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Abstract

New information technologies have the potential for transforming the ways governments are organized, the activities they perform, the manner which they are performed, and the nature of work itself. Governments in the US and Scandinavia have followed fundamental different approaches to the introduction of computing and to dealing with its effects.

In the US, automation has been individualistic—each individual unit of government has introduced the technology for its own needs. For the most part, the systems that have been implemented have been small scale, have followed functional lines, have merely automated existing operations, have been implemented incrementally, and have evolved slowly over time.

In contrast, in Scandinavia automation has been communal-systems have been designed, developed, and implemented by communal data processing agencies serving an entire level of government-national or local. The systems that have been introduced have been relatively large scale, have crossed functional lines, have involved the reorganization of work, have integrated both data and work processes, and have been implemented more or less simultaneously for all units or agencies of government.

These differences in approach to automation have influences each country's view of the role of government in anticipating and dealing with the effects of changes in computer technology on the public workforce.

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There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.

Niccolo Machiavelli, The Prince (Chapter 6)

New technologies are frequently described as "transforming", or "having the potential to transform" state and local governments and society more generally (Nora & Minc 1981, Osborne 1988). In fact, however, technology has rarely been shown to have such effects. Rather than transforming state and local governments, technology has been adapted by government leaders to fit their perceptions of the opportunities and threats of its application. For the most part, such adaptive application of technology has been incremental and evolutionary precisely because, as Machiavelli's words suggest, dramatic revolutionary change is difficult, perilous and uncertain. Taken together however, incremental, evolutionary change can, and often does, affect the way in which state and local governments operate.

Nowhere is this more the case than with information technology. New information technologies such as computers, airport metal detectors, traffic signal video monitors, radar detection jammers, automated teller machines, and genetic fingerprinters are changing the day-to-day operations of many state and local governments. Figure 1 shows a few examples of these new technologies which illustrate that these new technologies bring new opportunities, but they also bring constraints and dilemmas (Bozeman & Rahm 1989). Constraints arise because both financial and human resources are seldom sufficient to take advantage of all the opportunities that exist.

Constraints arise because both financial and human resources are seldom sufficient to take advantage of all the opportunities that exist. Dilemmas arise because existing government employees seldom are prepared for the new technologies and the changes they bring to work life.

Thus, we are interested in two broad questions:

1. What is the nature of information technology use in the public sector?
2. What will be the effects of IT use on the public service during the 1990s?

This article addresses these questions with respect to information technology (IT) and computers and information systems in particular.[1] For each of these questions we are interested in examining the differences between Scandinavia and the United States.

Nature of IT Use in the Public Sector

Computing in the public sector in Scandinavia[2] and the U.S. historically differ in several important regards: Similarities and differences can be seen with regard to: (1) extent of use, (2) organization for use, (3) nature of use, (4) government role in computing affairs, (5) worker involvement in automation, and (6) work organization and computing. However, these differences might be diminishing over time as the technology itself changes and as public officials gain greater control over its deployment and use.

FIGURE 1. Examples of new information technology in public administration

Citizen information. Expert-systems for determining health and social welfare subsidies and software for providing improved, computer-supported information directly to the clients in the municipalities have affected government-citizen interaction and the structure of functions within the government in Scandinavian countries. The systems have been a challenge for the municipalities which traditionally have been split into specialized departments. The new technology has enabled turning over a number of routines from various functions to a "front services" office that interfaces with citizens (Hoff & Stormgaard 1990).

Automated services delivery. Automatic Teller Machines (ATMs) and smart cards which permit cash withdrawal and credit charges have in the United States reduced the time welfare recipients must wait in line for payment, and reduced the stigma attached to their having to stand in line to cash their welfare checks, use food stamps, etc. in making purchases for daily living. But, this innovative and client-sensitive method of service delivery, currently costs about ten times that of the paper system and is not widely accepted by merchants or banks. (Fiordalisi 1988)

Management information systems. Computerized case management systems have allowed detectives, inspectors, social workers, probation officers and other case workers to be more personally productive, handle a larger caseload, and do better casework (e.g., better follow-up, more "completion" of cases, etc.) thereby increasing the diversity of their work, the bottom line performance, and the sense of accomplishment in their work. At the same time, the speed-up of work, the errors in case records entered by co-workers, and the insatiable appetite of supervisors for more information about the cases from computerized files has sometimes increased worker stress. (Danziger & Kraemer 1986).

Detention monitors. Electronic monitors for detention of both adult and juvenile offenders in homes or workplaces have reduced the overcrowding of jails, facilitated policing by probation and social workers, and allowed offenders to perform useful work and community service. However, stress has resulted for probation and social workers who are insufficiently trained to use this new technology and for offenders whose lives or work are needlessly disrupted by mistakes and insensitive use of the monitors. (Baumer *et al.* 1991, Maxfield & Baumer 1990)

Extent of use

In the U.S., nearly 100 percent of all state and local governments have adopted computing, and computing accounts for about 3 percent of state and local government operating budgets (Kraemer *et al.* 1986 and 1989, Caudle & Marchand 1989). Most governments have one central computer installation but the larger state and local governments have multiple installations, or so-called "departmental computing." The adoption of PC's has been fairly rapid since the early-mid eighties and the PC inventory often equals the dollar value of computing equipment in central and departmental installations. Thus, computing within governments has gradually been extended so that 75 percent of all functions within government have kind of IT basis. Moreover, the technology has increasingly been extended to individual users through terminals, PCs, and workstations. The ratio of such end user devices to state and local government employees currently is about 1:200 and is expected to reach 1:1 by early in the twenty-first century.

TABLE 1. Nature of IT use in Scandinavia and the U.S.

Comparison	*Scandinavia*	*U.S.*
1. Extent of Use	All state and local governments	All state and local governments Greater sophistication
2. Organization for Use	Centralized, shared pattern	Decentralized, diverse
3. Nature of Use	Conventional business functions Experiments	Conventional business functions
4.Governmental Role in Computing Affairs	User Promoter Regulator for social implications	User Promoter
5. Worker Involvement in Automation	Participation in various issues Influences on policy and research Unions supportive	Participation in design for new applications Unions supportive
6. Work Organization and IT	Concern and use of work organization and IT relations	Little concern

Computing in central and local governments in Scandinavia is at a higher level than most other OECD-countries. While the U.S. traditionally lead in the extensiveness of applications (lead users) compared with Scandinavia, a larger fraction of the cities in Sweden and Denmark were already using IT in the mid-1970s. Ninety percent of the Danish municipalities and 72 percent of the Swedish municipalities used IT compared to 51 percent in the U.S. (King & Kraemer, 1985, p. 38). Today all cities use computing. The technology has also been extended to individual users. The use of computing in the public sector in Scandinavia might be more important for the working conditions for the workforce because the public sector employs a larger part of the total workforce and spends a larger part of the Gross Domestic Product than governments do in the U.S.

What accounts for the current relatively low use of computing in Scandinavia governments? Given that the public sector is such a greater proportion of the total economy on Scandinavia, one might have expected that automation would be used more widely as a means of achieving efficiency. However, the "communal" approach to organizing for use and the considerable influences of workers and unions have slowed the pace and extent of automation in Scandinavian governments. In addition, these governments have been concerned about possible social impacts and therefore have been slower to invest, adopt, pro-

mote, and use technology than might otherwise be the case. These points will become apparent in the following sections.

Organization for use

Governments at all levels in the U.S. have followed a decentralized pattern of organization for computer use in the seventies. Whether and how computers would be used has been left to each level of government, each unit of government, and each agency within a government to decide. While the computing function was initially centralized within government organization and provided as a service to all departments, the advent of minicomputers in the mid seventies brought about departmental computing, just as the advent of microcomputers in the mid eighties brought about end user computing. While most computing services are still provided by one or more computer installations in MIS departments, a plethora of organizational arrangements exist. These include individual offices for computing, office automation, end user computing, and telecommunications, as well as integrated offices combining these functions in various ways. In addition, as the size of government databases continues to grow yearly, attention has been focused on managing the information in computerized systems and a new function—information resource management—has been born. This is commonly known as Executive Information Systems (EIS). In short, diversity is the key characteristic of organization for computer use in U.S. state and local governments.

The Scandinavian countries have historically followed a communal or shared pattern of organization for use, through large data centers established to serve each major level of government (national, county, and local), although the largest units (e.g., cities like Copenhagen and Stockholm) have established their own computing centers. The central governments and the associations of local governments in Denmark, Norway, and Sweden established the Kommunedata centers that provide most of the computing service to local governments. These centers have had profound effects on the overall diffusion rate of IT-use in those countries. The establishment of the Kommunedata in the Scandinavian countries (in Sweden in 1965 by the Swedish Union of Local Authorities) was done to provide central IT-use and a technical organization of sufficient strength to handle advanced applications, to coordinate the technical personnel resources, and to develop new application systems for the municipalities.[3] The growth problems (unbalanced economic growth, shifting production structure, etc.) in the cities and regions in Sweden directed the development of computing toward specific, restricted fields of application rather than general, abstract ideas such as urban databanks or MIS. It also led to the design of applications designed to serve the country as a whole, rather than the independent development of a large number of scattered, uncoordinated experiments with varying types of applications (OECD 1974, p. 109-119). An indicator of the relative strength of the Kommunedata centers is the number of staff trained as computer operators, system planners etc. In 1986 approximately 1,500 professional staff (systems analysts, programmers) were employed at the Danish Kommunedata center, and only 108 staff in the 275

municipalities (Hoff & Stormgaard 1990, p. 123).

Beginning in the early 1980s, the pattern of centralized computer organization in the government administration underwent a transition as part of a general transition in the national government. The transition was towards decentralization to local bodies (counties and municipalities). Indeed, computer technology was a major factor facilitating the decentralization of government administration because it permitted data in support of local administration to be collected and restored locally while also sharing and accessing data in the central government (Ingelstam & Palmlund 1991).

Character of use

Most applications of computing in U.S. state and local governments currently are conventional and oriented toward business functions and administrative support rather than direct service delivery to citizens (Kling & Kraemer 1985). A primary reason for this character of applications is government emphasis on productivity and administrative control. While control benefits have been achieved, the productivity improvements from these applications have been marginal for the most part, or confounded with other improvements and, therefore, difficult to identify and measure. However, productivity gains are expected to be greater in the future as more emphasis is placed on applications that restructure service delivery, both as a means of reducing costs and meeting special needs. For example, restructuring service delivery towards "one-stop shopping" and "little city halls", along with the introduction of computing, is expected to reduce the need for more staff, for multiple service centers, and for longer service hours as governments try to respond better to diverse needs of individuals, households, and business. These developments will only increase the pervasiveness of information technology in government.

In Scandinavia computing has already begun to be oriented towards direct service delivery to citizens, although the main part of the computing is oriented, as in the U.S., towards business functions and administrative support. Experiments with "front service" were introduced in the municipality of Ringsted (Denmark), to help the streetlevel bureaucrats to better attend to the problems of citizens. Citizens need only apply to one place, irrespective of the reason for their application, and a considerable number of matters can be handled through that place (Hoff & Stormgaard 1991). The front service has largely been developed to attend to the citizens' interests rather than bureaucratic interests.

Governmental role in computing affairs

Governments in the U.S. have perceived their role primarily as a user of computers, and to some extent a promotor of greater use through the demonstration of advanced or leading edge applications and the design, development, and transfer of mainstream applications. In some instances, federal or state agencies have developed model applications which they sought to have implemented by lower levels through a combination of carrot and stick incentives. Buoyed by belief in the benefits of technology, government agencies have not been highly concerned with the social and health aspects of the technology's use. Moreover, because computing has been used primarily to automate existing operations the

social effects have not been great. Most studies of computer use in government indicate that the computer's effect has been neutral, and when there has been an effect it has been positive for the quality of worklife of government employees (Danziger & Kraemer 1986).

In Sweden, the government paid close attention to the social implications of the penetration and development of the use of computing. Studies of social issues related to computer use were developed with governmental support on learning mechanisms for computer-based system, the work environment (high ergonomic and health standards), and managerial organizations for work involving computer-based systems (OECD 1991).[4] It has resulted in establishing a range of governmental institutions to deal with the technology. Coordination of the acquisition and utilization of computers in the government administration is provided by the Swedish Agency for Administrative Development (SAFAD). Improving the interface between human beings and computer-based systems is provided by the Swedish Environment Fund (AMFO), a government agency that belongs to the Ministry of Labor (OECD 1991). The latter agency in particular illustrates the awareness of the social implications of computerization in Sweden.

Worker involvement in automation

In the U.S., worker involvement in computing affairs has focused on participation in design for new applications. The purpose of their involvement has been to communicate to computer specialists the nature of their operations, the information and processing requirements, and the data definitions in order to facilitate the design of new computerized systems. Worker involvement has extended to the number and nature of screen designs and reports produced by the systems, training of government staff for use, and even evaluation of the system once it became operational. It usually has not been extended to decisions about whether to introduce new systems as these were usually made by high level managers or professional staff. However, the decentralization of computing to departments through minicomputers and the introduction of PCs has brought about greater user involvement in the spectrum of decision making about computing matters.

In Scandinavia, the nature of industrial relations implies considerable influence for employees regarding issues of working conditions. Any consequences that may arise from computerization in the work place may therefore be seen against this background of active and often constructive consultation in the process of implementation. The labor movement in the Scandinavian countries has been highly influential in decisions taken by the government, the research conducted, and the formulation of strategies for influencing technology development.[5] The labor movement has, by and large, over the years supported, rather than resisted new technology.

The employee is by legislation and cooperative arrangement given the right to receive *information* about new technology, and its attendant changes in working methods and processes (Mathiassen *et al.* 1983). However, no general regulations secure employees any influence upon technology *change*—the employers have the last word. The Swedish unions' attitude towards new technology is more positive than in many other

TABLE 2. Effects on Public Service: Activities Performed by Government

New Institutions	*Primarily in the IT arena*
Organization and Distribution of Activities	Automation follows transitions in administration rather than leads
	Centralization versus decentralization facilitates either
	New organizational forms primarily in IT arena
Alteration of Work Processes	Coordination and optimization facilitated
	Automation of service delivery in special cases
	Electronic communication with citizens

countries. The main reason for this is that unemployment caused directly by technical change has been limited (Ullmark 1988).

Work organization and Computing
Because most U.S. computer applications were automating existing activities in government agencies, there has been very little concern with the relationship between work organization and computing. Employee unions have generally been supportive of government automation. Experiments were conducted during the seventies with information and referral (I&R) systems for health, social services, and aging in an attempt to bring about greater coordination and cooperation among public agencies, but these effects generally failed because insufficient attention was paid to agency incentives for participation in the systems. The brief characterization of work organization and IT-use in the U.S. then is the general absence of consideration of this important relationship.

In Scandinavia, experiments with new technology has enabled turning over a number of routines from various functions to "front services" offices that interfaces with citizens (Hoff & Stormgaard 1990). Expert-systems for determining health and social welfare subsidies and software for providing improved, computer-supported information directly to the clients in the municipalities have affected government-citizen interaction and the structure of functions within the government (Karlström 1986, Khakee 1985). The systems has been a challenge for the municipalities which traditionally have been split into specialized departments. The brief characterization of work organization and computing in Scandinavia then is the awareness of this relationship.

Effects of IT use on the Public Service
Our review of research and practice indicates that the effects of computing can be

broadly classified into four general areas: (1) the creation new institutions; (2) the organization and distribution of activities performed by government; (3) alteration of work processes; and (4) the nature of work. These effects are generally well documented by individual studies, empirical surveys (both cross-sectional and longitudinal), and/or literature reviews. However, not all effects are equally well understood as will become apparent below.

Creation of New Institutions

The largest effects of computing and other information technologies have been concentrated in the computing and information systems function in government rather than on the other functions and activities of government. In the United States, information technology has resulted in the creation of new government functions and institutions—the information systems function and the MIS department, the telecommunications function and the Office of Telecommunications, the information resources management (IRM) function and the IRM Office (Andersen & Dawes, 1991). Most often these institutions have existed separately, but some governments have integrated them into a single institution. The computing function has undergone the greatest change.

Initially, it was set up as a centralized function in most governments, usually under the finance department. In time however, as computer use expanded throughout the government, the function was often made an independent government department outside the finance function. The continued spread of computer use along with the advent of microcomputers led to the distribution of the computing function among large departments with the former central unit serving finance and administration and the myriad small government functions and agencies. The advent of microcomputers reinforced and hastened this trend towards distribution of computing equipment and expertise to even the smallest functions and activities. In an attempt to manage and facilitate these effects, central IS units created new "information centers", "computer stores", and "end user computing offices." At the same time, department users have created their own informal users groups for sharing information and expertise. These have been independent of the former IS units and sometimes in opposition to their attempts to manage, facilitate, or control computing on a organization-wide basis. These developments have occurred because top managers have not known how to deal with these computer-based developments and/or did not choose to become involved. The disruption and trauma for IS units has been considerable in some instances, and relations between the IS units and the user departments have seriously deteriorated with an overall loss of effectiveness to governments.

In Sweden also, computing also resulted in establishing a range of governmental institutions. The Swedish Agency for Administrative Development (SAFAD) was established to coordinate the acquisition and utilization of computers in the central government administration. The Swedish Environment Fund (AMFO), a government agency in the Ministry of Labor was set up to improve the interface between people and computer-based systems (OECD 1991). The software houses, referred to as Kommunedata, were established to providing

computing and development services to local governments. Kommunedata was established in Sweden in 1965 and in Denmark in 1972. The Kommunedata organizations established a highly centralized activity which provided computing to local governments via terminals to a central mainframe and with development services via a central staff which developed applications intended for use by all local governments. The Kommunedata organizations grew in computing power and number of staff throughout the seventies and eighties as computer use expanded throughout local governments. However, computing also grew in the larger municipalities and counties, which were allowed to obtain their own computing equipment and staffs because of their size and purported unique requirements.

Organization and distribution of activities

Information technology facilitates much wider forms of organization and distribution of governmental activities. Information technology permits either centralized or decentralized organization, and central or local distribution of the activities of government while also permitting greater central monitoring and control. For example, some federal agencies use large centralized information systems to facilitate and monitor state and local government implementation of federal programs. Some states also extend their operations to regional offices and local administrations through mandated statewide information systems for health, social services, and employment. Some local governments do similarly, with citywide systems for distributed activities like libraries, parks and recreation, and little city halls.

Beginning in the 1950s, with the first introduction of the computer, governments followed a centralized approach in automating government activities such as budgeting and accounting. This trend continued in the 1960s with time-sharing and intergovernmental systems such as NCIC/CCH[6]; and in the 1970s with largescale computer networks and services integration (Quinn 1976). Throughout the eighties, there has been a trend towards decentralization of federal government activities to the states and, in turn, from the states to local governments. This decentralization trend will continue and perhaps even accelerate during the nineties. It will be facilitated by the increasing availability of computer networks, databases, electronic mail systems and microcomputers at each level of government and throughout the federal system.

In all of these technology deployments, governments choose the approach they will take. Some governments choose centralized approaches whereas others choose decentralized ones (Kraemer *et al.* 1989). For example, the state of Virginia has a centralized social services information system whereas California has a decentralized one. Some governments provide one-way information services to citizens whereas others provide for two-way information and communication (Gurwitt 1988a). This is illustrated by the different approaches of Kansas City, KS and Santa Monica, CA. In Kansas City, a 24-hour city hall based on voice mail, provides information to citizens about government operations and activities, and takes request or complaints from citizens which are handled

and answered within 24 hours. The Santa Monica system, which is based on computer conferencing and electronic mail, allows interactive communication among citizens and between citizens and government officials.

The experience of Sweden also shows that governments choose the approach they will take to automation, and that automation follows transitions in the administration of government activities rather than leads them. For example, the administration of social welfare in Sweden traditionally was centralized and supported by a nationwide computerized system serving all social welfare agencies at the national, county, and municipality levels. Computerization allowed centralized control of the various social welfare payments for child care, sickness, parental care, unemployment, housing for the aged, and handicap care. The first initiatives to computerize the administration of these welfare services were taken in the 1950s and concentrated from the beginning to become a centralized, national computer-based information processing system. The system has enabled the government to implement a series of social reforms and provide citizens with a reliable service of payments and different social benefits (Ingelstam & Palmlund 1991). Beginning in the early 1980s, however, the organization of social welfare was changed dramatically from its centralized form to a more decentralized one with the distribution of social welfare functions to local administrations along with the required computing equipment, staff and databases (Ingelstam & Palmlund 1991).

A related change is the *distribution of workers themselves*. The bulk of government workers will continue to be located in central places like the statehouse (central governmental buildings), the county hall of administration and city hall. Some will be decentralized to distributed workplaces such as regional offices, metropolitan subcenters, and little city halls. Still others will work at home with a link to the office via the computer and telecommunications, that is, they will "telecommute" (Kraemer 1982). In the United States, the proportion of such workers is estimated to be around 10 million nationally by the year 2000. Whether it reaches such numbers or not, government workers are likely to be among such telecommuters because of the "services" nature of their jobs. The type of workers who will telecommute first and foremost are those who already work at home, such as computer professionals, writers and editors, handicapped workers, and "piece workers." For the most part, work at home will not replace work at the office, but will supplement it. That is workers will work certain days (or parts of days) at the office and the remainder at home (Vitalari & Venkatesh, forthcoming).

In Scandinavia, the introduction of "front services" into city and county governments has changed both the distribution of activities and workers. In the past, when citizens needed governmental services they had to interact with each functional bureaucracy independently. There was no way to take care of all their needs at one place. The introduction of front services has created a single office for interfacing with citizens for all their needs. This office then does the interface with each of the functional bureaucracies and communicates with the citizens about questions or issues that arise during the processing of requests. Another

illustration is provided by the use of portable computers by the Danish VAT auditors. The VAT auditors bring computer-stored information to the clients (companies) and, in turn, store the information obtained from the clients in their portable computers for transmittal back to the central office (Vittrup 1989). This has increased the control of the VAT auditors while also increasing their direct contact with the clients. The auditors, and not the clients, travel more as a result of the computerized system.

Thus, the experience in the United States and Scandinavia indicates that the technology facilitates either centralized or decentralized organization and distribution of government activities and workers. Historically, mainframe computers have been viewed as facilitating greater centralization. The advent of microcomputers is viewed as facilitating greater decentralization. In fact, computing has always facilitated either approach, or a mix thereof, and still does today (Attewell & Rule 1984, Robey 1981). But peoples' perceptions of what computers can do have been influenced by these technology developments. And public officials, knowingly or unknowingly, have chosen to implement the technology one way or the other. Often too, those who have chosen a particular approach have rationalized their decision made on personal or bureaucratic grounds on the technical requirements, technical advantages, or cost of the approach (Danziger *et al.* 1982).

Alteration of work processes within institutions

The foregoing changes in organization and distribution of activities will be reflected in changes in the processes by which work is carried out within and between institutions. Although the possible changes are many, three are especially important: sophisticated coordination and optimization, automation of direct services to citizens, and electronic communication with citizens.

Coordination and optimization

Coordination and optimization refers to the ability of government agencies in far flung locations to coordinate their activities and to optimize them in terms of some overall interest. While such systems do not currently exist in U.S. state and local governments, the prototypes exist in the federal government and can be extended to state and local governments. The U.S. Army's computerized REQUEST system for assisting recruiters in meeting military occupational specialty needs while providing incentives for recruits to join the new "all volunteer" army is an example (Kelman 1990a). Basically, REQUEST starts with a listing of requirements for different military occupational specialties, pay bonuses for signing-up for the specialties, training slots for new recruits, and available first assignments for the recruits once trained. This information is available at all army recruiting offices in the U.S. and abroad. The recruiter at each local offices inputs information about the recruit's preferences for a specialty, training, and first assignment and shows the availabilities on the computer screen, along with any bonuses, to the recruit. When the recruit makes his choices, they are recorded in the central computer and printed out immediately for the recruit and the local office. REQUEST not only helps the army to meet its personnel needs, but it optimizes the needs

of the army and the desires of the recruits and helps to insure that recruiters seldom lose a "sale."

A modest example at the state level is Colorado's job-bank, a system that exists in other states as well (Ullman & Huber 1973). Most of the Colorado's major cities and counties are linked through a central computer to a system that keeps track of participants in job training programs and job openings and allows social service personnel to match job openings to clients' backgrounds and qualifications. A logical extension of this system is to provide terminals for both employers and employees so that they can enter job openings and resumes and do searches for a match on their own (Gurwitt 1988b, p. 41). Similar systems exist in Scandinavia. Job banks in Sweden have widened the possibilities of locating a suitable position for applicants (SAFAD 1980, p. 12). Also the job-banks make it possible to match newly registered positions against applications in a faster way than in the manual system. However, it has not been possible to show that there is any reduction in the period people are unemployed or the number of people who are unemployed.

Automation of service delivery

Automation of service delivery refers to the completely computerized handling of requests for information or service. Here there are many examples already in operation around the U.S. Several cities have automated citizen access to public services such as building inspections and bibliographic retrieval (from public libraries) and to public records such as land records, tax records, vital records, business licenses, and other "public" information (Kahl 1990). For example, Dallas (TX) has a system for the scheduling of building permit inspections. Instead of calling a city office that is only open from 8 to 5 to schedule an inspection, builders can now call the building inspection office at any time of the day or night. The phone is answered by a microcomputer with a voice response system, which asks them to key in information about the building on a push-button phone. It then gives them a time for an inspection. At the inspection office, that information is then fed automatically to a mainframe computer, which goes on to arrange inspectors' daily schedules and routes (Gurwitt 1988b, p. 40). Another example is provided by experiments in Ramsey County (St. Paul), Minnesota, the state of Washington, and Berks County, Pennsylvania, that involve rethinking the way in which public assistance payments are made to individuals. Instead of issuing checks, which the welfare recipients then have to take to the bank to get cashed, the county is issuing bank cards for welfare recipients who can then use them at ATMs around the county to draw out cash against their public-assistance accounts. Like any other bank cards, these cards have an expiration date and so the individual's eligibility and assistance is reexamined before a new card is issued. In addition, the cards and/or the ATMs can be programmed with information that limits the amount of any one cash withdrawal, the number of cash withdrawals within any time period, or other user options to encourage cash management (Gurwitt 1988b, Fiordalisi 1988).

In Sweden, automation of service delivery is illustrated by a computerized system for administrating various social insurances at the local level. Instead of

the citizens having to take the initiative to change their social insurance status, the system issues preprinted forms which are then mailed to citizens when action from their side is needed in order to change the social insurance status. The computer system then takes the information received from the citizens and combines it with the relevant eligibility and benefits rules to produce the new social insurance benefits. While this system provides citizens with better service, the personal contact between citizens and the administration has been reduced (Ingelstam & Palmlund 1991).

Electronic communication with citizens

Electronic communication with citizens can occur a variety of ways, but most frequently it is occurring through the automated handling of citizen requests for information and complaints and through two-way, interactive electronic mail and dialogues. An example is provided by Santa Monica's (CA) Public Electronic Network (PEN). Anyone with access to a personal computer, once registered with the city, can use PEN to obtain information about city council hearings, city commission activities, or communicate with city staff, city council members, and other city officials, or engage in a "public dialogue" on community issues such as rent control, the environment, the economy, women's issues or senior citizens issues. Computer terminals are located in city hall, in public libraries, senior citizen centers, other public buildings, and shopping malls to facilitate access by people without computers (City of Santa Monica 1989, Gurwitt 1988a).

Videotex, a combination of computing and television, makes it possible for the citizens in the Danish municipalities to communicate with databases about government service. The citizens have access to large quantities of information through public videotex terminals and do not need to have a private computer at their disposal (Hoff & Stormgaard 1991, p. 228-232). In one experiment, the citizens have videotex terminals placed in their homes and can access a number of private services (advertising and home-shopping). In another experiment, terminals have been installed in post offices, libraries, and day-centers for old-age pensioners. The citizens have access to information on activities in the municipality, job vacancies, public housing, and a "bulletin board" permitting participation in public debate within the municipality.

The Nature of Work

As might be expected from the foregoing changes, the new information technologies are changing the nature of work in state and local governments. Empirical research has been conducted in both Scandinavia and the United States over the last twenty years. The findings are essential similar and show that the increasing automation of work processes is producing several changes, including: (1) a speed-up of work, (2) a tighter coupling of work, (3) greater independence for professional and staff workers and greater interdependence for operations workers, (4) greater control over people for managers and professionals and greater control over jobs for clerical and administrative workers, and (5) greater flexibility in work organization (Attewell & Rule 1984, Kraemer & King 1986).

Speed-up of work

Computerization has produced a speed-up of work at all levels within government, ranging from street-level workers to office workers to professional workers to policy makers and managers. The speed-up has occurred because the technology allows individuals to work faster, shortens the cycles for processes such as billing, paying and collecting, and records information in real-time, as events and actions occur, and thereby creates an expectation for fast response. An important effect of this speed-up is a general increase in time pressures felt by all types and levels of workers (Danziger & Kraemer 1986, Irving *et al.* 1986, Jackson 1987, Kraemer & Danziger 1990).

Tighter coupling of work

Information technology is also creating a tighter coupling of work, especially where individuals from several different governmental departments and functions are tied together in a single system such as a financial system, personnel system, geographic information system, or emergency dispatch system. A tighter coupling of work means that what a person does in one part of the organization triggers decision or action by others, or that what people do in their own parts of the organization creates a picture of something happening that all must respond to in a coordinated fashion. The former is illustrated by the case of a building inspection which discovers serious health, safety and environmental hazards and triggers the need for response by the fire department (hazardous materials), health department, and police department. The latter is illustrated when the independent actions of these departments result in determinations that taken together suggest that a building must be vacated, sealed-off, and torn down because of the total set of hazards present and the improbability of their amelioration.

Independence/dependence of work groups

As might be expected from the tighter coupling of work, there is a growing interdependence among some work groups as a result of automation; but there is also a growing independence for others. Information technology appears to increase the independence of highly professional and specialized work groups such as engineers, planners, economists, statisticians, management analysts, and staff analysts. These groups have always been able to function relatively independently, and computing has only increased their independence at the margins. It has done so by providing them with direct hands-on access to the technology, to data, and to the power to manipulate data in order to produce information relevant to their jobs. This increased capability has tended to heighten their stature and their independence of action (Danziger & Kraemer 1986).

In contrast, the extension of computing into government has increased the interdependence of office work groups at the operational level, especially when they rely upon one another for input of data (and its accuracy, timeliness, format), for processing cases/clients in a sequence of steps, or for manipulations of data which form the basis for action by others (for example, forecasts or work schedules). The groups most often affected are the clerical, administrative, and managerial in both operational and staff functions such as finance and per-

sonnel, planning and building, fire and police, and across these functions (for example, geographic information systems, financial systems, and personnel systems).

Control/autonomy of individuals and jobs

IT-use has been shown to have several effects related to control of individuals and jobs (Kraemer and Danziger, 1990). First, computing provides a higher level of organizational control and greater capacity for judging performance via computerized monitoring systems built into the operating systems of government. And this capacity for work monitoring via the computer is now a reality for professionals as it has been for clerical/administrative workers (Bjørn-Andersen *et al.* 1986, Irving *et al.* 1986).

Second, managers and professionals generally enjoy greater increases in control attributed to computing than do clerical/administrative workers (Danziger & Kraemer 1986, Majchrzak 1987, Millman & Hartwick 1987). However, computerized systems also can make the task of control more difficult, especially for those in superordinate roles who themselves become dependent on the technology. For example, a study of supervisors and customer service representatives in a large public utility (Kraut *et al.* 1989) found that as a result of installing a new customer inquiry system, the supervisors' work was both made more difficult and more technology-dependent. In the past, supervisors had known the job of their subordinates because they themselves had previously been customer service representatives. However, with the introduction of the new computerized system, their knowledge was suddenly obsolete. And the supervisors did not possess nor were they provided with training to develop the skills they needed to operate in the new computerized environment.

Third, computerization has increased workers' sense of control over certain aspects of the job, including mastery over relevant information and improved communications. This has especially been the case for clerical and administrative jobs, and has been accompanied by an increase in time pressures (Kraemer & Danziger 1990).

Flexibility of work organization

The most significant impact of computing on work organization is that the technology enables managers and policymakers to choose whatever structural arrangements they desire, including combinations of structural arrangements. IT-use does not determine work organization; computing facilitates it. While information technology may enhance employee skill and autonomy, thereby facilitating decentralization and distribution of work, it also facilitates hierarchical control and task fragmentation (Bjørn-Andersen *et al.* 1986, Thompson *et al.* 1989). For example, hierarchical control and task fragmentation are facilitated by information technology when efficiency is the primary goal, the organizational scope is limited, capital cost is low, equipment reliability high, workforce interest low, and computerized monitoring effective (for example, in the mail room or central records department of a state or local government organization). This fact highlights the importance of recognizing that the organization of work is at least as much a matter of political/managerial choice as it is of function/task ne-

cessity. It is a matter of choice about the structure of governance in organizations (Kraemer 1991).

IT-use can influence the work organization through, for example, automating parts of the production- or job-routines, and, in some cases, establishing separate organizations that are fully, or highly, automated while the remaining parts of the "old" organization are manually oriented. This might lead to a high degree of computer networking in the automated part of the organization, but it also might reduce the degree of integration between automated and manual tasks. Also, establishing separate organizations reduces the possibility of formal rotation between kinds of tasks in the manual and computerized organizations (Child & Loveridge 1990).

As all of the foregoing suggests, the effects of changing computing are being felt at all levels of state and local government. IT-use has generated opportunities to reconfigure relationships, including those between levels of government, among subunits of the same jurisdiction, and between levels within state and local governments. The effects of computing on the activities of state and local governments and the organization of work have had ramifications for the nature of work itself. State and local government employees are experiencing greater time pressures, tighter coupling of their work activities, and changes in dependence and autonomy.[7]

Conclusion

Computing and other information technologies are part of the general transitions affecting the public service and also bringing about their own transitions. The transitions are evolutionary—not revolutionary. The use of computing is still in the early to middle stages in most governments.

Governments in the U.S. and Scandinavia have followed fundamentally different approaches to the introduction of computing and to dealing with its effects. These differences stem from differences in views about the beneficence of technology, the need for reorganization of work along with the introduction of new technology (the popular word today is re-engineering), and the role of government in anticipating and mitigating the effects of technology. In the U.S., the introduction of IT has been individualistic—each individual unit of government has introduced the technology for its own needs. For the most part, the systems that have been implemented have been small scale, have followed functional lines, have merely automated existing operations, have been implemented incrementally, and have involved slowly over time. While the U.S. has occasionally implemented vertically integrated systems such as NCIC/CCH, these tend to be the exception rather than the rule. Attempts to implement such systems outside the criminal justice area, where command and control system of authority exists, have generally been unsuccessful.

In contrast, in Scandinavia the introduction of IT has been communal—systems have been designed, developed, and implemented by communal data processing agencies serving an entire level of government—national, county or municipality. The systems that have been introduced have been relatively large scale, have crossed functional

lines, have involved the reorganization of work, have integrated both data and work processes, and have been implemented more or less simultaneously for all units or agencies of government.

These differences in approach to the introduction of IT have influenced each country's view of the role of government in anticipating and dealing with the effects of changes in computer technology on the public service workforce. In the U.S., the effects of government IT-use have almost never been startling because the introduction of IT have been incremental and governments have followed a policy for reducing staff through attrition rather than layoffs. Thus, U.S. governments have been relatively unconcerned about effects of IT-use, have responded to each situation in ad hoc fashion, and have been reactive rather than proactive in dealing with effects. Scandinavian countries have reorganized work along with the introduction of IT such that the potential effects on government employees have been more serious. Consequently, they have been concerned about effects of IT-use from the start, have developed plans to deal with these effects, and have been proactive rather than reactive in dealing with the effects of automation.

Citizen information
Expert-systems for determining health and social welfare subsidies and software for providing improved, computer-supported information directly to the clients in the municipalities have affected government-citizen interaction and the structure of functions within the government in Scandinavian countries. The systems have been a challenge for the municipalities which traditionally have been split into specialized departments The new technology has enabled turning over a number of routines from various functions to a "front services" offices that interfaces with citizens (Hoff & Stormgaard 1990).

Automated services delivery
Automatic Teller Machines (ATMs) and smart cards which permit cash withdrawal and credit charges have in the United States reduced the time welfare recipients must wait in line for payments, and reduced the stigma attached to their having to stand in line to cash their welfare checks, use food stamps, etc. in making purchases for daily living. But, this innovative and client-sensitive method of service delivery, currently costs about ten times that of the paper system and is not widely accepted by merchants or banks (Fiordalisi 1988).

Management information systems
Computerized case management systems have allowed detectives, inspectors, social workers, probation officers and other case workers to be more personally productive, handle a larger caseload, and do better casework (e.g., better follow-up, more "completion" of cases, etc.) thereby increasing the diversity of their work, the bottom line performance, and the sense of accomplishment in their work. At the same time, the speed-up of work, the errors in case records entered by co-workers, and the insatiable appetite of supervisors for more information about the cases from computerized files has sometimes increased worker stress. (Danziger & Kraemer 1986)

Detention monitors

Electronic monitors for detention of both adult and juvenile offenders in homes or workplaces have reduced the overcrowding of jails, facilitated policing by probation and social workers, and allowed offenders to perform useful work and community service. However, stress has resulted for probation and social workers who are insufficiently trained to use this new technology and for offenders whose lives or work are needlessly disrupted by mistakes and insensitive use of the monitors (Baumer *et al.* 1991, Maxfield & Baumer 1990).

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Notes

[1]IT includes computers, office automation, telecommunications, and management science techniques. We focus on information technology for several reasons. First, it is pervasive in governments and will become more so during the next decade and beyond. Second, it is illustrative of other pervasive technologies such as biotechnology and materials technology which are expected to have major effects in the distant future. Third, information technology is embodied in many other discrete technologies such as those specific to a particular area like transportation, criminal justice, health care, or infrastructure. Fourth, there is more known about the diffusion, use, and effects of information technology than about discrete technologies which tend to have more limited scope of application.

[2]There are important historical, cultural, economic, and social differences between the Scandinavian countries (Denmark, Norway, and Sweden). However, in this paper we will mainly use examples from Denmark and Sweden, though we believe that similar examples can be found in Norway.

[3]The public sector employs a large part of the total labor force, the public sector spends more than half of the GNP. The local governments plays an important role in managing the welfare state. In Sweden the public sector spends 67 percent of the GNP, while the public sector in the US spends 38 percent (1982). The Swedish local government spends 35 percent of the GNP (1981), the US local governments 8 percent (1982). The main expenditure in the Swedish local governments is health, education, and welfare (Bogason 1987).

[4]Sweden also has a well-organized system of planning and project implementation in IT policy. In addition, government and private sector have had frequent mutual interaction in the planning of programs for IT development. An incident that triggered the establishment of large scale IT programs in Sweden happened at the beginning of the 1980s. The NATO-member countries refused to provide integrated circuit (IC) chips to Sweden, claiming that Sweden exported some systems listed by the Coordination Committee for Mutual Export controls (COCOM), for construction projects associated with the information systems used in the Moscow Olympics. This incident increased public awareness of the necessity of ensuring a secure supply of key components of manufactured products on which Sweden's international competitiveness relied. Automation and process control equipment were examples of these.

[5]The Scandinavian approaches for studying computerization is thus highly linked to improving the conditions for the workers (Bermann 1989, Bjerknes *et al.* 1987, Floyd *et al.* 1989).

[6]National Crime Information Center/Computerized Criminal History.

[7]Still, there are many areas where we do not yet know the effects or have a completely clear idea of the effects. These include the following:

1. A quantitative indication of the job displacement, new jobs, and net employment effects of the adoption of information technology. It is probably impossible to determine these effects across all state and local governments. However, a few carefully constructed empirical case studies over time in highly impacted governments and/or agencies would provide a good indication of the extent of such effects and the key relationships that would help other governments to make their own assessments.
2. The effects on citizens and public servants of the very new technologies for services automation, computer-assisted service delivery, communication with the public, and automatic monitoring. Current knowledge is mainly anecdotal, derived from newspaper and promotional accounts. What is needed is serious study of these technologies in order to draw out more fully their implications for the public service.
3. A quantitative indication of the numbers and distribution of new technology-related functions and new job classifications in state and local governments. How many technology policy analysts, technology transfer agents, information resource managers, information analysts, GIS specialists, end user specialists, multi-media specialists, and similar new jobs exist in state and local governments? Where are they? And, at what rate are they growing?

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