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STUDENT REPORT

MANAGING MICROCOMPUTERS: A SURVIVAL
KIT FOR FUNCTIONAL MANAGERS

Major Emile C. Iverstine

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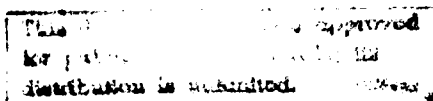
AUTHOR(S) Major Emile C. Iverstine, USAF

FACULTY ADVISOR Major Charles E. Zimmer, ACSC/EDCM

SPONSOR Lieutenant Colonel David A. Riemondy, HQ AFSC/CCXC

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Military and civilian use of microcomputers has expanded at a phenomenal rate. Their popularity stems from the fact that they put computational power in the hands of users. But this capability presents new challenges to functional managers in the military community because they now must manage their computational tools (microcomputers) as well as their work units. This article defines the microcomputer management environment facing functional managers and outlines some principles for meeting this challenge.		

PREFACE

Effective employment of microcomputers hinges on whether the user (not a computer specialist) is knowledgeable enough to use the system. The purpose of this article is to define and explain fundamental principles to guide the computer layman in managing his microcomputer system. The principles are a synthesis of research, discussion, and firsthand experience. The author sincerely thanks Lt Colonel Dave Riemony and Mr. Michael Tervo of HQ AFSC and Lt Colonel Ken Noccitto of the Rome Air Development Center for their assistance and responsiveness in providing a wealth of information on microcomputer use and management. The author extends a special thanks to Mr. John Smith of the Air Command and Staff College faculty for his excellent editorial help in preparing the article for publication. Subject to clearance, this manuscript will be submitted to Defense Management Journal for consideration.

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ABOUT THE AUTHOR

Major Emile C. Iverstine has an extensive management background relative to application of automated systems. As an aircraft maintenance officer, he managed the automated maintenance data collection and analysis function for a maintenance complex of 1200 people. While assigned to the F-16 System Program Office, he was the Program Manager of the F-16 Centralized Data System--a computerized field data collection and analysis system used to identify hardware and support problems for the multinational deployment of the F-16. Most recently, he was a systems effectiveness inspector for the functional management inspection of automated management systems in Air Force Systems Command. This four-month inspection assessed the Command's ability to effectively develop, acquire, and use automated management systems for the collection, use, and dissemination of information.

Major Iverstine received a BS degree in Mechanical Engineering from Louisiana State University in 1971, and an MS degree in Engineering Management from the University of Missouri--Rolla in 1977. His professional military education includes Squadron Officer School in residence and Air Command and Staff College by seminar and in residence.

MANAGING MICROCOMPUTERS:

A SURVIVAL KIT FOR FUNCTIONAL MANAGERS

The first seminar attended by the Class of 1984 at Air Command and Staff College began with introductions and biographical sketches of seminar members. The first member to speak was a B52 pilot who had just completed a tour as a personnel specialist at the Air Force Military Personnel Center. He was followed by an engineer who had devoted most of his career to weapon system acquisition, and a KC135 navigator with experience in statistical analysis. The next speaker, a manufacturing management officer, outlined his experiences at an Air Force plant representative's office, and an Army officer discussed his role as commander of a Hawk antiaircraft missile battery. Although these members of the seminar had diverse backgrounds, all of them were military officers with varied experiences in middle management. And they shared another common characteristic: all of them owned microcomputers.

Use of microcomputers in the private sector has grown phenomenally. In a keynote address to the Air Force Small Computer Conference in October 1983, David P. Moffet, President of Zenith Data Systems, stated that sales by the microcomputer industry in 1983 would probably reach \$8.5 billion representing 4.2 million units. Mr. Moffet went on to say that sales of personal microcomputers costing less than \$3,000 will double by 1985 and that sales of desk-top models costing less than \$5,000

will triple by 1986. Others predict that intelligent terminals (microcomputers) will grow 150 times within the next decade and that typewriters will be obsolete by 1988 if they cannot emulate the capability of microcomputers to store, edit, and transmit data electronically. (1)

Increased use of microcomputers within the Department of Defense has mirrored rapid growth in the civilian sector. With the Air Force as lead agency, the Defense Department recently signed a fixed-price contract with the Zenith Data Systems Corporation to purchase microcomputers for both the Air Force and the Navy. (2) Dr. Thomas Conrad, Deputy Assistant Secretary of the Air Force (Information Systems), stated during the small computer conference that the intent of the small computer program is early and liberal placement of microcomputers within the Air Force and Navy. Dr. Conrad added that the initial contract was only the beginning; plans are underway to acquire transportable units and equipment cleared for classified data.

Why have microcomputers become so popular? For one thing, decreases in price by as much as 30 to 60 percent a year makes them affordable commodities. (3) But the key to their popularity is uniqueness in the sense that they place computational power in the hands of users and allow them to share computer application with experts in automated data processing. This development presents new challenges for functional managers because they now must manage both their work units and their computational tools.

A New Management Environment

A manager's effectiveness in performing his assigned functions hinges on the ability to make decisions based on reliable information. (4) For example, a division chief managing travel funds for his work unit must first generate a travel budget, and, in all likelihood, he will use figures from previous years as a guide. After establishing the budget, he must obtain periodic spending reports (weekly or monthly) to measure the extent to which actual expenditures meet his budget profile. With this information, he can determine the trips that can be funded or the effort required to build a case for more travel monies.

But there is another side to the coin. The chief must establish and manage an information system within his division to support management of his travel budgets. He not only needs someone to file and retrieve previous travel budgets; he also requires a mechanism for routinely collecting, collating, and reporting individual travel expenditures. These efforts are not free because he must use his work force to file and retrieve the past budgets and generate the spending reports. Since his information system consumes resources, he must manage it in addition to managing his travel budgets. But what is the connection between the division chief and microcomputers?

In the first place, information systems have become more dependent on microcomputers because of their versatility in

standard business functions. These functions include accounting and inventory control; office automation of mail, filing, and text editing ; and support functions encompassing automatic calendaring, project management, graphics, operations research, decision support systems, and data base management.(5) The driving force in this versatility is the generic nature of microcomputer software characterized by a "create your own application" approach. For example, a prime software tool is the electronic spreadsheet, which is simply a matrix of columns and rows tracked by the computer. The user can tailor the spreadsheet for its many applications to accounting, calendars, or statistical analysis.

In the second place, the requirement to "create your own application" has changed the fundamental management approach to automation. For example, R. L. Patrick, a computer scientist with the Rand Corporation, stated in 1978 that a computer layman has two options when he needs a computer application. He can make the application himself by becoming a computer programming specialist, or he can employ a computer specialist to make the application for him.(6) But, when an authorized unit of the Department of Defense orders a Zenith microcomputer under the current requirements contract, the unit receives a number of boxes with the various pieces of hardware, a set of floppy disks with the generic application software (e.g., a spreadsheet), and a set of instruction manuals. In this environment, the functional work unit must adapt the general purpose microcomputer

to its specific use. Thus, effective employment of the microcomputer system hinges on whether the user (not a computer specialist) is knowledgeable and sophisticated enough to use the system.(7) The functional manager (e.g., the division chief) now owns the automated tool and must manage its application.

Principles of Microcomputer Management

But how should the functional manager approach his microcomputer application? One way is to emulate the classic technique used for general management where a generic set of ideas or principles are distilled from past experiences. Koontz and O'Donnell, two well known management theorist, describe management principles as fundamental truths that take two or more sets of variables and define their relationship. They state that distillation of knowledge into major principles will provide an organized approach to managerial problems and serve as lessons that transmit experiences of the past to the future.(8)

The Human Dimension

People are key elements in implementing microcomputer systems and numerous examples from the real world confirm this statement. In one typical case, a bank information manager suggested centralization of the bank's administrative personnel to take advantage of new automation equipment driven by

microcomputers. The proposed automation met with major resistance because bank employees resented the breakup of their work units. In a second attempt, the bank placed the equipment in individual offices to minimize the impact on the organizational structure and this arrangement was well received.(9) Similar conclusions were reached during the Air Forces's Laboratory Office Network Experiment (LONEX), which entailed an extensive test program to measure the productivity of automated tools. One of the key lessons learned from the LONEX program was that the human element of the equation is one of the manager's most important variables.

A major consideration is to encourage user participation in system design and implementation. A study of 56 automated systems by Steven Alter shows a clear link between levels of user resistance and the extent of user participation. Less than 17 percent of the systems that involved users in design and implementation met significant resistance, and, in a similar study by McKinsey and Company, user involvement improved implementation of new systems by a three to one margin.(10) Why does user involvement produce these results? Psychologically, involvement reduces user apprehension concerning the potential impact of automation on jobs and develops a sense of belonging to the organization. Users probably have the best knowledge of manual systems subject to automation and can make valuable inputs toward development of the automated process. And the involvement of users in developing the automated system provides a sound

baseline of understanding for future training.

Another consideration is the need to insure the usefulness of the system. A common fault of many automated systems is that they simply perk information to the top and offer minimum application at the grass roots level. On the other hand, users will be more likely to accept the system if automated outputs help them perform their jobs. And use of the system will lead to further improvements, identification and correction of problems, and more accurate data bases.

Other aspects of the human dimension include the functional manager's responsibility for developing the skills of his people to use a new system. Managers with practical experience in implementing microcomputer systems consistently stress the importance of training. In his keynote address to the Air Force Small Computer Conference in 1983, Col (now Brig Gen) Denis M. Brown, Deputy Assistant Chief of Staff for Information Systems at Headquarters Air Force, stated that training is a prerequisite for the effective use of small computers. In making his point, Colonel Brown recalled a tactical air forces procurement where 1,500 microcomputers had been distributed to a number of tactical units. The purpose of the purchase was to increase the productivity of the units under the assumption that numerous people skilled in the use of microcomputers were waiting for the units. But a different picture emerged. The people were not skilled in using microcomputers, and the equipment sat underutilized until they completed a minimum training program.

The Laboratory Office Network Experiment also pointed to a strong need for frequent and interactive user training.

A computer training program should include continuing instruction in specific operating procedures and application. The program should be designed from three perspectives. First, it should not require users to devote inordinate time to a single block of training because they normally perform a number of concurrent functional duties. Second, it should be structured in a phased approach to allow time for users to gain practical experiences that reinforce the training syllabus. And, third, it should provide repetitive instruction to compensate for personnel turnover. The program should focus initially on fundamental operating techniques and procedures and then require participants to apply an analytical process in using generic software for specific applications.

Cost-to-Benefit Relationships

Functional managers must use sound judgment in selecting manual systems that warrant automation because microcomputers are so versatile that most managers can identify numerous manual systems for potential automation. In such instances, the focus shifts to systems that would benefit most from automation and the order in which they should be considered. The guiding principle in this decision is the relationship of the cost of automating to the benefits expected. Conscientious managers can determine their

priorities in a number of ways.

One approach is to establish a quantitative relationship between the cost of automation and the expected benefits.(11) But this technique depends on the manager's ability and willingness to develop accurate estimates of common costs and benefits so that he can make valid comparisons. Since these estimates are necessary prior to defining the proposed automated system, specific numbers are often difficult to predict accurately.

An alternate approach is to take a more subjective view of the cost-to-benefit relationship. Relative costs and benefits of automated systems depend on the stability of requirements for information processing. Once fixed initial costs are incurred to satisfy a given set of requirements for information processing, they do not recur unless requirements change. The longer the automated system can be used before modification (i.e., requirements change), the higher the cumulative benefits. Therefore, a better cost-to-benefit relationship will ensue for stable information requirements than for changing requirements.

Costs and benefits also depend on both the quantity and unit value of the data processed. The incremental cost of processing additional pieces of similar data through an established automated system is small. Therefore, for processing larger quantities of data, more cumulative benefits are received for relatively small increases in costs. And the value of each piece of data acts as a multiplier of this effect. For example, if two

similar manual processes require the same volume of data processing and the value of each piece of data in the first system is three times the value of each piece in the second system, then the benefits derived from automating the first system will be triple the benefits derived from the second. These subjective factors should direct the manager toward a stable, high-volume, high-value manual system when he is establishing his priorities.

Implementing Approaches

After the manager selects and prioritizes manual systems for automation, his next challenge is to convert his resources into an efficient and effective automated system. Irene Nesbit, President of a computer consulting firm, states that "the greatest risk (for installing a microcomputer system) stems from the problems of developing a functional, smoothly operating application." (12) The Rand Corporation reached similar conclusions in a study of 10 Air Force computer resource management activities. The most significant factor in system problems was a disorderly approach to planning and implementation. (13)

In general, the manager should assign specific responsibility within his organization to manage his automated resources. A single-point manager will insure an orderly approach to automation. The responsible element should plan and coordinate

microcomputer applications and monitor operation of the system after it has been established. This approach will enable the manager to focus the system on supporting the objectives of the work units and avoid the possibility that the system will become the "end" rather than the "means." Systematic evaluation after implementation will fine tune the system to improve its efficiency, and continuous monitoring will help identify improper use and reduce the potential for computer abuse. But the manager must consider some of the implications of over-centralizing management of microcomputer operations.

The level at which to centralize management and operation of an automated system is a tradeoff between efficiency and effectiveness. On the one hand, a highly centralized system promotes a number of efficiencies. Centralized management creates a strong corporate memory that insures cross-feed of good ideas. Common procedures for application can be developed for the generic software to prevent a "re-invent the wheel" syndrome. And centralized control promotes commonality among the hardware and software and thus enhances communications among various elements of the work unit. On the other hand, centralization tends to separate automated systems from the users. In such an event, one group of individuals manages the computer aspects of the operation, while another group attempts to employ the system for functional tasks. The results can be loss of operational perspective by computer managers and loss of interest by users.

But a manager can employ a number of techniques to help mediate these extremes. He can organize user groups to capitalize on information cross-feed and continue to decentralize day-to-day management of the automated system. He can establish a technical center as a focal point for training and consultation and as a clearing house for new technology. And he can appoint a steering group to oversee the planning and coordination of microcomputer application. This steering group can establish overall policy relative to system architecture and develop standards to insure compatibility among various systems developed by users. When he employs these techniques, the manager can reap the benefits of a decentralized management approach and still insure an efficient operation through centralized coordination and control.

Another tradeoff for the manager involves the extent to which he integrates his automated system with other systems. Electronic connections among multiple automated systems increase productivity because each system can share information with other systems. But management of interconnected systems is more complex. Since data elements are shared, interconnected systems become highly interdependent and tend to compound problems of coordination. For example, any structural revision of the data base for system A requires close coordination with automated systems that rely on data from system A. Thus, coordination of a large number of related systems may delay or even prohibit revision of system A. The manager must obviously weigh the efficiencies of an integrated approach against the complexities

created by interdependent systems.

The five military officers introduced at the beginning of this discussion have now been assigned to middle-level management positions. When they report to their next assignments, each officer will probably meet a familiar friend -- the microcomputer. The pilot and the navigator will probably see their friend cranking out crew schedules and computing mission profiles. The engineer and manufacturing officer will be impressed at the efficiency of their friend in tracking development and production schedules. And the Army officer will probably find his friend controlling equipment inventories and programming airlift requirements for deploying his unit. As they take charge of their new units, each officer will inherit significant computational power. But the value of their microcomputer systems will depend on their skill in adapting this versatile tool to their needs.

Notes

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