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MICROCOMPUTERS AND CITY GOVERNMENTS

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Introduction

In 1976 a revolution occurred. No shots were fired, no blood was shed, but the effects of the revolution in electronic data processing have been felt throughout the country. What is more, its effects will continue to be felt for many years to come.

That was the year that two young Californians, Steve Jobs and Steve Wozniak, developed the world's first commercially successful microcomputer, the Apple.

From 1946, the date of the first electronic computer ever developed, to the introduction of the microcomputer, less than 500,000 digital processing units had been sold by all manufacturers combined. By 1982, a mere six years after the introduction of the Apple, the estimated 1.75 million micros sold was triple that of mainframe and minis. In 1982 alone, an estimated 2.5 million microcomputers were sold, and an even greater number are expected to be marketed in 1983.

The widespread use of microcomputers in homes, businesses, and schools has helped to generate interest in the application of this remarkable technology by local governments. Microcomputers are inexpensive, easy to use, and capable of performing an amazing array of activities.

Almost taken for granted is the fact that microcomputers increasingly will be used by local governments throughout the nation.

In order to assist its membership make decisions regarding the acquisition and use of micros, ICMA published a Management Information Service Report entitled Microcomputers: Tools for Local Government in October, 1982. This report explained what microcomputers are, examined their use in one small city, and discussed the integration of microcomputers in the activities of a larger municipality.

A month later, in November, 1982, McGraw-Hill's Product Information Network released a report for local government managers entitled Microcomputer Applications and Trade-offs of Decentralized Computers. This report examined such issues as decentralization of data processing, networking of microcomputers, governmental application programs, procedures for acquiring microcomputers, and many more.

Countless books and articles have been written examining the application of microcomputers to a wide array of activities, and numerous magazines exist that are devoted largely, if not exclusively, to microcomputers.

To date, however, no systematic examination has been made of the use of microcomputers in American local government.¹ Most analyses of microcomputer use in local

government are limited in scope. Many rely on case studies, often are based on anecdotal information, and frequently engage in an unwarranted degree of speculation regarding the potential (as opposed to actual) uses of microcomputers.

To help fill this information gap, in 1982-83 ICMA conducted a survey of microcomputers in American municipal governments. The survey included all cities over 5,000 in population, half those from 2,500 to 4,999, and all cities under 2,500 that are recognized by ICMA. (See Table 13.) These cities were asked several questions regarding microcomputer ownership and use and future intentions regarding microcomputers. The data from this survey will be analyzed in the pages that follow.

Microcomputer Ownership

A total of 5,808 cities received questionnaires from ICMA. Of these, 2,433 (or 41.9 percent) responded with completed instruments. Perhaps the most significant finding of the survey is that relatively few of the cities responding (322 or 13.2 percent) either owned or leased a microcomputer. (See Table 1.) Of these, a proportionately greater share of the cities over 100,000 than those under had microcomputers.

By region, cities in the south (14.3 percent) and west (18.9 percent) were more likely to have microcomputers than those in the northcentral and northeast. Also central

cities (33.6 percent of these responding) reported a greater ownership of micros than did suburban (11.3 percent) or independent cities (10.5 percent). Finally, council/manager cities reported greater ownership of micros (16.7 percent) than cities with mayor/council (9.1 percent), commission (14.0 percent), town meeting (11.6 percent), or representative town meeting (9.5 percent) forms of government.

The relatively small number of cities reporting micro-computer ownership, however, suggests that the data on variances among categories of city governments should not be viewed as significant. For example, no city of 1,000,000 or greater responded to the survey, but America's largest cities probably use microcomputers as extensively if not more so than other cities. Regional variations do not appear indicative of any particular trend, especially when the absolute numbers of cities in each geographic division are examined. With the possible exception of the northeast's relatively low showing, little significant difference was found in the ownership of microcomputers among cities by region of the country.

Also, few significant differences were found among forms of government. The relatively strong showing by city manager cities can be explained in part by the fact that this was an ICMA survey and could be expected to receive greater participation by city managers.

Future Plans

Microcomputers were not owned by 2,111 cities (or 86.8 percent of the survey respondents). Table 2 examines the intentions of these cities regarding future acquisition of a microcomputer. Of the 1,814 cities responding to the question of whether they planned to purchase or lease a microcomputer in the next two years, 641 or 35.3 percent said they had such plans, and 1,173 or 64.7 percent said no. The striking finding here is that only slightly over one-third of the non-owning cities said they planned to buy or lease a microcomputer in the next two years.

Combined with the data from Table 1, these findings suggest that municipal governments lag behind other organizations, notably the public schools, in current uses and future plans for use of microcomputers. Scanning the responses by population group, geographic division, metro status, and form of government fails to reveal any significant patterns of difference among cities of various types in their plans to acquire microcomputers.

Reasons for Not Purchasing a Microcomputer

Various possible reasons exist to explain why an organization has not acquired a microcomputer. All 2,111 cities reporting that they did not have a microcomputer were asked for their reasons. Table 3 presents the data from their responses.

The two primary reasons given for not having a microcomputer were "lack of available funds" (550 responses or

26.1 percent of the non-owning cities) and "use of a centralized data processing system" (541 responses or 25.6 percent). These were followed by "no need" (484 responses or 22.9 percent) and "uncertainty about usefulness" (432 responses or 20.5 percent). The remaining categories contained relatively few responses, or in the case of the "other" category contained a somewhat larger number of unrelated answers.²

By and large, the data contain no surprises. They indicate that lack of funding, use of a centralized data processing system, failure to believe that microcomputers are needed in their organizations, and uncertainty about the usefulness of microcomputers are important reasons for not acquiring these systems. These reasons make intuitive sense and are hard to challenge. This is another way of saying that the non-owners' decisions not to acquire microcomputers were soundly based, given their current budgetary status and perceptions of the role of microcomputers in local governments.

Microcomputer Brands

The 322 cities that said they owned or leased microcomputers listed ownership of 414 separate systems.³ Not surprisingly, Apple (n=124 systems), Radio Shack (n=108), and IBM (n=80) were the three most popular brands. These were followed by the Hewlett-Packard (n=25) and a variety of "other" (n=77) brands including Altos, Cado, Commodore,

Compupro, Crememco, Data Point, DEC, Dynabyte, IMS, NEC, Osborne, Scientific, Xerox, and a few others. None, of the "others" however, were owned in sufficient numbers to warrant separate attention in this analysis.

One especially interesting element of the survey not shown by these data is that a sizeable number of responding cities did not know whether they had a microcomputer. For example, a number of word processors, electronic typewriters, and minicomputers were reported as microcomputers, and numerous cities responded with answers that could not be interpreted. These included responses that provided only a brand name, like IBM or DEC, without providing a model name or number. The number of cities responding by naming something other than a microcomputer or with answers that could not be interpreted was nearly 230 or over two-thirds the number of respondents actually owning microcomputers.

These findings suggest that nationally three of the largest companies selling microcomputers, Apple, Radio Shack, and IBM, are also the big three to local governments. The data also indicate that city governments are probably as eclectic as the rest of the population in their choices of microcomputers with 102 or 24.6 percent of the identified systems being other than the most popular brands.

In addition, the findings show that a sizeable number of local governments are not especially literate about computers. Many do not know what is or is not a micro-computer or even whether they own one.

Who Uses Microcomputers?

The cities were asked which persons in city government made use of microcomputers. The following personnel were listed as users in order of frequency of response: technical staff (n=167), secretaries (n=128), department heads (n=102), administrative assistants (n=68), city managers (n=50), and assistant city managers (n=28). (See Table 5.) A plurality of cities (43.2 percent) reported that only one person or office used the city's microcomputer(s), and 64.6 percent reported two or fewer users. Almost one-fourth (24.2 percent) said three persons or offices used the microcomputer(s) in their cities, and only 8.4 percent indicated more than three users.⁴ (See Figure 2.)

User Problems

Among the more attractive features of the present generation of microcomputers is that they are "user-friendly." User-friendliness, among other things, means that persons with little or no knowledge of computer technology or programming can learn to use a micro. Microcomputers are also considered versatile, flexible, and highly reliable machines.

However, both the popular and scholarly literature over the past few years have contained numerous examples of partial and complete computer system failures, problems involving hardware and software inadequacy, weakness of vendor support, outright vendor dishonesty, and organizational problems resulting from the implementation of computer systems.

Survey cities were asked whether they had encountered any problems with a microcomputer. Almost one-fifth (18.9 percent or 61 cities) said they had had no problems. No single problem was cited by more than 30.7 percent (or 99) of the cities, and a plurality of cities (156 or 48.4 percent) checked ^{ONE OR} two or fewer problems. (See Table 6 and Figure 3.)

For convenience of analysis, the cities' responses can be grouped according to type of problem. For example, the most frequently cited problem, training personnel, is an organizational problem as is resistance to new technology and organizational change. Together these totaled 164 out of 552 responses or 29.7 percent.

A second type of problem is one involving internal system use. This problem area includes the response categories of under-utilization of microcomputer capacity, scheduling and priorities, and integration with mainframe. Together responses in these categories totaled 185 out of 552 or 33.5 percent. Vendor and equipment problems consti-

tute a third problem area and include the categories of vendor servicing, equipment performance, and equipment reliability. Here 89 responses (16.1 percent) were found. A final problem area is software availability, and 76 cities or 13.8 percent responded that this constituted a problem for them.

Relatively few cities reported problems in any single category, and most cities mentioned experiencing only one or two problems with their microcomputers. These findings tend to confirm the notion that micros are reliable, easy to use machines, at least according to these respondents.

Impacts of Microcomputers

The cities were also asked to identify the positive and negative impacts of microcomputers on their operations. Tables 7 and 8 present their responses.

As is clear from Table 7, very few cities felt that microcomputers produced negative impacts on their operations. In fact, only 22 cities out of the sample of 322 cited any negative impacts at all. These included a high of 13 that said microcomputers disrupted employee routine, four each that responded that micros wasted staff time or eliminated jobs, three that said that microcomputers cost too much, and two that said that micros reduced productivity. These are insignificant numbers, suggestive of potentially strong support among responding cities for microcomputer technology.

The litany surrounding use of microcomputers in local government contends that these machines will produce a number of positive impacts or benefits. In order to determine whether the respondents agreed, they were asked to assess the impact of microcomputers on their operations. Six possible positive impacts were included: improving general productivity, reducing costs, enhancing employee creativity, enabling in-depth analysis, providing additional services, and reducing the need for additional staff.

The distribution of responses is presented in Table 8. Of the 322 cities that reported owning microcomputers, almost two-thirds (65.5 percent) indicated that micros had improved general productivity. The ability to conduct in-depth analysis was reported as a positive impact by almost half (49.2 percent) of the cities.

Micros enabled 146 cities (45.3 percent) to provide additional services and reduced the need for additional staff in 121 (37.5 percent). Micros enhanced employee creativity according to 119 cities (36.9 percent), and 117 (36.6 percent) indicated that microcomputers had reduced the costs of operations.

The cities reporting positive impacts were nearly equally distributed across geographic regions with one exception, the northeast. Most of the positive impacts were

reported by cities with suburban status (n=104), the mayor/council form of government (n=140), and populations between 5,000 and 49,999 (N=123).

Staff reaction is another way of assessing the experience that cities have had with microcomputers. As Figure 4 indicates, the reaction of staff was generally favorable. Of the 322 cities reporting having microcomputers, 87 (27.0 percent) described staff reaction as highly favorable, and 92 (28.6 percent) said it was favorable. Seventy-one (22.0 percent) of the cities described staff reaction as mixed, 29 (9.0 percent) as unfavorable, and 11 (3.4 percent) as highly unfavorable.

If the two response categories, highly favorable and favorable, are combined, then 179 or 55.6 percent of the cities reported staff reaction as favorable. This proportion stands in marked contrast to the 40 cities (12.4 percent) that described staff reaction as unfavorable or highly unfavorable.

Figure 5 presents the cities' ratings of their overall experience with microcomputers. The cities were asked to rate the extent to which microcomputers had met their expectations. Sixty-four (19.9 percent) responded that micros exceeded and 157 (48.8 percent) that micros met their expectations. This totals 221 (or 68.7 percent) cities whose expectations with micros were met or exceeded.

Only 20 cities (6.2 percent) indicated that microcomputers did not meet their expectations, although another 72 cities (22.4 percent) reserved judgment and indicated that it was too early to tell whether or not microcomputers met expectations.

Data from Tables 6, 7, and 8, and Figures 4 and 5, when combined, provide evidence of solid support and highly positive reactions to microcomputers by city governments. Few cities felt micros produced negative impacts on their operations, and most believed positive impacts were associated with micro use. Staff reaction to micros in the majority of cities was favorable and was unfavorable in only a small minority. Finally, over two-thirds of the cities felt that micros had met or exceeded their expectations.

Microcomputer Applications

The cities with microcomputers were asked to identify those functional areas of municipal government for which they were using microcomputers. Included in the survey were 58 possible microcomputer applications. The cities were also asked to identify the source of programming or software (commercial off-the-shelf, professionally programmed, or programmed in-house) for the various applications.

The most frequently reported application of microcomputers in local government was word processing. The

respondents included 94 cities that were using off-the-professionally programmed software, and 11 programmed in-house software. Care should be taken in interpreting these figures since they are not additive; a city could be using word processing software from all three sources. While the exact proportion of the 322 cities with micros using word processing cannot be determined given the format of the questions in the survey, clearly word processing was the most frequently reported application.

Microcomputer applications in the area of public finance were also reported with some frequency. A number of cities were using micros for forecasting revenues and expenditures, accounting, budget formulation, equipment and property inventory, enterprise fund accounting, and payroll. Cities reporting these applications generally indicated that they were using off-the-shelf or professionally programmed software rather than programmed in-house software.

With the exception of using micros to maintain personnel records, few applications were reported in the area of personnel administration.

The use of microcomputers in the public safety area was also very limited. This was also the case in the public works and utilities area with exception of applications in traffic signal coordination and utility billing analysis.

Off-the-shelf software for traffic signal coordination was reported by 21 cities. Use of professionally programmed software for utility billing analysis was reported by 52.

Few cities reported microcomputer applications in the areas of planning and community development, parks and recreation, library, and general administration. The one exception in the general administration area was word processing.

Assuming that the questionnaire reasonably addressed the principal functional areas for microcomputer use in city government, the finding of relatively limited use of micros by the cities surveyed is intriguing. First, most cities with micros felt quite positive about the use and impacts of these machines on their operations. At the same time however, micros are apparently not extensively used by their municipal owners.

Second, although micros are not used extensively, the data indicate that they are put to a wide variety of uses by city governments. This suggests that microcomputers are indeed being used as "personal" machines to perform limited and specific ranges of functions. The use of a micro as a personal computer to extend the capability of the human user is highly consistent with the marketing verbiage surrounding these machines.

However, caution must be exercised in relying too heavily on these data. At best they are suggestive of the

use of microcomputers principally as personal computers in city government. They do not provide conclusive proof.

Micros and Mainframes

The question is often asked whether microcomputers are being used as alternatives to, in addition to, or in conjunction with mainframe computers. Today's technology can support sophisticated systems in which microcomputers are linked to mainframe computers and to each other. In a completely integrated system, all of the micros owned by a city would be linked to and take advantage of a city's mainframe computer. Communication could take place between all micros as well as between micros and the mainframe. In theory, such a system would provide the user with the best of both micro and mainframe computing.

At the other extreme is the situation where a city has both micros and a mainframe without any linkages between them. Another situation is where communities without the need or the ability to pay for a mainframe or minicomputer are using low cost microcomputers instead.

Table 10 provides the responses to two questions designed to help gauge the status of micro and mainframe linkages in city governments. Of the 322 cities reporting ownership of a microcomputer, 187 or 58.1 percent reported that they also had mainframe or minicomputers. Of these, only 31 or 16.6 percent (and 9.6 percent of all microcomputer owning cities) reported that they had micros

linked to mainframe or minicomputers. These findings suggest that cities with both micro and mainframe computers have only begun to scratch the surface of fully integrated systems.

Desired ICMA Services

Recognizing that the use of microcomputers in local government is relatively new and that increasing numbers of cities will be acquiring microcomputers in the near future, ICMA wanted to identify microcomputer related services that it could provide to cities. Table 11 gives the responses of those cities with microcomputers and Table 12 the responses of those cities without microcomputers to the question of what services related to micros would be most helpful.

In descending order, those cities with micros (n=322) expressed a desire for a software library exchange system (67.7 percent), case studies (53.7 percent), canned software (50.3 percent), user network and newsletter (45.0 percent), micro workshops (36.3 percent), technical assistance packages (23.9 percent), and needs assessment and procurement guidelines (20.4 percent).

For cities without micros (n=2,111), the descending order of desired services was case studies (21.8 percent), software library exchange system (21.3 percent), needs assessment and procurement guidelines (17.8 percent), canned software (17.4 percent), micro workshops (15.4

percent), user network and newsletter (13.8 percent), and technical assistance packages (12.6 percent).

The data indicate that cities without microcomputers want essentially the same services as those with microcomputers. The biggest difference between cities with microcomputers and those without is in the percentages of cities that desired potential ICMA services. Depending on the particular service, between 20.4 and 67.7 percent of the cities with microcomputers reported a desire for potential services from ICMA. Of the cities without microcomputers, only from 12.6 to 21.8 percent expressed a desire for ICMA services related to microcomputers. However, because non-owners were considerably more numerous, the absolute number of non-owning cities desiring ICMA services was greater than that of cities that owned micros.

The types of potential IMCA services desired did not appear to depend on city classification. In general, the order of desired services was the same regardless of city classification. This applies both to cities with and without microcomputers. The value order of preferred services for both categories follows:

Cities With
Microcomputers

1. Software library exchange
2. Case studies
3. Canned software
4. User network and newsletter
5. Micro workshops
6. Technical assistance
7. Procurement guidelines

Cities Without
Microcomputers

1. Case studies
2. Software library exchange
3. Procurement guidelines
4. Canned software
5. Micro workshops
6. User network and newsletter
7. Technical assistance

As can be seen, the preferred order of assistance from ICMA varies only slightly and can be explained largely by ownership or non-ownership of microcomputers. For example, micro owners ranked procurement guidelines last. This is understandable as they already own micros. Non-owners, on the other hand, felt procurement guidelines were more important and ranked this category of assistance third.

Conclusion

The principal findings and conclusions drawn from the data from this nationwide survey of microcomputers and city government include the following. First, relatively few cities owned or leased micros at the time of the survey. Only about a third of the cities without microcomputers said they had plans to acquire a microcomputer within the next two years. These findings compare poorly with the widespread sales of micros in recent years to businesses and schools, suggesting that city governments

may lag behind these organizations in the use of micro-computer technology.

A second finding is that the local government market for microcomputer sales does not appear to vary too much from the broader computer marketplace. Apple, Radio Shack, and IBM were the micros most frequently owned by the surveyed cities. However, the purchasing habits of city governments were relatively eclectic and included a number of other brands, including some that are well-known and some that were not.

Third, approximately 230 cities (or two-thirds the number that owned micros) did not know whether they owned a microcomputer, or else they provided the survey with answers that could not be interpreted. This suggests a surprising degree of ignorance about computer technology among American municipalities that claim ownership of such high technology equipment.

Fourth, few cities reported problems with micros, and a high proportion reported positive impacts from microcomputers. This finding is especially interesting in light of the relatively small number of cities with micros. When the base of micro owners grows to a more sizeable number, will the positive reactions to micros remain proportionately as strong? The answer will be interesting.

Fifth, responding cities reported use of a variety of types of microcomputer applications. However, the number

of respondents reporting use of any single application was relatively low. For example, word processing was the most frequently cited application, but only 94 or 29.2 percent of the respondents said they had purchased off-the-shelf software, 12 or 3.7 percent reported purchasing professionally programmed word processing software, and 11 or 3.4 percent said they wrote such programs in-house. The next most frequently used application programs were in the area of financial management. Application areas such as personnel, public safety, public works, and others trailed far behind the leading areas in terms of frequency of use by surveyed cities.

Sixth, both microcomputer owning and non-owning cities provided some measure of support to the idea of microcomputer related services from ICMA. Micro owners were proportionately more likely to provide support for such services than non-owners, but the absolute number of non-owning cities that supported such services was greater than the number of owners.

Finally, a relatively small number of cities reported microcomputer ownership. Hence, generalization of these data to the broader population of American cities should be done only with great caution. Moreover, given the nature of the sample and the response rate, the analysis has been unable to draw definitive conclusions regarding the effects of city size, geographic location, metro status, or form of government on municipal ownership or use of microcomputers.

FOOTNOTES

¹The largest study of computing in American local government was conducted in the mid-1970's by Kenneth Kraemer and his associates at the Public Policy Research Organization, University of California at Irvine. Numerous analyses, including several articles and books, have been published using data from this study. However, the study was undertaken prior to the commercial introduction of microcomputers. Hence, it does not contain data on the use of micros in local government.

²All responding cities could select as many answers as applied. Hence the total number of responses in all categories combined exceeds the total number of respondents.

³Each responding city could list up to three separate systems. As Figure 1 shows, nearly three-fourths of these cities (73.6 percent or 237) owned three or fewer micros. However, since 12.5 percent or 41 of these cities owned more than three systems, the figure of 414 computers understates the total number of microcomputers owned by these cities.

⁴Some of the cities that responded to this question were owners of more than one microcomputer. Hence, a sharing of microcomputers by more than one user in those cities would be less likely than multiple users having their own systems.

APPENDIX A: METHODOLOGY

ICMA conducted a survey in 1982-83 to assess the status of microcomputer usage by cities across the country. Respondents were asked to provide answers to a variety of questions on present and anticipated microcomputer uses and applications.

The survey was mailed to 5,808 cities in August, 1982 with a follow-up in November. Responses were received until February, 1983. A total of 2,433 cities responded for an overall response rate of 41.9 percent. Although this rate was adequate, the small number of cities with microcomputers (n=322) was only 13.2 percent of those responding and 5.5 percent of those surveyed. This places extreme limitations on those parts of the analysis that apply to cities with microcomputers, and caution should be exercised in making inferences to the larger population of United States cities.

Insert A: What is a microcomputer?

Five types of computers currently adorn the electronic market place. In order of size, they are super computers, mainframes, super minicomputers, minicomputers, and microcomputers. Except for the super computers that are exceptionally large, powerful machines used principally for scientific and engineering purposes, the distinctions among the other four types are rapidly blurring. This is due to miniaturization or large scale and very large scale integration (LSI and VLSI) in which tens of thousands of electronic circuits are placed on a silicon chip about the size of a fingernail. As a result, present day microcomputers have the capacity and power of earlier generations of mini and mainframe computers.

A microcomputer is often called a personal computer, home computer, desktop computer, or small business computer. These differences in terminology often reflect no more than the marketing approach of a particular vendor. However, they may mask significant differences in system capabilities that can be extremely troublesome to the unsuspecting buyer.

Microprocessors

Microcomputers are based on microprocessor technology. A microprocessor is a computer on a chip. That is, a microprocessor contains the memory and arithmetical and logical elements necessary to perform all of the functions of a computer.

Memory

Computer memory is referred to in terms of k or thousands of bytes. A byte is a single character of data, such as a number, letter, or symbol. Microcomputers almost always have what is known as RAM or random access memory. RAM is also known as volatile or erasable memory because information placed in RAM memory can be erased to make room for new information. RAM memory is also erased whenever the power is turned off.

Micros may also have ROM or read only memory. ROM is used primarily for the operating and application programs so that they cannot be erased or tampered with.

Most commercial microcomputers are either 8 bit or 16 bit computers. That is, they address of 8 bits or 16 bits of data at a time. Other things being equal, a 16 bit computer is faster and more powerful than an 8 bit computer. Moreover, many 16 bit microcomputers are multi-user, multi-function systems. Eight bit machines are single user, single function computers.

The standard maximum memory size for 8 bit microcomputers is 64k, although some manufacturers have been able to devise methods of going beyond 64k. Sixteen bit microcomputers can be configured to 512k and beyond. The rule of the industry is that computer memory gets larger and cheaper every year.

Mass Storage

Microcomputers commonly use what are known as floppy disks for mass storage of data. Floppy disks are operated on units called disk drives that both read data from and write data onto the disks. Floppy disks resemble 45 rpm records and are typically $5\frac{1}{4}$ inches in diameter, although additional sizes have recently come onto the market.

Floppy disks can store from a few thousand to over one million bytes of information. Hard disks that range in size from five million to a recent release that will hold 380 million bytes of information are also available for microcomputers.

Dual floppy disk drives allow data to be copied from one disk to another and are recommended for purposes of creating back-up files. Like computer memory, storage capacity can be expected to increase in capacity and decrease in price in coming years.

Display Screen and Keyboard

Human interaction with the microcomputer occurs via a device that looks like a standard typewriter keyboard with special function keys and perhaps a numerical key pad. Data and commands are entered through the keyboard and are displayed on a video display unit or screen that resembles (and may be) a small television set. Some systems are marketed with the display monitor "bundled." For others,

the purchaser must buy his or her own monitor. Display monitors typically are either black and white, green phosphorous, or have full color capability. The type of use to which the system will be put will determine the type of monitor to use.

Printer

Two basic types of printers are available to use with microcomputers. These are character and word processing printers and vary in price from a few hundred to a few thousand dollars. Character printers are for use when printing reports, and word processing printers are for letter and document type production. Local government use of microcomputers almost always will require a printer capability of some kind.

Operating Systems

All microcomputers require operating systems. An operating system is a software element that enables the microcomputer to function. It instructs the system in what to do and in the proper sequence of activities to follow.

Operating systems act as a constraint on the usability of microcomputers. Application programming written to run under one particular operating system, say Apple's, will probably not run on a different machine, say an IBM, which has a different operating system.

Although many microcomputers have their own unique operating systems, CP/M (for Control Program for

Microcomputers) has emerged as somewhat of a standard for 8 bit systems. CP/M allows transferability of software from machine to machine. No such standard operating system has yet emerged for 16 bit systems.

Application Programming

This is the computer software that does the work of an organization in functional areas like accounting, payroll, utility billing, equipment management, police records, word processing, and the like. Application programming is the single most important element of a computer system. First consideration in acquiring a microcomputer should be given to those functions that need to be computerized and to the availability and adequacy of programming in these areas.

Generally, more software in a greater number of functional areas is available for 8 bit microcomputers. This means that 8 bit micros are more advisable for most local government activities than 16 bit systems.

Microcomputer Outlets

Microcomputer hardware and programming can be purchased from a wide variety of sources: department stores, video and appliance stores, computer stores, software organizations, hardware manufacturers, and mail-order houses. Depending on the source from which the micro is purchased, training, support, and service may or not be readily available. The purchaser should carefully evaluate the need for training, support, and service when deciding where to purchase its micro.