; they figure markedly in the descriptive and explanatory work in the field. By recognizing the fact that explanations are at least in part ideological, and that ideology is an essential and required component of social analytic work, we are able to "triangulate" on a set of facts from several explanatory positions. This permits social phenomena to be explained more comprehensively and precisely by gathering insight from each point of view, and using contrasting elements from various perspectives to test the intellectual coherence of alternative perspectives. The multiple perspectives approach provides increased self-consciousness during observation and explanation, and increased precision from having explicit perspectives that can be examined in light of the facts and other perspectives for explaining the facts. [13, 19, 27]

The dominant analytical perspectives in the MIS field have traditionally been tied to the supply-push world of technical development, coupled with a rational-economic interpretation of managerial behavior. These explanatory perspectives have considerable power, and have yielded useful results. However, they have distinct limits. Technological determinism and narrow managerial rationalism do not explain the variance observed in the patterns and processes of adoption and routinization of information technology in various tasks, and fall far short of explaining the considerable differences in successful use of the technology across organizations. Indeed, such perspectives are at a loss to explain the fact that "success" in use of information technology is singularly elusive. As economist Eliot Soloway has stated so succinctly, the effects of the information revolution have shown up everywhere but in the profit figures.

There certainly are technical and economic-rational elements to be considered in understanding information technology in organizations. Missing, however, are the more finely grained explanations of volition in shaping behaviors of those that adopt and use the technology, or that react to the effects of its use. While it is clear that information technology has brought major opportunities for change to organizations, it is the individuals and features

of the organizations within which they work that determine whether given technologies are adopted and how they will be absorbed into the complex of factors operating in complex, modern organizations. Organizations are political, social and managerial constructions that involve interactions among competing and cooperating groups, each of which seeks to pursue some mix of its own and common interests, within the framework of broader organizational and social constructions of what is appropriate and expected. Since the true consequences of using information technology are unforeseeable, the actions of individuals in organizations are always based to some extent on faith, social pressure, perceived political advantage, and other factors, in addition to "cost-benefit" calculi covering applications to given activities. [4, 20]

The multiple perspectives approach can be difficult to use due to a variety of definitional and measurement problems. Nevertheless, this approach is essential to maintaining robust research programs dealing with complex phenomena such as the effects of information technology use in organizations.

A Critical Stance Toward the Subject

Research in the Irvine School proceeds from a critical stance. It is concerned with challenging existing ideas, examining expectations about technology and organizations, and counteracting unsubstantiated biases in both. It focuses particularly on the important role played by ideology and expectations in the use of information technology. The expectations of managers and others in the organization influence the choices they make in adopting and using the technology. Managers who believe in technological solutions are likely to introduce information technology on faith, while discounting other considerations. And experiences with technology shape future expectations about the efficacy of technology in meeting organizational needs. The ongoing relation between expectations and outcomes is a crucial part of understanding the dynamics of information technology in organizations and how their future expectations are affected.

Research from the Irvine School suggests that there is often a gulf between expectations and subsequent experience with the technology. It is important, therefore, to start from common expectations and accepted explanations, and then attempt to corroborate them with empirical evidence. When the corroboration is incomplete, explanations can be modified, expanded or displaced in order to develop a more accurate fit of theory with the facts. The combination of the critical stance and the multiple perspectives approach reveals biases inherent in popular claims, and provides leverage to think critically about alternative explanations. [13, 16]

A Focus on Technical Innovation and Organizational Change

The Irvine school is widely recognized for its focus on the organizational and social impacts of information technology. This is a central interest of the Irvine researchers, but not the only interest. Less well known is the more comprehensive effort of the Irvine School to understand the relationship between technical innovation and organizational change. In this endeavor, information technology is simply one of several possible organizational

technologies that might be studied. The Irvine work contains descriptive elements, but its more basic concern is with why changes occur and why other possible changes do not occur.

The conception of change followed in the Irvine research is richer than the simple one-way causality implied by the impacts research label. It is that technology and organizations are interactive. Organizations adopt the technology for complex social reasons, and adapt the technology to their ends in a dynamic manner as new circumstances evolve. Organizations are affected by their use of the technology in the process of adaptation, and continually deal with consequences that are anticipated and unanticipated, desirable and undesirable. We are interested therefore in examining the reciprocal relations between technology and organizations. The Irvine Research examines the reciprocal relations between technology and organizations to determine how these iterative processes of action and consequence shape overall growth in use of the technology. This concern with consequence-explanations and interactive effects over time has led to dependence on longitudinal research and the development of evolutionary models, as discussed below.

Organizations are the Irvine School's primary units of analysis, although specific projects adopt different units. The focus on organizations serves several purposes. Organizations are the largest users of information technology, which makes the study of them relevant and convenient. Even the use of computers in the home has proven to be an adjunct to organizationally-based computer use in the form of supplemental work-at-home or school work. Organizations are also of central interest to management, which is a concern of most of the Irvine researchers. Study of organizations finally provide an effective means of addressing the broader societal impact of the technology, through both intra- and interorganizational studies. The focus on organizations naturally imposes some limits on the questions that can be addressed, but the range of coverage is still broad. The research coverage of Irvine projects has spanned from role type at the "individual" end of the spectrum, up through the work group, department, division, organization, sector, and institution levels at the "society" end. [3, 4, 12, 19, 20, 24, 27]

The Irvine school is noted for its work in governmental organizations, and the largest project of the group has been oriented towards local government agencies. However, this should be seen in the context of the larger objectives. Local governments provide a productive venue for long-term study, and have traditionally been a setting for important research in organizational structure and behavior. The venue of the research is less important than the overall objective, which is to develop sound explanations of change first, and generalize those explanations to other sectors second. Moreover, the Irvine School pursues work in other sectors as well, including central and state governments, international agencies, business organizations, and households.

An Empirical Research Strategy

A dominant outward characteristic of the Irvine school is its empirical orientation, especially *in vivo* studies of living organizations in the field as opposed to *in vitro* laboratory studies. This focus is required by the subject of

the research. Organizations are not reproducible in laboratory settings. This mode of study requires sustained work by teams of researchers. The teams usually include graduate students working on Ph.D. dissertations and professional, Ph.D. level research staff to assist with fieldwork. However, the principal investigators must be involved directly in the fieldwork and interpretation of results. Many of the most important insights from the research derive from first-hand observation.

The empirical research tradition of the Irvine School involves a mix of quantitative and qualitative research methods. A major component of the research over the past fifteen years has been large-scale survey research, but this work is nearly always augmented by detailed qualitative studies. The mixing of qualitative and quantitative methods is consistent with the use of multiple perspectives in the formation of research questions and explanations, by providing comprehensive and valid evidence for understanding the social aspects of information technology. Qualitative research permits concentration on micro issues, which prove to be important to understanding how things work and why they work the way they do. However, qualitative work is usually so labor-intensive that only very small populations of organizations can be studied at one time, limiting generalization. Quantitative work such as survey research enhances validity of findings by investigating a larger population. This not only provides an overview of conditions, and a check on the generalization of findings from qualitative work, but also suggests where further qualitative work would be fruitful. This mix of approaches is a particularly strong feature of the Irvine School's research³. [4, 20, 22, 27]

Although most of the Irvine School's research is empirical, analytical and historical research also play a role. Some questions of importance cannot be studied using conventional tools of empirical social science research. For example, the long-term implications of the use of information technology for democratic government cannot be assessed in the present by watching and waiting to see what happens. Yet, the questions raised are important, and need to be addressed now. Some scholars argue that the technology potentially poses basic threats to constitutional freedoms. Others argue that the technology provides the means for achieving higher levels of participation in government. And still others argue that the technology basically fits into the existing arrangements of democratic government. This issue must be approached through an assessment of the historical context of democratic government, past experiences with major technological and social innovations, and construction of analogies to information technology. When specific information on the institutions of democratic government are lacking, one must extrapolate from what is known about other organizational and institutional settings. By understanding the interplay of technology and social circumstances at these levels, it is possible to gain insight about the probable consequences of technology and democratic government. [7, 20, 24]

These types of issues influence two other aspects of research in the Irvine School: the programmatic nature of research and the focus on specific institutional sectors. Individual projects are usually conceived as part of longer term research programs concerned with basic research questions that require long term, large-scale research. However, projects are used to answer specific questions in

the expectation that other similar projects will provide answers which build up to the larger, more basic question.

In addition, the Irvine school is noted for its work in the governmental sector, even though work is conducted in the office, the factory and the home as well. Concentration on the government sector fits a tradition of organizational studies that have found governments to be a good venue for research. By studying public organizations one is better able to control environmental variables and to understand them. Environmental variables are potentially overwhelming and can swamp the results in studies of private organizations, especially when the organizations are in volatile and highly competitive industries. Business organizations appear much more susceptible to environmental factors, such as competition, business cycles, and economic change, than do government organizations. Thus, while the Irvine school is known for its work in the public sector, this feature is less important than the fact that the public sector has proven to be a useful and effective venue for study of the technical innovation and organization change.

An Emphasis on History and Change Over Time

The Irvine School's broad interest in understanding the ways in which technology is adopted and adapted, and the effects of technology use on subsequent organizational behavior, entails a focus on change over time. The larger projects in the Irvine research stream are designed around this focus, and as such, incorporate longitudinal research methods. The scope of the projects varies, from the Project NOAH (National Outlook for Automation in the Home) [30, 31, 32] two-year study of computing in households, to the Desk-Top Project's three-year study of computing in office work [20], to the URBIS Project's twenty-year longitudinal examination of computerization in municipal corporations [3, 4, 16, 27]. Longitudinal study is costly and time consuming, but it is necessary for answering difficult questions about the interaction of technology and social entities.

In addition to longitudinal studies, the Irvine research depends increasingly on historical studies. Historical analysis differs from longitudinal analysis in that the data collection is retrospective rather than contemporary. This compromises data collection somewhat, but it opens for investigation issues and events that show great promise for informing our understanding of the processes of change.

One of the most important elements of the historical and longitudinal approaches is the development of a coherent explanatory framework. In recent years, substantial elements of the Irvine research program have been built around the emerging paradigm of evolutionary explanations in the social sciences. In particular, "reinforcement evolution" models provide a means of accounting for change that incorporates both environmental and volitional explanations in systematic ways. [13,27] Evolutionary perspectives are central to several current projects in the Irvine program.

A Concern with Policy Implications

Finally, a central concern of the Irvine School's research is to improve understanding of the role of man-

agement and policy in shaping use and effects of information technology. Earlier research at the Irvine School was based on the expectation that environmental circumstances would be the dominant factors in shaping use of the technology. However, the research shows that in most situations the actions of management are instrumental in determining the success or failure of particular innovation efforts, and shape the ways the technology evolves in organizations.

A major objective of the research is identifying management policies that are most likely to produce desired outcomes in use of information technology. The aim is to first determine the importance of policy relative to environmental and organizational factors, and then to determine the relative effectiveness of specific policies. Two books in particular--*The Management of Information Systems* [23] and *The Dynamics of Computing* [12]--illustrate this approach.

Another objective is to assess government policies for the promotion and diffusion of the technology. Federal and state governments periodically adopt policies that have substantial effects on the direction of information technology in American cities. One aim of the research is to assess the relative effectiveness of these policies on the formation of local strategies for use of the technology, the distribution of technology resources within and across governments, the nature of applications produced as a result of such intervention, and the distortion of local priorities that results. This work is illustrated by the book, *Technical Innovation in American Local Governments* [28].

A third objective is evaluating the policy implications of the promotion, use and impact of information technology more generally. Here the concern is with assessing the implications of the increasing pervasiveness of the technology in organizations and society with respect to broad issues such as vulnerability, privacy, and democracy. This concern is illustrated by studies of electronic funds transfer, privacy concerns with government computing, and computers and the constitution. [14, 16, 25, 24]

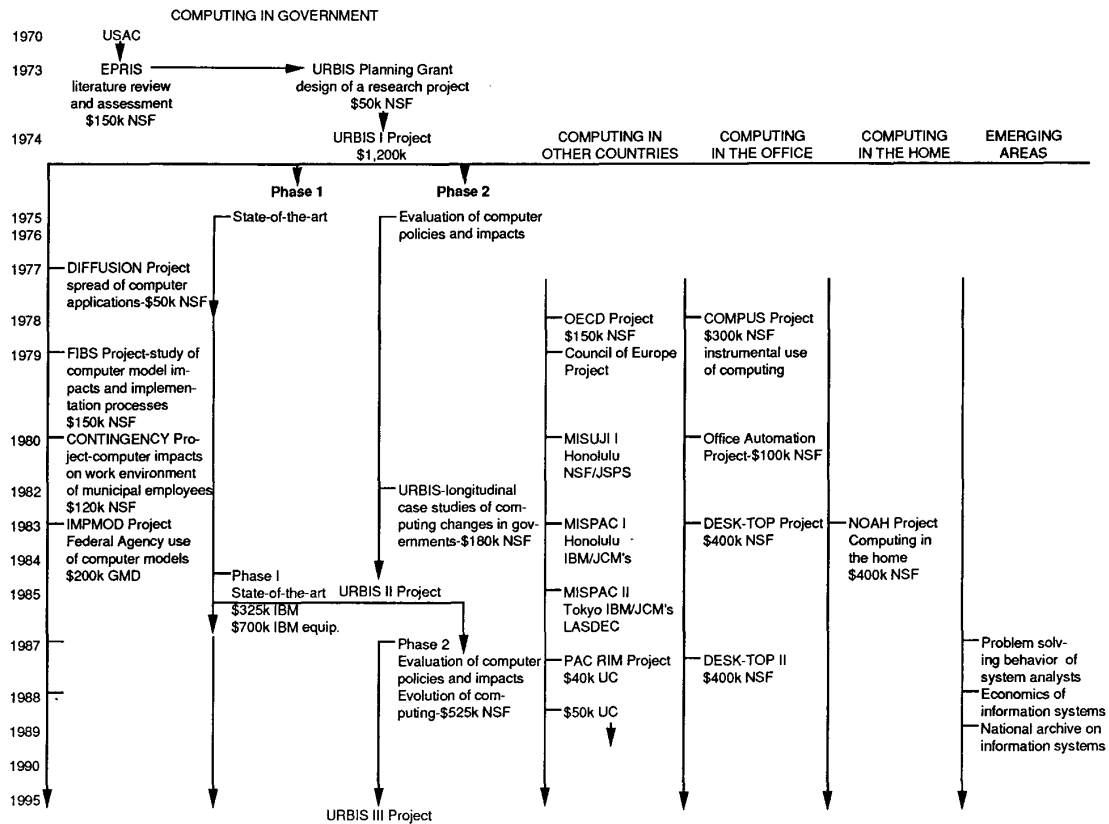
RESEARCH CONTRIBUTIONS

The contributions of the Irvine school to MIS have been both substantive and methodological. The substantive contributions have come from both the introduction of new concepts and from the systematic empirical examination of these concepts. The methodological contributions have come from innovations in research design and mix of methods.

As shown in Figure 1, research in the Irvine school has followed several lines of work. Primary among these have been:

1. Computing in government, e.g., URBIS (Urban Information Systems) and its continuation projects.
2. Computing in the office and work, e.g., COMPUS (Instrumental Computer Use) and its Desk-top continuation; the Contingency project.

FIGURE 1. LINES OF WORK IN THE IRVINE SCHOOL



3. Computing in the home, i.e., NOAH (National Outlook for Automation in the Home).
4. Computing in policy making, e.g., FIBS (Fiscal Impact Budgeting Systems) and IMPMOD (Implementation of Models).
5. Computing in other countries, i.e., MISUJI (Management Information Systems--U.S. and Japan), MISPAC (Management Information Systems--Pacific Area Community), Dynamics (Europe), and PACRIM (Pacific Rim).

Although the contexts of the research have been different, these studies have tended to focus on similar issues related to the use and impact of computers and other information technologies. Consequently, it is possible to identify five contributions from this body of research. Each is discussed next.

Automation is a Complex Social Phenomenon

The process of automation involves more than the acquisition and implementation of discrete components of technology. Automation is a social phenomenon involving a "package" of technology (hardware, networks, software),

people (technical experts, users, managers), and technique (organizational protocols, policies, and procedures) (Danziger, et.al., 1982). All of these components interact with one another, and with the broader external environment. Research of the Irvine School views computing activities as a "web" of activities incorporating this package, and the development of computerization as establishment of a "trajectory" of change. [18, 27]

Automation is also well characterized as the interplay of the stimulus of technology supply and the inherent or fabricated demand for technology. While the adoption and diffusion of information technology is influenced by both demand pull and supply push factors, their effects vary. Demand forces dominate the evolution of large, complex applications, while supply forces appear to exert a major influence on the evolution of small, simple applications. Nevertheless, research of the Irvine School shows demand forces to be decisive determiners of success in adoption, implementation and use of the technology. [12, 28]

The Impacts of Automation are Seldom as Predicted

Common predictions about the effects of using information technology frequently fail to materialize as expected. For example, the use of information technology

has brought about an increase in the tasks of middle managers and the stress they face, rather than a reduction or splintering of these ranks as originally predicted. Indeed, many predictions about the effect of computerization on work life have proven off-base. Similarly, many unpredictable impacts have appeared. For example, instead of the idealized "service bureaucracy" model of MIS departments predicted in the literature, many such departments emerge as "skill bureaucracies" of politically-motivated staff who use their technical expertise to maintain freedom from control by management and users alike. [3, 4, 7, 20, 27]

The failure of a prediction is not a signal that the outcome is negative. It is good that computerization has not resulted in widespread job displacement of middle managers, and MIS skill bureaucracies frequently produce leading-edge applications of the technology. The important lesson from the research is that failures of expectation and prediction are commonplace in the world of automation. The technology and its applications are best characterized as evolutionary in impact rather than producing radical change. Most organizational managers desire stability and work against surprises. New information technology is generally introduced slowly so that it can be adapted, and so staff can adapt to the technology's introduction (King and Kraemer, 1985).

Technology is Political

Rational perspectives of change seldom acknowledge the explicitly political character of technology. They emphasize organizational efficiency, concentrate on the positive potential of technology, and assume organization-wide agreement on the purposes of computing use. In contrast, political perspectives see efficiency as a relative concept, embrace the notion that technology can have differential effects on various groups, and believe that organizational life is rife with social conflict rather than consensus. In a political perspective, organizations are seen to adopt computing for a variety of reasons, including to enhance their status or credibility, or simply in reaction to the actions of some other organization. Moreover, applications of the technology can cause intra-organizational conflicts. Decisions about technology are inherently political, and the politics behind them may be technocratic, pluralistic, or reinforcing, with different consequences for different groups in each case. [3, 16, 25]

Political perspectives are essential for understanding technology's role in organizations. Technocratic politics helps explain the relations between the technologists and end users; pluralistic politics helps explain the relations among various user interests vying for access to computing resources; and reinforcement politics helps understand the effects of computing on power and authority in organizations. Reinforcement politics has proven to be an important explanation of overall computerization decisions in organizations, wherein the technology is used primarily to serve the interests of the dominant organizational elites. Reinforcement occurs sometimes through the direct influence of the elites, but more often it occurs through the actions of lower level managerial and technical staff in anticipation of the interests and preferences of the elites. The political mechanisms used to determine the course of organizational automation will vary, depending on the broader political structure of the

organizations themselves, and these mechanisms tend to remain stable over time.

Management Matters, but in Complex Ways

Prescriptive literature is full of admonitions about the importance of management in effective use of information technology. However, empirical research into the role of management and the efficacy of management policies is lacking. Research of the Irvine School has demonstrated the crucial role of management action in determining the course of automation, even in cases where major environmental changes were present. Moreover, there are distinct patterns of management action that yield different outcomes. The effect of management action is a function of the structure of control over use of the technology, coupled with the basic orientations of those controlling agents regarding the appropriate applications of the technology. Rather than evolving through "stages" of growth, these Irvine studies show that computing evolves through "states" that are less deterministic and more dependent on the judgments of management. [12, 27]

Effective management of automation efforts is much more difficult than suggested, however. Specific policies for automation are contingent in their effects on the state of computing management as well as the characteristics of the organization. Policies recommended in the practitioner literature have proven to be associated with serious problems in the computing environment, and it is unclear whether the policies are not working, whether they have not yet had time to work, or whether they work only under special conditions. The Irvine School has made several contributions to the policy literature. Among them are: that keeping up with the technology ("mainstreaming") is strongly associated with the productive use of the technology; that the mobilization of political support for computerization efforts is essential to continued success; that certain policy problems such as centralization vs. decentralization have no inherent resolution; and that conventional approaches to training do not bring positive results in user performance. [11, 12, 23]

Social Analysis Requires Innovation in Research Design

The Irvine School has produced methodological as well as substantive contributions. Most are innovations in research design which are especially suited to social analysis. The basic research strategy of the group is that the scale of research has to match the scope of the problem one seeks to address. Large, complex and multifaceted problems require similar approaches. Given customary constraints (shortage of knowledge, resources, and talented people), one is challenged to focus both energy and effort.

Four basic components of our research have emerged in response. First is a focus on leading adopters of the technology when studying the effectiveness of policies for managing computing. This focus enables determination of what works and what does not in the process of innovating, and to provide advice that will bring others up to the level of the leading performers. Second, when studying policies, we have sampled sites at the extremes of policy application (e.g., high and low centralization, insignificant and extensive user training). This maximizes

the variance on the policies, and provides better indication of the basic direction in the relationships [22]. Third, we have census surveys to investigate the extent of the technology's diffusion, the extent of its use, and the nature of its organizational impact. In addition to eliminating all sampling bias, a census provides a much better indication of the distribution of patterns of diffusion throughout a population of heterogeneous organizations. Fourth, we have concentrated on long-term study of organizational and social impacts. Such impacts cannot be studied over the short term because changes occur slowly, the effects of the technology are indirect more often than direct, and the organization and the technology are interactive. [3, 13, 22, 27]

EMERGING RESEARCH DIRECTIONS

Five emerging directions characterize the Irvine School. The first is expansion of existing research into new sectors. A project is currently in process to develop a longitudinal study of information technology and organizational performance, similar to the URBIS study but extending into other major sectors of the economy and society. This project will measure the contributions of information technology to productivity, effectiveness, and competitive advantage in different industry sectors, and in several areas for each sector. Approximately 200 organizations will be selected to provide adequate representation of sectors, creating a study that is larger and more complex than anything done before.

The second is an increased emphasis on the economic aspects of information technology. Planning is underway on two projects applying the tools of economic theory and research to questions of the effect of information technology on management decisionmaking, inter-organizational interaction, and industry structure. These proceed from a base of work already completed in the study of corporate investment behavior with respect to information technology, and the application of agency theory to studying the effects of organizational and political factors on decisions about adoption of the technology. These tools also have applicability to broader welfare-related questions of shifts in relative power distribution following the creation of new electronic intermediaries in markets, and to the analysis and design of governance mechanisms for markets. [1, 2, 8, 9]

Third is the identification of the role of government policy in shaping the international diffusion of information technology. A ten-year study was recently begun of the role of government policy in the diffusion of information technology in different countries in the Pacific Rim. Data are being collected on the rates of technology diffusion in different industry sectors in developed, newly industrialized, and developing countries. The goal is to characterize differential rates of diffusion, and identify the influence, over time, of government policies on the rate of diffusion.

Fourth is the study of the role of social structure and context in the creative process of designing new technologies. A study of the sociology of technical design was recently started, which in time will grow into a program of research. This work focuses on the ways in which social constructs in the lives of designers eventually manifest

themselves in the kinds of technologies that are created. Of particular interest is the creation of technologies that are intended to facilitate the collective work of individuals from varying cultural and substantive backgrounds. [29]

Fifth is the development and use of data archives for long-term study of automation in organizations and society. Several large-scale databases have been created from projects of the Irvine School, and the construction of such databases will continue as part of the research program. Presently, the archives contain data on information technology in government, the office, the home, and MIS organizations. Plans are underway to expand the archive through data from the projects noted above, but the overall objective is to create a national center for data and analysis on information technology in organizations and society.

CONCLUSION

The Irvine School is nearly twenty years old. During this time it has developed a distinct identity and made numerous contributions to research in the information systems field. The School's identity has been developed through focus on a common research objective—understanding the organizational and social impacts of information technology, and more broadly, the role of technical innovation in organizational change. The common research objective and methods developed to attain it grew from a large multidisciplinary project that has been underway for more than a decade, and that at one time or another, involved most of the current actors in the Irvine School. That single project had a substantial influence on the creation of the Irvine School, and the definition of its character. The emerging research directions of the school build upon this foundation, but expand into new areas and new challenges.

FOOTNOTES

1. The founders of the information systems research program at UCI were Julian Feldman, Fred Tonge, Alexander Mood, George W. Brown, and Kenneth Kraemer. Feldman and Tonge were students of Herbert Simon at Carnegie Institute of Technology, and were among the original five faculty at the Irvine campus when it opened in 1965. Both were instrumental in establishment of UCI's Department of Information and Computer Science and UCI's Graduate School of Management, which remain two separate academic units. More important, they brought to UCI an interest in application of computing technology to organizations. Mathematicians Alexander Mood from the RAND Corporation and George W. Brown from UCLA, who were involved in early large-scale computer applications for the Air Force and at the Western Data Processing Center, joined soon thereafter, and strengthened the Irvine commitment to study of information technology. Kenneth Kraemer joined the Management faculty from USC in 1967, and started the focused program of research that continues to this day. Early research efforts concentrated on exploring the potential for information technology in complex organizations, and shifted to management and policy issues with the group's first National Science Foundation support

in the Evaluation of Policy Research in Information Systems (EPRIS) project of 1971-73, followed soon by the first phase of the Urban Information Systems (URBIS) project. These projects pooled the talents of Rob Kling, James Danziger, William Dutton, Alana Northrop, Deborah Dunkle and John King to begin the nexus of the current research group. For all practical purposes, the research program in information systems at UCI came together during in the EPRIS and URBIS projects. The subsequent growth of research in the Irvine School is outlined in Table 1.

2. Social analytic examinations of information technology in organizations are becoming more common. When the Irvine School began its work in the early 1970's it was difficult to persuade leading journals to take such research seriously. Since that time the importance of information technology has become manifest, and scholars in many fields have become interested in the interesting array of issues raised by the technological and social upheaval that appears to be underway.
3. We have employed three particular approaches in our work: between-methods, within-methods, and holistic. The between-methods approach is the most common in our work and is characterized by the use of multiple methods in different studies of the same phenomena to determine if one gets the same results. It is illustrated by the use of case studies in *Datawars* and the use of survey research and case studies in *Modeling as Negotiating*. Although they used different methods both studies pointed to the critical importance of political factors in the implementation and use of computer models. The between-methods approach is a check on the external validity of the data.

The within-methods approach involves the use of multiple measures and indices of a single concept within a single study. For example, it might involve the use of multiple scales or variables to tap political ideology. Thus, the within-methods approach is a check for internal consistency in the data. It is illustrated by the use of multiple measures of technology diffusion in *Technological Innovation in American Cities*. Finally, the holistic approach involves the direct mixing of qualitative and quantitative methods within a single study. The most common example of this approach is combining probability sampling of sites with fieldwork collection of data. It is illustrated by both the URBIS I and URBIS II projects.

In sum, our work has been characterized by both quantitative and qualitative approaches, and by a mix of methods both across studies and within particular studies.

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