Key Information Systems Management Issues for the Public Sector[1]

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Abstract

The public sector has multiple, conflicting, and often intangible goals. It produces "public goods" for problems that should be solved (like crime and poverty), even though these problems may have no known feasible solutions; and it is heavily impacted by politics and bureaucratic red tape. These and other features of the public sector make it potentially a much different setting for IS management than the private sector. This article reports on the first national survey of public sector managers identifying their most important IS issues. The survey, covering respondents from federal, state, and local governments, drew upon prior survey research in the private sector and the literature on public/private sector differences.

While most of the top public sector issues also appear on the top private sector issue lists, the rankings show a lag in public IS development as compared to the private sector. Perhaps the most interesting results of the survey, however, are from a deeper analysis. At the main effects-level, we have preliminary evidence that (1) middle-level (instead of top-level) public managers are critical for IS technology development; (2) small government agencies are more interested in IS technology transfer than large ones; (3) governments with a lot of red tape tend to have flexible IS; and (4) local government IS issues are driven by transaction processing while state and federal governments have IS more suitable for their oversight mission.

Introduction

MIS Quarterly has published five articles assessing the importance of information systems (IS) issues to managers. Three surveyed Society of Information Management members (Ball and Harris, 1982; Brancheau and Wetherbe, 1987; Dickson, et al., 1984), one used a sample of organizations from the St. Louis, Missouri, area (Hartog and Herbert, 1986), and another employed interviews conducted with top managers in 49 Irish organizations (Moynihan, 1990). These studies identified key issues that support decision making by "businesses and government agencies . . . [affecting] profitability and effectiveness," and the information profession in regard to "commitment of its limited management, research, and educational resources" (Dickson, et al., 1984, p. 135). The surveys in these studies are limited, however, to the private sector. Their public/non-profit sector sample sizes range only from one to 19 respondents per survey.

The contribution of this article is that it is the first national survey of *public* managers' ratings of IS issues. Conducted in mid-1988, the survey sampled high-level public managers in federal, state, and county agencies. A comparison of our importance-rating results with those from the

previous private sector surveys shows many similarities between the two sectors but also some pronounced and critical differences.

The next section reviews the underlying factors contributing to public/private sector differences and leads to several uniquely public IS issues. Subsequent sections summarize the survey instrument, its administration, and overall survey results. Next is a comparison of the survey results with previous private sector surveys, followed by a close look at the variations within the public sector survey.

Differences in Public and Private Sector Information Systems

Rainey, et al. (1976) summarize the literature on differences between public and private organizations. Stated in terms of the public sector's characteristics relative to those of the private sector, these differences include:

1. **Environmental Factors:** Less market exposure (and therefore more reliance on appropriations) resulting in less incentive for productivity and effectiveness, lower allocative efficiency, and lower availability of market information; more legal and formal constraints; and higher political influences, including impacts of interest groups and need for support of constituencies.

2. **Organization/Environment Transactions:** More mandatory actions due to the unique sanctions and coercive powers of government; wider scope of concern and significance of actions in the "public interest"; higher level of scrutiny of public officials; and greater expectation that public officials act fairly, responsively, accountably, and honestly.

3. **Internal Structure and Processes:** More complex criteria (e.g., multiple, conflicting, and intangible); managers with less decision-making autonomy, less authority over subordinates, greater reluctance to delegate, and a more political role for top managers; more frequent turnover of top managers due to elections and political appointments; difficulties in devising incentives for individual perfor-

mance; and lower work satisfaction and organizational commitment.

Using these general differences and some propositions on public information systems (Bozeman and Bretschneider, 1986), we proceed to identify IS issues unique to the public sector.

Proprietary versus shared IS

Private sector firms often treat information technology as proprietary, for use as a competitive advantage in the market place (Camillus and Lederer, 1985; Keen, 1988; King, et al., 1988; Lucas, 1986; Marchand, 1985). In contrast, government provides "public goods," such as education, public health, public safety, and national security (Savas, 1982). By definition, it is not possible (nor desirable) to exclude consumption of public goods. Thus, while Brancheau and Wetherbe (1987) introduced the issue of using IS for competitive advantage, we introduce a public sector counterpart.

> **Technology Transfer:** Agencies should find ways to increase sharing of applications and technical assistance with other agencies having similar functions or providing similar services.

Goals

The most frequently mentioned difference between the public and private sectors concerns underlying goals (Self, 1977). Market signals and profit guide the private sector. In contrast, public sector organizations face multiple goals, many of which are intangible or in conflict with one another. Problems faced in the public sector are ones that "should" be addressed (e.g., reduce crime) even though they may have no known solutions; whereas, problems faced in the private sector are driven by feasibility considerations (Downs and Larkey, 1989).

A consequence of these difficulties is that information requirements are inherently more difficult and unstable in the public sector (Caudle and Newcomer, 1987; Newcomer and Caudle, 1986). We therefore include the following issue.

> **Identification of Information Requirements:** Agencies should develop systematic processes to identify and prioritize information requirements.

This issue is comparable to, but somewhat narrower than, the top-rated issue in all of the private sector surveys, IS planning.

Bureaucracy and paperwork

Partly in response to the inherent difficulties in public sector information requirements and the resulting proliferation of forms and records, the Paperwork Reduction Act of 1980 sought to institutionalize information resource management in the federal government (Caudle, 1988; Newcomer and Caudle, 1986). Some states are also adopting information resource management practices. We therefore include the following issue.

> **Information Resource Management:** Agencies should adopt information resource management concepts (e.g., integration of information technology management, records management, and other information management areas) and assign a central institutional responsibility for information collection, processing, dissemination, policy, and operations.

Political influences

Politics disrupts the long-range planning necessary for information resource management. Downs (1967) points out that elected officials typically have shorter planning horizons than bureau officials and are more sensitive to public pressures. Political cycles cause periodic changes in top-level management and program priorities (Nigro and Nigro, 1977; Self, 1977). Bozeman and Bretschneider (1986) state that, "The appropriations process generally operates on an annual basis, Congress turns over every two years, and the presidency is subject to change every four years. Constant pressure exists to achieve quick results—results that can help the agency receive a larger share in the next round of appropriations; results that can help in reelection" (p. 479).

To offset political influences, public sector IS managers and users should place importance on planning mechanisms that provide continuity for long-range goals. We therefore include the following issue.

> **Political Influences:** New planning and budgeting procedures should be developed to reduce the impacts of short-run political priorities and the lack of political continuity that can undercut comprehensive and long-term IS planning.

Another implication of political cycles is that frequent leadership and program changes can cause discontinuities in basic data element definitions (e.g., as welfare recipient classes change, components are added or subtracted to tax bases). Thus, time series and other data need special documentation to allow interpretation and preserve information value (Gorr, 1986). We therefore include the following issue.

> **Data Discontinuity Between Administrations:** IS management should find ways to provide for long-term continuity of data definitions and data aggregate classifications, or a historical record of changes, to maintain the usefulness of historical data.

The Public Sector Survey

Table 1 lists the 37 issues in the survey by category, and the Appendix contains the portion of our survey instrument defining these issues as assertions appropriate for Likert-scale responses. We used a five-point scale where 1 is "not important at all" and 5 is "extremely important." We defined importance in terms of management support, attention, and other organizational resources required to ensure the success of IS over the typical government budget planning horizon of two or three years. Issues unique to this survey are marked by an asterisk; however, issues like #1, "educating elected officials," which have a comparable private sector issue already identified in the literature (educating senior personnel), are not marked as unique.

Respondent selection

For federal agencies, we mailed surveys to all executive-branch officials identified as "information resources manager operational contacts" in the 1987 directory provided by the U.S. General Services Administration. This sample provided complete coverage of federal personnel directly

Table 1. Public Survey Information Systems Issues

A. Strategic Management Concerns

Educating elected officials
Political influence
Long-term planning mechanisms*

Comprehensive planning integration
Information resource management*
Research and development

B. Operational and Tactical Management Concerns

Identification of information requirements
Measuring IS effectiveness

Procurement and contracting*
Oversight requirements*

C. Applications Development and Maintenance

Technology transfer*
Technology transfer mechanisms*
Mainframe software development

Database management system impact*
Application generators
Software maintenance*

D. Personnel Issues

Civil service constraints*
Meeting mainframe personnel needs
Meeting microcomputer applications
   personnel needs

Substitution of technology for trained
   personnel*

E. Data Management

Distributed data processing
Data security
Computer viruses*
Data integrity

External data sources*
Database administration
Public and private information interests*
Data discontinuity between administrations*

F. Information Technologies

Integration of technologies
End-user computing
Mainframe computing
Office automation
Decision support systems

Artificial intelligence and expert systems
Microcomputer software management
Technology security
Telecommunications technology

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*Indicates issues unique to this survey.

responsible for information resource management programs, policies, control, and oversight.

For state agency representation, we sent surveys to officials in charge of the 50 state data processing centers. We also had the survey completed by participants of two information systems planning workshops sponsored by the Ohio state government and by members of the New York Information Resource Forum (see Simmons, 1988). The latter two groups constitute samples of convenience made up largely of top-level managers from the user community who have substantial distributed, satellite, or end-user computing responsibilities in their own agencies. They nevertheless represent all state government branches (executive, legislative, and judicial) and a great number of program areas.

Finally, surveys were sent to all counties exceeding 250,000 population and to a probability sample of counties with less than 250,000 population provided by the National Association of Counties.

Instrument pretesting and survey administration

Pretesting consisted of mailing the draft survey instrument to a limited number of respondents in two levels of government. In the federal government, we sent it to four officials, two at the department level and two at the agency level. At the state level, we sent it to the head of a state's data center, to an agency head of a department of another state who had a satellite computer center in his agency, and to the director of an information system consortium of state agencies. Resulting revisions included some changes in the wording of issues and dropping a difficult ranking of issues within categories.

The survey was mailed in April 1988. Data collection was terminated five months later. Approximately one month after the initial mailing, a single follow-up mailing including another copy of the survey instrument was sent to non-respondents.

Response rates

With the exception of county officials, well over 50 percent of those sampled responded: (1) federal responses were 102 out of a total of 172 surveyed for a 59 percent response rate; (2) state-level data processing officials returned 32 out of 50 sent for a 64 percent response rate; (3) the Ohio workshop members returned 39 out of 60 surveys for a 65 percent response rate; (4) the New York forum members returned 44 out of 55 surveys for an 80 percent response rate; and (5) county respondents returned 137 out of 717 sent for a 19 percent response rate. Forty-nine percent of those sampled from counties with a population of less than 50,000 responded; 10 percent of those sampled from counties with a population between 50,000 and 100,000 responded; 15 percent of those sampled responded from counties with a population between 100,000 and 250,000; and 20 percent responded of those sampled from counties with a population of over 250,000.

Findings Regarding the IS Management Issues

Table 2 shows the percentage of "important" or "extremely important" (referred to as "important" hereafter to simplify exposition) responses for the total sample. A number of the issues rated lowest in the total sample (e.g., data discontinuity between administrations, research and development, and artificial intelligence/expert systems) are highly rated by certain respondent segments. A later section of this article presents segmented rankings. First, the top 10 issues for the total sample are discussed.

#1 Integration of Technologies: Ninety-one percent of the respondents agreed on the importance of IS management ensuring that current and future data processing, telecommunications, and office automation technologies are integrated to prevent incompatibility. Integration of technologies is the number one issue across all respondent categories except for those in lower management offices, small agencies, and central state agency offices who selected comprehensive planning integration as their number one issue.

#2 Comprehensive Planning Integration: Eighty-six percent of all respondents rated as important the issue that there should be a process that integrates information resource planning with the agency's overall planning process. This issue reflects the increased emphasis on IS planning in the past several years.

#3 Information Requirements Identification: Seventy-eight percent of all respondents said that an important issue is agencies developing systematic processes to identify and prioritize information requirements. Emphasis on requirements analysis reflects the difficulty of public sector problems; i.e., their multiple and intangible criteria, multiple and conflicting interest groups, and lack of feasible solutions.

#4 End-User Computing: Seventy-eight percent of all respondents believe it is important that agencies provide and increase support, such as information centers and standardized hardware and software, for end-user computing, The expansion of office automation and end-user applications has increased the importance of support for computer and applications literacy and standardization of applications and machinery.

#5 Office Automation: Seventy-seven percent of all respondents agreed on the importance of IS managers taking a leadership role in planning, implementing, and managing office automation. No longer are office automation applications

Table 2. Percentage of "Important" or "Extremely Important" Responses for the Total Sample

Issue	Total Sample
Integration of technologies	91
Comprehensive planning integration	86
Information requirements identification	78
End-user computing	78
Office automation	77
Data security	74
Long-term planning mechanisms	73
Database management system impact	70
Distributed data processing	70
Software maintenance	70
Telecommunications technology	69
Database administration	68
Mainframe software management	68
Technology transfer	67
Educating elected officials	66
Technology transfer mechanisms	66
Substituting technology for personnel	66
Data integrity	66
Measuring IS effectiveness	66
Information resource management	63
Political influence	63
Civil service constraints	63
Application generators	58
Micro software management	58
Procurement and contracting	56
Mainframe computing	53
Microcomputer personnel needs	53
Oversight requirements	53
Mainframe personnel needs	50
External data sources	50
Computer viruses	49
Data discontinuity between administrations	48
Public/private information interests	47
Decision support services	47
Technology security	42
Research and development	42
Artificial intelligence/expert systems	38

viewed as separate and apart from more traditional IS in the organization.

#6 Data Security: Seventy-four percent of the respondents rated as important the issue that agencies should balance data security and data availability through appropriate protocol and access controls. Our discussions with selected respondents indicated that public sector managers would like to find ways to cut through red tape barring data access.

#7 Long-Term Planning Mechanisms: Seventy-three percent listed as important that agencies periodically submit and approve information resource plans before they submit plan-linked budget requests. This results in improved long-term decision making.

#8 Database Management System Impact: Seventy percent of the respondents rated as important the need for IS to increasingly use database management systems to enhance application development and maintenance. The flexibility provided by such systems is important for the ill-structured and dynamic set of problems faced by public organizations.

#9 Distributed Data Processing: Seventy percent also agreed on the importance of the need for policies that support the advantages of distributed data processing while maintaining the integrity of central IS.

#10 Software Maintenance: Lastly, seventy percent of all respondents said that an important issue is that IS managers need to find ways of improving productivity in software maintenance. This result likely reflects the preponderance of centralized data processing respondents in the sample.

Comparison With Private Sector Research

Table 3 compares the top 15 issues from four of the previously published private sector surveys and this article's public sector survey. The fifth private sector survey (Moynihan, 1990) uses open-ended interview questions and thus is not easily incorporated into an item-by-item comparison. Discussion will focus on the top 10 issues of the public sector survey list. An additional five issues are included in the table (#11 to #15), however, to show relationships between the top 10 public issues and private sector survey trends. For instance, office automation was the #6 issue in the 1982 private sector survey, but then fell to #12 in 1984, #11 in 1985, and off the top 15 list in 1986. In contrast, office automation is the #5 public sector issue. Italics indicate issues that are on both private and public sector surveys. Issues that have some portion modified for sector differences (e.g., educating elected officials versus educating senior personnel) are counted as the same. To facilitate comparisons,

some issue labels are changed in individual studies to make them consistent throughout the table. At times these changes shade meaning, but we believe that overall meaning is preserved. Issues in our opinion that are unique to any particular study in this table are marked with asterisks.

First, looking down the public sector survey's column, seven out of 10 top issues also appear on the private sector surveys' top 10 issues. None of the top 10 public sector issues, however, is uniquely "public." (We have to go down to the 14th-ranked public sector issue, technology transfer, to find the single uniquely public sector issue.) Linking IS planning and budgeting (#7), appearing only on the public survey list, could also be an issue for private sector firms. Budgeting, however, does play a much more central resource allocation role in the public sector because there is little equivalent to market signals. Software maintenance (#10) is also applicable to both sectors. Thus, although some differences exist, there is considerable agreement between the two sectors on the top 10 issues. The rankings of issues, however, is markedly different. The public sector appears to be lagging the private sector in the development of some major IS issues.

Integration of technologies was the #1 public sector issue in the survey. It has been on a decline in the private sector, however, ranking #3 in 1984, #7 in 1985, and #10 in 1986. We speculate that the private sector has been getting this issue under control. The public sector, however, is hamstrung by red tape and procurement rules leading to long delays and divergent mixes of equipment.

Aligning IS with agency goals, #2 on the public sector list, is in line with the private sector rankings, which were #7 in 1984 and #2 in 1985. IS planning, #3 on the public sector list, has consistently been #1 on the private sector lists. The lower rating on the public sector list may be the result of only recent vigorous activity in IS planning.

End-user computing (#4), has recently declined on the private sector lists. It was #11 in 1982, #2 in 1984, #5 in 1985, and #6 in 1986. We speculate that it ranks higher in the public sector because of (1) the relative ease of purchasing microcomputers versus mainframe computers in the public

Table 3. Information Systems Issues and Importance Rankings

Rank	Ball/Harrison (1982)	Dickson, et al. (1984)	Hartog/Herbert (1985)	Brancheau/Wetherbe (1986)	Public Sector (1991)
#1	IS planning	IS planning	IS planning	IS planning	Integration of technologies
#2	Measuring IS effectiveness	End-user computing	Aligning IS with business goals	IS for competitive advantage*	Aligning IS with agency goals
#3	Impact of communications on IS	Integration of technologies	Software development	Educating all managers	IS planning
#4	Role of information resource manager*	Software development	Database administration	IS's role and contribution	End-user computing
#5	Decision support systems	Measuring IS effectiveness	End-user computing	Aligning IS in the organization	Office automation
#6	Office automation	Educating all managers	Data security	End-user computing	Data security
#7	IS human resources	Aligning IS with business goals	Integration of technologies	Database administration	Linking IS planning and budgeting*
#8	Educating non-IS management	IS human resources	Educating senior personnel	Info. architecture development	DBMS impact*
#9	Centralization vs. decentr. of IS	Database administration	Software quality assurance	Measuring IS productivity	Distributed data processing
#10	Employee job satisfaction	Decision support systems	Telecommunications technology	Integration of technologies	Software maintenance*
#11	End-user computing	Applications portfolio	Office automation	Telecommunications management	Telecommunications technology
#12	Data security	Office automation	Information centers*	IS human resources	Database administration
#13	Software engineering	Telecommunications planning	Telecommunications deregulation	Software development	Software development
#14	Information privacy	Data security	Measuring IS effectiveness	Multi-vendor integration	Technology transfer*
#15	Management science and IS*	Role/contribution of IS	IS human resources	Artificial intelligence*	Educating elected officials

*Indicates a unique issue; italics indicate issues appearing on both private and public sector issues lists.

sector; (2) the long public sector backlog of applications awaiting development; and (3) the need for this flexible resource in the paperwork-driven environment of government. As mentioned above, office automation, #5 on the public sector list, has had a downward trend on the private lists. It was #6 in 1982, #12 in 1984, and #11 in 1985. The private sector surveys tend to be dominated, however, by the manufacturing sector. If there were a private sector survey with adequate sample sizes for reliable industry-level rankings, we might see this issue also rated as high as in the public sector by, say, financial organizations. Data security, #6 on the public sector list, is in line with the private sector ratings, which increased to #6 in 1985.

Comparison of Public Sector Respondent Categories

We requested additional data from our respondents to help explain differences in the perceived importance of IS management issues. The variables included respondents' level of government, agency size, organizational position of respondents, agency mission, the degree of centralization or decentralization of information services, the mix of mainframe versus microcomputer applications, and IS management categories.

Contingency tables and the chi-squared test of independence were used to analyze the data. Even though we did not obtain a fully random sample, we believe this analytical method provides a better guideline than simply reporting average scores or percentage comparisons. Because cell sample sizes were often too small according to a common rule of thumb,[2] responses were aggregated into two groups: "not, slightly, or somewhat important" (scale points 1, 2, and 3) and "important or extremely important" (4 and 5). Differences between categories that are statistically significant at the 0.95 or higher level are included in Table 4.

Level of government

We expected there would be differences in survey responses across the local, state, and

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[2] Cell expected value frequencies less than five under the null hypothesis of independence should be avoided.

federal levels of government. For example, as the level of government increases, primary work moves from operation of service delivery systems to support of oversight and regulatory systems. Local governments are primarily concerned with providing direct services, e.g., public safety, solid waste collection and disposal, and primary/secondary education. These services require mainframe, transaction-processing systems. The federal government, while providing some direct services like national security and national parks, largely has policy making and oversight responsibilities. These policy analysis and administration needs require flexible IS technologies like database management systems, end-user computing, and computer networks (Caudle and Newcomer, 1987). We reasoned that the states should be somewhere in-between the local and federal governments in regard to transaction processing versus flexible and distributed processing needs.

We asked respondents, therefore, if their agency's primary program mission involved the collection, maintenance, and processing of individual records. The federal and state government respondents were nearly identical, with 38 and 35 percent respectively indicating a mission involving individual records. This statistic is dramatically higher for county governments: 84 percent of county respondents had a mission involving transactional records.

As expected and as can be seen in Table 4, local governments place more importance on mainframe systems and efficient transaction processing while the federal government places more importance on distributed data processing, microcomputer systems, and flexible IS. Specifically, both county and state governments place significantly more importance on mainframe computing, while the federal government places more importance on distributed data processing and satisfying microcomputer personnel needs than the other two levels of government. The federal government also places much more importance on database management system impacts, showing a need for flexible IS development and use.

Another factor leading to differences in survey responses across the local, state, and federal levels of governments is difficulty in making changes (i.e., "red tape"). The size of agencies

Table 4. Statistically Significant Differences in "Important" or "Extremely Important" Responses: Level of Government, Agency Size, and Management Level (0.05 or lower type I error)

Level of Government	Federal	State	County
Educating elected officials	59	64	74
Research and development	45	50	33
Procurement and contracting	83	54	40
Oversight requirements	69	49	44
Database management system impact	82	66	65
Civil service constraints	79	68	45
Microcomputer personnel needs	64	56	41
Substituting technology for personnel	75	70	55
Distributed data processing	79	67	65
Data security	69	84	70
Mainframe computing	39	57	59
Size of Respondent Agency (Federal and State Only)	**Small <200 FTE**		**Large >200 FTE**
Procurement and contracting	45		74
Technology transfer mechanisms	80		58
Data discontinuity between administrations	60		43
Management Level	**Middle**		**Top**
Comprehensive planning integration	97		84
Research and development	65		39
External data sources	73		47
Public/private information interests	66		45
Data discontinuity between administrations	65		46
Artificial intelligence/expert systems	68		35

increases with level; the bigger the agency, the more rules and layers of management exist, and the more difficult it is to make large changes (Downs, 1967). Also, the higher the level of government, the more diverse and widely scattered are constituents. These factors increase controls and accountability requirements, make it difficult to hire and retain technical and professional staff, slow down procurement processes, and increase transaction costs. Indeed, as seen in Table 4, the percentages of importance ratings for the red tape issues (procurement and contracting, oversight requirements, and civil service constraints) increase with increasing level of government and are remarkably higher for the federal government than the state and local governments.

Lastly, in the level of government section of Table 4, note that educating elected officials becomes increasingly important as the level of government decreases. At lower levels, IS managers experience increased contact and dependence on politicians. Constituencies are smaller and more intensely focused as the level of government decreases, placing more pressure on politicians. In turn, local-level politicians exert more influence on the management of government than their state or federal-level counterparts. This attention can divert funds away from IS or, if politicans can be "brought on board," can increase IS support.

Agency size

The size-of-agency variable, with categories for less than the greater than 200 full-time equivalent (FTE) employees, again provides some evidence that red tape increases with size of agency. Seventy-four percent of the managers in large

state and federal agencies[3] rate reducing procurement and contracting red tape as important, as compared to only 45% in small agencies. The next issue, technology transfer mechanisms, is much more important for small agencies than large ones. Small agencies likely have limited or even non-existent software development budgets, and technology transfer may be one of the few ways of obtaining specialized software. On the last issue in this group, data discontinuity between administrations, smaller agencies rated this more important than large agencies, perhaps because small agency respondents are more responsive to transition issues and are closer to service delivery than their counterparts in larger organizations.

Management level

Top managers in government organizations have a politicized, larger external role then their counterparts in private firms. Top government officials must seek appropriations through political means, are appointed and serve at the pleasure of elected officials or other political appointees, and must deal with political influences and the wants of multiple interest groups (Bozeman and Bretschneider, 1986; Lachman, 1985; Marchard, 1985; Mintzberg, 1973; Nigro and Nigro, 1977; Rainey, 1983). This means that government officials are much more concerned with policy agenda-setting processes rather than management functions. Consequently, they do not focus their attention on information resource management as much as their private sector counterparts. We therefore speculated that in the public sector, middle-level (career) managers fill this gap by placing higher importance on information technology development and pursuit of emerging information technologies than upper-level (elected or political appointee) managers.

To investigate this possibility, we asked respondents how many management levels existed between the head of their immediate office and the agency head. The "top" management level category in Table 4 is for a respondent whose department head is within two levels of

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[3] We excluded county data from this analysis because agency size responses are biased high. Relatively few counties with population less than 250,000 have separate data processing departments, so respondents tended to provide total county government employment and budgets rather than just department values.

the agency head. "Middle" is three or more levels below the agency head. As seen in Table 4, the middle-level managers place significantly higher importance than top managers on five issues dealing with IS R&D and new uses of data: research and development, external data sources, public private information interests, data discontinuity between administrations, and artificial intelligence/expert systems. This result is as expected.

Organizational arrangements for computer services

We asked respondents to classify their office in terms of organizational arrangements for supplying computer services. Table 5's top half shows that almost three-quarters of the total sample's respondents were from centralized data processing shops. The federal government respondents have more dispersion among the processing categories shown; state and county government respondents reported a preponderance of centralized data processing shops. Respondents were also asked what percentage of their agency's total information system applications are supported by in-house mainframe staff, in-house microcomputer users, outside consulting services, or by another agency's mainframe and/or microcomputer staff. Median responses in each category, shown in the bottom half of Table 5, indicate that 80 percent of the respondents' total information system applications were supported by in-house mainframe staff; county respondents are high with 86 percent followed closely by the states' 80 percent. Only 40 percent of federal total information system applications are supported by in-house mainframe staff. Federal government agencies have the highest level of in-house microcomputer staff, 20 percent, which decreases to 10 percent for state governments, and 5 percent for county governments.

We expected that respondents would see issues affecting their computing support as more important. For comparison, we used two variables. One was type of processing—either placement in a centralized data processing shop or in a microcomputer shop (defined as 15 percent or more of applications written by in-house microcomputer users). The other was type of computer applications, measured by predominance of in-house mainframe applications (defined as at least

Table 5. Type of Information Processing and Computer Applications (%)

Processing and Applications	Level of Government			Total Sample
	Federal	State	County	
Type of Processing (%)				
Centralized DP shop	53	72	88	73
Satellite of centralized DP shop	0	3	1	1
Decentralized departmental unit	16	11	2	12
Use DP services of others	28	4	8	12
Other	2	11	0	5
Total	99%	101%	99%	100%
Median Type of Computer Applications (%)				
In-house mainframe staff	40	80	86	80
In-house microcomputer users	20	10	5	10
Outside consulting services	10	0	0	0
Other agency's staff	0	0	0	0

75 percent of an agency's total IS applications are supported by in-house mainframe staff).

As seen in Table 6, managers in "microcomputer shops" ("Yes" column) are not interested in mainframe computing, controls that may be placed on their planning or purchasing ("long-term planning mechanisms"), or advanced IS technologies like decision support systems. The mainframe-oriented agencies ("Yes" column) want to develop and protect their kind of services (e.g., "mainframe computing").

Information systems management category

Lastly, respondents were asked to pick one of four descriptions that best characterized the *overall* state of IS management in their agency. The categories of information system management were a variation of Nolan's stages (Gibson and Nolan, 1974; Nolan, 1979; Rainey, 1983; Rainey, et al., 1976) with the addition of information resource management descriptors (Newcomer and Caudle, 1986). The choices were as follows.

Initiation: Focus on early use of computers by a small number of users to meet basic applications (such as accounting and record keeping); decentralized control and unstructured planning; physical paperwork and records management are important.

Expansion: Focus on experimentation with and adoption of computers by many users, proliferation of applications; information management is in transition from basic applications to management of more extensive applications and automated technologies.

Formalization: Focus on increasing efficiency; charging users for IS services under development or being implemented; professionalization of information system staff and procedures underway; schedule of prioritized information system projects under development; management of information technologies and technical attributes are important.

Integration: Focus on an established set of applications covering priority operational and management information needs; database administration established; planning well-established and linked to the budget process; information resource management practices established.

We recognize that this measure has limitations in that the respondent has to integrate judgmentally over all IS components in his/her agency to produce an overall assessment. Thus, while we included a four-category measure in the survey, we collapsed it to two categories for analysis: integration stage and less than integration stage (labeled "other" in Table 7). In the total sample, 47 percent of the responses were in the integra-

Table 6. Statistically Significant Differences in ''Important'' or ''Extremely Important'' Responses: Organizational Arrangements for Computer Services (0.05 or lower type I error)

Organizational Arrangement	Yes	No
Processing:		
Microcomputer Shop?		
Comprehensive planning	81	89
Procurement and contracting	66	50
Long-term planning mechanisms	65	79
Mainframe personnel needs	44	55
Mainframe computing	44	58
Data discontinuity between administrations	40	53
Decision support systems	40	52
Technology security	35	47
Applications:		
Mainframe Orientation?		
Procurement and contracting	47	67
Mainframe software management	74	61
Oversight requirements	45	62
Mainframe computing	64	38

Table 7. Statistically Significant Differences in ''Important'' or ''Extremely Important'' Responses: IS Management Category (0.05 or lower type I error)

IS Management Category	Integration	Other
Long-term planning mechanisms	79	69
Mainframe software management	76	62
Database management system impact	76	66
Data integrity	73	60
External data sources	56	45
Database administration	79	58
Mainframe computing	61	45
Office automation	82	72
Technology security	48	37
Telecommunications technology	76	62

tion stage, 28 percent were in the formalization stage, 21 percent were in the expansion stage, and 5 percent were in the initialization stage.

The 10 issues in this category with significant differences in Table 7 simply show that already advanced agencies (in integration stage) want even more advanced technologies. The demand for IS technology ''snowballs'' over time.

Conclusion

Twelve of the 15 top-ranked IS management issues in the public sector survey of this article also appeared on the top 15 issue lists of the private sector surveys in the literature. This replication of results across sectors, with substantial variation in data collection and analysis methods, is gratifying. It suggests that past ef-

forts have developed a valid set of IS management issues. It also suggests that there are many similarities between the public and private sectors (a result consistent with Lachman, 1985). There are also notable differences.

First, two of the top 15 public sector issues—linking IS planning and budgeting, and technology transfer—are unique and paramount in the public sector. The budgeting process is central to the operation of governments, a process that substitutes for the market allocative mechanisms of the private sector. Linking IS budget requests to long-range IS planning is a mechanism for overcoming the short-range emphasis in government on political pressures. Seventy-three percent of the respondents to our survey ranked this issue as important or extremely important. Second, technology transfer is an issue derived from the "public" nature of goods produced by governments. It is impossible and undesirable to exclude individuals from consuming such goods, so their costs need to be shared. Sharing IS development costs through government consortia and freely transferring technologies from one agency to another contrast sharply with proprietary, private-sector IS developed for competitive advantage.

Second, three issues that have peaked in importance in the private sector and are now on the decline rank in the five top public sector issues: integration of technologies, end-user computing, and office automation. The literature on public/private sector differences and the corresponding empirical findings found in this article suggest this lag to be due to many factors, such as the complicated nature of public goods, short-run perspective of politicians, and limitations caused by the government red tape and accountability requirements. An alternative explanation is that the private-sector surveys largely represent manufacturing firms and are not representative of service organizations, which, like government agencies, are still highly interested in paperwork-oriented IS.

Finally are some findings on theoretically derived issues. One is that top-level (political appointee) public managers are less inclined to develop new information technologies than middle-level (career) public managers. In contrast, MIS success in the private sector is closely tied to the support of upper-level executives (Bozeman and Bretschneider, 1986). Apparently, strategies for developing IS technologies in the public sector need a middle-up emphasis. Another conclusion is that red tape, increasing with size of organization and level of government, has major impacts on information technologies employed: the more red tape, the more flexible the information technology employed.

In summary, we believe that IS management issues research can provide overall guidance to managers, researchers, and educators. The value of such research can be greatly increased, however, by proceeding to theory-based research designs. Prior research has tended to report summary survey responses at the total sample level and apparently without much theoretical guidance. This article has provided main effects-level results, driven by IS and organizational theories. Although the results are still exploratory, they demonstrate the feasibility and attractiveness of theory-based IS management issues research. We encourage additional such research in the public and private sectors. In the private sector, we would like to see research including market segmentation (e.g., one-digit standard industrial classification code level), organization size and structure variables, type of IS (transactions processing, MIS, DSS, etc.), and other factors. A study contrasting public and private service delivery systems would be extremely interesting, especially one that ties into the literature on "privatizing" the public sector.

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Appendix

Survey Questions: Importance of Information Systems Issues

A. *Strategic management concerns*

Issue 1: Educating Elected Officials. Top political leaders need to learn the role of information resources, such as information systems, in government.

Issue 2: Political Influence. New planning and budgeting procedures should be developed to reduce the impacts of short-run political priorities and the lack of political continuity that can undercut comprehensive, long-term information systems planning.

Issue 3: Long-Term Planning Mechanisms. To provide for long-term decision making, agencies should submit and approve information resource plans periodically before the submission of corresponding, plan-linked budget requests.

Issue 4: Comprehensive Planning Integration. There should be a process that integrates information resource planning with the agency's overall planning process.

Issue 5: Information Resource Management. Agencies should adopt information resource management concepts (e.g., integration of information technology management, records management, and other information management areas) and assign a central institutional responsibility for information collection, processing, dissemination, policy, and operations.

Issue 6: Research and Development. Agencies should devote more resources to monitor and evaluate technological developments for agency needs.

B. *Operational and tactical management concerns*

Issue 7: Identification of Information Requirements. Agencies should develop systematic processes to identify and prioritize information requirements.

Issue 8: Measuring IS Effectiveness. Agencies should develope better measures and estimation methods to show the true costs of information and evaluate the net benefits of proposed information system projects.

Issue 9: Procurement and Contracting. Agencies should modify procurement and contracting procedures to expedite the delivery of information services, hardware, and/or technical assistance.

Issue 10: Oversight Requirements. Agencies should balance accountability demands and management practicalities so external controls do not needlessly hamper technological innovation.

C. Applications development and maintenance

Issue 11: Technology Transfer. Agencies should find ways to increase sharing of applications and technical assistance with other agencies having similar functions or providing similar services.

Issue 12: Technology Transfer Mechanisms. On a statewide or national basis, similar agencies should avoid "reinventing the wheel" in applications software development and technological innovation by forming or using cooperative arrangements.

Issue 13: Mainframe Software Development. Mainframe applications software should be developed more quickly and with consistently higher quality.

Issue 14: Database Management System Impact. IS must increasingly use database management systems to enhance application development and maintenance.

Issue 15: Application Generators. IS must increasingly use application generators and fourth generation languages in place of third generation languages to increase productivity.

Issue 16: Software Maintenance. IS managers need to find ways of improving productivity in software maintenance.

D. Personnel issues

Issue 17: Civil Service Constraints. Civil service rules that hamper or prevent the recruitment of skilled information management and technical personnel should be changed.

Issue 18: Meeting Mainframe Personnel Needs. Continued personnel shortages will increase the need for resources to recruit, retain, and retrain mainframe personnel.

Issue 19: Meeting Microcomputer Applications Personnel Needs. Continued personnel shortages will increase the need for resources to recruit, retain, and retrain personnel in microcomputer software and applications positions.

Issue 20: Substitution of Technology for Trained Personnel. Continued personnel shortages will require IS to depend more heavily on application generators, database management systems, end-user computing, and so on, to meet information needs.

E. Data management

Issue 21: Distributed Data Processing. Policies are needed that support the advantages of distributed data processing while maintaining the integrity of central information systems.

Issue 22: Data Security. Agencies should balance data security and data availability through appropriate protocol and access controls.

Issue 23: Computer Viruses. Agencies should develop and implement active programs for diagnosing and protecting information systems from computer viruses.

Issue 24: Data Integrity. IS must devote additional resources to the accuracy, timeliness, and adequacy of data provided to users.

Issue 25: External Data Sources. IS managers should screen external data sources, heighten user awareness of external data valuable to the organization, including interagency and intergovernmental sources, and provide access to such data.

Issue 26: Database Administration. IS should increasingly use database administration to provide quality assurance of data holdings across many end users and deal with information resource ownership concepts across the organization.

Issue 27: Public and Private Information Interests. Agencies should balance agency users' information needs with the requirements of legislation, such as the Freedom of Information Act and the Privacy Act.

Issue 28: Data Discontinuity Between Administrations. IS management should find ways to provide for long-term continuity of data definitions and data aggregate classifications, or a historical record of changes, to maintain the usefulness of historical data.

F. Information technologies

Issue 29: Integration of Technologies. IS management should ensure that current and future data processing, telecommunications, and office automation technologies are integrated to prevent incompatibility.

Issue 30: End-User Computing. Agencies should provide and increase support such as information centers and standardized hardware and software for end-user computing.

Issue 31: Mainframe Computing. Agencies should provide more resources to improve mainframe computer services.

Issue 32: Office Automation. IS managers should take a leadership role in planning, implementing, and managing office automation.

Issue 33: Decision Support Systems. IS should develop and implement decision support systems that facilitate their use in an agency's political environment.

Issue 34: Artificial Intelligence and Expert Systems. IS managers should study artificial intelligence and expert systems now to plan for their use over the next several years.

Issue 35: Microcomputer Software Management. Initial selection of microcomputer software and subsequent upgrades should be better managed.

Issue 36: Technology Security. IS management should implement better physical security over information technologies, such as computers and peripheral devices.

Issue 37: Telecommunications Technology. IS management should ensure that long-term voice and data telecommunications decisions are made despite continuing technological changes, telecommunications deregulation, and the scarcity of experienced personnel.