

Bozeman (1993) indicates that the discipline of public management is comprised of such issues as strategy, interorganizational relations, and the intersection of public policy and management and includes the implications of technological innovation. Information technology issues in public management are well represented in the literature. As previously discussed, government is a collector, user, and disseminator of information. Information technology tools, in conjunction with reengineering or process improvement, can increase productivity and reduce the cost of government while improving the quality of services. Many factors influence the degree to which these types of benefits are realized. The following public management issues have been identified from the preliminary review:

- Information as a government resource
- Process improvement and reengineering
- Strategic information resource management in government
- Information resource management and information technology issues in local government
- Hiring and maintaining an IT-skilled workforce
- Government information systems
- Government publishing
- Budgeting for IT resources
- Evaluating government information systems
- Factors that affect the use and effectiveness of information and information technology
- Procurement
- Use of specific technologies

Information as a government resource

Bozeman and Bozeman (1989) discuss local government use of federal statistics. They indicate that incompatibility of data obtained from multiple sources; dissimilarity of data collection efforts between state, local, and federal agencies; and a reduction in funds and an increase in responsibility as problems in local government use of federal statistics. They further indicate that the federal government can take steps to increase the utility of federal statistics to local governments. For example, the provision of resources and technical assistance to local government in answering their questions about data structures, a move toward maximum uniformity of definitions and procedures, devotion of more resources to small areas and categories, consideration of a quinquennial census, and the provision of assistance for the implementation of geocoded systems are suggested as mechanisms that the federal government can use to increase local government use of federally-developed information.

While much research focuses on information technology in public organizations, another stream of research focuses on how policy makers select and use information in policy deliberations. Bretschneider and Gorr (1992) describe the forecasting process in government by extending an existing model used to explain forecast accuracy to include a series of complex factors related to the potential political and policy use of state sales tax revenue forecasts. The factors include economic uncertainty, political influence, and organizational designs for forecasting. Bretschneider and Schroeder (1988) propose an approach to evaluating commercial economic forecasts for use in local government budgeting.

Kowlowitz and Kelly (1997) emphasize the need for the integration of electronic records management mechanisms into the design and development of government information systems. They indicate that many organizations lack adequate tools to manage the growing number of electronic records and that some organizations are in danger of losing access to records stored in personal computers, e-mail boxes, or personal local area network directories while others face the challenge of linking documents created in different forms and formats to business transactions. From an archival perspective, which focuses on long-term organizational and societal needs, these problems may result in the loss of records of enduring value. They present preliminary versions of practical tools to support the identification and implementation of records management requirements in system design and development.

Process improvement and reengineering

Information technology is often discussed in terms of its role in business process improvement or business process redesign. Much of the literature emphasizes the role of process improvement and reengineering as a critical component to realizing benefits of IT. Davenport and Short (1990) discuss the role of information technology and business process redesign in the transformation of organizations. Davenport (1993) describes

performance improvements and changes in organizational efficiencies resulting from information and communication system implementations. Information technology provides the capability of hardware and software applications and telecommunications, while business process redesign involves the analysis and design of work flows and business processes within and among organizations. They identify the following as important factors or tactics toward achieving business outcomes: using IT as a design tool, understanding generic design criteria, and creating organizational prototypes. They indicate that obtaining and maintaining management commitment is perhaps the greatest difficulty in IT-driven process redesign and that modifying structural dimensions such as function, product, and geography along process lines can aid in achieving desired outcomes.

Mechling (1994) also discusses the perception that reengineering in the public sector may not be much of a reality. He indicates that true reengineering is characterized by a fundamental redesign of work processes associated with the production of a good or service, rapid and large scale improvements in performance, and the aggressive use of supporting information technologies. Reengineering is discussed in terms of both a goal and an approach for reaching a goal and given that information technology can be used to organize work processes in substantially more efficient manners, the time is right for reengineering. He argues that organizations and societies that reengineer will be much more successful than those that do not and that reengineering, as an approach or process can take many forms.

Bashain et al. (1994) discuss the organizational conditions that influence the degree of success in business process reengineering. Sampler and Short (1994) discuss an explanatory framework based on expertise half-life and information half-life. They propose that under certain conditions, project failures are associated with a disjointedness between reengineering project objectives and the organization's general business and information systems planning agenda. Under other conditions this decoupling can be associated with successful projects. They arrive at two observations regarding strategic assets, IT, and process reengineering. First, information technology's capability to destroy tangible as well as intangible assets suggests a more substantial and complex role for IT in the development of an organization's core competencies. Second, reengineering efforts that do not take into account the difference between restructuring physical assets and rethinking the flow, or characteristics of, intangible assets are incomplete. King (1995a) stresses that the role of government and shifting public-private interactions are within the realms of social and technical change that can be considered in the context of business process reengineering.

Kambil and Short (1994) discuss the need to alter both the fundamental structures of organizations and their environments, therefore shifting the focus of study of electronic integration-- the use of IT to reengineer business processes, from that of the organization to the entire business network. They indicate that the role-linkage perspective is a useful abstraction to characterize the business network and to guide research on the effects of IT on organizational structures. Earl et al. (1995) describe a framework for analysis of the relationship between business process reengineering and strategic planning. Four case studies are used to demonstrate variability in the following four domains: process, strategy, information systems, and change management and control. A taxonomy of BPR strategies is identified through the case studies suggesting a richer variety of BPR practice than had been previously documented as well as opportunities for further research.

Strategic information resource management in government

Andersen et al. (1994) discuss the role of strategic information management in government restructuring to meet demands for integrated customer-oriented services in an environment of increasing fiscal constraints. Soh et al. (1993) describe Singapore's statewide strategic planning process for information technology. They describe Singapore's plan for a national information infrastructure designed to capitalize on the country's information as a key factor for production and improvements in quality of life. The planning process, the participants' roles, and the main recommendations are outlined. The plan is evaluated in terms of its objectives, unanticipated results, and impacts on industry participants. Implications and lessons are drawn to support strategic IT planning at national or sectoral levels.

Caudle (1996) indicates that in light of public demand for improved government services at reduced costs, government organizations must show increased accountability for positive results. She highlights six fundamental strategic information resource management best practices that can improve government performance in terms of service delivery and accountability: directing IRM changes; integrating IRM decision making in a strategic management process; linking mission goals and IRM outcomes through performance management, guiding IRM project strategy and follow-up through an investment philosophy; using business process innovation to drive IRM strategies; and building IRM/line partnerships through leadership and technical skills.

Fletcher and Foy (1994) provide a review of the literature from 1980 to 1993 discussing the uses of information

technology by state and local governments. The paper provides a history of information technology management, including a discussion of current information technologies including information architectures and information resource management, and geographic information systems. Citizen access to information and the role of government information professionals is also discussed. Caudle (1990b) presents the results of a national survey conducted by the School of Information Studies at Syracuse University that focused on state information resource management. The study found that communication is a primary area for innovation and change in state government. In particular, voice, data, video, and image transmission were found to be key areas of interest. Organizational and telecommunications issues such as telecommunications expenditures were also indicated as important.

Information resource management and information technology issues in local governments

The management of information and information technology at the local government level has also been addressed by a number of researchers. Northrup et al. (1982) discuss the results of a study focused on the management of computer applications in local government. They conclude that the single most important factor influencing the success of computing is a commitment to advanced technology. They also indicate that the more advanced the technology application, the greater the pay-offs associated with the application. Policies such as user involvement and decentralization, while important, appeared to be of secondary importance in comparison to the state of the technology's development.

Fletcher and Bertot (1994) discuss the role of county government in the management of information technology. They discuss a national study of centralized management of information technology conducted to identify practices, critical success factors, and future challenges. The study also focused on assessing the benefits, costs, and constraints of centralized county-level management of information technology.

Norris and Kraemer (1996) present survey results comparing computing characteristics in cities that use only personal computers as opposed to those that use central computer systems. The findings did not support the claims that PC systems would increase the rate of speed of automation of government functions. Rather, it was found that those cities with central systems were more extensively automated, had more widespread use among staff, and were more likely to implement leading-edge computing technologies than those cities that had only PC's. The results indicated that respondents in cities with centralized systems were positive about computing impacts and were satisfied with computing. Those cities that had only PC's had an advantage over those with central systems in that they reported fewer computer-related problems, however there was only weak statistical significance in the test. The authors argue that the reliance on ad hoc solutions, outsourcing, and computer gurus, resulted in a failure to support sufficient on-going support activities in PC-only cities while in those cities with central systems, these capabilities were developed over time and therefore provided greater support for the computing function in addition to a more stable technology platform.

Sparrow (1994) discusses the role of information management in the evolving strategies of three U.S. enforcement professions: policing, environmental protection, and tax administration.

Hiring and maintaining an IT-skilled workforce

Another key area for research focuses on maintaining an IT-skilled public sector workforce. Kraemer et al. (1986) discuss the need to upgrade public management education to reflect changes in society, government, and knowledge, in particular those areas related to information technology. Three levels of computer literacy courses are recommended and investments in hardware, facilities, and faculty are suggested. Caudle (1987) also stresses the need for public management training that addresses: 1) knowledge about current and emerging technologies; 2) understanding of equipment and software; 3) understanding of organizational behavior. Caudle (1990a) also points out that public management education should take into account the substantial organizational changes associated with the applications of information technologies.

In particular, information technology can present both new opportunities and obstacles for public managers. She identifies three critical skill sets for inclusion in public management education: information technology management, information management, and human resource management. She further indicates that new ethical issues in information management such as privacy, accuracy, property, and accessibility will pose challenges in terms of creating an environment in which human resources can be creative and entrepreneurial.

King et al. (1992) explore the concept of the knowledge executive. Using data collected from 500 U.S. municipal

government department heads, they present results on the degree to which the respondents use microcomputers, mainframes, and computers for record search and explore the degree to which the concept of knowledge executive applied to public managers. They note a lack of knowledge executives among local level public managers and that greatest efficiency increases are found in those executives that use computers.

Dawes (1994) discusses the influence of changing information technology on the nature and operation of government programs, the structure and function of government organizations, and the related shift in content of government jobs. Problems related to such areas as title structures, recruitment, testing and selection, and civil service processes are also discussed.

Galvin (1995) describes a tension between unification (convergence) and specialization (divergence) in education for information professionals. He identifies issues such as striking a balance between theory and practice in curricula and the appropriate place in curricula for skills training. He also discusses the controversy over whether a professional school should have as its priority the development of knowledge and skills for entry level jobs versus a focus on lifelong career preparation.

Government information systems

Government organizations differ from private sector organizations in a number of ways. These differences must be considered in the design and implementation of information systems. Caudle et al. (1991) indicate that government has multiple, conflicting, and often intangible goals and that government is substantially affected by red tape and politics. These features or characteristics must be taken into account in the management of information systems. Based on a national survey of public information managers, a lag in information systems development was identified as compared to the private sector. The analysis also showed that middle-level public sector managers are critical for information system development, small government agencies are more interested in IS transfer than large agencies, governments with a lot of red tape tend to have flexible information systems, and local government information system issues tend to be driven by transaction processing while state and federal governments use information technology to support their oversight missions.

Government publishing

Hernon and Relyea (1995) provide an overview of publishing across levels of government, in particular, in the context of US federal government. They discuss the shift from paper to electronic publication for some governments as well as the implications of the shift.

Budgeting for IT resources

King (1989) describes the complexity of budgeting for information systems in a constantly changing environment. He indicates that the budget development process requires an analysis of current activities, a projection of activities that will occur in the future, as well as an estimate of the resources required to support future planned activities. He states that the degree of stability within an environment is affected by changes in the mission of the department, costs of inputs to production, the degree to which increased needs for one input increase that for another (input complementarity), and the degree to which one input can be used to replace others (input substitutability).

Evaluating government information systems

The distinguishing characteristics of government must also be taken into account when evaluating proposals and fully implemented information systems. Consequently, research has focused on evaluating the effectiveness of government information systems. Evaluations are critical both before and after systems are implemented. Newcomer and Caudle (1991) stress that the key issues to be considered in the design of a government information system center on the purpose of the information system. In particular, the focus should be on the users of the system, their responsibilities, and the type of administrative or programmatic decisions that the system will support. They further indicate that once an information system has been implemented, the following characteristics can be used to assess the level of system success: usefulness, understandable output, currency or timeliness, relevant output, access, adaptability, accuracy, and ease of use.

Caudle (1994) presents the results of a US General Accounting Office (GAO) study that examined the strategic information resource management fundamentals of 19 private, state, and federal government organizations. The

following practices were shown to have a direct, positive effect on the quality, quantity, cost, and timeliness of organizational products and services: top leaders recognize that change is needed and have strategies for transitioning, implementing, and reassessing new IRM processes; leading organizations develop a formal strategic management process that covers all major management decision and action points; senior managers select, control, and evaluate IRM projects as investments; organizations develop and integrate rigorous performance measures within the organization's existing management and decision making processes; and leading organizations focus on dramatic business process innovation and change.

Northrup et al. (1990) discuss the technical or operational payoffs from computerization such as the increased availability of information, better information for management control, better information for city planning decision, greater efficiency of operational performance, and better interaction with the public. Based on survey data, they indicate that the respondents were experiencing the most payoffs in the areas of fiscal control, cost avoidance, and better interaction with the public while only minimal levels of payoffs were observed in non-fiscal management control and planning decisions.

Factors that affect the use and effectiveness of information and information technology

Kraemer et al. (1993) present data gathered from 260 public managers to assess general perspectives of the potential of information technology and the value of computer-based information (CBI). The two perspectives are the knowledge executive and consumers of computer-based information. The results of the analysis indicated that public managers believe that CBI is important and heavily relied upon. The findings also showed that information is more valuable in supporting control of financial resources than in the management of operations. Four sets of factors were identified that might account for variability in the usefulness to public managers of computer-based information. Quality and accessibility of information were found to be particularly important as were the manager's style of use. The authors also indicate that the managers who found CBI the most useful were those that used support staff to mediate their CBI environment. They conclude therefore, that IT design efforts should include mediating support staff as well as executives. Danziger et al. (1993) present the results of a survey of 1,869 end users in 46 U.S. cities. The survey results identify three major factors that can be controlled to influence the quality of computing services: the structure of service provision, the level of technological problems, and the service orientation of computing service specialists. The authors indicate that the survey results do not support the argument that the degree of centralization of computing services is the most important factor in quality of computing systems. They conclude that service improvement strategies that focus on the socio-technical interface between users and computing service providers should be stressed.

Kraemer et al. (1994b) compare the government computing implementations in the US with those in Scandinavia. They indicate that in the US, individual units of government have implemented information technology to support their own needs while those in Scandinavia have been designed and developed via communal data processing agencies serving an entire level of government. Additionally, systems implemented in the US have tended to be small scale, following narrow functional lines, implemented incrementally, evolved slowly over time, and have essentially automated existing operations. As compared to Scandinavian efforts, US efforts have focused little attention on automation effects, have responded to situations in an ad hoc fashion, and have been reactive rather than proactive. Scandinavian efforts, in particular those in Sweden, have done more to address the reorganization of work processes along with automation and the potential effects on government workers are more substantial.

Henze and Lenk (1988) describe a high level of intergovernmental coordination and cooperation as a salient feature of information technology as used in the German public administration. They indicate that large automated data processing centers at the federal, Laendar (states), and municipal levels play a coordinating role in bringing together major government users of information technology. They indicate that the prevailing information technology application and coordination structures have resulted from a stage of information technology development that was reached by the end of the 1960's and that the future application of IT in the federal administration will focus on performance improvement, communications, and quality of service. Dawes (1996) also argues that the sharing of program information among government agencies can aid in the achievement of important benefits such as increased productivity, improved integration of services, and more informed policy making. Technical, organizational, and political barriers however, often limit government agencies' ability and willingness to share information. Results from a study of state government managers are presented and a theoretical model for understanding the interactions among policy, practice, and attitudes is proposed. Stewardship and usefulness are suggested as two policy principles to enhance the benefits and mitigate the risks associated with information sharing.

Procurement

Another issue that has drawn attention from the research community is that associated with government procurement. Kelman (1990) presents case studies of federal government technology acquisitions. In particular issues associated with procurement regulation, official discretion, and relationships with contractors are discussed.

Use of Specific Technologies

Internet

Ryan and McClure (1995) report on the perceptions and views of 67 government officials and contractors who had or were about to embark on the development of Internet services. The group participated in a Strategic Information Resources Management Seminar entitled "Building and Managing Government Internet Services." Survey instruments were implemented to identify key issues and concerns about the building and managing of government Internet services. The following issues were identified by the respondents: technical challenges; including security, encryption, and document integrity; data quality and organization; cost and funding issues; moving the barriers created by bureaucracy; integrating Internet services with agency mission and function; developing external partners with non-governmental organizations and the commercial sector; understanding and communicating with users; evaluation criteria for extensiveness, efficiency, effectiveness, impact and usefulness; personnel and training needs; and federal or agency policy adjustments. The respondents also identified the strategic benefits to their agency that had resulted thus far from the provision of government services over the Internet including improved communication, coordination, and collaboration; wider dissemination of information; and enhanced agency profile.

Expert Systems

Expert systems have been developed and used to support a diversity of government operations. Van de Donk and Snellen (1989) discuss the development and introduction of knowledge-based systems in public administration. Three types of knowledge-based systems: handling systems, advisory systems, and expert systems are examined in terms of the functions of public administration as derived from political, legal, technical-scientific, and economic rationales. Bourcier (1989) describes the main features of MAIRILOG and BRUITLOG, expert systems developed for the mayoral and municipal offices of Paris. She discusses how the systems work as well as evaluation methods and methodological problems. Coursey et al. (1993) describe an expert system, the Intelligent Waste Stream Advisory System (IWSAS), that provides phone survey assistance in the collection of information from small quantity generators of waste in New Jersey. The system facilitated the completion of 252 surveys and contributed to the understanding of factors influencing waste generation.

Group decision support and cooperative work systems

Group process is a critical component of government planning and policy making. The Delphi Method, Nominal Group Technique, and Social Judgment Analysis are identified by Reagan and Rohrbaugh (1990) as decision processes that have been developed to increase the quality of group decision or commitments to decisions once they have been made. They indicate that with the increased availability of Group Decision Support Systems, organizations are expected to invest substantial resources in new information technology to support the work of teams and expert groups. Further as the number and variety of group processes and supporting technologies increases, identifying the most appropriate methods and technologies will become more difficult. They suggest the Competing Values Approach as a mechanism for evaluating group decision process and provide an example of its use. Many private sector and government organizations are choosing to use computerized decision support systems or automated group decision support systems to facilitate decision making and planning. These technologies facilitate decision making through the use of automated decision support models. Research has focused on the factors that influence the degree to which these systems are effective. For example, Nunamaker et al. (1988) discuss principles of group processes and the hardware and software features of computer-aided deliberation. They discuss findings from their group decision support system research with respect to such factors as anonymity of participation, facility design, need for multiple public screens, use of knowledge and databases, communication network speed, methodological approach, and software design.

Kraemer and King (1988) indicate that technology to support cooperative work and group decision making has grown out of three traditions: computer-based communications, computer-based information service provision, and computer-based decision support. Their paper provides an overview of group decision support systems

(GDSSs) that support group work and evaluates experiences with such systems. They indicate that progress has been slower than originally expected due to shortcomings in the available technologies, insufficient integration with various components of the computing “package,” and an incomplete understanding of the nature of group decision making. They conclude however, that the field shows promise in the area of tool creation to aid group decision making and in the development of mechanisms to support the study of group decision making dynamics.
