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Payoffs From Computerization: Lessons Over Time

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Today the federal government, all 50 states, and virtually all city and county governments utilize computers. At the city and county levels alone, computers are used for some 450 different computer applications including paying employees, sending utility bills, analyzing demographic data, routing vehicles, and allocating manpower.[1] This extensive use of computers is the result of the promised payoffs from computerization.

Early on, Anthony Downs argued that the final payoffs from computer use would be either technical or power related.[2] Technical payoffs would include such things as increased availability of information and greater efficiency in operational performance. Power payoffs would include shifts in the relative resources or influence of different groups, such as technical experts gaining increased influence over elected officials from their enhanced ability to access and use information. It is now known that major power shifts have not occurred as a result of computerization. Rather, computer use has tended to reinforce existing power relations in organizations.[3]

But to what extent have the promised technical payoffs been realized? The literature has given a variety of answers to this question, and the answers have often been in conflict.[4] One scholar characterizes the current state of the literature as follows:

> Much of the literature still presents hearsay, speculation, opinions, or evidence gathered by parties with vested political interests. Unfortunately, carefully conducted theoretical and empirical research studies are still scarce, and even these works are frequently plagued by incomplete, conflicting and counter intuitive results.[5]

This article seeks to overcome such past deficiencies in considering the techincal payoffs from computerization. First, the data are collected from 42 leading-edge cities in the United States in 1976 and from 46 such cities in 1988. The data are quantitative and were collected by established principles of survey research and sampling design. Second, the data include a panel of cities; 37 of the cities are in both the 1976 and 1988 databases. The panel data from leading-edge cities permit study of the possibility that part of the conflicting and vague prior findings on the impacts of computerization could be due to the various different stages of computerization in the organization(s) studied as well as to differences in the stage of the technology itself. To be specific, the panel nature of the data allow exploration of whether some payoffs come quickly from automation whereas others take time. The same can be said for problems with computing. The early literature on the impacts of computing suggested that computing was likely to have many negative effects as well as positive benefits.[6] Panel data allow exploration of whether problems that existed early in computerization persist or have been dealt with and minimized over time.

Third, the analysis focuses on the general payoffs from computerization, payoffs that would be relevant to any governmental department or task and payoffs that were touted in the early days of computerization. This focus reduces the possibility that part of the conflicting and vague prior findings on the impacts of computerization could be due to the choice of technical payoffs studied. The following payoffs are examined: increased availability

Are governments that adopted computers early receiving the payoffs today? Yes, but a major finding of this panel (1976-1988) study of 46 U.S. cities is that most payoffs from computerization are not felt immediately. Instead they take years to reach fruition. The major payoffs occur in the areas of fiscal control, cost avoidance, and better interaction with the public. But some anticipated benefits, such as better information for planning and managerial control, still have not been realized—even by cities that were on the leading edge of automation in the 1970s. Moreover, the prospects for future payoffs in these areas are mixed.

of information, better information for management control, better information for city planning decisions, greater efficiency of operational performance, and better interaction with the public.[7] In addition, the study considers computerization's possible negative effects dealing with the technical quality of information and computer services. The actual measures used in the analysis were developed in 1976 based on the common complaints and promises regarding computerization heard in the practitioner, academic, and vendor circles.

The study hypothesizes that prior studies did not consistently find technical payoffs from computerization for several reasons other than methodological ones, although methodological reasons could be part of the explanation. First, most payoffs take time to be realized. Computerization of information and tasks is done in stages, and there is a learning curve for user personnel as well as for the technologists (software development). Second, payoffs most clearly are realized in the more simple tasks such as recordkeeping rather than across the board. Third, some payoffs may be realized only at a minimal level even after years of experience by the most technologically advanced cities due to the political nature of the tasks. For example, payoffs from computerization for planning and management decisions are a minor part of these tasks given the often overriding influence of intuition, judgment and politics.

Data and Methods

The data for this article were collected as part of two studies referred to as URBIS I and URBIS II, which were conducted through the Public Policy Research Organization at the University of California, Irvine, and supported by grants from the National Science Foundation.[8] The method here is derived from the URBIS I design. In 1976, information was gathered from 42 cities in the United States. These cities were chosen using an innovative design to sample different types of cities purposely rather than to sample randomly all cities per se. Through an initial mail survey inquiring about computer services in every city over 50,000 in population (N = 403), data were collected to stratify cities on six policy variables. These included the degree of (1) automation, (2) centralization, (3) data integration, (4) technical sophistication, (5) user involvement, and (6) charging for services. Thus, the sample reflects leading-edge cities, not simply in terms of technology but also in terms of computing practices.

Each variable was dichotomized, yielding 64 possible combinations. Forty groups out of the possible 64 were randomly selected, and then a city in each group was randomly selected. Two additional cities were added due to resource allowance. In 1988 five of the original cities were unable to participate again, and therefore new cities were added to the original sample. Nine new cities were added and were chosen to reflect the single most important change in local government computing since the mid-1970s—the proliferation of personal computers, especially among cities between 50,000 and 99,999 in population. Consequently, the 1988 sample represents leading-edge cities for that year and thereby permits this research to address whether there are payoffs by 1988. The cities reflect the diversity, although not proportionately, of United States cities in terms of population, region, and current state of computing practices (see appendix).

The methods for this article focus on leading-edge cities and the computer users within those cities as predictors of where the majority of cities and government employees will be in the future. Thus, while the two samples are biased toward more technically advanced cities and toward those city employees who use computers and information systems, the design has a distinct advantage for the purpose of this analysis. Specifically, the purpose is to chart the payoffs from, and problems with, automation. Technically advanced cities by definition would potentially be the first to realize generalized payoffs as well as problems from computerization since they were the first to automate and then to automate extensively. Because they had no one to look to and learn from, they may actually have experienced more problems. Moreover, technically advanced cities would, by definition, have the most experience with automation and thus should have the best chance to realize benefits while reducing costs over time. Finally, this article is also concerned with the future payoffs from automation, and thus the sampling frame uses cities which are technologically advanced today as predictors of the common state of computerization in government in the future.

This article uses only the responses of chief executives, department managers, and division heads given its focus on payoffs. An average of 26 such respondents per city, 1,185 total, filled out anonymous questionnaires on computing use in 1988, which is more than an 80% response rate. The 1976 data had a 91% response rate.[9] Of the 1988 respondents, 45% had worked for their city for 12 or more years, 52% for less than 12 years, with 3% unknown. The overall average number of years in their respective departments was approximately 12. Consequently, while all the respondents had not been in the same cities in 1976, a great many of them had been. Moreover, it is not necessary to have the exact same respondents in 1988 as in 1976 because the questions were not worded to cover the 12 years, but only whether computers have had an effect. Furthermore, a large array of computer applications were introduced into these cities after 1976. Finally, for the purposes of this article, responses were aggregated by city to reflect the organizational state of computerization as viewed by management. (The responses of chief executives, department managers, and division heads did not differ when analyzed separately.)

The data are based on the perceptions of these top managers. It can be argued that perceptions are not necessarily the most valid measures of computer payoffs. Yet, top managers act on the basis of their perceptions. For example, computer adoption decisions, which this article argues will affect future payoffs, are heavily dependent on managers' perceptions of payoffs. In addition, managers' per-

ceptions provide the most direct measure possible for some payoffs, such as whether computerized information is helpful in identifying problems or providing information about employee performance. If the information exists and does not reach managers or is not used by them, it is not helpful. Moreover, top managers are in positions to know whether payoffs are realized because they receive reports, budgets, problems, complaints and praise about computing. In addition, during the fieldwork in each city, managers were consistently asked to back up their perceptions with actual examples where, for instance, computerized information helped to change a management decision or resulted in cost savings. The perception-based data in this article complements the pattern of responses in the interviews. Furthermore, with their years of firsthand experience with computers, the managers, if anything, should be less sanguine about computers because it is hard to achieve the promised payoffs immediately. For example, one may notice cost savings early on and then forget it or discount it as operations, services, and clients naturally increase. But if massive computer effects exist, the perceptual data should reflect them. Complimentarily, aggregating individual responses to the city level should reduce perceptual errors stemming from any single manager's short tenure in a department. Finally, given that not all respondents may have been around to observe payoffs and given that payoffs might be subtle and marginal and thus less easy to detect, the data may underrepresent impacts. In fact, any perceived improvement from 1976 to 1988 could be argued to be less than more direct measures would obtain.

Findings About Technical Quality of Computerized Information and Computer Services

Before beginning the analysis of the payoffs from computerization, it is necessary to consider what is an obvious given or assumption of computerization; that is, that the technical quality of information and the provision of computer services are good. It is unlikely that cost savings will be realized, for instance, if no one uses computerized information because it is inaccurate. Then again, the data might be accurate, but one rarely refers to them because it takes too long to get, e.g., the computer is down, or one has low priority, or the data processing staff is just slow. Hence, the technical quality of computerized information and computer services are key determinants of even the possibility of payoffs from computerization, and therefore this study begins by considering technical quality and accuracy in particular.

Accuracy is a basic concern in terms of how information is kept. If the data are not accurate, they become useless or problem plagued. Thus, it is important that computerized data be as accurate as manual data. While manual data is not error free, manual data is the standard. Hence, it is essential that computerized data be at least as accurate as manual data. The experience of the sample cities is that this has been very much the case and has steadily held true over time. Table 1 shows the managers' index of agreement in 1976 and 1988 with a statement regarding the accuracy of information. The median score across all managers was "somewhat agree" to "agree" in 1976 and a significant change to "nearly always true" in 1988 (see Table 1). Thus, managers' rating of the accuracy of computerized information was high in the mid 1970s and has increased with time. While accurate data is essential, computerized data also should neither take a long time to get nor be difficult to change. Otherwise, any anticipated payoffs would be diluted by the poor technical quality of manipulating computerized information. Both in terms of

Table 1

Technical Quality of Computerized Information and Computer Services

	Index of Agreement[a]	
Item	**1976**	**1988**
Technical Quality of Information:		
Computerized data is as accurate as data in manual records and files.[b]	2.5*	3
It does not take too long to get the information I need from the computer.[b]	2	2.5
Information is not difficult to change or correct once it has been put on a computerized file.[b]	2	2
	Problem Index[c]	
DP Problems:		
Slow response of data processing to requests for information.[d]	1*	1
Difficulty in getting priority in using the computer.	1*	0
Foul-ups in day-to-day computer operations.	1	1
Frequent technical and organizational changes in data-processing services.	0	0

a. Respondents for each city include the mayor, city manager, or chief administration department and division heads. The index of agreement is the median of the median response within each city across all these respondents where individuals' responses were scored as: 0, disagree; 1, somewhat disagree; 2, somewhat agree; 3, agree, in 1976; and 0, almost never true; 1, sometimes true; 2, frequently true; 3, nearly always true in 1988. In so building the index, the N in 1976 was 42, and in 1988 it was 46.

b. Question wording was changed for table comparability only. The question was actually phrased in the positive in the questionnaire.

c. The problem index is the median of the median response within each city across all top managers, where individuals' responses were scored as: 0, not a problem; 1, at times a problem; 2, often a problem; 3, very often a problem.

d. While the median is the same for 1976 and 1988, the median test shows a significant difference because the range of scores differed between these two years. In 1976, scores ranged from a low of 0 to a high of 3; in 1988, the highest score was a 1.

* Significant at the .05 level or below—determined by an SPSS two-sample median test which computes chi-square. The data is ordinal and the medians were calculated.

quickness of access and correcting of computerized data, the managers in the study's cities tended to have had positive experiences in 1976 (see Table 1). But, by 1988, they experienced no significant improvements in either of these two areas (Table 1). Perhaps, the lack of significant improvement is due to managers asking for more sophisticated computer-based information in 1988 than in 1976. As their experiences with computers and their capabilities have increased, so too might their demands. Or perhaps systems, once operational, are inflexible in terms of quickness of access and ease of correcting data.

Overall, then, the technical quality of information needed to be good from the start if automation was to become the wave of the future in cities. The respondents indicate that technical quality was and has continued to be good, but there is room for improvement.

Another key technical concern is the quality of the data processing operations. Frequent organizational changes, foul-ups in the day-to-day computer operation, poor response by data processing staff to requests for information or lack of priority can frustrate computer users. If the computer always seems to be down or if one has to wait a week for information that is needed today, then the accuracy of computerized information becomes meaningless since it is not accessible in a timely manner.

In 1976 such occurrences were perceived to be a problem at times (see Table 1). While they represented a low level of problems, they were nonetheless pervasive. Today computer problems such as poor response time and organizational changes are still rare. Clearly the priority problem has been significantly tempered by the spread of personal computers (PCs) and can only get better from the continued diffusion of PCs. In addition, organization and hardware hassles have remained low even as computer services have expanded. Therefore, given that every city has some automation and PCs have sharply accelerated the rate and level of automation, the authors predict that operational problems with data processing services will continue to remain minimal.[10]

Given that these technical aspects of computerization are uniformly good across U.S. cities, one can now consider the extent to which the general payoffs of computerization are being achieved. The focus here is on five general payoffs: (1) increased availability of information, (2) better information for management control, (3) better information for city planning decisions, (4) greater efficiency of operational performance, and (5) better interaction with the public.

Payoffs in Increased Availability of Information

Information improvements are the basic selling points of computers. Entering, storing, and accessing information in or through a computer is supposed to make it easier and quicker to access information when needed to answer a question or to make a decision. One no longer has to search file cabinets, make phone calls, or ask someone to get information. All one has to do is go to a terminal or computer keyboard and search. And this can be done even after normal working hours, in a car, or at home in addition to at work. Thus, ease of retrieval and time savings are two key improvements supposedly stemming from computerization. In addition, since information can also be entered or changed at ease by those closest to the current situation, data tend to be more current. Furthermore, the restructuring capabilities of computers allow for standard data to be grouped, broken down, or mathematically altered, thereby providing new information.[11]

Intriguingly, while the technical quality of computerized information was good in the mid-1970s, the basic payoffs in better information from computerization were mixed (see Table 2). The managers in the study's cities "disagreed somewhat" over whether new information was made available, but "agreed somewhat" that computers saved time, computers made it easier to get information, and computers provided them with more up-to-date information. By 1988 these managers were frequently and significantly seeing new information payoffs as well as continuing to see payoffs in ease of retrieval, timesaving, and more up-to-date information (see Table 2). In fact, the payoffs in availability of information between 1976 and 1988 may well be underestimated given the change in

Table 2
Computer Impacts on Availability of Information

Item	Index of Agreement[a] 1976	1988
Availability of Information:		
Computers have made it easier for me to get the information I need.	2	2
Computers save me time in looking for information.	2	2
The computer provides me with more up-to-date information than that previously available.	2	2
The computer makes new information available to me which was not previously available.	1*	2
	Problem Index[b] 1976	1988
Information problems:		
Difficulties in accessing computer-based data gathered or held by other departments and agencies	1	1
Computer-based data not available for the analysis of specific questions or problems	1*	2

a. The agreement is the median of the median response within each city across all top managers, where individuals' responses were scored as: 0, disagree; 1, somewhat disagree; 2, somewhat agree; 3, agree in 1976; and 0, almost never true; 1, sometimes true; 2, frequently true; 3, nearly always true in 1988.

b. The problem index is the median of the median response within each city across all top managers, where individuals' responses were scored as: 0, not a problem; 1, at times a problem; 2, often a problem; 3, very often a problem.

* Significant at the .05 level or below determined by the two-sample median test.

response categories. For instance a "2" in 1976 represented "somewhat agree" but in 1988 represented "frequently true."

Such information payoffs are expected to continue as cities continue to accelerate their automation. For instance, on average these cities plan to automate 57 additional applications within the next two years. However, experience with computerized information can create an unending appetite for data. Given that all data are not automated, are not automated in the way one would want, or are not available to everyone, some problems with the availability of information will continue as dependence on computerized information increases (see Table 2, information problems).

Payoffs in Better Information for Management Control

Beginning in the 1960s, the computer began to be perceived as a tool for management control.[12] Although a number of organizational resources might be computerized in the interest of managerial control (e.g., money, personnel, equipment), budget control traditionally has been the chief instrument of monetary control and, indirectly, of other resource control as well.[13] Some form of budget-control automation has existed for years in the nation's largest cities. However, it was the urban fiscal crisis of the 1970s that provided the spark for wider-scale budget-control automation.[14] The computer's capacity for assisting in budget and managerial control was perceived as a major tool for handling the crisis.

In the mid-1970s computer-based information was considered "somewhat useful" in day-to-day expenditure decisions and in providing the real costs of programs and activities and "useful" during the annual budget cycle (see Table 3). Computer-based information has remained as useful with no significant improvements by 1988.

On the one hand then, budgetary computerization has provided a moderate amount of managerial fiscal control which has not increased over time. On the other hand, the level of managerial fiscal control resulting from computerization is inherently limited. This limitation has been especially felt since the 1970s when inflation, the energy crisis, and the withdrawal of federal monies dramatically constrained city governments. Technological improvements can contribute to managerial fiscal control, but the contributions are constrained by outside factors. Given these constraints, managerial fiscal control may very well be less driven by computerization. For example, a city might obtain a ten percent improvement in managerial fiscal control after a major new software package is introduced; but if a similar city were hit by recession, it might only obtain a one percent increase in managerial fiscal control from introducing the same software package. But if it were not for computerization, the city might have experienced a serious decline. In fact, put in this context, the steady state in managerial control stemming from computerization of budget information since the mid-1970s could be actually impressive when weighed against the dramatic increase in constraints that forced budget control into crisis control during this time.

Aside from fiscal issues, computerized information can aid in other aspects of managerial control. "Can" is clearly the watchword here. Computerized information generally was rated "not at all useful" for nonbudgetary aspects of managerial control by the cities in the mid-1970s with a significant move toward "somewhat useful" in only two personnel areas by 1988 (see Table 3). To be specific, when it comes to allocating manpower, setting goals, identifying internal problems, and assessing employee performance, computerized information has not lived up to claims of usefulness or to its probable potential (see Table 3).

Why the near failure in these areas? Mainly, applications of computers for management control have not yet been developed outside the fiscal area. Recordkeeping was and is the driving force of most computerization in local government. Thus information tasks that have a dominant recordkeeping component to them, such as budget reporting, tend to be automated first and are the most understood and well developed. Complementarily, the only significant increases in usefulness of all computerized management control tasks are in the provision of performance

Table 3
Computer Impacts on Management Control and Planning Decisions

Item	Index of Usefulness[a] 1976	1988
Management Control:		
How useful to you has computer-based information been:		
during the annual budget cycle?	3	3
for day-to-day expenditure decisions?	2	2
in providing real costs of programs and activities?	2[b]	2[b]
in allocating manpower?	1*	1.5
in providing information about performance of subordinates?	1*[b]	1.5[b]
in setting realistic goals for the units or individuals you supervise?	1	2
in identifying problems, abuses or inefficiencies in the unit you supervise?	1.25	2
Planning Decisions:		
How useful to you has computer-based information been in identifying city problems?	2	2
How useful to you has computer-based information been in determining solutions to city problems?	1.25	1.5

a. The index of usefulness is the median of the median response within each city across all top-manager respondents, where individuals' responses were scored as: 0, no computer-based information; 1, not at all useful; 2, somewhat useful; 3, useful; 4, very useful.

b. This item was scored somewhat differently. Responses were scored: 0, no computer-based information; 1, not at all; 2, yes, in a few cases; 3, yes, in many cases; 4, yes, in nearly all cases.

* Significant at the .05 level or below determined by the two-sample median test.

information and allocating manpower, which are likely to be set up in a recordkeeping form (see Table 3). Therefore, until better management control applications are developed, serious management control payoffs are not expected from computerized information, except in the fiscal area. Moreover such control payoffs are likely to be constrained by the professional versus political nature of the city administration. As other published work from the URBIS research indicates, the more professional the administration is (e.g., the city is headed by a professional manager) and the more it follows professional management practices, the more likely the administration supports decision making aided by applications such as computer models.[15]

Payoffs in Better Information for City Planning Decisions

The situation for planning decisions is as poor as it is for management control other than fiscal. Managers in the sample cities see computer-based information for city planning as barely useful in 1976 and the same in 1988 (see Table 3). The usefulness of computerized data in planning decisions is severely limited by the quality of database management applications and especially by the political factors that necessarily must be taken into account in decision making. For instance, many planning decisions require data that identify community conditions (e.g., housing supply, occupancy, ownership, condition). Such data are or can be automated in most cities. At the same time, setting up computer models that identify city problems or evaluate solutions to problems is far more complex. Such models would require criteria for defining problems and evaluating solutions, analysis of data in several files, and information that cannot be automated, such as interest group feelings about problems or support for various solutions. Moreover, there has been a clear trend in planning decisions for well over ten years now to devalue community statistics and, instead, to emphasize the opinions of the affected citizens. Given this trend, along with supporting data from this research, it is likely that computerized information will have little impact on city planning decisions in the near future.

Payoffs in Greater Efficiency of Operational Performance

Computers are supposed to have their greatest impacts on the operational efficiency of governmental departments.[16] The computer's vast capabilities for storing, retrieving, and processing information were expected to pare down rapidly the "army of clerks" in city and county halls, thereby reducing costs without a loss in service effectiveness. However, it has been apparent for some time that staff and cost savings from automation occur mainly in large-volume, highly repetitive information processing tasks such as tax, utility, and other large volume processing operations. Because many government functions involve many varied, small-volume information processing tasks, the overall efficiency benefits from computing have been considerably less than expected.[17] This situation is reflected in the perceptions of the managers, who "somewhat disagree" that computers produce staff reductions and "somewhat agree" that computers produce cost savings (see Table 4). Yet the dashed hopes for large cost savings from most municipal automation can be replaced by the satisfactions from cost avoidance which the managers "somewhat agree" has occurred (see Table 4). In fact, no city disagreed or even somewhat disagreed with this payoff.

The reason why there have not been significant, observable staff savings may be attributable to the fact that (1) computerization allows new services to be offered as well as greater volume of work to be performed, i.e., more work done with about the same size staff, and (2) creates

Table 4
Computer Impacts on Efficiency of Operational Performance and the Effectiveness of Public Service

Item	Index of Agreement[a] 1976	1988
Efficiency of Operational Performance:		
Cost Savings—		
Where they have been applied, computers have reduced the number of people necessary to perform tasks in my department.	1.5	1
Where they have been applied, computers have reduced the cost of department operations.	1.5*	2
Cost Avoidance—		
Computers allow departments to handle a greater volume of service without corresponding increases in cost.	2	2
Cost Problem—		
High cost of computer use.	1*[b]	0[b]
Effectiveness of Public Service:		
Computers have made it easier to handle routine citizen requests for information.	2	3
Computers seldom make things hard for citizens because mistakes in computer records take a long time to correct.[c]	1*	2
Citizen complaints about this department seldom are related to foul-ups or problems we have with the computer.[c]	2.5	3

a. The index of agreement is the median of the median response within each city across all top-manager respondents, where individuals' responses were scored: 0, disagree; 1, somewhat disagree; 2, somewhat agree; 3, agree.

b. The problem index is the median of the median response within each city across all top managers, where individuals' responses were scored as: 0, not a problem; 1, at times a problem; 2, often a problem; 3, very often a problem.

c. The wording of these questions was changed for table comparability. The question actually said "sometimes" instead of "seldom."

* Significant at the .05 level or below determined by the two-sample median test.

the need for new jobs in many departments to support the computer application(s). Therefore, if operational efficiency is improved through computerization, it is improved by avoiding higher personnel costs and not necessarily by cutting present or preautomation costs. Finally, only those information processing tasks that experience higher volume growth or offer new services realize major cost avoidance. While staff and cost savings from computer use may not be immediately apparent, managers are no longer concerned about the "high cost of computer use" (see Table 2). It may be that they feel the benefits outweigh the costs or that the costs of computer use have declined substantially.

Payoffs in Better Interaction with the Public

The promised benefits of computerization were many, and they were directly pitched to appeal to managers and mayors. Citizens were also said to benefit for they would live in a better managed and more effective and efficient city. Still, these are indirect citizen benefits and collective goods. Yet, some direct benefits accrue to citizens; when they individually initiate contacts with the city. Computers can make citizens' requests for information easier to the extent that computerization has increased the availability of information while maintaining technical quality (see Tables 1 and 2). In 1976 and 1988 citizens were somewhat realizing this benefit from computerization (see Table 4). In addition, while computerization increased during this time period, there was a perceived significant decrease in citizens' frustrations with computerized data (see Table 4). Thus, while automation can increase government effectiveness and efficiency, at times an intangible benefit to citizens, it is important that it also improve direct government-citizen relations, which is a very tangible benefit to citizens.

Conclusion

The computer industry promoted computers with stories of untold benefits that would result from the introduction of computers into the workplace. Little was said about the technical quality of computerized information. Very quickly, automating workplaces realized that more questions should have been asked about the accuracy and ease of manipulation of automated files. Then there were also the unanticipated organizational and hardware problems. Still, while such problems tended to come as a surprise, they were not major problems in terms of their frequency and manageability. Admittedly, they were sometimes a source of major frustration for employees and citizens alike.

Good technical quality of information is an essential characteristic of computerized information, but in itself it is not a benefit or payoff. On the most fundamental level, computerization was supposed to increase the availability of information. Yet, by the mid-1970s the payoffs in better information were mixed.

In 1976 what specific payoffs were United States cities perceived to be receiving from computerization? Answer: more fiscal control, some cost avoidance, better interaction with the public, and a bare improvement in information for planning decisions (see Table 5). What payoffs were these cities perceived to be receiving? Answer: overall improvements in availability of information, infor-

Table 5
Summary of Payoffs from Computerization

			Significant Improvement By 1988	
	1976[a]	1988[a]	# dimensions	# significant
Increased availability of information	Mixed	Yes[b]	6	1up 1down
Better information for management control				
Fiscal control	Somewhat useful to useful	Somewhat useful to useful	3	0
Personnel matters	Not at all	Toward somewhat useful	2	2
Setting goals, identifying problems	Not at all	Not at all	2	0
Better information for planning decisions	Barely	Barely	2	0
Greater efficiency				
Cost savings	Questionable	Mixed	2	1
Cost avoidance	Somewhat	Somewhat	1	0
Better interaction with the public	Better	Better	3	1

a. The words are a qualitative characterization of the meaning of the score. See previous tables for the actual responses used for each measure.
b. An improvement is noted due to the change in response categories in 1988 that distort the tests of significance.

mation for management control in nonfiscal areas, and cost savings (see Table 5). That is not a good return given all the high expectations. But in 1976, while 95 percent of all United States cities over 50,000 in population were automated, the automation was not extensive; it tended to be concentrated in a few selected departments, such as police, finance, and public works. Thus, the payoffs from automation could be argued to be minimal due to the low level of automation.

However, by 1988, one could no longer use as an excuse for the poor payoffs that few departments were automated. Today, based on the 1985 survey of all U.S. cities over 50,000 in population, cities average 84 applications. They are distributed across nearly all city departments, and 84 percent of the managers as well as staff indicate that their work involves major interaction with computers.[18] So have the payoffs been realized with the extensive computerization of cities? The answer appears to be a qualified yes, but there is still much room for improvement (see Table 5). By 1988, cities were experiencing the most payoffs in the areas of fiscal control, cost avoidance, and better interaction with the public (see Table 5). A minimal level of payoffs were observed in nonfiscal management control and planning decisions. Some cost savings were cited as were payoffs in increased availability of information (see Table 5).

Newer and more up-to-date information that is easier to access will be the hallmark of future automation.

And what further payoffs from automation does the future hold for U.S. cities and governments in general? Newer and more up-to-date information that is easier to access will be the hallmark of future automation (see Table 1). More available information was the basic selling point of computers, and it is generally perceived to have lived up to those promises. This finding is important because record searching is the common denominator of all computer tasks.[19] Another sizeable payoff is better interaction with the public. While this may be considered only as a nice "side dividend" from automation, positive benefits were received early and continued to improve (Table 5). Another payoff now and in the future is cost avoidance (see Table 5). In contrast, net cost savings are still low (Table 5). It appears that probably high volume tasks and ones which can offer new services are the only major beneficiaries of direct cost savings. Finally, while better information for fiscal control was an early payoff, there is clearly room for improvement although it appears at first puzzling that no significant amount has taken place in the last 12 years (Table 5). In actuality, we hypothesize that the steady state from 1976 to 1988 may be impressive when weighed against the major financial constraints in cities that occurred in the late 1970s. Moreover, we are confident that more sophisticated analysis of financial data can result in greater fiscal control as the fiscal crunch of cities is reduced and given that some cities have experienced strong fiscal control improvements. But we are less confident that more extensive and intensive computerization in the federal government would have similar effects on fiscal control given the looming deficits.

In contrast, the payoffs from automation in regard to nonfiscal management control and planning decisions have been barely realized even in leading-edge cities by 1988 (Table 5). This dismal situation is further constrained by technical and practical limitations. The technical limitations stem from the quality of database management applications. The practical limitations are that databases and models do not tell one what should be done. Databases can help to focus decision making on the critical issues, and models can aid the decision-making process by imposing a discipline on it. For example, models require users to specify precisely the assumptions they are making and the basic facts of the decision situation and then to calculate the consequences. But a computer analysis can only tell a city, for example, that one-person patrol cars are more cost effective then two-person cars. The decision to go to one-person cars has to be balanced with officer safety concerns and union demands, factors that are hard to fit meaningfully into computer models. In essence, political judgment and insight are still key to good management decisions and cannot be supplanted by computerization. Planners and policy makers are especially cognizant of this reality. Thus, major payoffs in nonfiscal management control and planning decisions are not expected in the near future although there definitely is room for improvement.

In conclusion, based on this longitudinal panel study of 37 leading-edge cities in the United States, the expected payoffs from automation have been slow to be realized, but that may be the nature of the "beast." Yet there is a potential for future improvements. Such improvements can be achieved, as demonstrated by a few leading-edge cities. However, given the data and their admittedly perceptual nature, managers should continue to focus computer dollars on applications that have a large recordkeeping component such as financial, personnel, and land records, as well as utility bills, traffic tickets, etc. More sophisticated applications, such as those information systems which set and measure goals whether internally (to departments) or externally (to larger community planning decisions), appear to be a long way away from delivery of major payoffs if, in fact, the political nature of these application tasks will ever allow them to be dramatically affected by computerization. Finally, data accuracy and accessibility to data are necessary preconditions for success, but they do not guarantee success early if, at times, at all.

The longitudinal nature, as well as sampling frame of this data, appears to be advantageous for sorting out some of the conflicting and incomplete findings of prior theoretical and empirical studies. Yet, future research needs to explore how the attitudes of management, as well as the organizational structure, impact the payoffs from automation.

Equally important, future research should take a more micro approach by concentrating on the automation pay-

offs in specific types of information processing tasks. This more micro level of analysis could target payoffs stemming from specialized software as well as from variations in tasks themselves. It can also focus on questions of productivity. The macro approach taken in the present article can mask and does not attempt to address payoffs and problems unique to different information processing tasks in government. In addition, a micro approach could include harder measures of payoffs.

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Notes

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1. Based on fieldwork, an application questionnaire was designed in 1975 listing some 300 different computer applications. New fieldwork in 1985 led to expansion of the 1987 application questionnaire's listing to 450. See Kenneth L. Kraemer, John Leslie King, Debora E. Dunkle, and Joseph P. Lane, "Trends in Information Systems, 1975-1985," *Baseline Data Report*, vol. 18 (March/April 1986), pp. 1-11; Kenneth L. Kraemer, John Leslie King, Debora E. Dunkle and Joseph P. Lane, "Municipal Information Systems: State of the Practice," *Baseline Data Report*, vol. 21 (January/February 1989), pp. 1-10.
2. Anthony Downs, "A Realistic Look at the Final Payoffs from Urban Data Systems," *Public Administration Review*, vol. 77 (May/June 1967), pp. 204-210.
3. See James N. Danziger, William H. Dutton, Rob Kling, and Kenneth L. Kraemer, *Computers and Politics* (New York: Columbia University Press, 1982).
4. See Kenneth L. Kraemer and John Leslie King, "Computing and Public Organizations," *Public Administration Review*, vol. 46 (November/December 1986), pp. 488-496; and Paul Attewell and James Rule, "Computing and Organizations: What We Know and What We Don't Know," *Communications of the ACM*, vol. 27 (December 1984), pp. 1184-1192.
5. Ron Weber, "Computer Technology and Jobs: An Impact Assessment and Model," *Communications of the ACM*, vol. 31 (January 1988), pp. 68.
6. See Kenneth L. Kraemer and John Leslie King, *Computers and Local Government, Vol. 2: A Review of Research* (New York: Praeger, 1977) and Alan Westin and Michael Baker, *Databanks in a Free Society* (New York: Quadrangle Books, 1972).
7. See F. Edward, R. Hearle and Richard J. Mason, *A Data Processing System for State and Local Governments* (Englewood Cliffs, NJ: Prentice Hall, 1963) and Kenneth L. Kraemer, William H. Mitchel, Myron E. Weiner, and O. E. Dial, *Integrated Municipal Information Systems* (New York: Praeger, 1974).
8. URBIS stands for Urban Information Systems and is a 25-year panel study of the management, use, and impact of computerization in U.S. local governments. Data for the first panel were collected in 1975 and 1976, for the second panel in 1985, and 1987-1988. Data collection for the third panel will begin in 1995. For more detail on the URBIS design, see Kenneth L. Kraemer, William H. Dutton, and Alana Northrop, *The Management of Information Systems* (New York: Columbia University Press, 1981) and Alana Northrop, William Dutton, and Kenneth L. Kraemer, "The Management of Computer Applications in Local Government," *Public Administration Review*, vol. 42 (May/June 1982), pp. 234-243.
9. The 1976 response rate is the standard rate computed by dividing the number of returned questionnaires into the number of questionnaires mailed and/or handed out. We do not have an exact 1988 response rate. In 1988, questionnaires were allotted to cities first by their size (160 for cities 100,000 or larger in population and 130 for smaller cities) and second by the number of department heads and relevant computer users in certain positions which varied by city. The return rate just for managers and division heads, the only respondents used in this article, is probably in the high 80s, given that site visits targeted these individuals.
10. While operational problems and informational problems are infrequent, managerial problems relating to the overall organization of computing, the successful implementation of development projects, and relations with user departments are expected to continue unabated.
11. See Janet A. Weiss, Judith E. Gruber and Robert H. Carver, "Reflections on Value: Policy Makers Evaluate Federal Information Systems," *Public Administration Review*, vol. 46 (November/December 1986), pp. 497-505; Robert P. McGowan and Gary A. Lombardo, "Decision Support Systems in State Government: Promises and Pitfalls," *Public Administration Review*, vol. 46 (November/December 1986), pp. 579-583.
12. See Harold J. Leavitt and Thomas L. Whisler, "Management in the 1980s," *Harvard Business Review*, vol. 36 (June 1958), pp. 41-48; and Herbert A. Simon, *The Shape of Automation* (New York: Harper and Row, 1965).
13. See Aaron Wildavsky, *The Politics of the Budgetary Process*, (Boston: Little, Brown, 1974).
14. See Kenneth L. Kraemer, William A. Dutton, and Alana Northrop, "Management Control the Automated Budget and Information Handling," *Information Privacy*, vol. 2 (January 1980), pp. 7-16.
15. Kraemer, Dutton, and Northrop, *op. cit.*; William H. Dutton and Kenneth L. Kraemer, *Modeling as Negotiating* (San Francisco: Jossey-Bass, 1989).
16. See Hearle and Mason, *op.cit.*, and Kraemer, Mitchel, Weiner, and Dial, *op.cit.*
17. See James N. Danziger, "EDP's Diverse Impacts on Local Governments," *Nation's Cities*, vol. 13 (October 1975), pp. 24-27.
18. Based on analysis of all 5,000 city respondents, reported in Kenneth L. Kraemer and Alana Northrop, "Curriculum Recommendations for Public Management Education in Computing: An Update" *Public Administration Review*, vol. 49 (September/October 1989), pp. 447-453.
19. *Idem.*

Appendix

1986 Population of Cities in the URBIS Study

City	Population	City	Population
Albany	101,727	Milwaukee	636,212
Atlanta	425,022	New Orleans	557,515
Austin	345,496	New Rochelle	70,794
Baltimore	786,775	Newton	83,622
Bellevue	73,903	Oshkosh	49,620
Bloomington	81,831	Paterson	137,970
Boulder	76,685	Philadelphia	1,688,210
Brockton	95,172	Phoenix	789,704
Burbank	84,625	Portsmouth	104,577
Charlotte	314,447	Provo	74,108
Chesapeake	114,486	Quincy	84,743
Cleveland	573,822	Richardson	72,496
Costa Mesa	82,562	Riverside	170,876
Evansville	130,486	Sacramento	275,741
Ft. Lauderdale	153,279	San Francisco	678,974
Grand Rapids	181,843	San Jose	629,442
Hampton	122,617	Seattle	493,846
Kansas City	448,159	Spokane	171,300
Lancaster	54,725	St. Louis	453,000
Las Vegas	165,000	Stockton	149,779
Lincoln	171,932	Tampa	271,523
Long Beach	361,334	Warren, MI	161,134
Miami Beach	96,298	Warren, OH	56,629

Comparison of 46 Study Cities With All Cities 50,000 and Over: Structural and Technological Policies

	46 Cities (N = 46)		All Cities 50,000 and Over (N = 351)	
	Mean	Standard Deviation	Mean	Standard Deviation
Degree of automation (total applications operational)	110.3	49.9	84.1	44.3
Degree of decentralization of computing resources (number of installations)	1.9	1.4	1.4	1.2
Degree of user involvement in design	2.5	.6	2.4	.6
Charging policy	.4	.5	.3	.4
Degree of computer expenses (number of years DP in city)	21.4	7.7	18.2	8.3