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MICROCOMPUTERS IN DEVELOPMENT MANAGEMENT:

LESSONS FROM RESEARCH AND EXPERIENCE

A Dissemination Report

by
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PREFACE AND ACKNOWLEDGEMENTS

This paper summarizes lessons on the introduction, use and institutionalization of microcomputers for development management from a group of professionals engaged in this work over the past four years. It is based on a synthesis work session sponsored under the Performance Management Project of AID's Science and Technology Bureau. We would like to express our appreciation to Jeanne North and Ken Kornher of the Office of Rural and Institutional Development, and our colleagues at USDA's Development Program Management Center, for their participation in, and support of, this effort.

We extend special thanks to Dr. Janice Brodman, an Associate of the Harvard Institute for International Development, who undertook on our behalf the preparation of a major case study on this topic. Her work in documenting the experiences of the Ministry of Agriculture and Livestock Development and the Ministry of Finance and Planning in Kenya, as well as the Ministry of Finance in Indonesia, was extremely helpful for grounding our thinking in both theory and reality. Our thanks also to Noel Berge of Thunder and Associates, who has worked with us from the beginning, and Dr. Carl Gotsch of Stanford, who provided technical reviews and critiques (i.e., kept us honest) as we summarized our findings. Special editorial assistance was provided by Pat Isman of DPMC, and Sally Imler and Susan Secco of IDMC.

Finally, thanks to all those who attended the June 23-24 microcomputer synthesis work session. Their participation and experience form the basis of the findings and action guidelines presented here.

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS. i

I. INTRODUCTION 1

II. LESSONS. 2

A. Broad Observations 2

B. Microcomputer Introduction. 3

C. Microcomputer Use 5

D. Institutionalization of Microcomputers 7

E. Outstanding Issues. 8

III. CONCLUSION 9

REFERENCES. 11

APPENDIX

Microcomputer Synthesis Work Session Attendees . . 13

I. INTRODUCTION

During the past ten years we have witnessed an explosion in the power and accessibility of information technology; the microcomputers found on the desks of professionals today are many times more powerful than the largest computers available twenty years ago and speed and power improvements seem to be announced almost daily. Though larger computers have been used in developing countries since the 1960s, the advent of microelectronics has made the transfer of information technology affordable for the first time. However, the implications of using microcomputers in development management are much broader than the specific application. Use of the new technology has the potential for changing management practice: the way decisions are made, the way organizations are structured, and the way people relate to one another.

Four years ago, a workshop sponsored by the AID/S&T/RD Performance Management Project, brought together professionals concerned with microcomputers in development management. Since then, the International Development Management Center (IDMC) of the University of Maryland, the U.S. Department of Agriculture's Development Program Management Center (DPMC), and a number of our colleagues, have been involved in a variety of research and technical assistance activities in this area. These activities have generated a number of research papers and project reports containing a variety of observations, conclusions, and in some cases recommendations, about how microcomputers can be effectively used and the impacts -- positive and negative, potential and realized -- on organizations in which microcomputer-based information systems are implemented.

This year, on June 23 and 24, some of these professionals were reunited in a work session for the purposes of: 1) reflecting on our experiences with microcomputers in development and our conclusions to date; 2) summarizing these for dissemination in the form of generalized conclusions and action recommendations; and 3) identifying areas for further research involvement.

The session utilized Janice Brodman's case studies of the Ministry of Finance and Planning and the Ministry of Agriculture and Livestock Development in Kenya and the Ministry of Finance in Indonesia as a springboard to focus discussion. Those who attended the work session brought with them a wealth of research and technical assistance experience (see the appendix for a list of attendees). Other cases from which experience is drawn include the Caribbean Agricultural Research and Development Institute (CARDI) project, the Portuguese PROCALFER Project, and a large number of short term experiences. A listing of available papers and reports is included in the References section.

This paper summarizes the outputs of the work session in the form of generalizations found commmon to the experience of the various participants. Based on these generalizations, we present a set of initial action guidelines that should be considered by anyone managing, or involved in, the process of introducing microcomputers to improve development management. We believe that these

guidelines are sound, but recognize that they are simply our best judgements to date; specific action steps must certainly be adapted to any particular situation.

II. LESSONS

When any new technology is introduced, three stages in the process can be identified. The first is introduction, which is roughly the time from the initial proposal in favor of the new technology to its first use. The second is use, a period characterized by training and widespread utilization of the new technology. The third stage is institutionalization, when the new technology becomes a valued and regular part of ongoing operations. We have found this model helpful in organizing the lessons we have learned from our research and experience about effectively introducing and using microcomputers to improve management in the development context. Our generalizations and recommended action guidelines follow this general outline. First, however, we present a number of broad observations that cut across these three phases.

A. BROAD OBSERVATIONS

Observation 1: Microcomputers change the balance of power. Both the access to information and the processing power they introduce can disrupt traditional power relationships and make information available to new actors.

Throughout the introduction, use, and institutionalization of microcomputers, change agents must remain aware of the power implications for various stakeholders. They must beware of microcomputers becoming captured by individuals for their own ends rather than organizational goals. Microcomputers will be resisted by those who perceive them to be a threat to their power and supported by those who perceive the machines to confer power or other benefits.

Observation 2: Microcomputer intervertions should be viewed as part of an organizational change effort involving management improvement rather than simple hardware-software systems.

Successful microcomputer implementation improves organizational performance. Incentive systems should support the use of both microcomputers and the information they provide. Powerful incentives can be direct or indirect, formal and informal.

Observation 3: Microcomputer technology, if appropriately introduced, used, and institutionalized, can have a positive impact on management systems and organizational performance.

The evidence from our experience is clear: microcomputers are a technology

with great potential for improving management in less developed countries. To do so effectively, their introduction and use must take into consideration the impacts the new technology will have on management practices and organizational structures.

Observation 4: National policies concerning information technology strongly affect the ability to introduce, use, and institutionalize microcomputer systems.

Over the next few years, the developing countries will be designing policies affecting information technologies, such as procurement regulations, telecommunications regulations, and controls on the flow of information. To the extent possible, the development practitioner working in this environment should consider existing and potential policies.

Observation 5: Any microcomputer intervention involves risk of failure. The degree of risk depends on the size of the project, the familiarity of the organizational personnel with the technology, the clarity of objectives, leadership commitment, and the speed with which it must be implemented.

Change is often perceived to be a threat. To effect a change for the better, the key stakeholders must consider the change to be in their interest. In addition, where previous efforts have failed, key actors may be hesitant to make further attempts. Our purpose in presenting the generalizations and action guidelines below is to help implementors maximize the likelihood of success and reduce the risk.

B. MICROCOMPUTER INTRODUCTION

Generalization 1: Rapid reconnaissance of and consideration for existing bureaucratic structures and power relationships is crucial to the successful introduction of microcomputers.

Action Guidelines:

a. Be aware of and attempt to minimize threats that key actors may perceive from the introduction of microcomputers, and consequent impact on roles and authority.

b. Obtain support from top leadership and see that this support is regularly communicated through clear, consistent messages. Our experience shows that strong leadership messages in favor of the new technology make it much easier to introduce the microcomputer and ensure that it is used effectively. Do this by identifying and talking to key stakeholders. Build support by including them in the introduction process and showing them the benefits they will derive from the new system.

c. Use formal and informal incentive systems to support microcomputer introduction. Formal incentives may include new job opportunities, access to information, and training opportunities. Informal incentives may include learning opportunities, inclusion in users groups, and respect from colleagues.

d. Limit the initial risk of introduction by limiting the size of the initial microcomputer project and the scope of its objectives, and by providing adequate implementation time.

e. Limit threats from the newness of the technology by limiting initial hardware complexity, employing user friendly software to perform pre-existing tasks, and providing appropriate training at all levels.

f. Be aware of the fact that microcomputers themselves can be extremely distruptive; because of their nature (their newness, power, and desirability), they create new incentives and sanctions by their very existence within the organization. They can initiate revolutionary as well as evolutionary change.

Generalization 2: The introduction of microcomputers should provide a solution to a specific, immediate problem perceived as important by host country officials and for which automation is appropriate.

Action Guidelines:

a. Look for areas of key performance gaps where quick results and high impact can be expected from introducing the new technology. Focus attention where there is a lot of information to be processed with limited resources. Areas such as taxation, budgeting, and foreign exchange control are often good places to start.

b. Create "ownership" and support by involving all key stakeholders, including a variety of host country officials, in deciding where microcomputers should be introduced. It may also be possible to identify a "champion" for the new technology, an official with the desire and power to effectively support its introduction against opposition.

c. Introduce microcomputers as a component of a process to perform an organizational task. Focus on the problem rather than the technology itself. Other components of the system such as data collection, training, and output utilization, should also be considered.

d. In complex organizations, plan for hardware compatibility among projects to permit eventual networking and utilize compatible database systems to ease centralization of data storage.

e. Where possible, begin by computerizing a process already being done manually, to make it faster and more accurate. This eliminates the need for designing an application from scratch, minimizes new procedures to be learned, and provides quick and obvious results to generate support. Computerization of reports involving a lot of computation usually provides the most impressive

results. Word Processing is always in demand, but value-added may be harder to demonstrate.

Generalization 3: The introduction of microcomputers should be viewed and treated by the adopting organization as a learning process in building effective information processing.

Action Guidelines:

a. Microcomputer introduction should start small with bounded applications to allow for learning about the technology and the development of necessary supports, while incorporating flexibility to adjust as user requirements change.

b. Systems should be designed for modular development and expansion, phasing in new applications when necessary and feasible.

c. Provision should be made for periodic monitoring and planning of information processing needs to ensure that the learning process progresses appropriately.

Generalization 4: The introduction of microcomputers should be viewed as an investment in physical and human capital. The evaluation of costs should include both capital investment and recurrent operating costs, which are often underestimated.

Action Guidelines:

a. Recognize the magnitude of the costs of training and other system development activities, and of recurrent costs. While hardware costs are relatively low, required training and technical assistance will add substantially to the cost of implementation.

b. Be prepared to demonstrate the accomplishments (value added) of the system to all key actors, including donors, after each step during introduction. This will facilitate modular financing and build continued commitment and support, thereby increasing the likelihood of long-term success and institutionalization.

c. Consider local procurement wherever possible. Although local procurement may be inefficient in the short run, it will support development of a local market and supply, and ensure that local servicing is available.

C. MICROCOMPUTER USE

Generalization 1: The adoption and use of microcomputer technology creates information related jobs.

Action Guidelines:

a. Where information positions and job classifications do not exist, use microcomputer applications to introduce new job descriptions and career paths.

b. When recruiting personnel to fill positions created by the introduction of microcomputers, throw the net broadly; look within the host organization before turning to specially trained MIS personnel.

c. Provide access to the machines as a means of determining aptitude and interest on the part of potential users and operators. This is particularly helpful where there is no history of microcomputer use in the organization.

d. Pay special attention to creating the critical position of key resource person(s), responsible for hardware and software issues, maintenance, user liaison, training, installation, programming, etc.

e. Lack of organizational positions for microcomputer-related jobs may make it necessary to use local consultants, either short- or long- term. Leverage this requirement into building organizational capacity.

Generalization 2: Because microcomputer applications can be made to be user friendly, microcomputers can be used by individuals with a very wide range of educational backgrounds, including those with minimal education beyond literacy.

Action Guidelines:

a. Write easy-to-read user's guides and lists of instructions in the local language.

b. Where appropriate, make applications usable by the lowest possible staff level, to free more skilled personnel for more complex and creative tasks. For instance, it is often more efficient for a less educated clerk to enter data into a menu driven accounting system than to have the end user, a more highly paid manager, enter the data into a spreadsheet.

c. Tailor training to the level of the users and their local situations. Specifically, sequence the training, beginning with simple applications and enough technical information to use the system without damaging it, and move to higher levels where necessary. Use local trainers where possible. Don't belabor technical details, such as the difference between bits and bytes and where the memory is physically located, unless it is absolutely necessary.

Generalization 3: When microcomputers are introduced, their use should be supported by training in the use of the information they provide.

Action Guidelines:

a. Focus initially on products of the existing system to improve their accuracy, timeliness, and effective use in decision making.

b. Next, address the value of adding information products, and the format they should take for maximum utility.

Generalization 4: Managers of microcomputer systems or of people who use microcomputer information must understand the potential and limitations of the technology.

Action Guidelines:

a. Provide general training about the technology to managers to make their expectations realistic while sensitizing them to opportunities. As the technology moves toward institutionalization, managers and technicians must understand the capabilities of the system so they can plan processes and procedures that make appropriate use of the technology.

D. INSTITUTIONALIZATION OF MICROCOMPUTERS

Generalization 1: Change agents can and should facilitate institutionalization.

Action Guidelines:

a. Build confident ownership of the information technology.

b. Encourage the ongoing use of valued products by organizations and individuals.

c. Build infrastructural supports for the technology.

d. Share early risks.

Generalization 2: Organizations and individual users need to perceive the value of using information products in achieving their goals. Organizations must assume the long-term expense and responsibility for ongoing operations, system maintenance, and further applications development. Individuals should use the technology in a way that is congruent with organizational goals. Once the project has credibility, change agents should initiate discussion with host country officials on an institutionalization plan.

Action Guidelines:

a. Plan development of hardware and software systems which can be maintained by host country nationals. This includes, for example, planning for ongoing hardware maintenance and trouble shooting and use of flexible software that can be modified as needed.

b. Set out a timetable for withdrawal of external financial and personnel support.

c. Plan for provision of host country budgetary support, including introducing new line items for hardware, software, and personnel.

d. Develop personnel categories and job descriptions for staff in all areas related to the microcomputer-based systems.

e. Develop a monitoring, review, and planning process to ensure that the technology in place remains appropriate.

f. Develop systems and procedures for integrating microcomputer-based technologies into ongoing operations.

E. OUTSTANDING ISSUES

Besides the generalizations and action guidelines presented above, our experience has left us with a number of questions for which we have no conclusive evidence.

One question is, to what extent should one plan before introducing microcomputer technology? We support the notion that those introducing microcomputers should consider management objectives (i.e., who will use the information and for what decisions), information products (i.e., what form will the information be most useful), information technologies (i.e., what hardware and software will be used), and the relationships between these three. Our experience also shows, however, that the plan for introducing microcomputers should be highly flexible, in order to stimulate positive change through users learning to apply the technology by themselves.

A complex organization like a ministry may ultimately require centralized information processing and a network of equipment including minicomputers or mainframes. The relatively low cost of microcomputers, however, permits projects to initiate efforts individually. This can be an effective strategy for developing support for a larger effort. However, some standardization of equipment and databases is needed to facilitate eventual integration. The question remains: what is the appropriate level of planning?

A second question is, what are we really seeking to institutionalize? Is it a particular application of the technology, a generalized information processing capability, or improved management practices? Most interventions begin with a particular application, and its institutionalization receives early attention. From there, however, the organization may develop a general information processing capability or continue to computerize specific management functions. The two approaches may compete for scarce resources.

What should be the role of technical assistance personnel in hardware, software, and management systems development? What mixture is needed of "technicians", doing the job, "trainers", transferring expert knowledge, and "facilitators", helping host country personnel to develop their own systems? How do these requirements vary across tasks and over time?

Another question is, how and to what extent does the introduction of microcomputer systems influence the redistribution of power within organizations? Microcomputers can support either centralization or decentralization. We need to study their roles in power redistribution -- both intentioned and unintended.

Despite concern in overpopulated countries, we have no evidence that microcomputers displace labor in absolute terms. An open question, however, is the extent to which there are differential impacts on groups by education, gender, or occupational background.

Finally, perhaps the most important research question is **which strategies for introducing microcomputer-based information processing have proven effective** and how can we adapt them appropriately to new situations.

These outstanding issues suggest questions for continued research on the introduction of information technology in the development context. Answers to them, translated into appropriate strategies, should enhance planning and implementation of information technology transfer projects.

III. CONCLUSION

In conclusion, introducing microcomputer-based information technologies for development management presents unique opportunities and dangers. Micros pack a lot of power into small, affordable packages and have proven to be exceptionally glamorous and desirable. Thus, they offer great potential for a "quantum leap" from traditional to high-tech managment procedures.

On the other hand, there is danger of being dazzled by the glamour of microcomputers and introducing the equipment without adequate consideration of other elements of the system -- collection of meaningful data, training of personnel, utilization of analyses, etc. -- which are just as necessary for effective task performance. If not carefully managed, the increased power of a micro can serve to multiply problems.

Our generalizations and action guidelines represent a concensus achieved by a variety of professionals coming at the problem from different perspectives. Thus, they represent a common denominator which should be widely applicable. Many are similar to basic project and program management principles cited elsewhere. These principles, however, are especially important with respect to microcomputers because of their phenomenal processing power. Proper management is needed not only to maximize their benefits, but also to minimize potential negative impacts.

The generalizations and action recommendations presented here represent only a synthesis of experience to date. We have also identified outstanding issues requiring further research. Most important are questions related to advance planning, institutionalization, technical assistance, power redistribution, and employment effects. Hopefully, continued advances in knowledge related to these questions will warrant a similar synthesis paper in the not too distant future.

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