Microcomputers in City Hall: Case Studies of Their Uses and Effects

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MICROCOMPUTERS IN CITY HALL:
CASE STUDIES
OF THEIR USES AND EFFECTS

by
Donald F. Norris
Vincent J. Webb

March 1987

CAUR
Center for Applied Urban Research
College of Public Affairs and Community Service
University of Nebraska at Omaha

The University of Nebraska—An Equal Opportunity/Affirmative Action Educational Institution
Preface

This report represents the culmination of a series of case studies on the uses and effects of microcomputers in municipal governments that were conducted between the spring of 1985 and the summer of 1986. The case studies were funded under a grant from the W. K. Kellogg Foundation as part of a broader project in the area of microcomputer uses for small and local governments. The intent of this research was to understand more completely what happens once microcomputers are introduced into local governments and to make those fundings available to governmental organizations.

The researchers on this project were Donald F. Norris, Director of the Institute for Governmental Service, the University of Maryland, and Vincent J. Webb, Chairperson of the Criminal Justice Department, University of Nebraska at Omaha. At the time of the research, Dr. Norris was a Senior Research Associate and Dr. Webb was Director of the Center for Applied Urban Research at the University of Nebraska at Omaha.

Dr. Norris conducted eight of the twelve case studies and wrote the initial draft of this report. Dr. Webb conducted the remaining four case studies and included the findings from those cases into the manuscript. Both researchers reviewed and edited the final manuscript.

The authors wish to express their thanks to Joyce Carson and Loni Saunders for typing the initial draft, Joyce Turner for typing the final manuscript and Gloria Ruggiero for assisting with editing the final draft.

We also wish to thank the W. K. Kellogg Foundation and Dr. Gary W. King, Program Manager for the Foundation, for the support that enabled us to undertake this study. We hope that the findings reported here, the dissemination of those findings and their use by governmental organizations that have acquired or are planning to acquire microcomputers will justify the foundation’s support.

Donald F. Norris
College Park, Maryland
January 1987
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MICROCOMPUTERS IN CITY HALL:
CASE STUDIES OF THEIR USES AND EFFECTS

Microcomputers first appeared on the commercial marketplace in 1976. Since then, an estimated 40 million microcomputers have been sold and more are being sold each day. A survey conducted in 1982 found that 13 percent of American cities owned microcomputers and that 35 percent planned to buy one or more microcomputers within two years (Norris and Webb, 1984). A follow-up survey conducted three years later found that between 75 percent and 90 percent of city governments owned microcomputers (Scoggins, 1986).

The widespread and rapid adoption of microcomputers by public organizations has occurred in the absence of objective information on the effects of this new technology on the people and organizations that use them. (See for example, Danziger, 1985, and Pearson, 1984 and 1985. This conclusion has also been reached by Norris and Thompson in their ongoing bibliographic research on computer effects.)

Much of the information about microcomputers available to public managers has been marketing literature or articles in the popular press and trade journals. This type of literature tends to be directed at selling hardware or selling magazines and is often superficial and biased. Nevertheless, many public organizations have purchased microcomputers, some in large numbers such as recent purchases by federal agencies like the Internal Revenue Service and the armed forces. Local and state governments, too, have acquired relatively large numbers of microcomputers.

By acquiring new technology without knowing the effects of the technology, organizations open themselves to potential serious and costly mistakes. Promised positive results may not occur. Negative effects may be more numerous than positive ones, and unintended consequences that produce serious dislocations may occur.

In September 1984, the Center for Applied Urban Research (CAUR) received a grant from the W. K. Kellogg Foundation that in part addressed the absence of objective information on microcomputer impacts. An earlier grant (1982) from the Kellogg Foundation enabled CAUR to develop training and technical assistance materials for local governments on the subject of
microcomputers and to field test the applicability of microcomputers to the management of small and rural local governments. The second award expanded upon this work. It provided for dissemination of the training and technical assistance materials and, importantly, provided the opportunity to investigate actual uses and effects of microcomputers in local governments.

This report represents a summary of findings from twelve case studies of the uses and effects of microcomputers in municipal governments conducted in 1985 and 1986. The cities selected for the case studies were chosen because the authors knew of their use of microcomputers and, in some cases, their reputations as innovators. They were also selected to represent a wide population range to include both council-manager and mayor-council forms of government, and because of accessibility for research.

<table>
<thead>
<tr>
<th>City</th>
<th>Population</th>
<th>Form of Government</th>
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</thead>
<tbody>
<tr>
<td>Ames, Iowa</td>
<td>47,000</td>
<td>Council-manager</td>
</tr>
<tr>
<td>Bellevue, Nebraska</td>
<td>32,000</td>
<td>Mayor/council with city administrator</td>
</tr>
<tr>
<td>Bonner Springs, Kansas</td>
<td>6,300</td>
<td>Council-manager</td>
</tr>
<tr>
<td>Englewood, Colorado</td>
<td>30,000</td>
<td>Council-manager</td>
</tr>
<tr>
<td>Marshalltown, Iowa</td>
<td>26,600</td>
<td>Mayor-council</td>
</tr>
<tr>
<td>Olathe, Kansas</td>
<td>50,000</td>
<td>Council-manager</td>
</tr>
<tr>
<td>Omaha, Nebraska</td>
<td>346,000</td>
<td>Strong mayor-council</td>
</tr>
<tr>
<td>Orleans Park, Illinois</td>
<td>27,500</td>
<td>Council-manager</td>
</tr>
<tr>
<td>Pasadena, California</td>
<td>119,000</td>
<td>Council-manager</td>
</tr>
<tr>
<td>Plant City, Florida</td>
<td>19,000</td>
<td>Council-manager</td>
</tr>
<tr>
<td>Venice, Florida</td>
<td>12,100</td>
<td>Council-manager</td>
</tr>
<tr>
<td>Yankton, South Dakota</td>
<td>12,000</td>
<td>Council-manager</td>
</tr>
</tbody>
</table>

The initial case study was conducted in Olathe, Kansas, in the spring of 1985. The final case study was carried out in the summer of 1986.

The research methodology employed in these case studies was qualitative. A semi-structured questionnaire that focused on several aspects of the use and effects of microcomputers was employed. The authors secured permission from officials in each city to conduct the case study and arranged mutually convenient schedules for on-site visits. Depending on the extent of micro-computer use, we spent from half a day to four or more days
conducting interviews, reviewing documents, and observing microcomputer use in the case study cities. In the smaller cities, and those with relatively few microcomputers, we interviewed top governmental officials, all department heads whose departments used microcomputers, and all end-users of the technology. In larger cities, we interviewed as many of these persons as time and scheduling would permit, endeavoring at each site to interview principal users, top officials, and heads of departments in which microcomputers were used extensively.

Interviews were semi-structured and essentially one-on-one. As a result, although we followed the format of the questionnaire, we were also able to focus on specific issues as they arose (for example, user frustration, productivity improvement) and to probe for effects that other research findings suggested might occur with microcomputers. We were able to observe the physical location of microcomputers, the configuration of workstations, specific work products, and, in many cases, employees using the microcomputers.

After completing the on-site aspect of a case study, we reviewed our field notes, and made follow-up telephone calls to secure any additional information that was needed or to obtain clarifications. Once a case study was completed, we coded the data into relevant categories and, using both the narrative field notes and coded data, prepared a site summary. Throughout the process of reviewing field notes, we evaluated the data and, as additional cases were completed, compared the results from city to city. When all twelve case studies were completed, we prepared a detailed examination of the results and an overall summary.

We cannot claim that the findings from these case studies are representative of the uses and effects of microcomputers in all local governments or in public organizations in general. A much larger number of cases that are representative of the broader universe of public organizations would be required. However, because the qualitative method employed in the studies enabled us not only to standardize our research approach but also to conduct in-depth examinations, we are confident of the validity of the findings. Insofar as the circumstances of microcomputer use in other organizations are similar to what we found in these cities, we are confident that studies of the use of micros will produce similar findings. Finally, we believe these findings can be used to formulate questions and hypotheses for additional research on the uses and effects of microcomputers in public organizations.
This report is organized into two parts. Part I contains a summary of the findings from all twelve case studies. These findings are presented under the major categories of hardware, communication, software and uses, training, user satisfaction, and effects. A brief conclusion follows these sections. Part II contains the individual summaries for each of the twelve cities. These are presented in alphabetical order.
PART I: SUMMARY OF FINDINGS
Summary of Findings

Hardware

The twelve cities studied owned nearly 300 microcomputers from several different manufacturers. The distribution of systems was far from equal. Pasadena owned the largest number of microcomputers (about 110) and Plant City owned the fewest (only 1). The vendor represented by the largest number of machines was Hewlett-Packard (HP) but that was because over 90 of Pasadena's microcomputers were HP devices. Englewood had 8 HP microcomputers. IBM accounted for the next largest number of microcomputers (about 44). These were mostly IBM PCs with a few PC XT's, one PC AT and one 3270 PC. Next were Apple (12 machines--Apple II and III models and MacIntoshes), Commodore (10 Commodore 64s in Marshalltown), Radio Shack (9 including Models 1, 4, and 16), Kaypro (4 including Models 2, 4, and 10), Seequa (2 Chameleons), Cromemco (2), and one machine each from AT&T, Columbia, Compaq, Corona, ITT, and Texas Instruments (a model 99/4).

Micros were purchased mainly out of regularly budgeted operating revenues as opposed to capital budgets. One city chose to lease its machines and this was because of favorable interest rates available through a local bank. In only three cases were microcomputers purchased with grant funds, and these machines were largely dedicated to the particular function for which they were acquired (for example, traffic engineering).

The more recently purchased microcomputers were often equipped with hard disk drives, although the majority of machines reported in this study were floppy disk models. The acquisition of machines with hard disk drives seemed to be as much a function of recent cost reductions on those units as of perceived need for greater disk capacity and speed. CPU memory ranged from the 64K on the 8-bit Commodore units to 640K on some of the 16-bit machines, with 256K and 512K being fairly typical memory sizes on the latter.

Most machines were equipped with monochrome monitors and dot matrix printers, although a number of color monitors and letter quality printers were reported. Printer choice, with few exceptions, seemed to be dictated by function, although we suspect that price played a role in at least some printer decisions. Letter quality units were chosen for correspondence and other narrative activity where typewriter quality print was required. Dot matrix printers were chosen for the balance of activities. Only a few cases
of inappropriate printer choice based on these criteria were observed. Laser printers were reported in Pasadena, Englewood, Ames and the choice of laser printers in those cities was a matter of printer capabilities and cost-effectiveness.

Regardless of manufacturer, the hardware worked reliably and effectively in all of the cities, although not without occasional difficulty. Six of the twelve cities reported incidents of hardware problems. These were few in number and relatively minor in consequence. The most frequently reported difficulties involved printer and disk drive failures. Other types of hardware problems included a few chip failures, CRT burnouts, hardware-hardware or hardware-software interface problems, and one instance of keyboard malfunction. For the most part, hardware failures were repaired or parts (including entire units) replaced quickly, effectively, and to the satisfaction of users. In only one case (disk drives for Commodore 64 microcomputers in Marshalltown) were repairs not fully effective. None of the reported hardware problems were considered severe, primarily because of expeditious repair or replacement, and because, unlike the failure of a minicomputer or mainframe, organization-wide activities were not affected adversely and backup systems were usually immediately available.

All but two of the cities chose to handle hardware maintenance without maintenance contracts. These cities reasoned that maintenance policies were excessively expensive considering the reliability and ease of repair of microcomputer equipment. For example, in Omaha a maintenance policy would have cost over $10,000 for basic carry-in service and the MIS director concluded that as-needed repairs would cost far less. Experience proved these cities correct.

One exception, Bellevue, paid $3,000 per year for a maintenance policy. This is equivalent to the cost of a new microcomputer with hard disk and printer each year or the cost of six different repairs at $500 each during one year. The incidence of hardware failure in Bellevue was minimal and did not appear to justify the cost of the maintenance policy. Bonner Springs reported paying just over $1,000 per year for a maintenance policy for its five microcomputers and local area network. This figure seems more reasonable. Moreover the need for hardware support was greater in Bonner Springs because of the complexity of the local area network.

All of the cities reported that at least some of their microcomputers were shared by more than one user. However, a distributional pattern was
not discernible. Sharing occurred in larger and smaller cities, and in cities with large and small numbers of machines. One common finding was that in all but two of the cities use pressure produced by sharing hardware resulted in acquisition of additional machines.

All of the cities owned or used other computer systems than the micros. These included multi-user microcomputer systems being installed in Plant City and Marshalltown at the time of the case studies, minicomputer systems in Ames, Bellevue, and Yankton, both mainframes and minicomputers in Englewood, Omaha, and Pasadena, and a mainframe and stand-alone word processors in Olathe.

Software on the larger computer systems tended to be for financial management activities, police records, large databases (e.g., parcel or property records), and for certain specialized activities such as fleet maintenance. In most cities with larger computer systems, a compelling reason cited by users and managers alike for acquiring microcomputers was lack of effective access to the mainframe or minicomputer. This was especially true in Ames, Englewood, Olathe, Omaha, Pasadena, and Venice. To a lesser extent it was also true in Bellevue, Marshalltown, and Yankton. In those cities, however, the question of access to larger systems was not raised directly because access was not feasible in them at the time microcomputers were acquired. Moreover, the microcomputers were introduced primarily as tools to help employees do their jobs rather than as elements of an information management system or to supplement the work of larger systems.

None of the case study cities had adopted formal plans or policies for microcomputer acquisition or use, although Ames, Englewood, Pasadena and Yankton came close. Engelwood had limited microcomputers to a learning laboratory, a few machines that could be justified functionally by departments, and as office automation workstations. Pasadena encouraged microcomputer adoption, had essentially standardized on Hewlett-Packard machines, and provided extensive hardware support and user training. In the remaining localities, procurement was a departmental option with widely varying degrees of a centralized control over whether a purchase was allowed and the type of machine that could be acquired. While none of the cities provided systematically for coordination of microcomputing, integration of microcomputers into a broader information management structure, or coordination of microcomputer software or databases, Ames and Yankton are two cities that came close.
In five of the seven cities that had numerous microcomputers, management had formally or informally restricted the type of hardware that could be purchased. These decisions had been made largely to standardize equipment for ease of maintenance, for software and database sharing, to facilitate communication with larger machines, and for ease of networking at some future date. However, in most of these cities users were able to acquire equipment outside of the established standard or the standard itself was broad enough (e.g., IBM, IBM compatible or MacIntosh) to allow the purchase of different brands of machines.

Nowhere did a policy, even an informal one, exist on software. In Omaha and Pasadena, training was provided only on three packages. This functioned to establish somewhat of a de facto software standard, although users in both cities were able to acquire other software if they desired and could afford it.

In eight of the twelve cities, once one or a few microcomputers were acquired, broader diffusion of the technology began. The speed and breadth of diffusion was dramatic in at least five cities, Pasadena, Bellevue, Ames, Marshalltown, and Olathe.

The assistant city manager of Bellevue offered an intriguing explanation of microcomputer diffusion in his city that may be more broadly applicable. He called it the "theory of concentric circles." What he meant was that departments with the greatest need acquired microcomputers first, and, as other departments with lower need levels saw this, they acquired microcomputers. This was followed by a third tier of departments with little or no need that, on seeing what earlier adopters had done, moved to acquire their own microcomputers.

Evidence from nine of the sites tends to confirm this theory, although in a modified version. To begin with, the definition of "need" is unclear and often in the eye of the beholder. That is, whether a department "needs" a microcomputer is probably arguable at best. What is clear is that in nine of the cities once one or a few departments (each for its own, often different reasons) acquired microcomputers, other departments observed their uses and effects, heard their praises sung, (suffered the pangs of jealousy), and took action to acquire systems. Often a micro being shared among users in different departments resulted in the acquisition of additional units.
The concept of concentric circles is probably correct in that the introduction of microcomputers is often followed by the adoption of additional units. (And, in at least two of the cities, microcomputer adoption also helped pave the way for acquisition of larger computer systems.) In a sense, too, this theory of concentric circles is similar to the "S" curve observed by Rogers (1985) and others that describe innovation adoption patterns.

Evidence from this study strongly suggests, however, that adoption of microcomputers is not solely need-based, at least in any objective sense. Need, as perceived by the adopter, was certainly one important factor in the adoption of microcomputers in the cities. But adoption was also driven by other forces. These include staff and management innovativeness and aggressiveness, the availability or ability to secure budgetary approval or external funding, and organizational climates that supported adoption of new technologies.

In all of the cities, one or a few persons aggressively pursued microcomputer acquisition. They included department heads (in at least five of the cities), potential users (most often professional and technical personnel who wanted better "tools"), and middle management personnel (e.g., division heads). Regardless of level in the organizational hierarchy, these key persons were usually responsible for their cities' initial microcomputer plunge. They were, in Rogers' words, the innovators and early adopters. (Rogers, 1985). It would be interesting to speculate what would have occurred in these cities had these persons not been present. We suspect that microcomputer adoption would have proceeded much more slowly, if at all.

Communication

Nearly all of the microcomputers in these cities were stand-alone devices. They were used independently of both other microcomputers and larger computers. Only a relatively few units were used to communicate either with other microcomputers, mainframes, or minicomputers. Exceptions included Bonner Springs which had a microcomputer-based local area network. Ames, Yankton, and Orleans Park used their microcomputers in conjunction with their minicomputer systems. All of Omaha's microcomputers were acquired with communication capability. But at the time of the study, only one was being used to communicate. The Hewlett-Packard microcomputers in Pasadena could connect to the city's HP 3000 for electronic mail and scheduling, but few users took advantage of this capability. In Olathe, one unit was used to upload and download data between the city's mainframe and
hand-held utility meter reading devices. Englewood had just implemented an HP based office automation system with eight microcomputer based workstations, but none of the other microcomputers were used for communications.

Among other things, this means that at least at the time of the case studies, data communication was not an overriding concern for these cities. It also supports the finding that the vast majority of microcomputers was purchased as perceived tools to help staff members do their jobs more effectively. Most of them were not acquired to fit into a broader information management scheme. However, a few of the cities used micro-computers in conjunction with larger systems and one had a LAN. Others still preserved their systems by acquiring microcomputers with communication capability so that if need arose in the future their microcomputers could be linked together with larger systems.

**Software and Uses**

In all of the cities covered by this study, microcomputers were viewed as instrumental objects. That is, as tools with which to do work. Most microcomputers were purchased with specific work activities in mind.

General reasons also motivated microcomputer acquisition. These tended to be global in nature, and focused on the potential microcomputer uses and benefits. In Englewood and to a lesser extent Ames, for example, microcomputer learning labs were established in response to pressure from department heads for microcomputers. City management did not feel that requests for microcomputers were specific enough or that, if acquired, microcomputers would be used effectively. Hence, the learning lab was set up to "see what would happen," (that is, would use occur and if so would it justify departmental acquisition of microcomputers?).

In other cities, several common general reasons were given. These included: the potential of micros, because it was the thing to do, in order to get experience with micros, to improve accuracy, to save time, to improve productivity, to do work that could not be done before, and for convenience. Lack of access to a mainframe or other large computer system was a factor in microcomputer acquisition by at least some departments in almost all of the cities. Finally, according to a few respondents, a micro "just appeared" at their desks.
For the most part, however, microcomputers were acquired to perform specific tasks. After their purchase they continued to be used for these purposes, although uses almost always expanded beyond original intentions. Indeed, actual uses in nine of the cities were numerous and varied. In Venice where the police department was the only microcomputer user, and Plant City, where the machine was located in the public works department, uses were more limited.

The following is a representative, although not exhaustive, list of microcomputer uses in the case study cities.

**Ames**
- Library circulation
- Parks and recreation scheduling
- Waste recovery automatic scale reading
- Equipment maintenance and records

**Bellevue**
- Manage a large database during a murder investigation
- Budget preparation
- Annexation studies
- Waste water treatment plant maintenance management

**Bonner Springs**
- Fire and ambulance service requests
- Recreational management
- Budget analysis
- Utility billing
- License record

**Englewood**
- Library administration
- Public access in the library
- Reporting on vehicle use of compressed natural gas
- Contractors examinations and licenses

**Marshalltown**
- Audit schedules
- Engineering calculations
- Crime analysis
- Finger print identification
- Preparation of union contracts
- Financial analysis
- Accounting
<table>
<thead>
<tr>
<th>City</th>
<th>Services</th>
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<tbody>
<tr>
<td>Olathe</td>
<td>Public works department management applications</td>
</tr>
<tr>
<td></td>
<td>Traffic signal optimization studies</td>
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<tr>
<td></td>
<td>Rental housing program management</td>
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<td></td>
<td>Sewer flow measurement</td>
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<td>Utility meter reading</td>
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<tr>
<td>Omaha</td>
<td>Budget preparation</td>
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<tr>
<td></td>
<td>Annexation studies</td>
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<td></td>
<td>Internal accounting and auditing</td>
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<td></td>
<td>Engineering estimates</td>
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<td></td>
<td>Capital improvement planning</td>
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<tr>
<td></td>
<td>Financial analysis</td>
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<td></td>
<td>Statistical analysis</td>
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<td></td>
<td>Forestry production reporting</td>
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<td></td>
<td>Investment management</td>
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<tr>
<td></td>
<td>Library administration</td>
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<td></td>
<td>Indexing of unique library holdings</td>
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<tr>
<td>Orleans Park</td>
<td>Emergency contact manual</td>
</tr>
<tr>
<td></td>
<td>Recreation scheduling</td>
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<td></td>
<td>Budgeting</td>
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<tr>
<td>Pasadena</td>
<td>Budgeting</td>
</tr>
<tr>
<td></td>
<td>Financial analysis</td>
</tr>
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<td></td>
<td>Engineering calculations</td>
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<td></td>
<td>Establishing speed limits</td>
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<td></td>
<td>Street lighting analyses</td>
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<td></td>
<td>Project scheduling and control</td>
</tr>
<tr>
<td>Plant City</td>
<td>Bid specifications</td>
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<tr>
<td></td>
<td>Housing rehabilitation schedules</td>
</tr>
<tr>
<td>Venice</td>
<td>Automation of police records</td>
</tr>
<tr>
<td></td>
<td>Financial monitoring</td>
</tr>
<tr>
<td>Yankton</td>
<td>Budgeting</td>
</tr>
<tr>
<td></td>
<td>Engineering studies</td>
</tr>
<tr>
<td></td>
<td>Federal grants management</td>
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<tr>
<td></td>
<td>City ordinance database</td>
</tr>
</tbody>
</table>
In addition, word processing was a microcomputer application in nearly all of the cities.

Three categories of personnel used microcomputers. They were managerial (division and department heads and top administrators), professional-technical (for example, planners, engineers, accountants—some of whom may also have had supervisory and/or limited managerial responsibilities), and secretarial-clerical employees. In none of these cities did elected officials make personal use of the microcomputers.

Professional-technical and secretarial-clerical employees used microcomputers the most. Indeed, in some cities (Olathe and Omaha) managerial personnel hardly ever actually sat down at the microcomputers and used them, while in others (Bellevue, Marshalltown, and Yankton) department managers were heavy users of microcomputers. However, managers in all of the cities routinely said they used information developed on microcomputers. In Ames, Omaha, Pasadena, and Orleans Park, middle managers used them, largely because middle managers in these larger cities had professional-technical as well as managerial responsibilities.

Because of the utility of microcomputers in activities like budget preparation, annexation studies, and engineering calculations, professional-technical employees used microcomputers in all of the case study sites. Because of their application in word processing they were widely used by secretaries, although many managerial and professional staff also reported using microcomputers for word processing.

Reported levels of use were rated as high (4 or more hours per day), moderate (2-4 hours), or low (less than 2 hours). Initially, we had thought that the extent of microcomputer use might indicate something about the effectiveness of use. It did not. Some uses required considerable amounts of time because of the nature of the activity (such as data entry for accounting and auditing or entry and revision of lengthy texts). Other uses (such as, repeated analyses of spreadsheet data, "what if" analyses, monthly reports, engineering calculations) took far less time once initial data were entered and applications were developed.

Throughout the cities, the extent of use varied with the type and amount of work to be performed. This often produced use variations by time of month and year and by workload in related activities. For example, more reporting work was done at month’s end, and springtime was particularly
significant for budget preparation activities in cities whose fiscal year began July 1. Some activities, like word processing and accounting in most cities and police records management in Venice, were relatively constant. However, even word processing was sensitive to fluctuations in user demand and demand produced by other activities.

All of the cities used off-the-shelf software, and off-the-shelf software represented the vast majority of programming used on microcomputers in these cities. The number of different packages in use ranged from a high of 25 in Marshalltown to a low of 2 in Plant City. The average across all cities was 8 packages, although three cities in addition to Marshalltown used more than 10 different packages. In a few instances, off-the-shelf software was "borrowed"--a polite euphemism for pirated--either from other users in the city or from non-city personnel or organizations.

Seven of the twelve cities used packaged software and four did not. Omaha, Pasadena and Olathe were the biggest users of packaged programs and the most typical packages were for traffic and engineering applications. Other packages included: on-line library network access, low-rent housing management, financial analysis, recreation scheduling, sewer flow monitoring, and utility meter reading. The packages were developed by software vendors, other governmental units and agencies, and a library services vendor.

In five cities, local staff persons developed their own microcomputer applications and four cities used outside firms or agencies for custom programming. In-house applications included a fuel usage reporting system in Englewood, databases and analysis routines for police records in Omaha, an investment management program in Omaha, various financial analysis templates in Pasadena, and use of a packaged database program to create a police record system in Venice. Spreadsheet programs were in use in all cities and database management programs were used in most. Spreadsheet and database management packages required at least a minimal amount of program development to set up a spreadsheet or database, customize output, merge data, and the like. Use of these programs can be said, therefore, to involve some degree of in-house application development.

The four cities reporting acquisition of custom written programming were: Bellevue--cemetary management, written by a local programmer associated with a computer store; Olathe--several public works applications, written by a local programmer hired by the public works director; Omaha--
forestry production reporting and dental claim processing written by the county data processing department, and an engineer's estimate program written by a local college student; and Pasadena--a traffic signal optimization program written by a traffic engineering consultant.

Very few problems were reported with any of the programs, whether off-the-shelf, packaged, or custom-written. Probably the worst examples of software problems that can be cited include the purchase by one city of a softball scheduling program from another community and failure to use the program because it did not meet the buyer's requirements, and a small number of examples of off-the-shelf programming that users either had not mastered, were not using but planned to use at some future date, or had abandoned in favor of other packages. Minor program bugs and glitches were reported in almost all cities, but these were either corrected by program writers or, if off-the-shelf software, were corrected by replacement disks. User satisfaction with software, regardless of source, was very high throughout the cities.

Training

One of the most consistent findings of this study is that user training is strongly related to the rapidity with which personnel became proficient microcomputer users, the effectiveness of microcomputer use within an organization, reduction and elimination of user fear and frustration, and overall user satisfaction. In most of the case study cities, user training was not provided or was provided only because of the initiative of specific users or departments. In some cases, training was provided as part of the hardware or software purchases. In several cities, training was almost an informal function carried out by self-taught staff.

Plant City and Venice are exceptions to this finding. Users received no formal training in either city and, except for initial computerphobia and resistance among records clerks in the Venice Police Department, absence of training was not perceived as a limiting factor in microcomputer use in either city. However, the number of microcomputers in both locations was limited as was the range of uses. Further, in Venice, the largest use of the multi-user microcomputer was for entry and storage of complaints and calls for service data in that city's police department.

Among the other cities, Ames provided a user support group, Pasadena provided full-time in-house training and user support, and Omaha contracted with an outside firm to provide training. In Pasadena and Omaha, computer
literacy training, instruction in hardware operation, and training in the use of specific off-the-shelf software packages were provided. In both of these cities, although more so in Pasadena, users reported that training was exceptionally valuable because it enabled them to learn to use the systems more quickly, more effectively, and with less frustration.

In some of the remaining cities, the absence of training or, in one case, the provision of poor quality training, had negative consequences. Without training, users required more time to learn how to use systems, a greater extent of user frustration was reported, and both lower levels and a greater extent of inefficient use occurred.

Absence of training did not affect all users equally, however, more technically inclined personnel (e.g., engineers), persons with prior computer experience, and staff members who made a greater personal commitment to learn and use a microcomputer were able to become proficient users on their own. Nevertheless, many of these persons said that training would have enabled them to learn more quickly and with less frustration. In most cities, Plant City and Englewood being exceptions, evidence of computerphobia and resistance was found, although it varied in degree from one city to the next. For the most part, fear of microcomputers and resistance to using them were limited to very small numbers of personnel. To these persons, no doubt, their fear and reasons for resistance were real. Repeatedly, however, users reported that training and use over time reduced or eliminated fear and frustration. However, isolated instances of continued resistance to use of microcomputers were noted.

It is not uncommon to encounter speculation in the trade literature and even among professionals in the field that older workers, personnel of lower socioeconomic status, and personnel on the lower end of the organizational hierarchy are the typical microcomputer resisters. Our findings do not support this speculation. To begin with, in the cities we studied resistance to microcomputers was limited to a very few persons. Second, persons of all ages, at all levels of the organization, and, within the range of employees found in municipal administration, all socioeconomic statuses used micros. Third, some persons in each of these categories also reported fear, frustration, and resistance. Finally, we found no pattern of either resistance or innovativeness. We can conclude, then, that at least based on the data from these case studies, neither age, socioeconomic status, nor hierarchical position are adequate predictors of acceptance or resistance to microcomputers.
The work environment in the city offices seemed to have some effect on the extent of computerphobia and resistance to microcomputers. Where positive management support for micros existed, where users were not coerced to use machines, where training was provided, and where ample time was provided for learning and for individual trial and error practice apart from the daily pressures of the job, users reported less frustration and an easier, quicker path to effective microcomputer use. On the other hand, where users were forced to use a microcomputer, were not provided training, and were not afforded time to learn apart from their normal daily work, frustration was greater, more widespread and longer lasting, and use proficiency took a longer time to develop.

User Satisfaction

Another salient finding is that user satisfaction was high in all of the cities studied. This finding seems to contradict earlier findings concerning instances of user frustration, computerphobia, and user resistance. It does not. User satisfaction was largely the result of proficient microcomputer use which itself was the product either of training or individual effort or both. Development of proficiency is time consuming and, for many users it is also somewhat frustrating. This should not be surprising because the development of any new skill is likely to be frustrating, at least initially. Because training enabled a quicker path to proficiency, it was strongly associated with reducing or eliminating fear and frustration, and as noted earlier, the opposite was also true. Once a degree of proficiency was achieved and users could see the results of their efforts, almost all, including most who had reported initial frustration, became highly satisfied with their microcomputers. Two statements commonly heard throughout the cities were "I don't know what I would do without my microcomputer," and "I don't know what I'd do if they took my microcomputer away."

Effects

The simple and most direct way to summarize the effects of microcomputers in the studied cities might be to say that much of the marketing hype was right. (Not that the writers of the marketing prose necessarily knew this, but right it was nevertheless.)

To put it another way, the vast majority of reported effects of microcomputers in the twelve cities studied were positive--on work, on people, and on the organizations. To be sure, some negative consequences
occurred in almost every jurisdiction, but they were relatively few in number and limited in severity.

All cities reported that efficiency and accuracy improved, more work was accomplished, costs were avoided or dollars actually saved, and that microcomputers made doing work easier (and in many cases, more enjoyable and personally rewarding). The two most significant positive effects turned out to be time savings and the ability to do work that was not feasible before the microcomputers. Time savings of 25 percent to 300 percent and more were regularly reported, depending on the type of task. Examples of time savings are available from every jurisdiction. Here are but a few:

- Budget alternatives prepared almost instantly during budget work sessions rather than taking several days,
- Monthly reports prepared in half a day rather than two and one half days,
- Union contracts revised in minutes rather than retyping lengthy documents, and
- Engineering design alternatives developed in 10-15 minutes versus 4 hours manually.

The time saved accrued to the benefit of the organization. It was not wasted, but was used to catch up on existing backlogs of work and to perform additional work. Microcomputers were also extensively used to do work that could not or would not have been done manually. Often, this involved sorting through large databases and conducting detailed analyses of data. Here are some examples:

- In-depth annexation studies,
- Analysis of fuel utilization patterns for city vehicles,
- Examination of urban land development alternatives,
- Traffic signal optimization studies,
- Street lighting analyses,
• Analysis of outstanding bonded indebtedness,

• Examination of potential impacts of urban development programs,

• Detailed project scheduling, and

• Ability to make changes in textual and statistical documents.

These and many other activities resulted in cost avoidance, cost savings, revenue generation, or produced what users and managers feel was "better" information for decision-making purposes. Omaha used microcomputers to avoid over $2 million in interest costs on city bonds, and Pasadena and Olathe both used microcomputers to generate revenue in the finance and public works departments. Better information is perhaps best exemplified by use of spreadsheet and engineering design programs in several cities to examine large numbers of alternative courses of action before making final decisions.

Other positive effects of microcomputer use in these cities included:

• Avoidance of hiring additional personnel,

• Confidence in data,

• Unarguability of data,

• Validation of earlier management decisions,

• Immediate access to information,

• Improved appearance of documents,

• Job enrichment,

• Availability of more information,

• Ability to develop applications using off-the-shelf software,

• Improved timeliness of information,
• Simplification of work, and
• Speed of processing.

Positive effects generally were not immediate. They came as the result of management decisions regarding system acquisition and implementation, training, user effort, and time. What is truly dramatic, however, is that nearly all users and managers interviewed reported positive consequences, even those who also suffered the greatest amounts of frustration and reported the largest numbers of negative effects.

Negative effects were reported by very few users, and included the following:

• Increased workload,
• Frustration,
• Pressure or stress associated with microcomputer use,
• Instances of physical complaints, and
• Instances of dual recordkeeping (microcomputer and manual).

Negative effects were few in number and, except for a secretary "chained to her desk" eight hours a day doing data entry at a poorly configured workstation who experienced musculoskeletal problems, none of the negative effects appeared severe. Even this one could be rectified by greater attention to ergonomics and redefinition of task performance.

Can anything really be this good? At this point the skeptical reader may wonder whether it was not the researchers or the methodology that failed to uncover expected negative consequences or overemphasized the positive ones? We were concerned about the same thing. Consequently, we probed in all interviews for both types of effects. With respect to potential negative effects we asked questions and probed about potential disruptions of work and of interpersonal communications and personal relationships; increased costs, stress, or computerphobia; decreased morale; reductions in the number of personnel; increased supervision; changes in hierarchical or power relationships; decreases in quantity or quality of work; physical complaints; and more. The results were clear and unequivocal, the vast majority of
effects of microcomputers in these twelve cities were positive, many significantly so, on work, the organizations, and people. Some negative effects were reported but, these were few in number, limited in severity, and most could be corrected.

**Conclusion**

In preparing to undertake this study, we fully expected to find that microcomputers would not have lived up to their advance billing; that they would not be used effectively in large numbers of cases; and that negative effects might be as numerous and consequential as positive effects. The marketing hype was simply hard to believe, and our own experience with computing had taught us that nothing could be as good as the advertising for microcomputers had suggested. Moreover, we had read the litany of complaints from organizations like "9 to 5" and in books like Technostress. While we were somewhat skeptical of these complaints, we tended to think that where there is that much smoke, some fire must exist. We were largely wrong.

Microcomputers--at least in the twelve case study cities--were being used effectively and were producing salutary results. Microcomputer use is not without a price and some pitfalls, and some negative effects are probably inevitable even under the best of circumstances. On the whole, however, microcomputers--even when their acquisition is poorly planned and their use essentially unmanaged--appear to be very sound investments for public organizations.

Can anything be done to improve their use, enhance positive effects, and reduce negative effects. Of course, and no authors worth their salt would abandon an opportunity to set forth a few recommendations.

Microcomputers in governmental organizations are tools that are used for specific, if sometimes limited functions, but they are largely unplanned and unmanaged. One finding from studies of large computer systems that appears to have applicability here is that good management improves the positive effects of large computer systems. Cities should be more attentive to planning for and managing microcomputers in order to improve their use and maximize their positive effects.

Second, cities should provide user training and user support, address issues like how microcomputers fit into information management (not just
computation and calculation) for the broader organization, and ensure continuing evaluation of microcomputer use and effectiveness. Potential users should not be coerced but should be lead into microcomputer use, and all users should be provided ample time to learn to use the devices (and related software) away from the pressure of daily work. Attention should be paid to ergonomics and task performance in order to prevent physical complaints associated with microcomputer use.

These case studies provide other lessons that may be of value to organizations that already have purchased or are considering buying microcomputers. Among others, the following seem particularly noteworthy:

- Hardware was not an especially critical factor to effective microcomputer use. Most hardware worked effectively and reliably, although it should be suitably configured.

- Software matters, because without it the microcomputer will not work, but particular brand of software does not seem especially important. The cities studied owned and satisfactorily used a wide range of hardware and software products.

- Most of the machines in use relied on the MS DOS operating system although the versions of MS DOS in the two largest groups of systems (Hewlett-Packard and IBM or IBM compatible) were incompatible. Nevertheless, MS DOS appears to be the operating system of choice by not only these cities but governmental and business microcomputer users in general. The main reasons for this appears to be application software availability and manufacturers' marketing decisions.

- The majority of the microcomputers in these cities were stand-alone units, and many of these were shared by more than one user. Five microcomputers were configured in a local area network. Two cities which had made commitments to office automation had substantial communication capabilities, and two other cities used microcomputers extensively to communicate with their minicomputers. Two multi-user microcomputers were reported.

- Microcomputers were viewed almost exclusively as instrumental objects; that is, as tools with which to do work. They are used in
almost every conceivable area of local government. Although uses were widespread and varied, they were also task and department specific.

- Microcomputers were acquired for both global reasons and with specific tasks in mind.
- Microcomputers were used for the purposes for which they were acquired, but uses rapidly expanded beyond initial activities.
- Use levels on machines are high but varied with types of work, fluctuations in user demand, demand from related activities, and time-driven considerations.
- All categories of personnel, and personnel in a wide array of jobs and ranks in the hierarchy used microcomputers, although in this study no elected officials used them.
- User satisfaction was high, although users paid a price to achieve satisfaction. That price was expressed in terms of the time required to learn their systems and occasionally severe bouts of initial frustration.
- Once one or a few microcomputers begin to appear in an organization, more generally followed. In some cases, diffusion was rapid and widespread.

The past few years have witnessed the widespread adoption of microcomputer technology by local governments. Between 1982 and 1985, adoption of microcomputers by American cities increased from 13 percent to greater than 75 percent. Other public organizations have had similar experiences.

The results of this study should help to quiet earlier concerns that the effects of these machines will not live up to their advance billing, or, worse, that the negative consequences will outweigh positive ones. Neither researchers nor public managers, however, should become complacent. If for no other reason than the rapidly changing technology, microcomputer uses and effects in public organizations should be subjected to continuing evaluation. This is something that few operating organizations do. And their failure to do so is often at their own peril.
Finally, the results of this study should help to refocus researchers' and managers' attention from questions like, "What are the uses and effects of microcomputers?" to questions like, "Under what conditions do particular effects occur?" and "How can positive effects be maximized and negative ones minimized?" Answers to these questions will be immensely valuable both for their theoretical insights into the process of technology diffusion and their practical utility in the world of public administration.
PART II: SITE SUMMARIES
Ames, Iowa

Ames is located in central Iowa about 30 miles north of Des Moines. Ames is the home of Iowa State University, the city's biggest business. The population of Ames is stable and was estimated to be 47,000 in 1980. The city has a council-manager form of government. One characteristic of Ames made it unique compared with the other cities studied; it owns and operates a municipal hospital. In fact, the city's data processing department is located in the hospital.

The city has a fairly comprehensive data processing department. The department includes a manager, five programmer/analysts, three operators, and data entry and secretarial staff. The department provides support to city-wide on-line applications. Its role in facilitating and managing microcomputer use has grown in recent years.

Increased information demands and a desire to upgrade hardware and software resulted in a long-range planning effort that began in February 1983. The city manager was getting requests for microcomputer hardware and software from nearly all city departments. As a result, the city manager organized a long-range planning and oversight committee. The committee's mandate was to assess needs and make recommendations on computer hardware, microcomputers, and word processing.

The long-range plan centered on the continued use of the city's IBM System/38 for on-line applications. At the time of the site visit, 17 distinct city offices were on-line with the System/38. The plan called for acquiring two IBM System/36s for office applications. It also called for a microcomputer configuration that consisted of IBM PC ATs and XTs. The XTs are to be used as terminals and the ATs are to be used as stand-alone word processors.

Initially, and based upon the recommendation of the planning and oversight committee, two IBM PCs with dual floppy disk drives were used to determine if a department would make use of microcomputers. Training was arranged and departments were invited to make use of the microcomputers; they had to use them in order to prove that they would use them. At the time, word processing equipment in the city's department consisted of Lanier and Olivetti memory typewriters.
Prior to the development of the long-range plan, the city was making use of two Apple IIIs. One was used to control a scale at the city's solid waste facility. The other was used for quality assurance in the city's hospital.

At present, microcomputers are dispersed throughout the city. Major departments with microcomputer equipment include: (1) power plant, IBM AT; (2) water plant, IBM PC; (3) waste recovery, IBM PC; (4) library, 6 IBM PCs; (5) public works, IBM PC; (6) finance, IBM AT and PC; (7) parks and recreation, IBM AT and XT; (8) data processing, IBM AT, XT, and PC, and Radio Shack 4P portable; (9) equipment operations, IBM PC; (10) police, 3 IBM PCs and an Atari; (11) fire, Apple Macintosh; (12) hospital, 15 IBM PCs.

Peripheral equipment used with the microcomputers consists primarily of printers. These include both dot matrix (Epson) and letter quality (Qume, Diablo, and IBM QuietWriter).

Microcomputer use in Ames is extensive and involves a wide variety of applications. The applications and software range from the common to the unusual. Most applications involve off-the-shelf software for applications that are unique to the individual department. In other words, while departments were using the same software, (for example, Lotus), they were using the software for their own unique applications. Several departments were using Symphony or Lotus for database, recordkeeping and budget management, and development functions. Graphics, scheduling, inventory, and the production of newsletters were other common applications using off-the-shelf software.

One of the more unusual applications in Ames has to do with the city library bookmobile. Books checked out from the bookmobile are entered into an IBM PC. Every morning, this information is uploaded to the System/38 and moved to the main library's computerized circulation system. At the same time the circulation system is downloaded to the bookmobile PC. This uploading and downloading allows the library to keep circulation up to date. It also provides bookmobile clients with timely information on book availability.

Managers, computer and other professionals, clerical workers, and technicians are among the users of microcomputers in Ames. Support for microcomputer users comes from within the city and from without. Very little formal training for users is provided. Self-instruction and informal technical assistance from other users seem to be the primary sources of training. Recently, the data processing department has formed a
microcomputer users group. The group has about 35 participants, meets monthly, and produces its own newsletter. The primary purpose of the group is to provide training and technical assistance to its members.

Few problems, equipment or human, with microcomputer use could be identified. Like most cities studied, Ames does not purchase maintenance contracts for its microcomputers. Equipment reliability is reported as being good, and officials report that they are money ahead by paying for equipment maintenance on an as-needed basis.

On the human side, few problems were reported with employees adapting to microcomputer technology. Very little user resistance was observed. City officials attributed this to having the microcomputers located where they were really needed. Employees were eager to have access to microcomputers and were willing to sit down and learn to use the new technology.

The willingness to learn coupled with the formation of a fairly extensive users group, are important factors contributing to a high degree of user satisfaction in Ames. The fact that the city has a data processing department with considerable technical expertise is also an important factor that has contributed to the relatively problem-free expansion of microcomputer use within city government.

Overall, the experience with microcomputers in Ames is positive. Substantial savings in time and costs are attributed to microcomputers. The expanded capacity for providing information-based city services is also perceived to be an important positive benefit. Employee morale, information accuracy, and information timeliness are additional positive benefits.
Bellevue, Nebraska

The city of Bellevue, Nebraska, the home of the headquarters of the Strategic Air Command, is located in the Omaha, Nebraska, metropolitan area immediately south of the city of Omaha. Owing to an aggressive annexation policy, Bellevue's population has increased from 22,000 in 1970 to over 32,000 in 1985.

Bellevue is a mayor-council city with an appointed city administrator. (In Nebraska the position of city administrator is created by ordinance rather than by charter as is the case for the position of city manager. City administrators typically have less formal authority than city managers, although local practice may be such that there are no real differences.) Management in Bellevue is characterized by a city administrator who relies extensively on department heads and does not become involved in the details of departmental operation. As a result, city departments have a high degree of independence.

The city had 13 microcomputers (from six different manufacturers) which were found in nearly every city department. Bellevue also had two separate minicomputer systems. These included an NCR 9300 for financial management activities (being installed to replace an older NCR minicomputer at the time of the case study), and a Burroughs B-96 with packaged law enforcement software in the police department.

Bellevue's first microcomputer (an IBM PC) was purchased in early 1984 by the planning department. It was acquired largely for use in word processing (for things such as planning and zoning document preparation) and also to assist in annexation studies. A staff planner and the planning director were instrumental in acquiring this system. Other departments observed what the planning department had done and heard the planners praise their microcomputer. Professional and management personnel from other departments even began using the micro in the planning department. Within a year and a half, twelve additional microcomputers had been acquired by other Bellevue city departments.

The procurement process for the microcomputers was driven largely by the desires of individual department heads. In the case of one microcomputer, however, a department head said "I didn't ask for it. One day it just appeared." Another said that he just bought a microcomputer and then decided what to do with it.
The city had no formal policy on microcomputer hardware or software procurement; no information management plan; and no coordination of information management technologies. No systematic consideration had been given to questions such as functions appropriate to microcomputers versus other systems, the relationship of the micros to one another and to the NCR 9300 and Buroughs B96 systems, and support and training for microcomputer users.

Personal considerations affected procurement decisions in at least three departments. These included: the husband of one user worked for a company that sold a system to a department; a micro was selected by one department head on the recommendation of a friend who sold microcomputer hardware (although the friend did not sell that particular machine to the city); and a department head received advice to buy a particular brand from a golfing partner who was not a computer specialist and from a vendor who sold the type of hardware that the department ultimately acquired. A fourth department, the police, received a microcomputer on loan from a vendor to assist in a murder investigation. After a few weeks use, the vendor asked that the machine be returned. The department then rented a microcomputer which it ultimately purchased from the same vendor.

There is nothing to suggest improper behavior in any of these purchases. However, it is clear that considerations other than objective information developed through rational procurement processes influenced the selection of these microcomputers.

The city's 13 microcomputers included seven IBM PCs, one Columbia transportable, one Corona 400, one AT&T 6300, two Apple IIs, and a Texas Instruments 99/4. The IBMs and IBM compatibles (the Columbia and Corona machines) represented somewhat of a de facto hardware standard. To some in Bellevue, this standard appeared to have occurred accidentally. That is, IBM and IBM compatibles are machines that simply happened to be purchased. This is not quite correct. A key person in microcomputer procurement before he left city employment was the purchasing director. He apparently held a strong bias for IBM microcomputers. With the exception of the library's machines (two Apple IIs and a Texas Instrument 99/4) and the AT&T 6300 at the wastewater treatment plant (which was acquired after his departure), the purchasing director was successful in establishing IBM as the city standard.
No standardization existed in Bellevue on microcomputer software. Each department was essentially free to acquire whatever software it desired. This resulted in the acquisition of at least 14 different off-the-shelf software packages, including five different word processing programs and five different spreadsheets. In addition, a certain amount of software borrowing occurred, with one department buying a package and another making a copy for its use. An employee in one department secured free copies of software from a relative. Only one department purchased something other than off-the-shelf software. This was a custom program for cemetery management written by a programmer who also worked for the vendor from whom the department's microcomputer had been purchased.

Few hardware problems were reported, and they were mainly printer related, including two cases of defective printers (that had been repaired or replaced), a few complaints of printers that were too slow, and an uncorrected interface problem. Two users reported problems with disk drives. These had been corrected quickly and satisfactorily. Only two minor software problems were noted.

The absence of training created considerable difficulty for most microcomputer users in Bellevue. The city provided no training and had no policy on training. The city administration seemed unaware that the absence of training had posed a severe limitation on microcomputer use or had caused substantial user frustration.

Most users reported a high level of frustration with their micros because they had received either no training or limited and ineffective training on the hardware and none on software. Only one user in one department received adequate training and it was clear that training enabled this user to make quick and effective use of the microcomputer. Most of the other users remained frustrated even after they had been using their microcomputers for several months. Only one user in the city who received no training reported a converse experience. That is, extensive use and no frustration. This was because of the user's desire to get a microcomputer and her personal commitment to use the system in order to make her job easier and more satisfying.

City departments acquired microcomputers for both general and specific reasons, although in one department the machine "just arrived." General reasons included faith in the potential uses of microcomputers, because "it seemed like the thing to do," and in order to improve the efficiency and
effectiveness of departmental activities. Specific reasons included use of microcomputers to replace worn-out typewriters, to assist in managing information collected during a murder investigation, to implement a maintenance management program, for budget preparation, and for annexation studies. In almost all cases, departments viewed microcomputers instrumentally or as tools to perform work more efficiently and effectively.

Users included management, professional, and secretarial personnel. Almost as many managers as secretaries used microcomputers and professionals used them least. Secretarial use was greatest probably due to the nature (largely word processing) of secretarial work. Overall, reported use of most machines was moderate (two-four hours per day). Some machines received greater use than others, often because of sharing, and most users reported that the extent of their microcomputer use varied considerably, largely because of workflow. For example, during budget preparation the city administrator used his microcomputer twice as much as at other times during the year.

Microcomputer uses were task-oriented and department specific. Uses were also quite varied, even where similar software packages were used. Word processing represented the greatest use in almost all departments. In addition to general correspondence, word processing uses were directed toward specific activities (for example, preparation of reports, ordinances, and mass mailings) relating to the functions of particular departments. Spreadsheets followed word processing in terms of frequency of use. Here again, spreadsheets were task-oriented and department specific (for example, annexation studies in the planning department, budget preparation by the city administrator, and financial monitoring and reporting in other departments).

Although, many users experienced high levels of frustration with their microcomputers, continued use of their systems both reduced frustration and produced user satisfaction. That is, after learning to use and actually using the machines, frustration gave way (in some, although not all cases) to satisfaction. Most users said that they would not know what to do without their microcomputers. Also, most users reported positive effects associated with microcomputer use. In fact, most reported effects were positive.

Almost all users said that after an initial, and often frustrating learning period improvements (often substantial) occurred in efficiency, speed, accuracy, timeliness, convenience, and ease of performing work. The micros
were reported to save substantial time over prior methods and to enable personnel to do work that they would not have been able to do otherwise.

No direct costsavings could be identified but one department was able to absorb a staff reduction because of the capabilities added to the microcomputer. Moreover, the city administrator felt that the improved information available from microcomputer use enabled him and city elected officials to make decisions that would have long-term cost payoffs. One example he gave was in annexations. Using a microcomputer for annexation studies resulted in better information about costs and revenues associated with annexing particular areas than prior methods.

Only one department indicated that it would do anything differently if it had the opportunity to begin anew. This department said it would examine software alternatives before buying hardware. The absence of other "do over" comments, however, should not be read to mean that all was well with Bellevue's procurement practices. Most end-users had not been involved in system acquisitions (another source of frustration) and most department heads and users had very limited knowledge about microcomputers. Interviews suggested that many would do nothing differently because they did not know what to do differently, and because most departments were achieving positive results from microcomputer use. Most departments had plans for future hardware or software acquisition or implementation of additional uses for existing micros.

Of all the cities studied, Bellevue had the greatest extent of negative consequences resulting from the implementation of microcomputers. The primary negative effect was widespread user frustration with the systems. This was because users received little or no training or support for the microcomputers. In addition, some users reported increased workloads because they had to do their normal work and learn to use the microcomputers at the same time.

One important factor, lack of training, affecting microcomputer use has already been mentioned. Several other factors also affected microcomputer use in Bellevue. Most department heads indicated that it was their policy not to pressure their employees to use the microcomputers. The idea was to give them the microcomputers and let them proceed at their own pace. In the absence of training and user support, this informal departmental policy probably kept the frustration level from being higher. In one department, effective training was provided by a vendor. This department also acquired an
easy-to-use, menu-driven, customized program for one of its activities. Both the training and the software were important elements in system use and benefits in this department. Finally, prior user experience with computer technology in one department resulted in that user mastering the microcomputer relatively quickly.
Bonner Springs, Kansas

Bonner Springs is a community of 6,300 located approximately 20 miles south of Kansas City, Kansas. Bonner Springs is a city manager-council city that has experienced slow population growth over the past few years. The city employs 42 full-time employees. In addition, it uses 70 volunteers and employs 60 part-time employees in the summer.

Like many cities of its size, Bonner Springs has no separate computer or data processing department. Most of the development that has taken place is the result of a collaborative effort between the city manager and the city clerk. Microcomputer operations are dispersed throughout city departments. Although there is no city employee with the title of data processing manager or its equivalent, the city clerk appears to function in this capacity. Much of the experimentation and innovation in microcomputer use in Bonner Springs can be traced to the city clerk.

Initially, the city developed a request for proposals for a minicomputer and gave serious consideration to the acquisition of a Wang system. The city manager and the city clerk were experiencing information shortage problems—"we didn't have information when we needed it." The city payroll took too long to process, and the city was in dire need of a general ledger system. Their consideration of the minicomputer system led to the conclusion that a minicomputer was too large for their needs. They also perceived a lack of city government software applications that could be used on the Wang and decided that they would have more flexibility with microcomputers.

Microcomputer development in Bonner Springs began in 1980, and has progressed steadily. In 1980, two IBM-PCs were acquired. Using hard disks, storage capacity was expanded to 35 megabytes. Most of the early uses of the PCs involved spreadsheet applications using SuperCalc. Word processing using PFS Write was also one of the early applications. These applications included such things as budgeting and databases for keeping track of occupancy licenses and dog licenses.

By 1986, Bonner Springs had developed a more complete microcomputer system. This system includes 4 IBM-PC XT's, 1 IBM AT, and 1 IBM-PC. Four of the XT's, the AT, and 1 PC are located in the city offices. The four XT's are linked to the AT to form a network for carrying out financial applications. The IBM-AT functions as a server unit for the network and provides a total capacity of 117 megabytes of storage. A Novelle Network
system was chosen for the multi-user system for two reasons, security and speed. The XT's were chosen as part of the system because their hard disk provided adequate backup capacity.

The other hardware that is part of the multi-user system is two printers. One printer is letter quality and is used for word processing and final reports. The other printer is a higher speed (350 cps) dot matrix printer.

Nearly all of the applications on the Bonner Springs multi-user system have to do with city finances. These applications include budget, general ledger, utility billing, purchase orders, accounts payable, payroll, and personnel. Most of these applications are interactive and are updated automatically.

The Bonner Springs police department and the volunteer fire department are two additional departments that are making extensive uses of microcomputers. The police are using an IBM-PC XT with a 35 megabyte hard disk. Their system also uses a dot matrix printer. They are using a software package (CISCO) that performs three functions: court reports, incident reports, and accident reports.

Bonner Springs' volunteer fire department has its own microcomputer system. It consists of an IBM-XT and printer. The department uses dBase III for three different functions. One program has been developed that enables the department to track fire and ambulance runs. Another program generates the fire reports that the city provides the state. A third program tracks volunteers and supplies a database on volunteer participation in fire and ambulance incidents. Programming, data input, and report generation are done by departmental volunteers.

The city's recreation department is making limited use of the Bonner Springs microcomputer system. The city clerk has developed and maintains a file on coaches' records. The public works department was not using the microcomputer system at the time of the site visit but indicated that it was trying to get software for job costing and service requests. Community development was not making use of microcomputers but was planning to link up with Wyandotte County for base mapping and parcel inventory applications.

Bonner Springs officials report few hardware or software problems with their microcomputer system. Adding terminals to the multi-user system
resulted in a slowdown in response time, although the Novelle system helped compensate. Maintenance problems are virtually nonexistent. Support from software vendors is reported as being excellent.

The users of microcomputers in Bonner Springs city government are generalists. No one on the staff is a computer professional. Learning takes place through self-instruction and training provided by the city clerk who has become a self-taught microcomputer specialist.

Negative comments about microcomputer development in Bonner Springs tend to focus on problems related to demand. For example, the city clerk indicated that "there is not enough time to get things done since everybody wants more from the computer."

Positive comments focused on such things as having useful data when you need it to help run the city like a business. Positive comments far exceeded negative comments. Although no specific cost savings could be identified, it was clear that the Bonner Springs microcomputer system has produced tremendous savings in time in addition to providing increased workload capacity.

Plans for future development include adding two more terminals and replacing monochrome terminals with color terminals. Additional plans call for developing the system so that low-cost dumb terminals can be added instead of the more expensive IBM XT's. The top priority for new applications is a fixed asset program which will be installed in 1987.

It is hard to place a label on the management style in city government in Bonner Springs. Whatever the management style, it is one that has allowed for substantial innovation and experimentation with microcomputers. Much of the success of microcomputer development in Bonner Springs appears to be attributable to the enthusiasm, commitment, and entrepreneurial spirit of city officials.
Englewood, Colorado

Englewood, a suburb of Denver, Colorado, is a city manager city with a population of about 30,000. The city's population had grown 10 percent between 1970 and 1980.

About two years prior to the case study, the city manager decided to establish a microcomputer learning lab for city departments. The learning lab was the manager's response to growing departmental requests for microcomputers. The concept behind the lab is best summarized in the statement that instead of allowing departments to acquire microcomputers for unspecified purposes, the lab would be established to make a few microcomputers available and "see what would happen," whether and how they would be used. The primary reasons that departments began making requests for PCs were lack of effective access to the city's main computer system and department directors' desire to automate then current manual activities.

Englewood had a data processing division with a director and a small staff. The division was located in the finance department and operated two Prime minicomputers with software primarily for financial management activities. Due to the failure of a software vendor, data processing staff were occupied writing, modifying, and supporting the financial management software. In addition to the Prime computers, the street department had a computerized Kargard vehicle fuel control system located at the public works building several miles from City Hall.

The PC learning lab in Englewood was minimally equipped. It had one Apple Macintosh, one IBM PC XT, and a limited selection of software. The lab was in an inconvenient location in City Hall and virtually no training was provided for potential users. As a result, the lab received relatively little use. Two building department staff used the Macintosh (and database management software) to develop programs but none of the programs were in operation at the time of the study. The finance department used the IBM PC XT for financial projections, analysis and monitoring, and for budget preparation. Personnel from a few other departments were reported to have used the lab, but interviews in those departments indicated otherwise.

In August 1985, Englewood began implementing a Hewlett-Packard (HP) based office automation system. At the time of the case study, eight HP 150 microcomputers connected to an HP 3000 minicomputer had been installed as secretarial workstations, and training had been conducted by the vendor in the
use of an off-the-shelf word processing program (HP Word). Eight more work secretarial stations were to be added in 1986, and the vendor was to provide training for additional application programs (principally spreadsheet and electronic mail).

Three reasons were given by city management for acquisition of the office automation system. They included: the need to remove word processing from the Prime systems because of response time degradation on those machines, the need for a networked technology to address lack of equitably distributed secretarial resources, and top management felt the city should "keep up with the technology."

The HP system had been installed barely three months, and users had received training on word processing only a few weeks before the interviews. Users who were interviewed rated their training (from HP) highly, and also felt that word processing on the HPs provided benefits over electric typewriters. However, due to the length of time the system had been implemented and the relatively limited use of it, insufficient experience was available on which to report effects.

Other microcomputer systems in the city had been in place long enough to warrant more in-depth analysis. These were the systems in the street department, library, police department, and learning lab (used by personnel from the building and finance departments). Exclusive of two Apple Macintosh units for public access in the library, results of use of those systems is reported here.

Hardware used by these departments included the Macintosh and IBM PC in the lab, an Apple IIe in the library, an IBM PC in the street department, and an IBM PC and a Compaq portable in the police department. No hardware problems were reported with these systems.

Sharing of hardware was reported by all users, especially in the learning lab. However, except for the lab, shared use was not seen as a constraint on use. Even in the lab, however, it was clear that sharing constituted less of a constraint than the location of the lab and the fact that potential users perceived the machines to be inconvenient. That is, they were not at user's normal work areas.

Software included five database managers, five word processors (only three of which were used), and five spreadsheet programs. Two departments
had written their own programming. One used the BASIC language and one used a database program. In one department, software development was motivated by the need to reformat data from an existing system in order to produce more useful reports. In the other, software was developed to provide greater efficiency in current manual activities.

Other departments made use of off-the-shelf programs for a variety of purposes largely involving word processing (for correspondence, memoranda, reports, and ordinances), and spreadsheets (for financial projection, monitoring, reporting, billing, and budgeting). Database uses, essentially for list management, were reported by two departments. Other than training associated with implementing the HP 150s, little or no training had been acquired with the microcomputers or was available for potential users. One department felt that absence of training constituted a serious limitation to system use. In three others, departmental personnel brought prior experience to the microcomputers and, for these users, absence of training did not constitute a serious constraint. However, they felt for others in their departments who were not computer literate the absence of training meant that they did not use the microcomputers. Personal commitment by users, including those with previous computer experience, was an important factor in microcomputer use. As in other cities, several users said that because of existing job requirements and the amount of time it takes to set up new activities on the microcomputer, they lacked the time to use them more effectively. Finally, the city had no personnel available to provide department-level microcomputer support.

Users were primarily professional-technical personnel. The second largest group of users were secretarial-clerical personnel. Use of the microcomputer systems in Englewood was low to moderate (less than 4 hours per day) and also varied with workload. However, as in other cities use, time was not a good measure of effectiveness of use. Only in two departments did management-level persons use microcomputers.

Two departments wanted to add communication capability (to the Prime systems) to their microcomputer. One department indicated plans to acquire additional software and one to acquire additional hardware. Three departments had plans to add specific applications to their existing systems.

Most of the reported consequences of microcomputer use in Englewood were positive. All users interviewed expressed a high degree of satisfaction with their systems, although at the same time several complained about the
inconvenience of the learning lab. Positive effects included saving time; the speed, ease, and flexibility of word processing; improved efficiency and accuracy; and improved management. Regarding the latter, use of printouts produced from the microcomputer resulted in a nearly 100 percent increase in the use of compressed natural gas (CNG) fuel in street department vehicles.

Timely, accurate information on CNG use had not been easily available prior to the implementation of a microcomputer. The printouts on CNG use were "hard data," and department management used them to show drivers their individual use levels. These data were "nonarguable," and resulted in a significant increase in CNG use. Another result of this microcomputer use was that it persuaded city administrators to allow the street department to acquire its own PC. Previously, the street department head had been generating CNG statistics on his personally owned home computer.

Factors associated with more extensive microcomputer use in Englewood included the personal commitment of staff and ease of learning on an Apple MacIntosh. Factors limiting use included location of the microcomputer lab, insufficient time to learn and use the systems, and the absence of training and support. Several users reiterated what was heard in other case studies: a great deal of time is required to learn to use a microcomputer, to write programs, and to enter initial data or text.

Englewood had a policy on microcomputer hardware that standardized on the IBM PC and the Apple MacIntosh. There was no policy on software. All PC purchases had to be approved by a data processing committee and by the city manager. Because of the establishment of the learning lab and the purchase of the HP office automation system, there were few stand-alone microcomputers in city departments in Englewood. Finally, although the city had a five-year data processing plan, it was unclear what role microcomputers played in overall city information management.

Management style in Englewood was difficult to assess. It appeared that operating departments were more closely supervised by top management than in other cities studied. This was especially noticeable in terms of numbers of microcomputers and control over acquisition. Englewood had relatively few microcomputers and purchases required approval by the city manager. Englewood's finances were considered "tight." Nevertheless, Englewood was engaged in an expensive office automation implementation.
Marshall, Iowa

The city of Marshalltown is located in central Iowa, about 35 miles east of Ames, and 40 miles northeast of the state capitol, Des Moines. It is located in a predominately rural agricultural area. According to the 1980 census, Marshalltown’s population was approximately 26,800, and was stable having grown only by 600 persons since 1970. Marshalltown is a mayor-council city with no professional administrator or manager in which department heads appear to have a reasonably high degree of independence.

In early 1983, owing largely to the efforts of the city’s personnel director and city clerk (each for different reasons) a citizen task force was appointed by the city council to examine the issue of computerization. The efforts of the task force produced at least four different results. First, it led to the purchase in June 1983, of ten Commodore 64 microcomputers for several of the city departments. Second, because of differently perceived requirements, six departments (some of which also had Commodores) were allowed to acquire other brands of microcomputers. Third, the task force supported the city clerk’s request for a multi-user microcomputer system with packaged municipal financial management software. (The financial management system was being installed at the time of the interviews in Marshalltown.) Finally, the task force supported the acquisition of a multi-user mini-computer system with packaged law enforcement software for the police department. (The city council authorized purchase of this system during the time of the interviews.)

The Commodores were purchased partly because of the strong recommendation of the city personnel director, partly because they could be acquired and serviced locally, and partly because they were quite inexpensive (from $800 to $1200 each depending on configuration). Several respondents indicated that the influence of the personnel director and the low cost of the machines were critical factors in their purchase. All of the Commodores and all but one of the other microcomputers in the city were stand-alone devices. The single exception was an IBM PC in the library that was acquired from a library services vendor. This machine had a modem and was used, among other things, for communicating interlibrary loan requests and for cataloging.

No hardware maintenance agreements were acquired for the Commodores or for any of the other microcomputers. The absence of a maintenance agreement did not appear to have been a problem. Like many other
organizations, Marshalltown secured repairs for microcomputers on an as-needed basis and received satisfactory results.

Hardware problems were common, although not disabling, on many of the machines. The main problem was with the Commodore disk drives which over-heated and suffered misalignments of the disk heads. Almost all Commodore users reported disk drive problems. Several hardware problems, ranging from chip failures to burned-out CRT's, were reported on other machines. Repair or replacement corrected all of the hardware problems, except for the disk drives on the Commodores which continued to malfunction.

Numerous uses were identified on all of the machines regardless of brand of hardware. These generally involved applications using off-the-shelf word processing, spreadsheet or database management software. In addition to word processing for a wide variety of purposes, the systems were used for engineering calculations, financial tracking and monitoring, financial analysis, statistical calculation and reporting, general reporting accounting, department recordkeeping, fingerprint identification and case management in the police department, and cataloging in the library. Only the engineering and parks departments and the library had purchased other than off-the-shelf programming. In all cases, whether off-the-shelf or custom software, use was highly task oriented, and the majority of applications were department specific. That is, they were activities that were not performed by other departments.

Users were about evenly divided among management, professional-technical, and secretarial-clerical personnel. However, the latter group exhibited a greater degree of microcomputer use largely because of its role in word processing and financial reporting and monitoring activities. In a few departments, managers and professional-technical employees were the exclusive users of microcomputers.

On the whole, use was moderate, between two and four hours per day per machine. This use figure is probably overstated for a few departments and understated by others. Like all cities studied, none of the departments in Marshalltown kept records of machine use. Estimates of system use were provided by users and managers.

Two things about extent of use were clear from interviews and observation. First, effectiveness and efficiency of microcomputer use as indicated by such things as productivity improvements, work simplification,
time savings, and the ability to do new work, were unrelated to the number of hours a machine was used. Activities such as preparation of complicated statistical reports or revisions of contract or other stored documents required far less time than doing the work using prior (usually manual) methods, often on the order of three or four to one. These activities may have taken only a few hours in a month using the microcomputer versus days of effort previously. Second, the extent of machine use was highly activity dependent. To use but two examples, if there were no reports to complete or documents to revise, a machine might be idle. This should not come as a surprise. Microcomputers in Marshalltown (and elsewhere) were viewed as tools to be used to do work and to make the work easier and more efficient.

If there was no task on which to use them, they were not used. But when they were needed to perform a task, use was usually effective and efficient. The principal reported positive effects of microcomputer use in Marshalltown included speed, accuracy, efficiency, ability to do more work, ability to do work that could not or would not have been done before, and the impact of the Commodores in reducing fear of computerization. Far more positive than negative effects were reported by all respondents.

Among the relatively few negative effects reported, the principal ones were that some staff persons were resistant to learning and using the micros, the slowness of the Commodores (especially their disk drives), and mechanical problems with the Commodore disk drives. Systems in only two departments appeared to be underutilized. The reasons for underutilization were user resistance, lack of training, and lack of applicable software. User resistance, where it occurred, was largely the result of lack of training and lack of software.

Lack of training, lack of adequate time to learn to use the machines (especially to use them proficiently), and, in some departments, the lack of software appropriate to the work of the departments were major complaints that were heard from the city staff. Indeed, lack of time to learn and lack of training were frustrating to many users and appeared to have been responsible for many staff not being more proficient in using the microcomputers. Another complaint was that several of the machines had to be shared. This was seen as inconvenient at best and, during periods of heavy use, as a more serious problem limiting employees' ability to do their jobs. In two departments, the pressure of sharing resulted in the purchase of additional microcomputers.
Even with these complaints, however, nearly all staff members interviewed indicated a high degree of satisfaction with the microcomputers. Most department heads were supportive of computerization and did not place undue pressure on their employees to learn and use the microcomputers. Some departments deliberately took a low-key approach, encouraged and supported (but did not pressure) employees, and did not force resistant employees to use a computer.

When respondents were asked what they would do differently if they were to do it all over, the most common responses were to do more research on hardware and software before buying a computer, to "get a better system," and to get training. Only a minority of departments said they had plans for future additional use of microcomputers. These most often involved greater use of the system by increasing the number of applications for which they were used. Only one department mentioned plans to buy additional hardware.

Marshalltown's procurement process for the microcomputers was supervised by a task force of community experts. However, the process appears to have relied heavily on department heads' statements of their needs. It also was strongly influenced by the personnel director in the initial choice of microcomputer equipment. In a two-year period, the process led to the acquisition of 18 stand-alone microcomputers, and two multi-user systems from six different manufacturers.

There was no overall coordination of information management systems or technology in Marshalltown. No plans or policies existed regarding communication between various systems. There was no coordination of software or databases. No training or user support were provided. No policy existed regarding the types of hardware or software that could be purchased. There was no person or department with overall responsibility for information management in the city. Finally, some users reported at least initial frustration with the microcomputers, especially due to lack of training.

Nevertheless, at the time of the interviews, Marshalltown was the beneficiary of numerous positive effects from the use of microcomputers. Positive effects far outnumbered negative effects. Moreover, positive effects were produced largely as the result of individual users taking the initiative and time to learn their systems, and, then, to use them to solve the particular problems and meet the particular needs of their departments.
Olathe, Kansas

Olathe is a city-manager city in suburban Kansas City, Missouri, that has experienced considerable population growth. Its 1970 population was 18,000. By the 1980 census, the population was 37,000 and, at the time of this case study in 1985, the population had grown to nearly 50,000. Because of population and economic growth, Olathe was relatively well-off budgetarily.

Computer use in Olathe was extensive. The city had a Magnuson (IBM plug compatible) mainframe computer, used primarily for financial management applications and police records. Stand-alone CPT word processors were available in most departments. The city also had ten microcomputers, including five IBMs of various models, three Radio Shacks of various models, one Kaypro 4, and one Osborne 1. No hardware problems requiring maintenance were reported for any of these machines.

The first microcomputer had been purchased in the public works department in 1980. Other departments acquired microcomputers incrementally thereafter. In mid-1985, firm plans existed to acquire five additional microcomputers and to acquire capability for one existing microcomputer to communicate with the city’s mainframe.

The primary factors affecting the adoption of microcomputers in Olathe included lack of effective access to the mainframe and general and programmatic reasons for microcomputer use in various departments. General reasons included a lack of cooperation from the former data processing director, a backlog of programming requests on the mainframe, the cost and time required to secure programming on the mainframe, a desire to get hands-on experience with microcomputers, and a belief in the potential uses of microcomputers. Programmatic reasons included automation of such activities as traffic signal optimization, rental housing management, sewer flow measurement, refuse collection information, and public works activities.

Olathe’s management style was essentially one of hiring good people at the department director level and letting them manage their departments. Among other things, this meant that department heads were relatively independent and autonomous. They also had considerable discretion, including the latitude to buy or not to buy microcomputers. The city’s management style also meant that there was administrative support should a department want to acquire microcomputers and absence of pressure should a department choose...
to do otherwise. In addition, the city manager encouraged and supported innovation in general.

Olathe had no formal policy on microcomputers. However, an informal, generally accepted policy had evolved. This policy supported the use of microcomputers in stand-alone applications that were specific to a department. City-wide activities were for mainframe application unless a department could not secure effective access to the mainframe. In addition, unless a department could justify other equipment, IBM or IBM compatible PCs were the only hardware allowed. No policy existed regarding microcomputer software.

All but two PCs were used as stand-alone devices. One of these was used in a utility meter reading application to upload and download information from the mainframe to portable utility meter reading devices. The other one had the capability to communicate with the mainframe, but it was not being used to do so at the time of the study. Eight of the ten microcomputers were shared by multiple users, although user pressure was heavy for only one of the eight.

Software included three different spreadsheet applications, two database management programs, one word processing program, and software for engineering calculations. These were all off-the-shelf programs. Several departments also had acquired numerous packaged or custom written programs for such functions as utility meter reading, capital improvement planning and budgeting, wastewater flow monitoring, public rental housing management, traffic flow management and analysis, fleet management, industrial refuse collection, refuse container management, commercial sanitation, pavement management, employee absenteeism, vehicle accidents, landfill billing, and workers compensation reporting. No city-wide software policy existed. Software choices and decisions were made at the option of individual departments.

Generally, no formal training was acquired for the microcomputers. However, this, too, was a matter of departmental choice. Two departments acquired training on system operation and a third acquired training for one or more software systems it acquired. Only one department felt that absence of formal training constituted a limitation on use. For example, absence of training in public works was not seen as a problem. However, the custom written software in this department was menu driven and user friendly, and
user level training was provided by the programmer when each software system was installed.

Few managerial personnel in Olathe used the microcomputers, although they reported extensive use of the information provided from the microcomputers. Indeed, as one management level person said, "not having a computer terminal on one's desk is becoming something of a status symbol."

Most microcomputer users were professional or technical personnel and in only two departments were secretarial-clerical personnel users. Possibly one of the reasons for this was that word processing was done on stand-alone CPT word processors in most departments. The level of use was generally moderate (two-four hours per day) and almost all users reported that use varied with need.

Consistent with findings elsewhere, uses were varied, task-oriented, and department specific regardless of software employed. Examples included engineering calculations in the public works department, capital improvement planning by a budget analyst, cash flow analysis in the finance department, several custom written applications by the public works department, traffic signal optimization and traffic flow analysis by traffic engineering, and public rental housing management by the public housing department. Very few departments used PCs for word processing, largely because of the availability of dedicated word processors.

In their choices of applications for their PCs and in decisions to acquire them, the departments behaved quite pragmatically. The machines were acquired to do work and they were viewed instrumentally. All users and management personnel interviewed indicated a high level of satisfaction with the PCs. The vast majority of reported effects were positive and, as in the case of other cities, dramatically so. The most frequently reported positive effect was the ability to do things that could not have been done before the microcomputer (for example, traffic signal optimization studies, development and analysis of budget and land use alternatives, and vehicle and equipment management). Other reported positive effects included time savings, speed, cost avoidance and hiring avoidance, accuracy, timeliness, elimination of computerphobia, enhanced job satisfaction, and service improvement. Only one negative effect was noted and that was increased workload. As one respondent put it "once people know you have the ability to do things on the PC, they ask you to do work for them."
Some departments said that during the initial stages of microcomputer implementation a degree of personnel resistance existed. However, because departmental management did not insist on or force microcomputer use, this was not perceived as an organizational problem. Equally often, personnel complained that they did not have sufficient time to learn to use the microcomputers more effectively.

Microcomputer procurement was an ad hoc, departmentally directed activity, and reasons for acquiring microcomputers were almost as varied as the departments, although they almost all involved a pragmatic decision to use a PC for departmental work. For example, public works acquired a microcomputer and custom software initially for fleet management purposes. The traffic engineering division acquired its microcomputer as the result of a grant funded program for traffic signal optimization. The public housing department acquired a microcomputer and packaged software as the result of a HUD grant program for management of public housing units. The traffic engineering and housing department microcomputers represented a departure from typical purchasing practices. Most microcomputers in case study cities were purchased out of operating revenues. None were acquired out of capital budgets, and very few were bought with grant funds.

In all cases, the microcomputers were being used for the purposes for which they were acquired originally. However, in most departments (notably, public works, engineering, and planning) uses had also grown well beyond initial applications.

Olathe (among other cities studied) provides support for the hypotheses that information produced with microcomputers is used to validate management decisions that were made previously with less exact methods. In Olathe, both city management and elected officials readily accepted recommendations based on microcomputer produced information. After all, they were hard data. Indeed, respondents felt that many of these decisions would have been questioned had they been based on more traditional information sources.
Omaha, Nebraska

The city of Omaha, Nebraska, is a strong-mayor city with a 1985 population of about 346,000. As the result of an aggressive policy of annexations since 1981, Omaha's population has increased about ten percent over the population reported in the 1970 census. In 1985, Omaha spent approximately $1 million for computing services from Douglas County, Nebraska. The county had a large IBM mainframe. City computing uses included an integrated law enforcement (police, sheriff, court) system, access to several shared databases (for example, real property), and applications for several city departments (for example, public works). The city had an NCR 8555 minicomputer in the finance department with packaged municipal finance software. Finally, Wang workstations, connected to a Wang minicomputer, provided several departments in City Hall with word processing and other office automation capabilities.

By the end of 1985, Omaha had 29 microcomputers. The microcomputers were located in the following departments: fire, police, public works, planning, finance, personnel, MIS, library, human relations, parks, and in the former Comprehensive Employment and Training (CETA) department. (The former CETA department was not included in this study because its 5 Apple IIe machines are used strictly for occupational evaluation and training. No administrative uses are made of these micros.)

Machines from the following manufacturers were represented: twenty - IBM, two - Radio Shack, one - ITT, and one - Seequa. Twelve additional units, all IBM PC, XT or AT models, were in the city's budget for purchase in 1986.

The city established the IBM PC as its hardware standard in 1983. The reasons for this choice were largely to ensure microcomputer compatibility, hardware and software sharing, ease of maintenance, to provide for communication capability with the county's IBM mainframe (all microcomputers must have 3270 emulation and SNA and SDLC protocol capability), and to facilitate networking at sometime in the future. The IBM PC was selected also because of IBM's perceived status in the marketplace, and the view that whatever happens with micros in this country, IBM will probably set the standard. Finally, in response to a competitive bid process, the lowest qualified bids received were for IBM equipment. Units that were not IBM had been purchased to meet specific needs of other departments for which IBM compatibility was not required, because departments managed to circumvent
the established procurement process, or, as in two cases (Seequa and ITT), were IBM compatible. Microcomputer procurement in Omaha involved departments justifying requests for microcomputers, receiving approval from the MIS director for the purchase of particular units, and securing budgetary authority through the normal budget process.

Only a few hardware problems were reported and these were related to disk drives and printers. In most cases, these problems were minimal and had been repaired quickly. The city chose not to purchase hardware maintenance contracts for reasons of cost, it being less expensive to have the equipment repaired as needed.

Although all IBM units had to have communication capability, most were purchased as stand-alone units. Only one machine had been acquired with the additional equipment needed for communication. It was used to communicate with a statewide network and with the county’s mainframe.

Most units of the city were used by more than one person. In some departments, this meant scheduling use before and after normal working hours. Use pressure resulted in the purchase of additional microcomputers in several departments.

Microcomputers were perceived as instrumental objects in Omaha. As one respondent put it, "they are just another tool to do the job." As such, it came as no surprise that microcomputers per se were not a priority in the departments or city-wide. There was no overall plan for them and little consideration given to how they integrate into the city's overall information management activities, although both issues are of concern to the MIS director and to several users. In most departments, potential users actively campaigned for acquisition of the microcomputers, although in at least two cases there was no user involvement in acquisition.

Omaha had informally standardized on three software packages: Lotus 1-2-3, and dBase (versions II and III), and several departments purchased Wordstar, even though the MIS director discouraged use of this package because it was considered too complex and difficult to learn. Some departments reported "borrowing" these packages from others rather than purchasing their own. In addition, there were two other off-the-shelf spreadsheets in use, four word processors, and two database programs. The planning, public works, parks, police, and fire departments also had purchased packaged programs specific to their activities (for example,
hydraulics, engineering design, and statistics) or had acquired or developed custom programs (for example, investment management, vehicle inventory, and forestry production). Almost all users reported a high degree of satisfaction with the software they used and hardly any bugs or other difficulties were reported. Only one department was dissatisfied with software, and that was a function of lack of effective training rather than the particular package.

In 1984, the city contracted with a local microcomputer store to provide user training. Initial training consisted of three half-day sessions that included general literacy plus limited hands-on exposure to Lotus, Wordstar, and dBase. In addition, there were in-depth programs on Lotus and dBase. This training was generally well received. However, some users questioned its relevance to municipal activities or to the specific activities of their departments, and a few users said the training did not go far enough for them. Training was also provided by knowledgeable users to novices in at least three departments.

Regardless of training, however, personnel still had to return to their offices and use their systems extensively in order to achieve proficiency. In addition, some elements of the training were almost always forgotten by the time employees returned to their offices and began using their systems. This meant that in Omaha, as in other cities, a significant period of learning involving actual system use was required before most employees became proficient users.

Microcomputers were acquired in Omaha for both general reasons and to perform specific functions. Among the general reasons were lack of access to other computer systems in the city, for word processing and spreadsheet activities, for departmental recordkeeping, to improve accuracy and productivity, and to save time. Specific functions included budget preparation, engineering estimates, engineering design, capital improvement planning, investment management, annexation studies, statistical analysis and reporting and searching remote databases.

The largest group of microcomputer users in Omaha were professional-technical employees. Middle-level management personnel (many of whom also had professional responsibilities) used micros, but few department heads used them. Secretarial-clerical personnel in almost all departments that had microcomputers used the machines, but their use was not as extensive as that of professional and technical staff. Use levels in most departments were heavy, four or more hours per day. Machines in all departments were shared
by multiple users and shared use resulted in pressure to acquire additional machines in several departments.

In most departments, the microcomputers were used for the purposes for which they were acquired originally. But, uses also expanded beyond original intentions. Uses were varied and were related to the activities of specific departments, such as producing burglary statistics by the police, maintaining eligibility lists in the personnel department, and developing roadway design alternatives in public works. Spreadsheets, word processor, and database management programs were used widely. They, too, were applied to the needs of individual departments.

User satisfaction was high, indeed, only three users in two of the several departments investigated expressed dissatisfaction. In one case, this was due to frustration over the absence of training and the resulting inability to use a database program. In the second case, it was due to the physical arrangement of the machine and the fact that the user sat at it virtually all day long entering data.

Although user satisfaction was high, microcomputer use was not without problems. A significant learning curve was associated with becoming a proficient user. Data entry and the development of spreadsheet and database applications were time consuming. Some potential users exhibited computerphobia, and a few resisted use. Finally, a limited amount of duplication of recordkeeping occurred. That is, both paper and computerized records were kept, and records were kept on microcomputers and on other computer systems.

Most reported effects of microcomputer use in Omaha were positive. The most frequently reported positive effects were time savings and improvements in speed, accuracy, and efficiency. The ability to do additional work and work that would not be feasible without a microcomputer, and the ability to produce better information were also widely reported. Time savings on the order of 25 percent to 300 percent and more were reported for many activities. For engineering calculations and engineering design alternatives, for example, a division head said that design alternatives that formerly required 4 to 5 hours of manual effort could be done in 10 to 15 minutes on the microcomputer.

Time that was saved accrued to the benefit of the city. That is, the newly available time was used to do more work, often involving developing
and evaluating additional alternatives (such as engineering designs, budget options, or annexation studies), or to do work that could not be done before. Two significant cases of cost avoidance that were directly attributable to microcomputer use in financial analysis were reported. Neither analysis would have been feasible at the level of detail that resulted in this magnitude of cost avoidance without the microcomputers. In one case, $2.8 million in costs were avoided, and $300,000 were avoided in the other. As the MIS director noted, this cost justifies a lot of microcomputers.

Few negative effects of microcomputer use in Omaha were identified. Those reported included duplication of recordkeeping, increased workload, duplication of data entry, and two reports of physical complaints. One department said use of a microcomputer reduced its ability to print personalized responses on medical claim forms and this was considered a reduction in the department’s responsiveness to its clients. Finally, as in other cities studied, a limited amount of user intimidation, frustration, and resistance occurred, although training and user experience with the machines helped to reduce all three. In one department, a microcomputer sat unused for several months because of limited staff capability and intimidation. This machine was transferred to another location where staff used it heavily.

Factors associated with effective microcomputer use and user satisfaction were training for potential users, department-level decisions to provide users ample time to learn the machines without the pressure of having to produce with them on the job, and prior user experience using either microcomputers or CRTs on larger systems. Users from technical disciplines (such as engineering and planning) who were accustomed to the use of new technologies seemed to have adapted readily to microcomputers, although other users with different backgrounds did so also. User commitment to learn and use the machines was also a factor in their effective use.

In two departments, use of microcomputers at home by employees spurred their use in the office. In at least one department, acquisition of microcomputers in the department led to their purchase by employees for use at home, in part so that they could take diskettes home to work on them on evenings and weekends.
Orleans Park, Illinois

Orleans Park is a rapidly growing suburban community about 30 miles southwest of Chicago. Its population had grown from 6,000 in 1970 to 27,500 at the time of the interviews in 1985. Most of the growth is strictly housing related because Orleans Park is primarily a commuter community. Orleans Park is a city manager-council city.

The growth in housing construction activity served as a major force in the city's decision to expand its data processing capacity. This growth resulted in a tremendous expansion of building permit and related data, as well as in utility hookups and billings. Water billings, accounting, and several related financial functions were processed through a service bureau, and the city decided that cost savings could be made if it began to process the billings. The city purchased an IBM System/36 along with seven terminals in 1984. Three of these terminals were regular IBM System/36 terminals and four of the terminals were PCs.

The policy was to get the finance and accounting, police, and parks and recreation departments computerized as soon as possible. The IBM System/36 terminals were placed in finance and accounting, and the police received an IBM AT as did recreation. Additional PCs were acquired and distributed among engineering, accounting and finance, police, and emergency services and disaster departments. Prior to the acquisition of the System/36 and the PCs, microcomputer use was limited to an Apple II located in the city clerk's office. Spreadsheet and database applications were the primary uses made of the Apple.

Orleans Park experienced serious problems in implementing its computer system. Most of the problems were related to the System/36, not the microcomputers. Most of the problems were vendor and software related, not hardware related. Inadequate training and support for the System/36 resulted in delays in system implementation. Serious delays were attributed to the vendor who provided the government accounting package for the system. Inadequate documentation was a major problem which, in turn, resulted in delays in converting over from the service bureau. City officials reported that it was nearly 6 months before "anything worked right." At the time of the site visit, utility billings were still not converted. This was nearly a full year behind schedule. The city did not acquire its software through a bidding process. Instead, the city acquired the software from a vendor who was recommended by a sales representative of the hardware manufacturer.
Many of the initial problems had been worked out by the time of the on-site visit. City officials reported that perhaps they had unrealistic expectations about the amount of time involved in implementing the System/36 and converting from the service bureau. The problems with the vendor had a negative impact on employee morale. However, according to several city officials, employees handled the situation well and were enthusiastic about computerization in city government.

At the time of the site visit, most accounting and related applications as well as word processing were being made on the System/36. Microcomputers were being used as dumb terminals in several departments. The engineering department was using a PC and Lotus for budgeting. The police were using their PCs for special recordkeeping projects, and the emergency services department was using a PC and database program to maintain an emergency contact manual. Parks and recreation was using a PC for scheduling, recordkeeping, and other applications in support of programming.

Several additional microcomputer applications were planned for the future. These included converting the programs used on the Apple II to use on the IBM PC, developing an inventory and fleet maintenance system for the public works department, scheduling the subdivision development process in the planning department, and acquiring a purchasing system for the finance department.

Enthusiasm for expanding microcomputer access was widespread in spite of the difficulties encountered with the implementation of the System/36. Such computerization was viewed as nearly necessary for survival, given the tremendous growth of the city. The ability to meet basic information needs and to carry out the functions of city government were viewed as the primary benefits of microcomputer use.

Few negative experiences or unexpected costs with the microcomputers were reported. Most of the negative experiences with computing in Orleans Park were associated with the System/36. In this regard it was interesting to note that the city was trying to hire an MIS director. One of the reasons the city purchased the System/36 was that they were led to believe that the system would not require additional specialized staff.

Most training for microcomputer hardware and software was self-training. Some individuals became knowledgeable about a particular computer or software package and became a source of technical assistance to new
users. Microcomputer learning processes in Orleans Park parallels those observed in several of the case study cities.

Overall, city staff were optimistic about the future of microcomputers in city government. Employees continued to request more access and wanted to use the microcomputers for more applications. The existing management style and philosophy seems to encourage experiments and innovation. This in combination with staff demand should result in continued expansion of microcomputer development.
Pasadena, California

The city of Pasadena, California, is located in the eastern suburbs of the Los Angeles metropolitan area. Pasadena's 1980 population was approximately 119,000. The population is essentially stable, having grown about 5.7 percent since 1970. The city has a council-manager form of government in which city departments have a relatively high degree of autonomy within the framework of overall direction by the city manager.

Pasadena had several computer systems. The first, implemented in 1983, was a Hewlett-Packard (HP) 3000 mainframe that supported programming primarily for the finance department, including an integrated financial management system. The city's payroll was handled by a service bureau, and the utility billing function was being transferred from the same service bureau to the HP 3000. Other programs on the HP served the city clerk's office, public works department, water and power department, and others. The HP 3000 system had over 75 terminals on-line. The city had three additional minicomputer systems. These were located in the police department, library, and fleet management division. At the time of the interviews, Pasadena was in the process of acquiring an automated fire dispatch system jointly with the cities of Glendale and Burbank.

The city's data processing department had a relatively small staff, including five analysts, three programmers, one operator, one office systems coordinator, one operator-supervisor, one administrative analyst-technician, and one data processing coordinator. This unit was responsible for operations and procedures for the HP 3000 system, and the minicomputers in the library, police department, and fleet maintenance division and for all microcomputers in Pasadena. The newly created position of office automation coordinator (previously a support position within data processing) had responsibility for training and user support for all micros.

Pasadena acquired its first microcomputer, a Cromemco, in 1981. Beginning in 1983, with the purchase of the HP 3000, the city acquired a few HP 125 microcomputers. These were augmented in 1984 with HP 150s after that model was announced. Also, during 1984 a committee established by the city manager recommended acquisition of microcomputers city-wide in order to implement office automation. As a result, city departments began requesting PCs in large numbers.
By late 1985, Pasadena had approximately 110 personal computers located in nearly all departments. The majority of these (over 90) were Hewlett-Packard model 150 and 110 microcomputers. There were also 10 IBM PCs, one IBM PC AT, a few HP 125s, an Apple II, a Kaypro 10, and a few DEC Rainbows. The largest microcomputer users were the Planning, Housing and Community Development Department with 15 HP 150s, and the Finance Department with 13 HP machines and six IBM PCs. (According to the Finance Department, the IBM devices were acquired because a greater amount of governmental finance software was available for IBM PCs than for Hewlett-Packard microcomputers.) A few other city departments also had microcomputers that were not HPs. These included machines from IBM (both PC and PC AT models), Kaypro (model 10), and Xerox (model 820). Although the city had standardized on Hewlett-Packard, IBM, and Apple Macintosh microcomputers, the HP microcomputer was clearly the machine preferred by the data processing department. This was because a single machine, especially one that was compatible with the mainframe, was easier to support. As a result, the data processing department recommended HP microcomputers to user departments. However, a department could acquire a different machine with little difficulty if it so desired.

Very few hardware problems were reported and users indicated a high degree of satisfacion with their microcomputers, especially the HP's. Users also gave high marks to the data processing division for its responsiveness when hardware needed repairs. The data processing department had determined that maintenance agreements covering all microcomputers would exceed $50,000 per year. Consequently, repairs were provided on an as-needed basis.

Most of the microcomputers had communication capability. The majority of the communication was either to access the city's electronic mail system (E-mail) or some database (finance, parcels, etc.) resident on the HP 3000. Experience with E-mail was too recent to provide useful information for this study. In addition, few microcomputer users reported using either E-mail or accessing databases on the HP 3000.

Microcomputers in many departments were shared by more than one user. In some departments, sharing was a problem because too few devices were available to satisfy the level of demand. In other departments, a combination of scheduling and lower demand produced satisfactory use patterns.
Two types of microcomputer software were used in Pasadena. The first was the software that, de facto, the city had adopted as standard for the HP microcomputers. This was off-the-shelf software and included Lotus 1-2-3, Wordstar, dBase II, Executive Memo Maker, and HP Desk (E-mail). Second, a few departments had acquired packaged software specific to their activities. To give but two of many possible examples, the traffic design division had acquired packages for street lighting design and analysis, and the finance department had purchased financial analysis packages. Regardless of whether off-the-shelf or packaged programs, software use was task and department specific.

Most users were highly satisfied with the programming available to them. In part, this was because of the training available to all users for general microcomputer use and to learn specific software packages, notably Lotus, Wordstar, and dBase. Indeed, the most important factors affecting microcomputer use and the relatively high level of satisfaction with microcomputers in Pasadena were the training and support provided by the dataprocessing department and office automation coordinator. Only a few users gave less than high marks to the training, and these users generally felt that either more training or more advanced training was needed.

As was true in all cities in this study, some degree of user resistance to microcomputers was observed. However, in Pasadena the degree and extent of resistance was minimal. Only one department noted strong resistance by users, and this was attributed to the need for more one-on-one training and also to the users' lack of time to learn the machines and keep up with their work. Most departments reported either limited resistance or an enthusiastic response to microcomputers. Two departments, made up predominantly of persons with engineering backgrounds, indicated overwhelming support. As a user in one of these departments said, however, because of the engineering and technical backgrounds of the people involved, they should not be used as a benchmark by which to judge other departments' use of microcomputers.

Microcomputers in most departments had been acquired as part of a citywide procurement. Most departments also reported specific reasons for wanting microcomputers. These ranged from the general (such as, improve word processing, save time, handle more data, or improve reporting), to the very concrete (such as, budget preparation, street lighting design, or engineering calculations).
Managers, professional and technical employees, and clerical staff used microcomputers. Within the departments investigated, the predominant number of users were professional and technical employees. However, clerical staff probably spent a greater proportion of time at the machines owing to the nature of their work (mainly word processing). There were no instances observed where employees spent eight hours at a microcomputer. Possibly, as a result, no physical complaints associated with microcomputer use were reported.

The average level of reported microcomputer use in the departments investigated was relatively high, four hours per day per machine or more. In some departments, persons scheduled use on systems before or after normal working hours, and some users took advantage of the portability of the HP 110s to take them home for use in the evening on city business.

Microcomputer use in Pasadena was extensive and varied, and uses were largely task and department specific. Typical uses included word processing, financial analysis, financial monitoring, budget preparation, calculations, and program or project monitoring. In each department, these were tailored to departmental activities. For example, spreadsheet use for financial analysis (a general use) was put to practice for different purposes in different departments. In addition, certain departments made use of packaged software for their particular uses, for example, establishing speed limits for street segments or developing detailed project schedules. Partly as a result of the specificity of use, most activities being carried out on microcomputers involved data processing as distinct from information management. This was no doubt partly the result of the absence of an overall city information management plan and partly because stand-alone desktop microcomputers lend themselves to individualized rather than organization-wide work.

Satisfaction with the systems was almost universally very high. Several users indicated that they would not know what to do without their PCs. When asked what they would do differently if they had it to do over, users in one department said they would get IBM PCs because of the availability of software they need on these machines. Other users generally either had no recommendations for change, wanted additional units, or wanted the pace at which automation occurred speeded up. Several departments reported plans to acquire additional equipment (usually HP 150s or HP 110s) and/or plans for use of their machines in more applications.
Repeating the pattern identified in other cities, most of the effects of microcomputers in Pasadena were positive. The microcomputers were credited with improving efficiency, effectiveness, speed, and accuracy, and with saving time. A number of examples of time savings in orders of magnitude of 3:1 and 4:1 and greater were provided. However, respondents said that the time saved was used to catch up on existing work, to accomplish new work, or to do a more effective job by doing such things as creating and examining additional data or alternatives. Additional positive effects included the ability to do work that would not have been feasible without the microcomputer, improved morale, improved analyses, improved quality of data, improved control over projects and budgets, cost avoidance, and, in one case, the generation of revenue.

No negative effects were observed nor were negative effects mentioned in the course of interviews, even with repeated probing. However, a few respondents indicated indirectly that microcomputers produced job pressure. This meant the pressure to do more work, not stress induced by the technology. For example, many users made statements about lack of time to learn the microcomputer and do the work required in their jobs. Also, knowledgeable microcomputer users found that their amount of work increased because less knowledgeable users came to them for help in using microcomputers.

Factors contributing to relatively high use and satisfaction levels included strong support from departmental management for microcomputer use, personal commitments by staff to learn and use the system, the emergence of a user network to share expertise within and among departments, the prior technical orientation of some staff members, and, most importantly, city provided training and support. Indeed, city provided training and support were consistently identified by users as critical to their success with microcomputers.

As in other cities, users in Pasadena noted that a significant time commitment is required for initial learning, for initial input of data, and for development of applications. They also said that payoffs in terms of increased efficiency and effectiveness were fast to follow the expenditure of learning and data input time.
Plant City, Florida

Plant City is located in central Florida, about 25 miles east of Tampa. It is a city-manager city and had a 1980 population of about 19,000. Like many south Florida cities, Plant City has experienced significant population growth in recent years, including a 33.3 percent increase from 1970 to 1980.

At the time of the case study, Plant City had a TRS Model 2 microcomputer in the public works department and an IBM PC based system (with three workstations) in the police department. The latter had been acquired nearly a year previously and was unused (most of the equipment had not been uncrated) owing to a dispute with the vendor who had supplied the system. A multi-user microcomputer based system with packaged municipal software was being implemented in the city clerk's office. Because the systems in the city clerk's office and the police department had not been implemented, this case study examined only the microcomputer in the public works department.

The procurement process for the microcomputer in public works involved the public works director's decision that a microcomputer would be useful in preparing bid documents and specifications. The director was generally familiar with computers, having used them in college level work and in previous employment. After deciding to acquire a microcomputer, he read extensively and developed bid specifications for a system. Radio Shack submitted the "lowest and best" bid. One of the reasons given for selecting Radio Shack was locally available service. According to the public works director, the only difficulty in the procurement was convincing a basically conservative city council to authorize the necessary money for the system.

In terms of managerial style and organizational climate, little was discovered in this brief visit. However, two seemingly contradictory but revealing items were noted. The first was that the public works director was able to acquire a microcomputer system essentially on his own. The police department did likewise, although it had not implemented the system. Interviews in the city suggested that the police department's computer was a sensitive issue and also that little was being done to produce a solution. The ability of both departments to acquire computers and the ability of one department to fail to implement its system suggests an absence of strong centralized management and the existence of independent, relatively autonomous department heads.
At the time of the case study, the city had no policy for either microcomputer hardware or software. No person or department was responsible for directing or coordinating information management technologies. And, no consideration had been given to relationships among different systems in the city.

The public works microcomputer had been acquired for use in a specific activity, word processing for bid documents and specifications, and word processing constituted the majority of its use. Spreadsheet applications ranked second and included things such as monitoring and reporting on vehicle fuel consumption, wastewater treatment plant effluent quantities and quality, and budget preparation. Two off-the-shelf software packages, one for word processing and one for spreadsheet activities, were in use on the system.

The hardware had been repaired twice in the 3 years it was in the department. Once for a defective chip and once for a keyboard malfunction. No software deficiencies were reported. The machine's 64K memory was insufficient for large spreadsheet applications (for example, the entire department budget).

The system was used by two persons (one professional and one secretary) and occasionally by staff from the Community Development Block Grant Program (also for word processing and spreadsheet applications). No problems were reported due to sharing. Total use time varied depending on work requirements. Users reported a high level of satisfaction and indicated no specific plan for hardware or software acquisition or future applications. However, the public works director indicated a general desire to buy a larger, more powerful machine.

Reported effects were all positive. They included the speed and accuracy of the machine, the ability to do work that could or would not have been done before, and the time saved through microcomputer use. As in other cities, time savings were considerable and staff time made available thereby accrued to the benefit of the city in that additional work, much of it to produce additional information, was undertaken.

Little training was acquired with the system, but users reported this was not a limitation as both the hardware and software were easy to use. They also reported that the vendor was responsive whenever help was needed.
Venice, Florida

Venice, located on the Florida Gulf Coast about fifty miles south of Tampa, is a resort and retirement community. Venice had a 1980 population of about 12,100. The city's population grew 82.5 percent between 1970 and 1980. At the time of the case study, Venice had an NCR minicomputer with the financial management software located in City Hall. The city's police department, located in a separate facility several blocks away, had a TRS Model 16 multi-user microcomputer system located in the records division, a TRS Model 4 in a captain's office, and an Apple IIe used by the secretary to the chief of police.

The reasons that the police department acquired these systems included lack of access to the NCR minicomputer, the high cost of acquiring programming to run on the NCR, and the desire to have a system that would be available 24 hours per day. Programmatic reasons for acquiring the TRS 16 included the belief that manual methods of operation, especially for recording and tracking complaints and calls for service, were unsatisfactory. Also, personnel in the records division were unable to keep up with the volume of records management work, and items were lost and misfiled. Programmatic reasons for the Apple IIe included word processing, financial monitoring, and recordkeeping.

Police administrative personnel, essentially the former chief of police and a police captain (both of them were considered innovators within the department), undertook a limited survey to identify the most appropriate system for their needs. This process involved reading about systems, visiting vendors, attending system demonstrations, and making site visits. They saw a TRS 16 based system in a neighboring city, liked what they saw, and decided to acquire a similar system. Formal bid requirements were followed but bid documents were written to ensure that the department would be able to acquire the system it had already decided upon. (This process is not without precedent in governmental purchasing or among the governments in this study.)

The only hardware problem that had occurred was a chip failure on the TRS 16 CPU. The system was repaired and back in service in 4 days. No problems were reported with the Apple IIe or the TRS Model 4. None of the units were used for communication, although the department had terminal access in the dispatch office to the NCIC system.

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Software for the TRS systems included a multi-user operating system (Xenix), and off-the-shelf database and word processing software. The database program was utilized by department personnel to create the programming used in the records division. Software for the Apple IIe included several off-the-shelf programs (three database managers, three word processors, and two spreadsheets) not all of which were used.

Training, which received a high user rating, had been acquired with the Apple IIe. No training had been acquired with the TRS 16, although the primary user said that absence of formal training was not a major deterrent to use. However, this user also indicated that "bootstrapping" a new data processing system is difficult. By this she meant implementing a system, creating data processing background and training and no outside assistance. One factor that evidently made conversion to a microcomputer based records management system in the department easier was the background and interest of the police captain in charge of the system who did most of the writing of programs and the enthusiasm and commitment of the officer in charge of the records division.

The Apple IIe was used by the secretary to the chief of police for such activities as budget preparation, financial monitoring, vehicle management, and a variety of word processing and database uses. The extent of use varied with the secretary's workload. The TRS Model 4 was used by a police captain and his secretary for access to files on the Model 16, word processing, software/program development, case management, detective assignments, and to maintain an intelligence file.

The TRS Model 16 was located in the records division and was in use constantly. It contained an automated master name file, a complaint file, a parking ticket file, and an arrest file. The modules of the system were integrated and multi-user.

Numerous positive effects of microcomputer use were identified. These included speed, efficiency, accuracy, time savings, the elimination of manual work, the elimination of paper and card files, cost avoidance, improved information (quality and timeliness), service improvement, increased job satisfaction, and the ability to do work that would not have been feasible without the microcomputer.
Examples of positive effects included:

- Elimination of 20 boxes of files used in the manual card system.
- Ability to track departmental expenses daily.
- Substantial reduction in errors that had previously resulted from misfiling and other manual mistakes in recordkeeping.
- Ability to do more work in the records division without hiring additional personnel.
- Implementation of a warrant tracking system for stolen vehicles.
- Ability to sort complaints in database in a variety of ways to provide better information.

The only negative consequence reported was resistance from some records division clerical personnel to automation. However, a system implementation proceeded and demonstrated beneficial results, resistance declined, and the system became generally accepted.

There were three key actors in this department's movement toward automation with microcomputers, the police chief, a police captain, and a records division officer. The chief and captain supported acquisition of microcomputers; the captain was largely responsible for program development; and the captain and the records officer were responsible for system implementation. In addition, the organizational climate in Venice was such that a single department (police) was able to secure and implement its own computer system without either support or opposition from the city administration. (According to officials in many cities, this sort of autonomy is not unusual for police departments.)

Venice had no microcomputer policy. However, a policy on microcomputers and word processing was under discussion and a plan was being developed for the latter. No city personnel were assigned coordination or management responsibilities for training, support, or procurement of microcomputers.
Yankton, South Dakota

Yankton, South Dakota, is situated in the south-eastern corner of the state. Yankton has a population of just over 12,000 and has experienced little population growth over the past several years. On a per capita basis, Yankton is South Dakota's most industrialized city.

Microcomputer development in city government in Yankton began in 1980 when the Public Works Department purchased a Radio Shack Model II to use for analyzing data related to water distribution construction projects. In 1983, the Public Works Department purchased a Cromemco computer in order to conduct bridge studies, to perform flood risk analyses, and to keep assessment records. This CPM based computer, was unable to keep up with the demand for more capacity.

About this time, city officials became increasingly concerned about the Burroughs B-80 that was used by the finance department. According to city officials, the B-80 never worked properly, provided too little capacity, and had very high maintenance costs.

As a result of the increased demand for capacity in public works and dissatisfaction with the B-80 in the finance department, the city undertook an in-house review of its data processing needs in 1984-85. This review was a collaborative effort, and was conducted jointly by the city manager, the public works director, and the finance director. They decided that a minicomputer system networked to microcomputers in operating departments would best meet their needs.

After reviewing alternative systems, they concluded that the software that best met their needs was developed to run on IBM hardware. They developed specifications, took bids, and purchased an IBM System/36. As the city manager stated "We bought the world's biggest 'do it yourself' kit." The kit included the System/36, eight System/36 terminals, five microcomputers, and seven printers. They also purchased emulation boards for the microcomputers, which when used in conjunction with "PC Support" software, enabled them to tie into the System/36.

The five microcomputers acquired as part of the system included an IBM AT and four IBM PCs. Printers included four System/36 printers and three IBM electronic typewriters for use as letter quality printers. The complete procurement process was conducted by city officials; no consultants were
used. The system became operational in late 1985. Today, five city departments are using microcomputers: public works, finance, city manager, parks and recreation, and waste water. Public works is using the IBM AT and off-the-shelf software for management functions. Spreadsheet and database software are used to manage federal grants and for a bookkeeping system that is used to keep track of expenditures of federal money. A street inventory system, a sign inventory system, and a maintenance record system are applications planned for the near future.

The primary use of the IBM PC located in the finance department was to access the System/36 and to use spreadsheet applications. Word processing and data transfer are additional PC functions. In nearly all of these applications the System/36 was used as the central computer, and microcomputers were used to download and upload information.

The city manager used a PC for budget development and word processing. The PC is also used to transfer data back and forth from the System/36. The parks and recreation department used a PC for game scheduling and word processing. This department hoped to expand PC use to three additional applications: program scheduling, a tree inventory, and a cemetery lot inventory.

The waste water department used its PC to generate reports required by the U.S. Environmental Protection Agency. A spreadsheet program was used for this purpose.

At the time of the site visit, all public safety functions (police and fire) were on the System/36. Future expansion of the system will probably include PCs for report generation and some recordkeeping but not for major police or fire reporting systems. The city library commission also had plans to acquire PCs for setting up inventory and check-out systems.

The city manager articulated a policy of viewing city data processing needs in terms of systems. The manager stated that the guiding philosophy was to try to share information as much as possible. If an application were not unique to a department, then the department should make use of the System/36. Conversely, if a department had a unique application, then it could use a PC. Policy also calls for future PC acquisition to be IBM or IBM compatible. Overall, city officials indicated that they were very satisfied with the system that they have developed. Initially, the public works director was skeptical about a shared system. After gaining some experience with it, the
director is now very positive about the system. Initial reactions among city personnel ranged from fear to disappointment because some wanted the system to do everything right away. The initial fear has disappeared, and most users are enthusiastic about the system.

Few negative impacts were identified. Areas of concern included a lack of time to develop new programs and a lack of personnel for data processing.

These concerns are mostly directed at the System/36, and not the microcomputers per se. Plans call for upgrading the position of operator of the B-80 to that of computer operator for the System/36 and adding a position for programming and system development.

Several positive impacts were identified by city personnel. Better information sharing and an easier and more accurate budget process were two major benefits identified. Increased speed and efficiency in word processing were also cited. Still another benefit cited was the reaction by senior staff, "to find out how we can do more with this tool."

Like several of the other cities visited, most training in Yankton was a combination of self-instruction or training conducted by other city personnel. Little training was sought or obtained from outside trainers or vendors. Some initial support problems were encountered by Yankton officials. The salesman from whom they acquired the hardware and software "promised some things that weren't delivered." Making the System/36 operational was made difficult when IBM sent the wrong version of the operating system and documentation. Once these problems were straightened out, few additional problems were encountered and officials reported that they have received good vendor support.

The management style in Yankton appears to be one that places a premium on rational planning and teamwork among senior staff. This style seems to have been reflected in the process used to acquire a computer system for city government. As reported previously, the system acquisition was conducted in-house by senior staff. They take pride in this and in the fact that they acquired a "system" rather than several different microcomputers. Additionally, they take pride in the fact that they did all this without the assistance of outside consultants.
References

